

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA24LA223

CONSTANT SPEED UNIT EXAMINATION AND TESTING SUMMARY

October 9, 2024

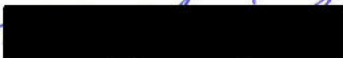
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A. ACCIDENT

Location: Lehigh Acres, Florida
Date: May 20, 2024
Time: 1008 EDT
1408 Coordinated Universal Time (UTC)
Airplane: N762MC, Beechcraft TC-12B

B. CONSTANT SPEED UNIT EXAMINATION AND TESTING SUMMARY

IIC	Timothy W. Monville NTSB-OAS/ERA Washington, DC	Timothy W. Monville	Digitally signed by Timothy W. Monville Date: 2024.10.08 13:49:59 -04'00'
Party Coordinator	Matt Zolnierczyk Product Integrity Coordinator Woodward, Inc. Love Park, IL		2024-10-09

C. SUMMARY

On May 20, 2024, about 1008¹ eastern daylight time, a Beechcraft TC-12B² airplane, N762MC, was substantially damaged when it was involved in an accident at Buckingham Field Airport (FL59), near Lehigh Acres, Florida. The pilot and the copilot were not injured. The airplane was operated as a public aircraft.

The purpose of the flight was to train a new copilot in the right cockpit seat for the Lee County, Florida Mosquito Control District (LCMCD). The flight instructor was in the left cockpit seat.

The LCMCD chief pilot reported the following. After an uneventful training mission, the copilot landed the airplane on runway 32 at FL59 on or very near the centerline. He reduced power to idle, then lifted the power levers over the gate into beta and then farther aft into reverse. At this point, the airplane quickly veered to the left. The flight instructor intervened and both pilots attempted to turn the airplane to the right and slow it down.

Both pilots reported that the airplane seemed to be accelerating as it departed the left side of the runway. The flight instructor attempted to move the condition levers to

¹ Subject to change based on pending GPS data.

² The aircraft data plate specified the model to be UC-12B, correlated to a civilian designation A200C.

cutoff; however, the airplane continued into a dry fishpond that was about 5 ft deep. The left main and nose landing gears collapsed, and the airplane came to a stop.

An inspector with the Federal Aviation Administration responded to the accident site and examined the wreckage. There was substantial damage to the left wing, the aft fuselage, and the areas around the nose and left main landing gear. Both propellers were damaged from ground contact.

D. DETAILS OF THE INVESTIGATION

As part of the airframe and engine examination that was performed on September 17, 2024, at FL59, the rudder and aileron trims were neutral.

Following documentation of the positions of the left and right engine controls, Beta valves, and engine controls and reverse linkages. Each power lever and propeller control lever were exercised, and continuity was confirmed from the pedestal to each respective attach point. Each power lever was moved aft of the idle stop into Beta range and moved freely but could not be moved farther aft into Reverse (normal) because the engines were not running³. Each propeller control in the cockpit pedestal moved forward to the full forward or High RPM position with no discrepancies noted.

According to the "Detail Report" provided by the operator, at the time of the accident the airplane hour meter reading, airplane total time, total cycles, and landings were 108.4, 19,460.3, 34,297 and 34,341, respectively.

The left constant speed unit (CSU), part number (PN) 8210-007-01, serial number (SN) 1442418, and the right CSU PN 8210-007-01, SN 1150406 were removed and shipped on September 24, 2024 via UPS 2nd Day Air, airbill 1ZA4E7150292339782, to the manufacturer's facility and delivered on September 26, 2024. The box was secured pending NTSB Virtual Examination and Operational Testing October 2, 2024.

At the start of the Virtual Examination on October 2, 2024, at 0900 EDT, the box was presented unopened (Figure 1). It was noted that one end of the box was damaged but there was no tear in the box. The box was opened, and the units were removed from their respective plastic zip top bags and individually visually inspected and then operationally tested.

³ No attempt was made to force the power levers beyond the point where normal force was required.
CONSTANT SPEED UNIT EXAMINATION AND TESTING SUMMARY



Figure 1: View of Unopened Box

1.0. Operational Characteristics of Constant Speed Unit (CSU)

The CSU mounted on the top, front position of the reduction gearbox of the PT6A-41 engine is driven by a bevel gear arrangement mounted on the propeller shaft. Gears mounted in the base of the governor increases the supplied engine oil pressure to the pressure relief valve, through internal passages to the pilot valve and then to the propeller transfer sleeve to automatically vary the propeller blade pitch to match load torque to engine torque in response to changing flight conditions based on the set position of the propeller control in the cockpit. The propeller control lever in the cockpit pedestal connects with the CSU via an engine control cable that attaches at the speed lever at the CSU.

The CSU is equipped with an integral beta valve which allows the pilot to vary forward thrust, and also provides reversing capability while on the ground.

According to the engine maintenance training manual, Beta Mode corresponds to a range of operation where the blade angle is between the Primary Blade Angle (PBA) and reverse. In Beta Mode control of the propeller pitch is a direct function of the position of the Beta valve.

Changing propeller blade angle on the ground below idle or PBA into Beta Mode requires movement of the power lever aft of the Idle detent and the CSU flyweights must be in an underspeed condition. A pneumatic orifice bleeds compressor discharge pressure (P_y) from the main engine fuel control, thereby limiting turbine speed in the beta control range to protect the engine against propeller overspeed.

The CSU speed lever maximum stop setting screw correlates to 2,000 propeller rpm and a governor rpm of 3,840.

2.1 Date of Manufacture Left Constant Speed Unit (CSU)

2.2 Date of Last Overhaul Left Constant Speed Unit

WOODWARD

P/N 8210-007-01
S/N 1442418
REV NEW

SB-025
ASSY DATE 7/12/16

WOODWARD GOVERNOR COMPANY ROCKFORD, ILLINOIS

[illegible]

Figure 3: Engine Maintenance Record Entry.

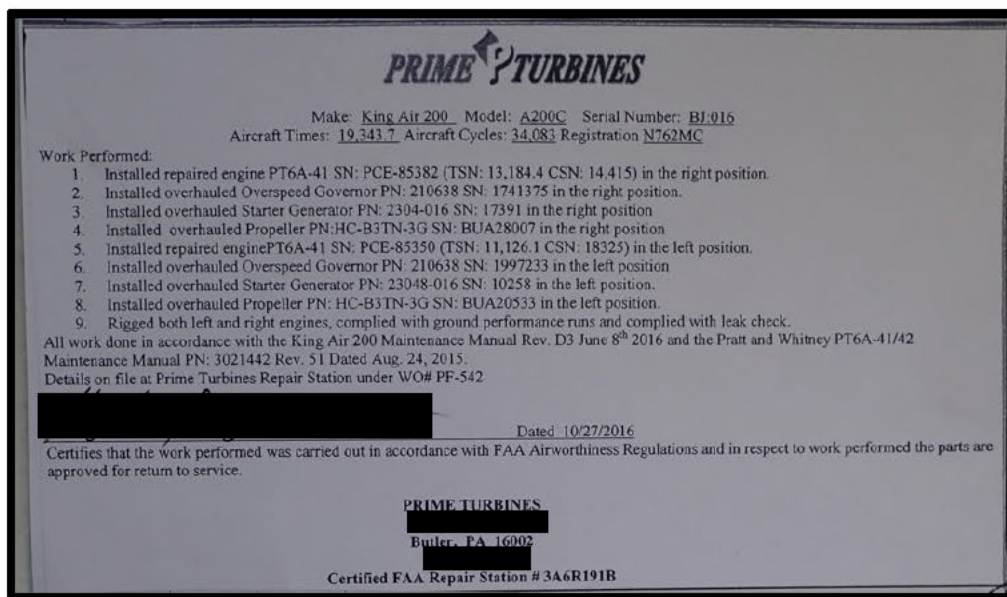
⁵ "New" is still the current revision.

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2.3 Installation of Left CSU After Overhaul

The left CSU, SN 1442418 was installed onto engine SN PCE-85350 on August 29, 2016 (Figure 3). And the left engine was installed into the accident airplane on October 27, 2016. At that time, the reported engine total time, total cycles, time since overhaul and cycles since overhaul were reported to be 11,216.1, 18,325, 1,182.3, and 2,119, respectively.

The airframe maintenance record entry for October 27, 2016 specified that the airplane total time and aircraft cycles were 19,343.7 and 34,083, respectively (Figure 4).



PRIME TURBINES

Make: King Air 200 Model: A200C Serial Number: BJ:015
Aircraft Times: 19,343.7 Aircraft Cycles: 34,083 Registration N762MC

Work Performed:

1. Installed repaired engine PT6A-41 SN: PCE-85382 (TSN: 13,184.4 CSN: 14,415) in the right position.
2. Installed overhauled Overspeed Governor PN: 210638 SN: 1741375 in the right position.
3. Installed overhauled Starter Generator PN: 2304-016 SN: 17391 in the right position.
4. Installed overhauled Propeller PN: HC-B3TN-3G SN: BUA28007 in the right position.
5. Installed repaired engine PT6A-41 SN: PCE-85350 (TSN: 11,126.1 CSN: 18325) in the left position.
6. Installed overhauled Overspeed Governor PN: 210638 SN: 1997233 in the left position.
7. Installed overhauled Starter Generator PN: 23048-016 SN: 10258 in the left position.
8. Installed overhauled Propeller PN: HC-B3TN-3G SN: BUA20533 in the left position.
9. Rigged both left and right engines, complied with ground performance runs and complied with leak check.

All work done in accordance with the King Air 200 Maintenance Manual Rev. D3 June 8th 2016 and the Pratt and Whitney PT6A-41/42 Maintenance Manual PN: 3021442 Rev. 51 Dated Aug. 24, 2015.
Details on file at Prime Turbines Repair Station under WO# PF-542

[Redacted Signature]

Dated: 10/27/2016

Certifies that the work performed was carried out in accordance with FAA Airworthiness Regulations and in respect to work performed the parts are approved for return to service.

PRIME TURBINES
Butler, PA 16002
[Redacted Phone Number]

Certified FAA Repair Station # 3A6R191B

Figure 4: Airframe Logbook Entry.

2.4 Maintenance Since Installation After Overhaul of Left CSU

Routine engine inspections were performed of the left CSU following installation of the engine with overhauled CSU. There was no record of removal, or replacement of the left CSU after engine installation.

2.5 Date of Manufacture Right Constant Speed Unit

According to Woodward, Inc. the right CSU PN 210-007-01, SN 1150406 was originally shipped from their facility on December 4, 1974. It had been returned to Woodward, Inc., a few times for repair/overhaul, and was most recently shipped from their facility on March 2, 1998.

2.6 Date of Last Overhaul Right Constant Speed Unit

Although FAA Form 8130-3 was not provided, the right CSU dataplate was marked with an Assembly Date of July 12, 2016 (Figure 5) at Revision "New"⁶. An entry in the engine maintenance records specified that CSU SN 1150406 which had 0.0 hours since overhaul was installed on August 30, 2016 (Figure 6).

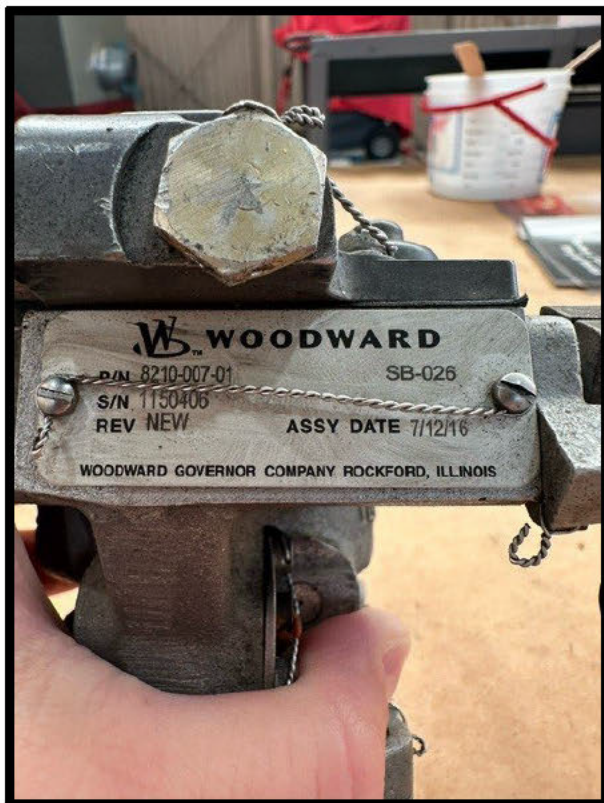


Figure 5: Right Constant Speed Unit Data Plate.

PRIME TURBINES, LLC.
5175 S. 1000 E. SUITE 100
TULSA, OK 74114-1000
TEL: (918) 438-1111 FAX: (918) 438-1112

Engine SN PCE-85382 received for REPAIR of Long Term Storage De-Preservation Inspection (ref. P&WC EIL-Gen 093R1) and Hot Section Inspection. Disassembled, Clean, Inspected and Assembled in reference to Pratt & Whitney Canada QHM 3021443 Rev. 47 dated 1/19/2015 and MM 3021442 Rev. 51 dated 8/24/2015.

Complied with H.S.I. on the following:

Nomenclature	Part Number	Serial Number	QTY	Condition
Combustion Liner	3105467-01	6D906	1	Serviceable
Large Exit Duct	3037772	NSN	1	Serviceable
Small Exit Duct	3100591-33	NSN	1	Serviceable
CT Vane Ring	3045671 CAV 652	9P761 CL 6.84	1	Serviceable
#2 Bearing Cover	3115924-01	NSN	1	Serviceable
Flange	3116047-01	PWV04-0322PT	1	Serviceable
Lock Plate	3024831	PWV09-0607PT	1	Serviceable
Baffle	3115212-01	NSN	1	Serviceable
CT Shroud Housing	3100122-04	PWC06L6008	1	Serviceable
CT Disk	3045291-01	A0004DM5	1	Serviceable
CT Blades	Unk (Not removed)	Unk (Not removed)	58	Serviceable

Installed the following items:

Nomenclature	Part Number	Serial Number	QTY	Condition
Interstage Sealing Ring	E3014960	NSN	2	New
Stator Air Seal	E3023682	NSN	1	New
CT Shroud segments	PF3018593CL10	NSN	9	New
Exhaust Duct Housing	3022406 SB3194	A3834	1	OH'd
Wiring Harness	3112214-01	NR23244	1	OH'd
# 8 Bearing	3102227-01	BB921077	1	OH'd
Oil Seal Runner	E3114682-01	NSN	1	New

Touch ground CT blades to a diameter of 6.536 and balanced. Ground segments to achieve a CT blade tip clearance of .012

Performed functional check of Fuel Nozzle assemblies, no discrepancies noted.

Overhaul Gov. SN: 1741375 TSO: 0.0

Functional Tested following: FCU SN: A62824 TSO: 482, Fuel Heater SN: WA16125 TSO: 482,

Performance Tested:
SHP: 850 NG: 30850 ITT: 1644 TSO: 1720 SFC: 613 (Data Plate Trim 87 deg F / 48.3 deg C)
Requires Trim Stick PN: 3053995CL09 / 21.7 Ohms

CTVR PN: 3045671 SN: 9P761 CAV: 552 CL: 6.84 / PTVR PN: 3022252 SN: B831 CAV: 151 CL: 19.01

Complied with the following Service Bulletins: 3194, 3276, 3358

Details regarding the work performed are on file at Prime Turbines, LLC. under the W/O number M5R1033.

TSN: 13,184.4 TSO: 482 CSN: 14,415 CSO: 996

SIGNATURE: [Redacted] DATE: 8/30/2016

PTPA Accept 10

Figure 6: Engine Maintenance Record Entry.

2.7 Installation of Right CSU After Overhaul

The right CSU, SN 1150406 was installed onto engine SN PCE-85382 on August 30, 2016 (Figure 6). And the right engine was installed into the accident airplane on October 27, 2016. At that time, the reported engine time since new, time since overhaul, cycles since new, and cycles since overhaul were reported to be 13,184.4, 482, 14,415, and 996, respectively.

⁶ "New" is still the current revision.

The airframe maintenance record entry for October 27, 2016 specified that the airplane total time and aircraft cycles were 19,343.7 and 34,083, respectively (Figure 4).

2.8 Maintenance Since Installation After Overhaul of Right CSU

Routine engine inspections were performed of the right CSU following installation of the engine with overhauled CSU. There was no record of removal, or replacement of the right CSU after engine installation.

2.9 Time Since Overhaul on Both CSU's

Based on the reported airframe total time at the time of the accident and installation following overhaul, both CSU's had accrued 116.6 hours since overhaul.

3.0. Constant Speed Unit Examination and Testing

3.1 Left Constant Speed Unit Visual Inspection

Visual inspection of the left CSU revealed no cover on the mounting base plate. A customer fitting was noted in the Py port. A lockwire seal likely associated with overhaul was not theirs. Also noted was no torque sealant on the maximum speed lever and at the air bleed set screw. Non Woodward lockwire was present at the Beta valve, pressurizing valve, cover, and maximum speed adjustment screw. Surface corrosion was noted on the pressurizing valve cap and on the air bleed lever, the later of which did not return on its own to the set screw position, and appeared to be less than ¼ inch away, although this was not measured. The maximum speed lever did return normally to the maximum stop after release. The lockwire at the eccentric screw and nameplate appeared a smaller diameter than what Woodward, Inc., uses on OEM builds. The drive shaft was noted to rotate freely and the Beta valve was fully extended (normal). The Beta valve was exercised by hand and moved normally.

3.2 Left Constant Speed Unit Operational Testing

The left CSU was operationally tested (Figure 7) to production unit standards using Accepted Test Procedure TSP-1527 Revision N1.

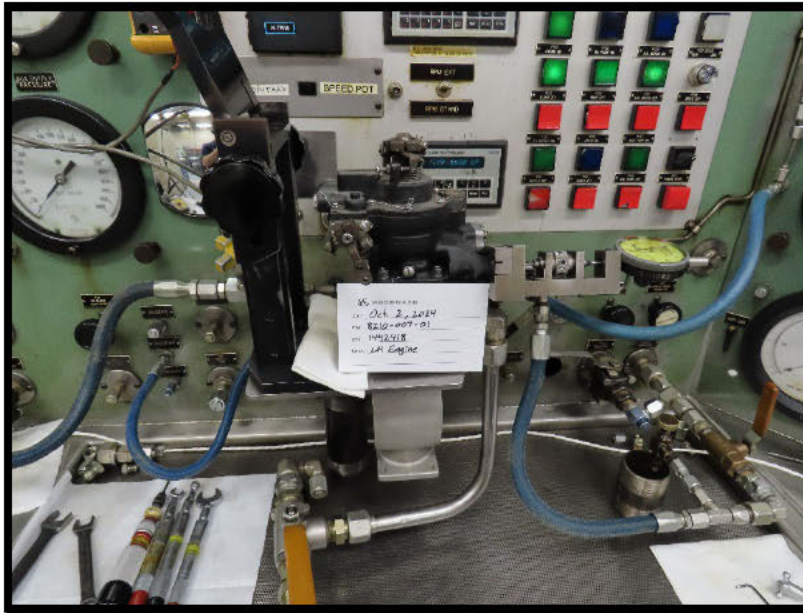


Figure 7: View of the Left CSU During Operational Testing.

The testing which lasted about 25 minutes included checks of relief valve pressure, supply pressure, maximum rpm speed setting, speed lever travel, feather stop, the position of the speed lever when feathering, pneumatic control valve, underspeed reset setting, leakage at the feather stop, pump capacity, internal leakage, control arm position at maximum rpm, Beta Pilot Valve, and External leaks.

Although noted during visual examination that the air bleed lever did not return normally to the set screw position, it did return to that position during operational testing. The unit passed all tests except the maximum speed setting, feather stop, pneumatic control valve for overspeed, underspeed reset setting, and control arm angle at maximum rpm setting. The maximum speed setting was 65 governor rpm higher than the highest allowed value, which equates to about 34 propeller rpm. The underspeed reset setting was 1 psid below the set point value at 3,620 governor rpm with the governor in an underspeed condition. The out of specification values were consistent with typical field adjustments. Adjustments to the propeller governor were performed and the unit was again operationally tested. All values were then within limits with the exception of the control lever angle at max speed and on the feather stop. This could be further adjusted by moving the control lever relative to the splined shaft if desired, however, this was not performed and did not affect overall CSU performance. Disassembly examination of the CSU was not performed. There was nothing mechanically wrong with the CSU that precluded going into Beta range if commanded while in an underspeed condition.

3.3 Right Constant Speed Unit Visual Inspection

Visual inspection of the right CSU revealed no cover on the mounting base plate. A customer fitting was noted in the Py port. A lockwire seal likely associated with overhaul was not theirs. A lockwire was missing at the maximum speed lever securing screw. Non Woodward lockwire was present at the Beta valve, pressurizing valve, cover, and maximum speed adjustment screw. Surface corrosion was noted on the air bleed lever and maximum speed lever. The air bleed and maximum speed levers returned to their normal position after release. The drive shaft was noted to rotate freely, and the Beta valve was fully extended (normal). The Beta valve was exercised by hand and moved normally.

3.4 Right Constant Speed Unit Operational Testing

The right CSU was operationally tested (Figure 8) to production unit standards using Accepted Test Procedure TSP-1527 Revision N1.

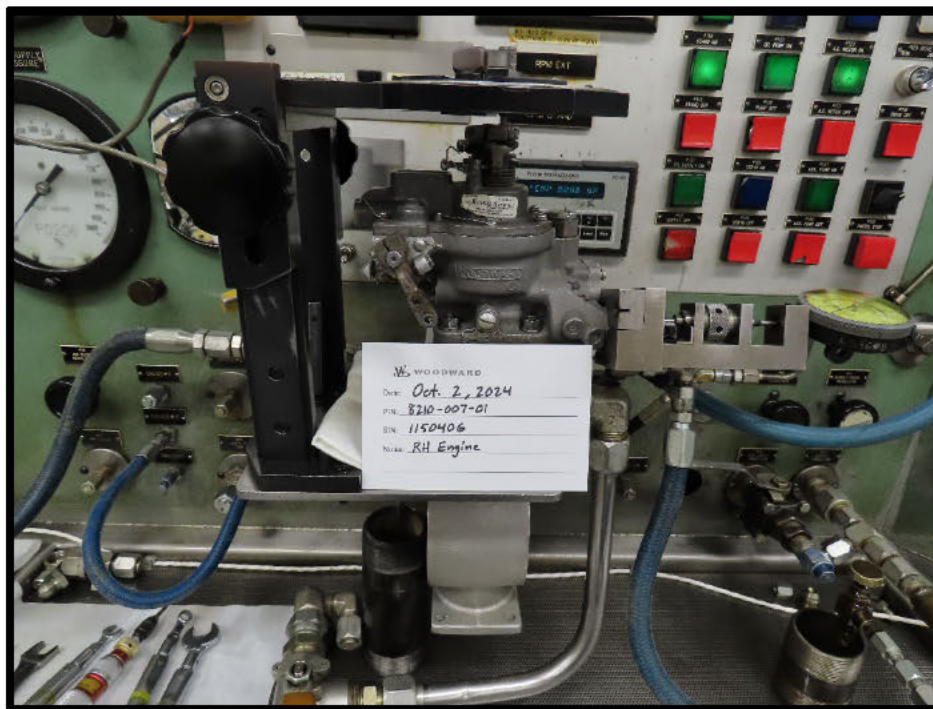


Figure 8: View of the Right CSU During Operational Testing.

The testing which lasted about 27 minutes included checks of relief valve pressure, supply pressure, maximum rpm speed setting, speed lever travel, feather stop, the position of the speed lever when feathering, pneumatic control valve, underspeed reset setting, leakage at the feather stop, pump capacity, internal leakage, control arm position at maximum rpm, Beta Pilot Valve, and External leaks.

The unit passed all tests except maximum speed setting, feather stop, pneumatic control valve overspeed setting, feather stop, underspeed reset setting, and control arm angle at maximum rpm setting. The maximum speed setting was 84 governor rpm higher than the highest allowed value, which equates to about 44 propeller rpm. The underspeed reset setting was 2 psid below the set point value at 3,620 governor rpm with the governor in an underspeed condition. The out of specification values were consistent with typical field adjustments. Adjustments to the propeller governor were performed and the unit was again operationally tested. All values were then within limits with the exception of the feather stop. Disassembly examination of the CSU was not performed. There was nothing mechanically wrong with the CSU that precluded going into Beta range if commanded while in an underspeed condition.

3.5 Comparing of Parameters of Left and Right CSU During Operational Testing

Comparing in part the maximum set rpm values for the left and right CSU revealed both were above the maximum specified limit for production testing, and the value for the right was 19 rpm greater than the value for the left⁷.

4.0. PARTS RETENTION OR FURTHER EXAMINATION

No parts of either CSU were retained for further examination or testing.

5.0. Pending Details

5.1 Component Return

Following finalizing of the Examination Summary, both CSU's will be returned to the operator's facility.

Submitted by:

Timothy W. Monville
Sr. Air Safety Investigator

⁷ According to the left seat pilot, Beta and Reverse was utilized during two separate landings earlier that day with no issues reported. He also indicated that the calculated Vref speed for the accident landing with full flaps was 88 knots indicated airspeed (KIAS) and the flight touched down on runway centerline at 100 KIAS. The Chief Pilot of LCMCD who flew the accident airplane on May 15, 2024, and performed multiple landings on that date reported no discrepancies with the use of Beta while taxiing, or Reverse during any of the multiple landings. Refer to NTSB Record of Conversation, and statements contained in the public docket for the investigation.