



The National Transportation Safety Board

Office of Aviation Safety
Central Region
Memorandum for the Record
Engine Examination Findings
CEN19LA156
Oaks, North Dakota
May 5, 2019

The engine, a Honeywell Model TPE331-10-511M turboprop engine, Serial Number P36443, was prepared and operated in a test cell at Honeywell's facility, Phoenix, Arizona, from February 22 to March 5, 2021. Following the test run, a teardown and inspection of the engine was conducted on March 11 – 12, 2021. The test cell operation and inspection were conducted at the request of and under the supervision of the NTSB.

Test Cell Operation

The engine was prepared for safe operation in a test cell. After verifying start fuel flow, the engine was then prepared for a start to run at idle. The chip detector on the engine nose cone was removed and checked for debris. No additional debris was present after the engine was motored.

Run time for the initial start was limited to 30 seconds. Engine vibrations were normal, and no leaks were observed on the engine after shutdown. The chip detector was again inspected, and no debris was present. The engine was started a second time and successfully operated at idle conditions for five minutes and the chip detector was inspected with no metal chips present.

A three-blade McCauley propeller Model X36FR36C606-B was installed on the engine. The engine was started to idle for a third time. During engine operation, there was no Beta pressure observed from the engine. The engine was shut down and the facility Beta pressure measurement system was verified to be operational. A review of the data showed Beta pressure increasing during the start, then falling to zero as the engine approached idle speeds. An additional motor check was conducted on March 5, which verified the increase in Beta pressure as the engine speed increased then dropped to zero. The results of the engine testing indicated and there was an issue with the torque system that prevented the buildup of beta pressure during engine operation. Additional engine testing was not performed, and the engine was removed from the test stand.

Teardown Examination (Torque Sensor and Helical Cam Gear)

- The torque sensor was found intact and was free to rotate.
- Rotational scoring was present in the bore of spur gear teeth of helical cam gear.
- There were witness marks on the forward end of the helical cam gear of the torque sensor.
- The spur teeth on the helical cam gear were found severely damaged. About ½ of the gear teeth were smeared and the remaining gear teeth broken off.
- There was a slight witness mark on the aft end of the helical gear teeth.

See Photos 1,2,3



Photo 1 Helical Cam Gear as found during Teardown Examination

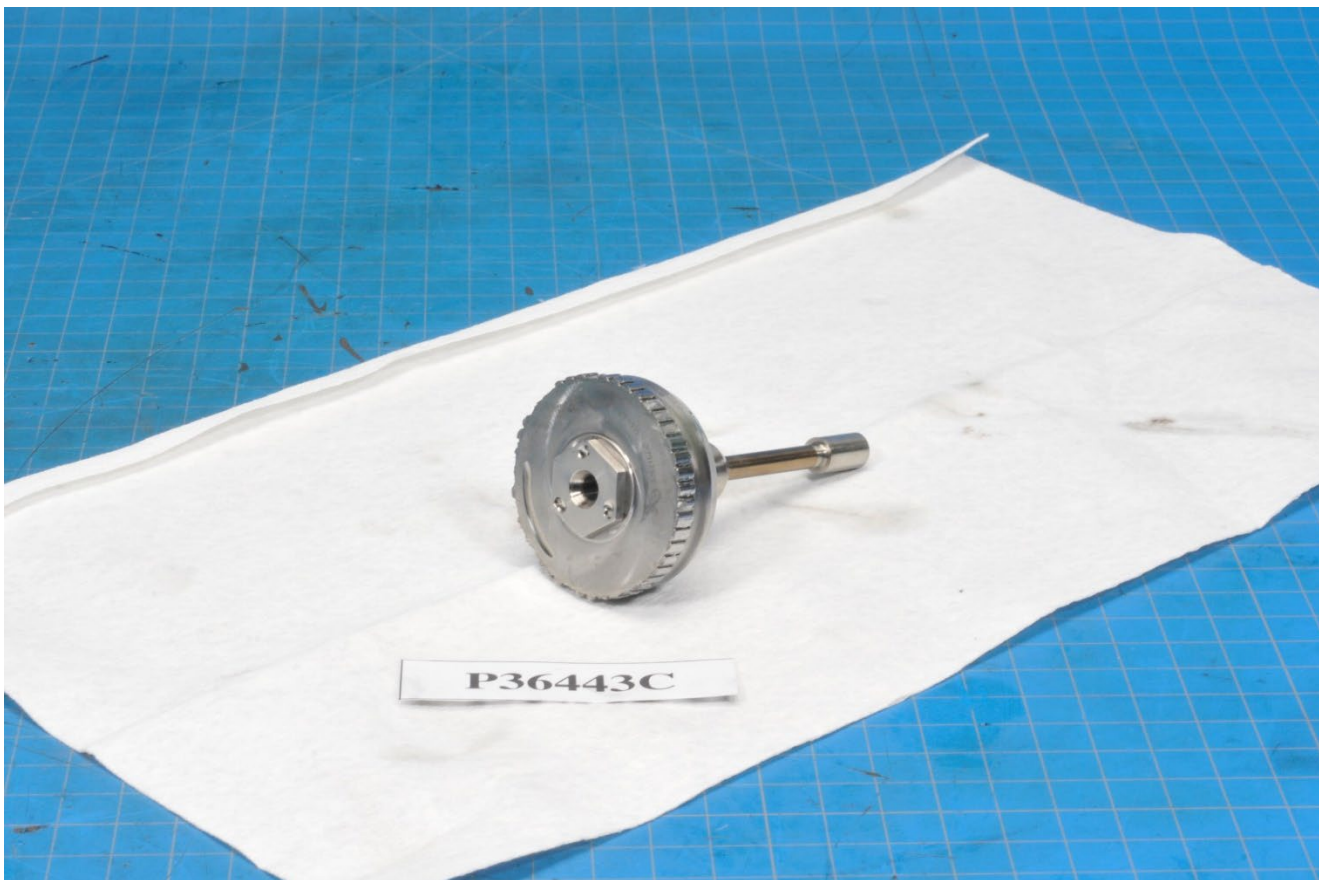


Photo 2 Helical Cam Gear Removed



Photo 3 Closeup of Helical Cam Gear Teeth

Summary

- The test, teardown, and examination of the engine disclosed that the type and degree of damage to the helical gear teeth was indicative of an uncoupling of the high-speed pinion from the helical cam gear of the engine torque sensor.
- Examination of the gear teeth of the helical cam gear shows indication of fatigue on several of the broken gear teeth. No defects in the helical gear were identified during the material analysis. The cause of the fatigue could not be identified.

Alexander Lemishko



Senior Air Safety Investigator
NTSB Central Region Aviation