

# National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23FA033

## **PROPELLER GOVERNOR EXAMINATION SUMMARY**

April 2, 2024

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## **A. ACCIDENT**

Location: Keene, New Hampshire  
Date: October 21, 2022  
Time: 1845 EDT  
2245 coordinated universal time (UTC)  
Airplane: N8020R, Beech A24R

## **B. PROPELLER GOVERNOR EXAMINATION SUMMARY**

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Loves Park, Illinois

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Loves Park, Illinois

## **C. SUMMARY**

On October 21, 2022, about 1845 eastern daylight time, a Beech A24R, N8020R, was destroyed when it was involved in an accident near Dillant/Hopkins Airport (KEEN), Keene, New Hampshire. The flight instructor and commercial-rated pilot were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

Prior to departure from KEEN, airport security video depicted the airplane taxi to the fuel farm where 24,380 gallons of 100 low-lead fuel were purchased. Following fuel purchase, a witness noted the airplane taxi to the approach end of runway 02.

According to recorded audio from the common traffic advisory frequency (CTAF), about 1843 EDT, an occupant of the airplane called on the frequency that the flight was departing from runway 02 and would remain in the airport traffic pattern.

According to several witnesses who were located on-airport, one of whom was a pilot and the other was a pilot and airframe and powerplant mechanic, the engine sounded abnormal with the pilot exclaiming that it never sounded smooth during the entire time the airplane was on the runway or while airborne. The pilot-rated

mechanic stated that when the flight was airborne along the runway he heard a momentary power reduction, followed by a power advance. The flight continued and was noted to be in a very shallow climb, by witness accounts climbing to between 50 and no higher than about 200 ft when the flight was near the intersection of runways 02/20 and 14/32, which was about 5,200 ft down the runway, with about only 1,000 ft of runway remaining. The flight continued in a wing and nose level attitude while several witnesses who were located northwest of the departure end of the runway reported the poor engine sound continued. A witness located about .5 nautical mile north-northeast from the departure end of runway 02 reported the airplane was flying not much higher than 50 ft above ground level when it flew by him. When he heard the airplane, he reported hearing pop pop sounds then the airplane began descending and the engine sound became louder but the popping sound stopped when the flight was descending. He heard the impact and ran to the accident site.

The airplane impacted into a storage building attached to a 2-story wood frame apartment building that had 5 separate apartments. There was no distress call made by an occupant of the airplane on the CTAF.

At the completion of the engine examination at the salvage facility, the propeller governor, separated head with attached lever and control cable, and governor drive-gear were retained and shipped via UPS Ground, Airbill 1ZA3978T0399348838. It was delivered on December 19, 2022, and retained pending examination and operational testing.

## **D. DETAILS OF THE PROPELLER GOVERNOR INVESTIGATION**

### **1.0 Propeller Governor Information**

#### **1.1 Propeller Governor Information, Manufacturing, and Maintenance**

The Woodward Governor, part number A210490, serial number 982979 was a constant speed, single acting component, and was designed such that the maximum governor rpm of 2,340 +/-10 rpm correlated to maximum engine rpm of 2,700. By design, the governor was supplied engine oil at normal engine oil pressure and increased it to 320 psi +/-20 psi which was applied to the propeller to increase pitch (higher blade angle). The drawing for the governor specified Test Specification (TSP) 197 to be used for operational testing.

According to Woodward, Inc., paperwork, the governor was manufactured in 1969, and shipped in October that year. They had electronic records going back to 1992 and there was no electronic record of it being returned to them since then.

The dataplate was marked in part with the part number, serial number, and with "2.Q.21".



**Figure 1: View of Governor DataPlate.**

A review of the airframe maintenance records revealed an entry dated June 11, 2021, indicating the overhauled propeller governor was installed at airplane total time 5027.7 hours.

A3-20

YEAR:	Make: Beech	Model: A24R	Reg. No.: N8020R
DATE	Date: 06/11/2021	S/N: MC13	Tach Time: 5027.7
	Airframe Log		Total Time: 5027.7
	1. Removed propeller governor p/n A210490, s/n 66398D. 2. Installed overhauled propeller governor p/n A210490, s/n 982979. 3. All work done in accordance with manufacturers service instructions. 4. Operational and leak check, good. Timothy S. Price [REDACTED] [REDACTED]		

**Figure 2: Propeller governor Installation Entry After Overhaul.**

## 1.2 Propeller Flight Manual Supplement Information

The Flight Manual Supplement for the propeller specified that the green arc rpm range was between 2,200 and 2,700, while the “Radial Red Line - (Rated)” rpm was 2,700. The supplement also indicated there was no performance change. The POH/AFM specified that during a static power check, the engine rpm should be between 2,650 and 2,700<sup>1</sup>.

## 2.0 Propeller Governor Examination

Examination of the propeller governor revealed heat damage and the Assembly Cover was fractured. Attached to the separated section of cover was a speed adjusting lever, control lever spring, control shaft, and length of actuating cable. The Speeder Spring was visible due to the fracture separated section of the cover. Due to impact damage to the cover and heat damage the governor could not be operationally tested as received.

<sup>1</sup> NTSB interviewed 3 days after the accident the airframe and powerplant mechanic with inspection authorization (A&P/IA) who performed a full power static check earlier on the accident date following completion of the annual inspection. He recalled the maximum rpm attained during a full power check was between 2,300 and 2,375. Refer to NTSB Record of Conversations which are in the NTSB public docket for the investigation.





**Figure 3: Propeller Governor as Received. Note the Overall Heat Damage and Impact Damage to the Cover.**



**Figure 4: View of the Top of the Governor Showing The Fractured Governor Assembly Cover.**

The customer hardware consisting of the governor driven gear was removed. The governor was equipped with a screen which when inspected had evidence of coked oil, but there was no abnormal particles.





**Figure 5: View of the Governor Base Gasket. Note the Coked Oil.**

The governor drive gear rotated freely. Oil sludge was noted in the inlet area of the governor and non-Woodward lock wire was noted in 3 places on the governor.

The remaining portion of the cover was examined, and the maximum speed adjustment post was bent and the maximum adjustment speed screw had 3 threads showing.



**Figure 6: View Showing the bent maximum speed adjustment post the maximum adjustment speed screw had 3 threads showing.**

The remaining portion of the cover was removed from the Governor Body for an internal inspection which revealed there was no wear or flats on either flyweight "toes" segment which remained secured to the flyweight ballhead; both flyweights moved freely. Examination of the Pilot Valve Plunger revealed corrosion on the spring seat area.<sup>2</sup> All bearing balls of the thrust bearing retainer were in place.

Complete disassembly of the governor was performed. Oil coking was noted in the gear area of the governor housing and the gears appeared satisfactory with no missing teeth. There was no visual wear of the gear pockets noted. The pressure relief valve was safety wired. Following removal of the pressure relief valve spring, it was checked with a calibrated dial caliper and the number of active coils, outside diameter, and wire diameter were within specification, but the free length was 0.097 inch less than the minimum specified.

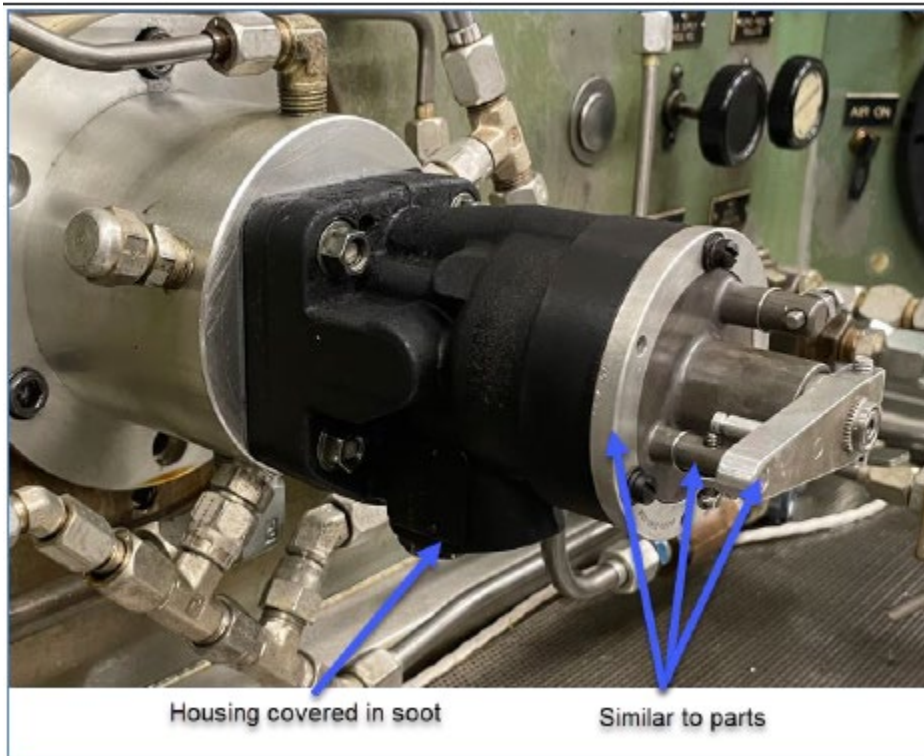
The speeder spring was not fully seated on the pilot valve. The speeder spring was tested on a calibrated machine and was within specifications at

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<sup>2</sup> According to manufacturer personnel, the corrosion would not affect governor performance.  
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both test points. It was also measured with a calibrated dial caliper and the outside diameter, coil diameter, number of active coils, and both ends of it were within limits.

Due to impact and heat damage, an exemplar modified cover with exemplar control lever and worm gear were installed for operational testing, while an exemplar relief valve spring was installed in the housing for operational testing.



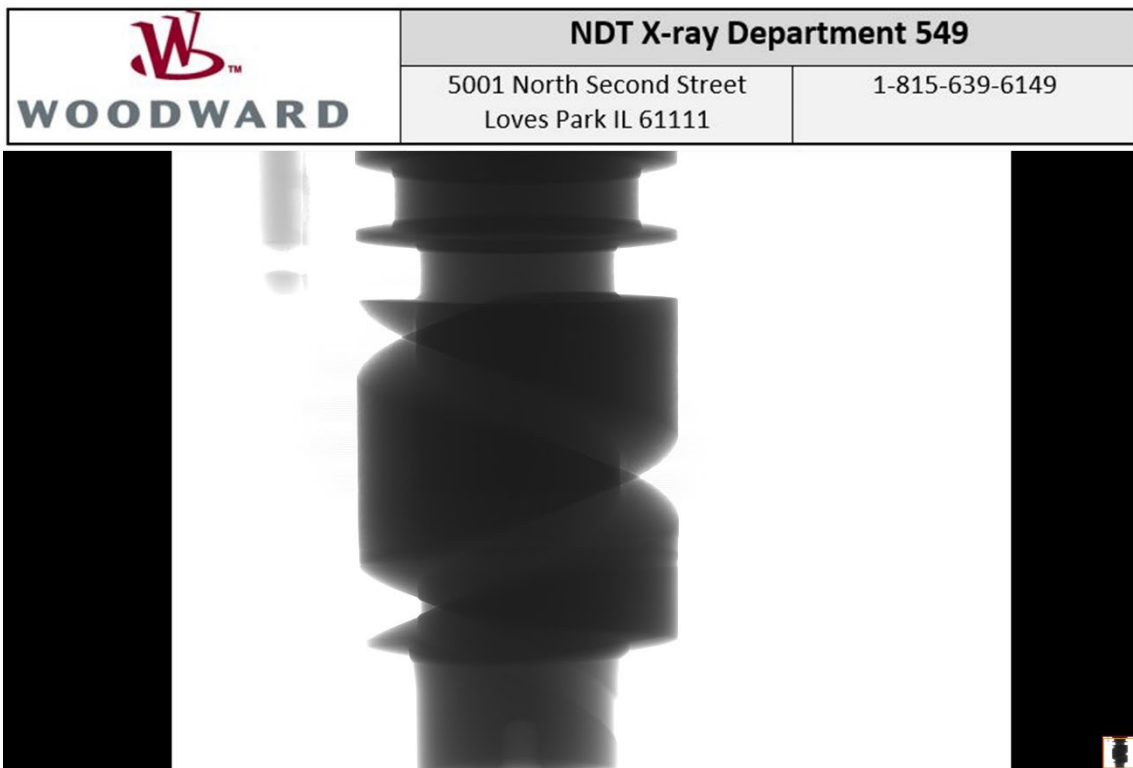
**Figure 7: Governor Installed on Test Stand. Arrows Pointing to “similar to parts” reflect the exemplar parts installed for operational testing.**

The governor was placed on a test bench and during operation a slow drip from the exemplar cover was noted because a gasket could not be installed with the exemplar cover. Because the original cover was not used for testing, calibration of the minimum and maximum speed points as well as any field adjustments were lost. The speed adjusting lever was re-indexed to set maximum rpm setting of 2,340 at 150 psi, and minimum rpm setting of 1,200 rpm at 150 psig. The pump capacity was 1.1 quarts-per-minute less than the minimum specified value, and the internal leakage was 5.0 quarts-per-hour greater than the maximum value for an overhauled governor. The governor responded to control input and the Pilot Valve Plunger was moving.

Because the control shaft or worm gear could not be removed without mechanical means from the Governor Cover Assembly, x-ray images of the section of

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cover with control shaft were performed. The control shaft or worm gear appeared normal.



**Figure 8: X-ray Image of control shaft or "worm gear".**

Disassembly of the governor after testing revealed some wear to the gears and housing bore.

### **3.0 Parts Distribution**

No parts were retained. The propeller governor was shipped to the salvage facility. Refer to NTSB Evidence Control Form contained in the public docket for the investigation for the tracking of the governor.

Submitted by:

Timothy W. Monville  
Sr. Air Safety Investigator

PROPELLER GOVERNORS FOR PISTON ENGINE POWERED AIRCRAFT

TEST RECORD

1. Part Number	<u>          A210490          </u>
2. Serial Number	<del><u>          [REDACTED] 982979 [REDACTED]          </u></del> <u>          2/21/2023 982979          </u>
3. Rotation, Facing Drive Pad	<u>          CW <input checked="" type="checkbox"/> CCW          </u>
4. Pressure Sense, Pressure To -	<u>          DEC <input type="checkbox"/> INC <input checked="" type="checkbox"/>          </u>
5. Maximum RPM	<u>          2340 @ 150 PSI          </u>
6. Control Arm Position (at Max. RPM)	<u>          SKIP          </u>
7. Unfeathering RPM (if applicable)	<u>          N/A          </u>
8. Relief Valve Press. (at RPM Specified)	<u>          320 PSIG          </u>
9. Pump Capacity (Qts./Min)	<u>          3.9 Qts./Min          </u>
10. Control Arm Angular Travel	<u>          SKIP deg. Total SKIP deg.          </u>
11. Minimum RPM or Feathering RPM	<u>          1200 @ 150 PSI          </u>
12. Pickup Output (RMS) (if applicable)	<u>          Volts N/A at RPM N/A          </u>
13. Internal Leakage (Qts./Hr.)	<del><u>          [REDACTED] 42 Qts          </u></del> <u>          2/21/2023 55 Qts/Hr.          </u>
14. External Leakage (none permitted)	<u>          Cover          </u>
15. Torque Check (After test before wiring)	
Control lever screw (33-38 lb. in.)	<u>  </u>
Stop Ring Clamp Screw (See page 4)	<u>  </u>
16. Sales Order	<u>  </u>
Date Tested	<u>          2/21/2023          </u>
Tested By	<u>  </u>

MARK N/A ON ANY LINE NOT APPLICABLE TO THE GOVERNOR ON TEST.