

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



December 8, 2021

MATERIALS LABORATORY FACTUAL REPORT

Report No. 21-087

A. ACCIDENT INFORMATION

Place : Sterling, MA
Date : 03/11/2020
Vehicle : Cessna 177RG, N1572H
NTSB No. : ERA20FA124
Investigator : Doug Brazy

B. COMPONENTS EXAMINED

Pilot's and Co Pilot's seat belt assemblies as received (Figure 1).

C. DETAILS OF THE EXAMINATION

The seat belt reels were manufactured by the Pacific Scientific Company. The pilot's reel had a part number 1107050-10 and the co-pilot's reel had a part number 1107050-08. The co-pilot's reel had a torn tamper indicating sticker on the cap covering the inertial locking mechanism that indicated that the cap had been previously opened. The pilot's reel did not have a tamper indicating sticker on the cap covering the inertial locking mechanism. The co-pilot's reel assembly still had the seat belt webbing wound around the spool as it would be in the fully retracted position. The pilot's reel assembly did not have any of the seat belt webbing wound around the spool. The seat belt webbing for the pilot's seat belt assembly was completely separated from the seat belt reel. The seat belt reel assemblies had guides that the webbing would pass through while retracting and extending from the spool.

Prior to testing the inertial locking mechanisms on both seat belt reels the reel assemblies were sent to an outside lab for Computed Tomography (CT) scanning. Both reels were CT scanned at the same time and the images were examined side by side to identify any differences between the two units while also looking for any signs of internal damage. The CT scans did not reveal any damage to the inertial locking mechanism on either of the two reels. The CT scan did reveal that on the pilot's reel the spool retraction springing that would retract the seat belt webbing back onto the spool after an extension was not properly connected to the axle running through the spool (Figure 2). The end of the retraction spring would normally pass through a spring slot on the end of the axle running through the spool. A dog leg on the end of the retraction spring would prevent the spring from pulling through the slot on the end of the axle. The CT images indicated that the end of the retraction spring did not pass through the slot on the end of the axle but instead was laying next to the spring slot on the end of the axle.

After the seat belt reel assemblies were returned from CT scanning, they were functionally tested in the Materials Laboratory. The co-pilot's reel assembly functioned as designed allowing extension and retraction of the webbing from the spool and locking when given a sudden tug. In order to functionally test the pilot's reel assembly, the cover of the retraction spring was removed (Figure 3) to properly engage the retraction spring into the spring slot on the end of the spool's axle after the webbing had been wound onto the spool. After reassembling the pilot's seat belt reel assembly, the reel allowed extension and retraction of the seat belt webbing and exhibited lockup when given a sudden tug.

After the functional testing did not reveal any anomalies with the performance of the inertial locking mechanism on the pilot's seat belt reel assembly the cover of the inertial locking mechanism was removed for examination (Figure 4). The internal components of the inertial locking mechanism did not exhibit any anomalies such as missing gear teeth on the ring gear or any problems with the engagement of the pawl with the ring gear (Figure 5). Functional tests of the inertial locking mechanism were conducted with the inertial locking mechanism's cap removed to observe the movement of the internal components. All the components in the inertial locking mechanism moved freely and functioned as intended.

In summary, the only anomaly identified with the pilot's seat belt reel assembly was the disconnected retraction spring identified from the CT images prior to disassembly. Once the retraction spring was properly connected to the spool spring slot after the seat belt webbing had been wound up the seat belt reel and inertial locking mechanism functioned as designed. A lack of clearance between the retraction spring cap and the retraction spring in the assembled position would not have allowed the retraction spring to come out of the spring slot on the end of the spool's axle without removing the spring cap. The dog leg on the end of the retraction spring would not have allowed the retraction spring to pull through the spring slot under normal circumstances.

Joseph Panagiotou
Fire Protection Engineer

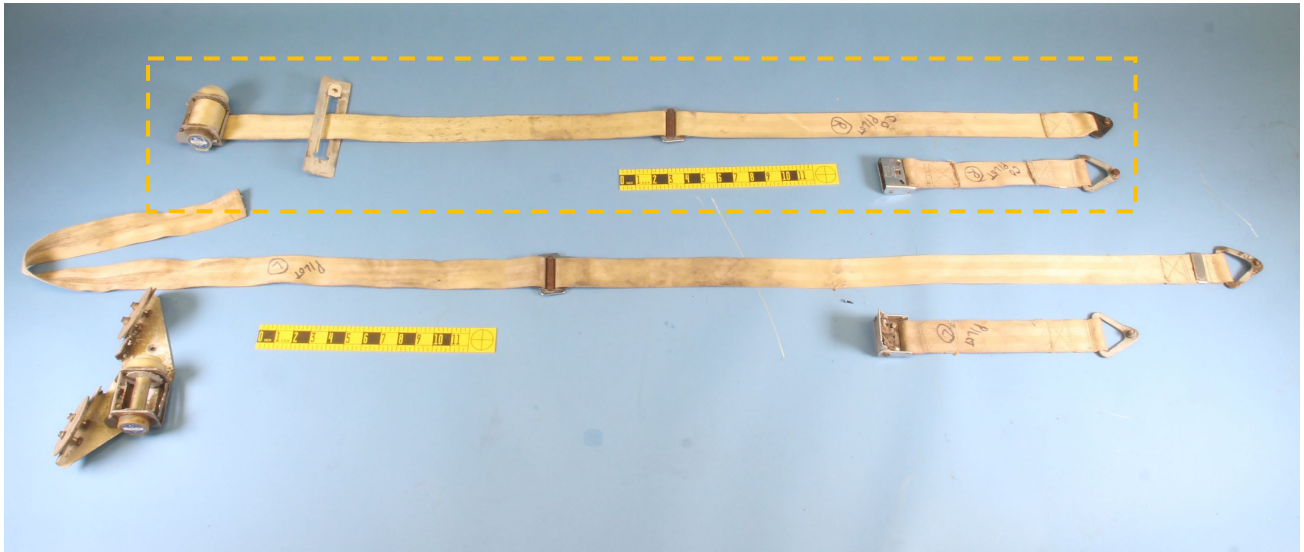


Figure 1: Seat belt assemblies as received. The Co-pilot's seat belt assembly is within the dashed outline.

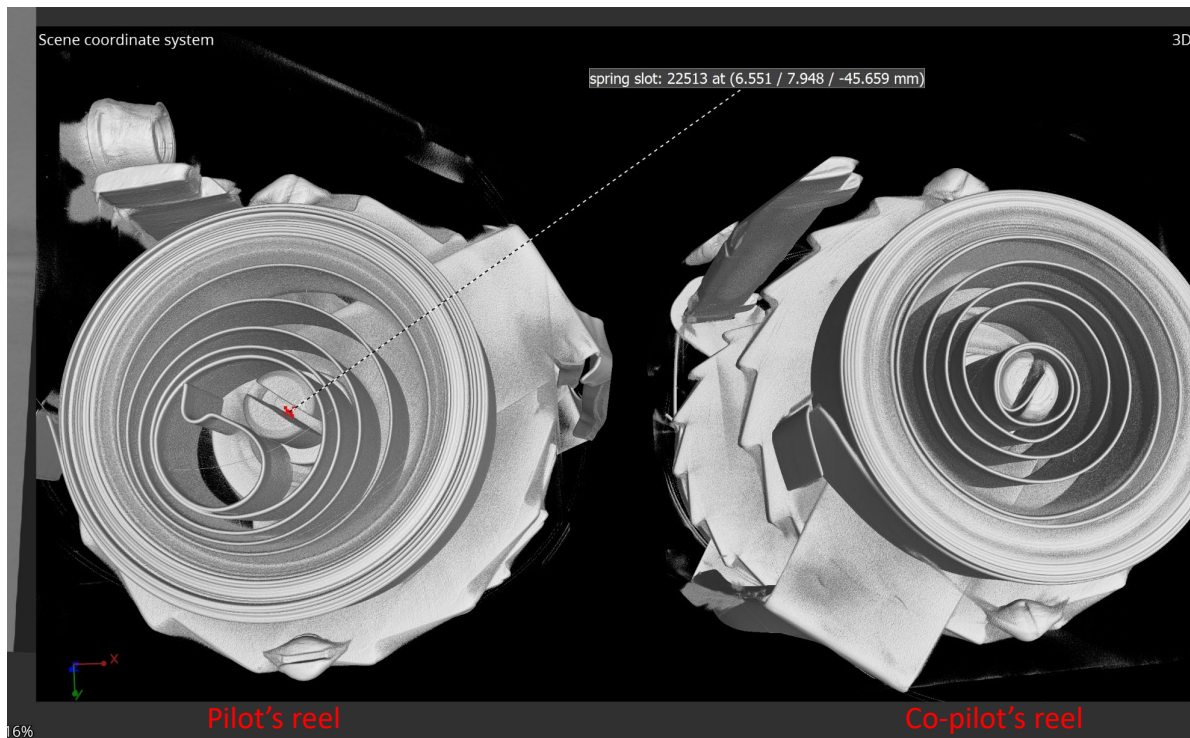


Figure 2: Pilot's and co-pilot's seat belt reel retraction springs.

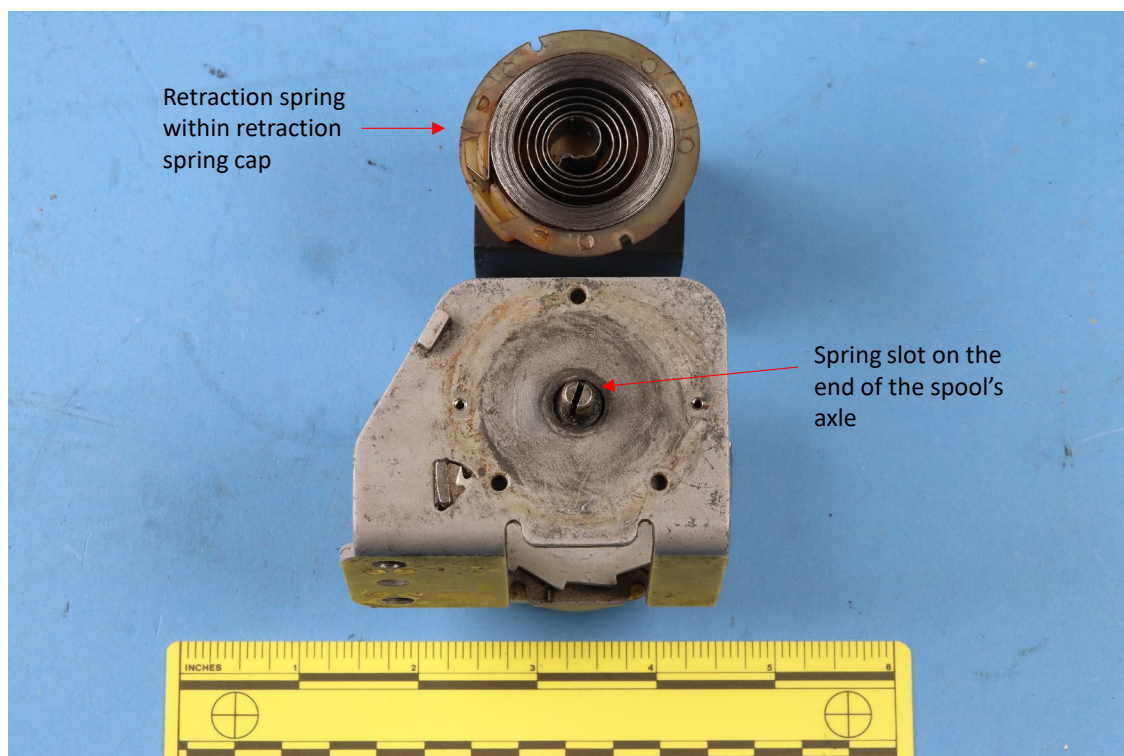


Figure 3: Pilot's seat belt reel with retraction spring and spring cap removed.



Figure 4: Pilot's seat belt reel with inertial locking mechanism cover removed.

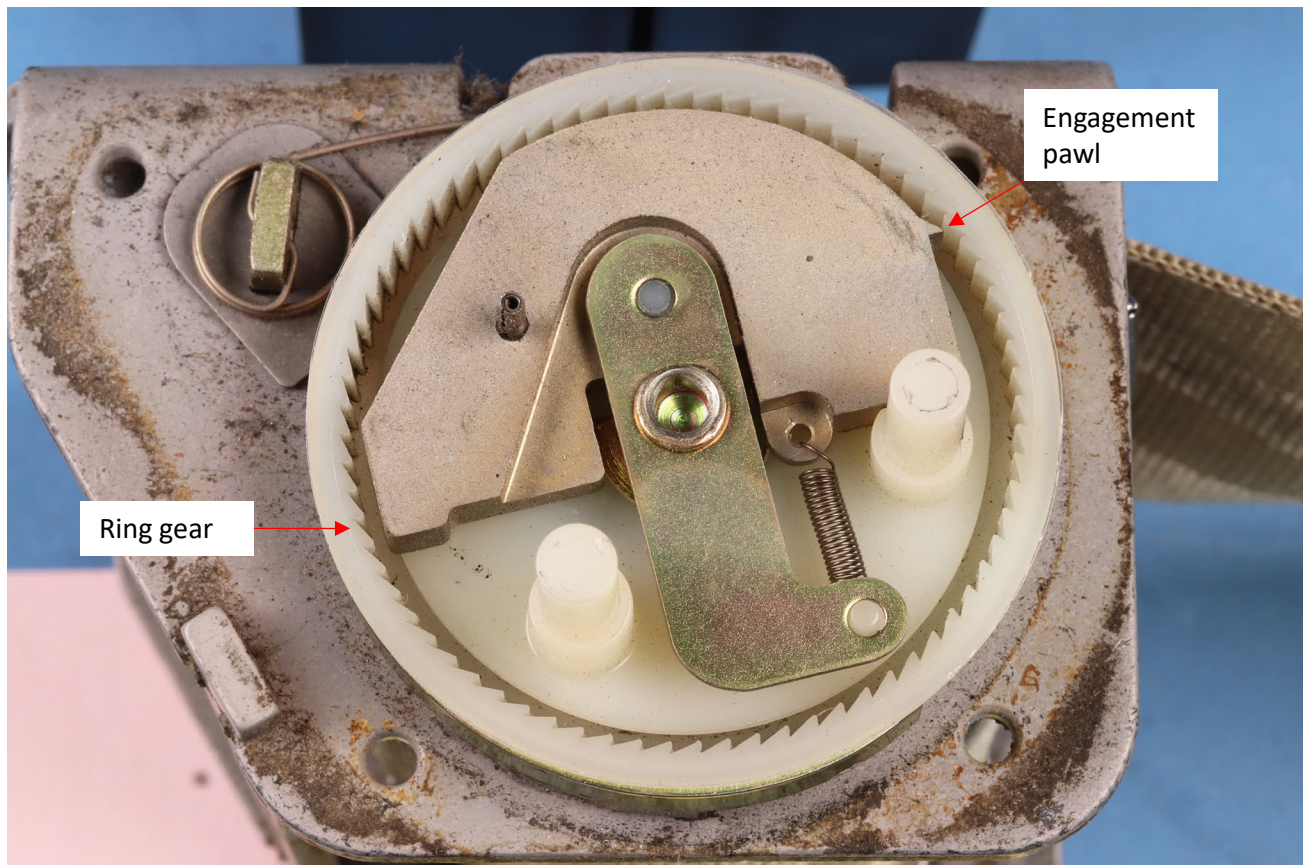


Figure 5: Close up of pilot's reel inertial locking mechanism internal components.