

Extract

**This presentation is provided for investigation purposes only.
In accordance with ICAO Annex 13, the purpose of the technical investigation is not to apportion
blame or liability.**



A109S N109EX – Wreckage Survey Follow-up **Los Angeles (CA, USA)**

December 23, 2020



AgustaWestland Products

A109S N109EX – Wreckage Survey Findings

The follow up exam of N109EX was conducted on December 15, 2020. Members in attendance were Leonardo Company, Pratt and Whitney Canada, Federal Aviation Administration, and Helinet Aviation Services. Highlights of the day's examination are included. The following information is preliminary in nature and only intended to highlight the day's activities. Please refer to the appropriate reports for accuracy.

- Leonardo.
 - Tail rotor control continuity check completed. No anomalies noted.
 - The tail rotor hydraulic servo and SAS actuator were visually examined. No anomalies noted. Hydraulic servo and SAS actuator removed and prepared for shipping for further examination.
 - The DAU was removed and prepared for shipping for data download.
 - Tail rotor assembly, rotating controls, and 90° gearbox were visually examined. The examination of the rotating controls revealed a ring nut (possibly part 109-0130-97-103) separated from the sleeve (possibly 109-0130-94-111). See enclosed photo. The 90° gearbox, tail rotor assembly, minus the paddles, and rotating controls were prepared for shipping to the NTSB Materials Lab for further examination.
- Pratt and Whitney Canada
 - Engine number 1 was visually examined. No anomalies noted. The DCU was removed and prepared for shipping to Pratt and Whitney Canada for data download.
 - Engine number 2 was visually examined. No anomalies noted. The DCU was removed and prepared for shipping to Pratt and Whitney Canada for data download.
- FAA.
 - Provided government oversight and assisted in examinations.

Update: I have received word from the NTSB recorder lab; the Appareo data card was downloaded and reviewed. The last 20 seconds of the flight were not recorded to the data card. It is hopeful this information is retained in the Appareo unit. I will be coordinating with Helinet to recover the Appareo unit and ship it to the NTSB recorder Lab. It is regretful that this information was not available yesterday when all hands were at the helicopter.

Respectfully

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Based on the above findings, LH takes the opportunity to highlight that the following cases events associated to loss of T/R control resulting from installation issues of the Ring Nut were notified, investigated and managed in the past:

- 1 A109LUH S/N XXXXXXXX– 15th December 2010**
- 2. A109E S/N XXXXXXXX - 1st October 2011**
- 3. A109C S/N XXXXXXXX– 9th May 2012**
- 4. A109E S/N XXXXXXXX- 21th October 2014**

A109LUH XXXXXX– 15th December 2010



A109E XXXXXX - 1st October 2011

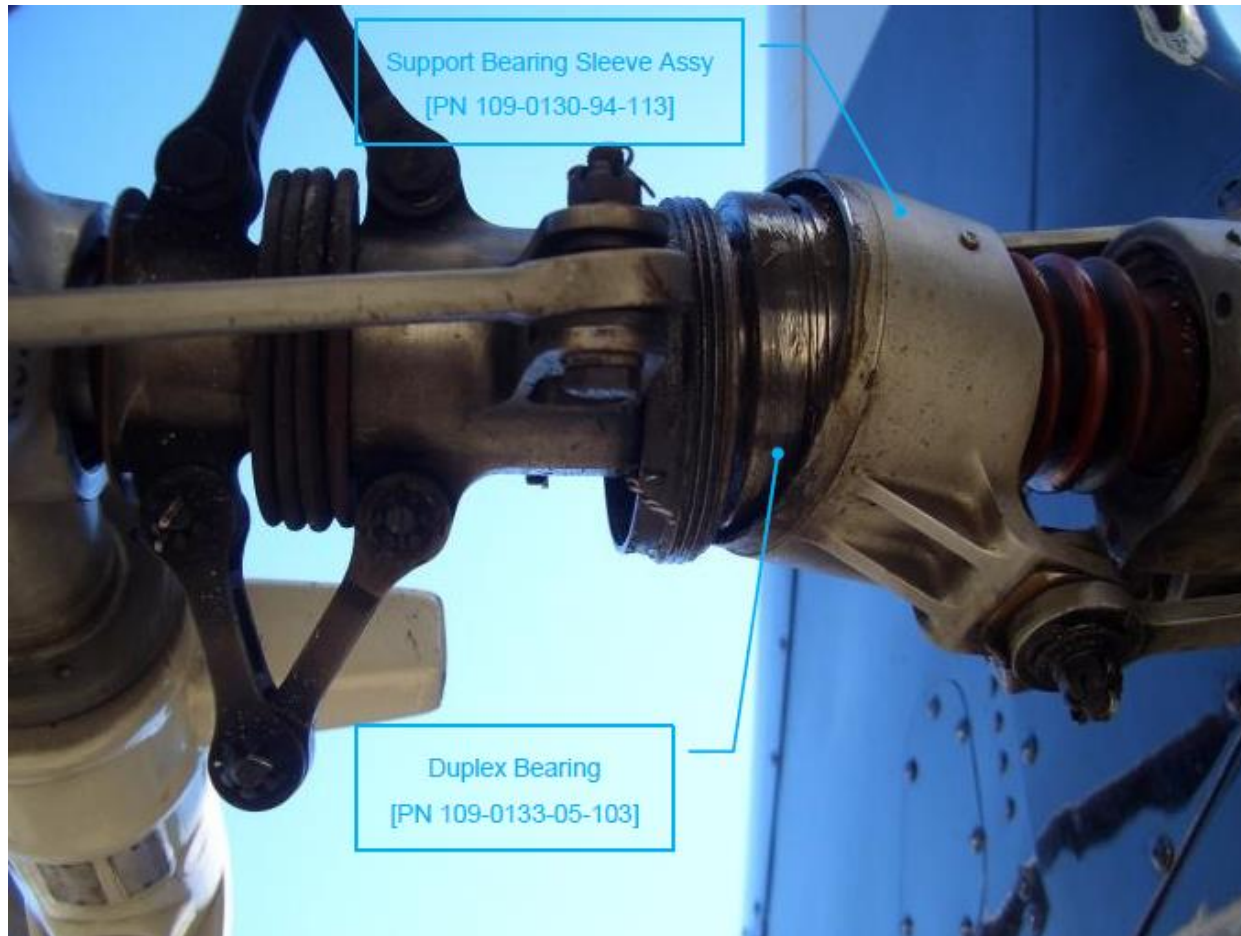


Company Internal

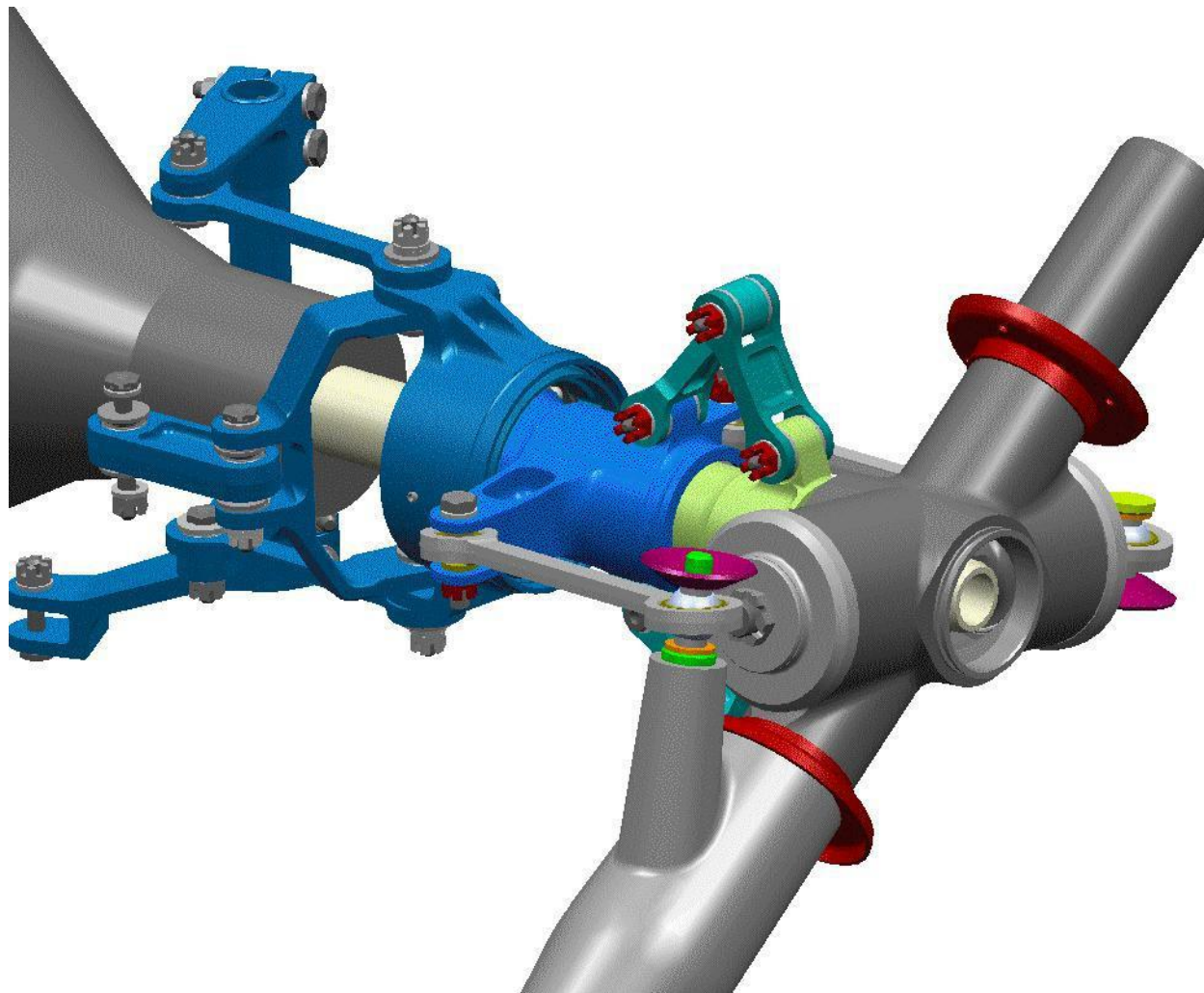
A109C XXXXXX – 9th May 2012



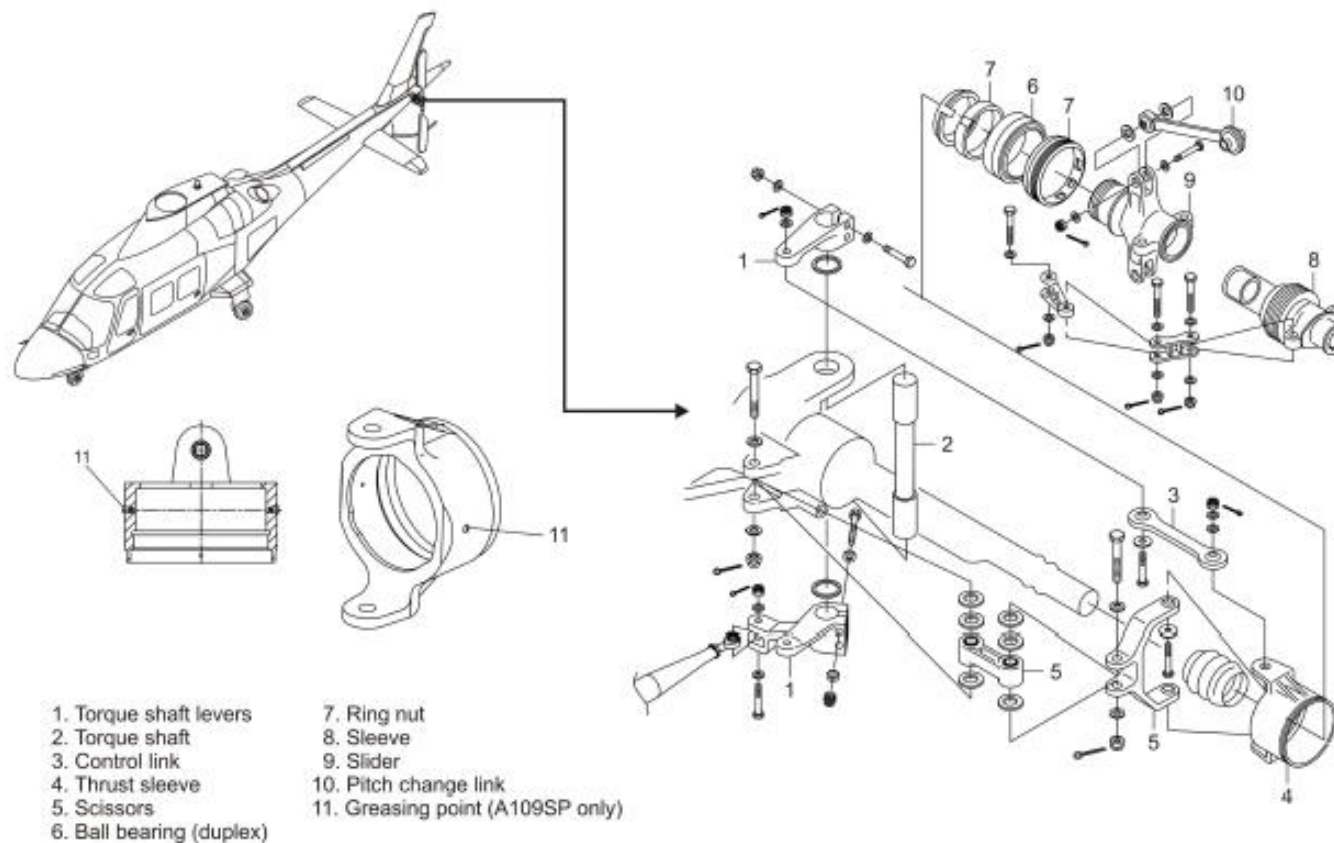
A109E XXXXXX – 21th October 2014



TAIL ROTOR ROTATING CONTROLS INSTALLATION



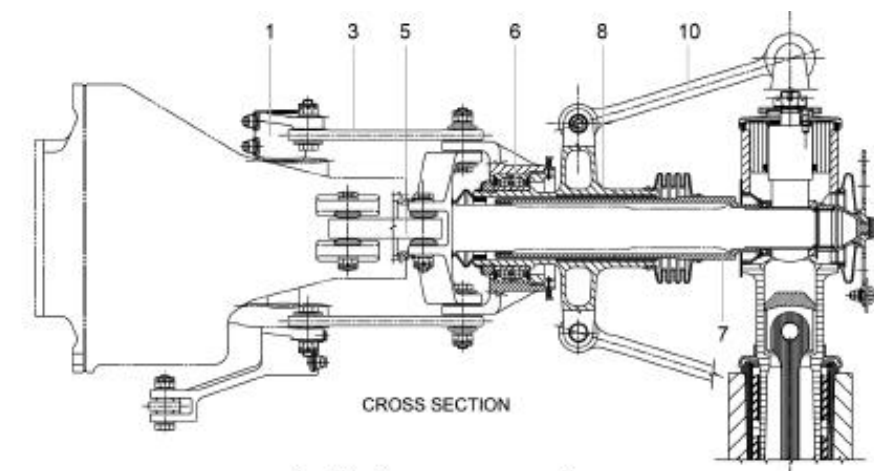
TAIL ROTOR ROTATING CONTROLS INSTALLATION



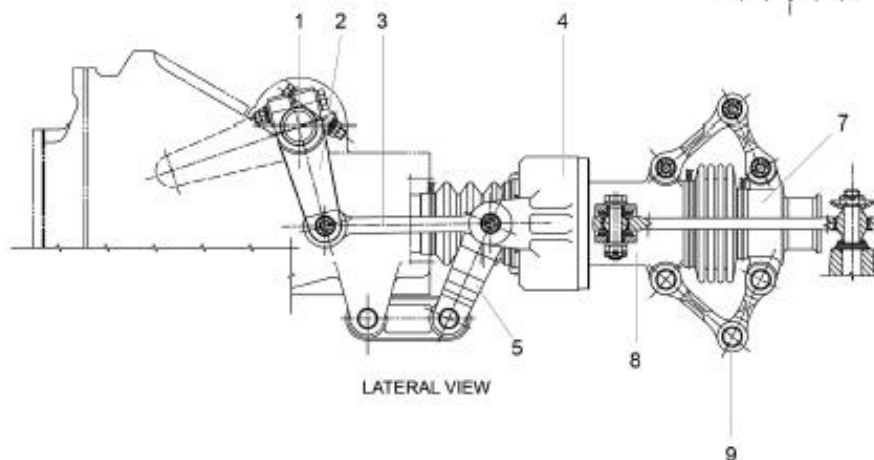
TAIL ROTOR PITCH CHANGE MECHANISM

ICN-ZK-A-643000-G-A0126-00525-A-01-1

TAIL ROTOR ROTATING CONTROLS INSTALLATION



CROSS SECTION



LATERAL VIEW

1. Torque shaft
2. Torque shaft levers
3. Control links
4. Thrust sleeve
5. Scissor assembly
6. Thrust bearing
7. Sleeve
8. Slider
9. Scissor system (double)
10. Pitch change links

TAIL ROTOR PITCH CHANGE MECHANISM

ICN-ZK-A-643000-G-AD126-00524-A-02-1

Corrective actions

- After the first three cases the following corrective actions applicable to all A109 variants have been defined:
 - The applicable MMs have been updated for:
 - Increase the ring nut torque value.
 - Dual lockwire application.
 - No° 4 of Loctite drops to be applied on ring nut.
 - Add a note to ensure that duplex bearing is properly seated against housing shoulder.
 - Improve the figure of locking ring (duplex bearing) installation.
 - Improve the cleaning (MM prescribes a cleaning of the threads with solvent before reassembling) and greasing operation of the duplex-bearing.

Corrective actions

- For the involved fleets the mandatory BTs ([109-134](#); [109K-54](#); [109EP-121](#); [109S-48](#); [109SP-51](#)) have been published requiring to perform:
 - One-time inspection to verify the presence and the conditions of the two locking wires securing the tail rotor duplex bearing locking nut P/N 109-0130-97-101/-103 to the housing (compliance: Within and not later than 5 (five) flight hours after the receipt of the BT).
 - Periodic inspection (every 25FH) to verify the conditions of the two locking wires until the compliance with the following part.
 - Disassemble and reassemble of the of the housing and slider group of the tail rotor rotating controls to perform the installation in accordance with maintenance manual improved instruction.
 - The BT's have been endorsed by the [EASAAD n° 2012-0195-E](#).
 - The [EASA AD n° 2012-0195-E](#) has been endorsed by the [FAA AD 2014-02-08](#), which consider the “Disassembly and reassembly” as Terminating Action to the AD.

Corrective actions

- Since FAA issued AD 2014-02-08 (January 31, 2014), a failure of a T/R duplex bearing ring nut installation occurred after the housing and slider group of the T/R rotating controls had been reassembled ([4th event occurred on A109E XXXXXX – 21th October 2014](#)).
- Therefore, FAA superseded the AD 2014-02-08 with the [AD 2015-11-08](#) to **remove the “Disassembly and reassembly” as Terminating Action.**
- Because of this additional event of the loosening of the bearing locking nut, FAA also retains the 25-hour inspection.
- **FAA also requires a daily pilot check** to enhance detection of an impending failure of a T/R duplex bearing ring nut installation.

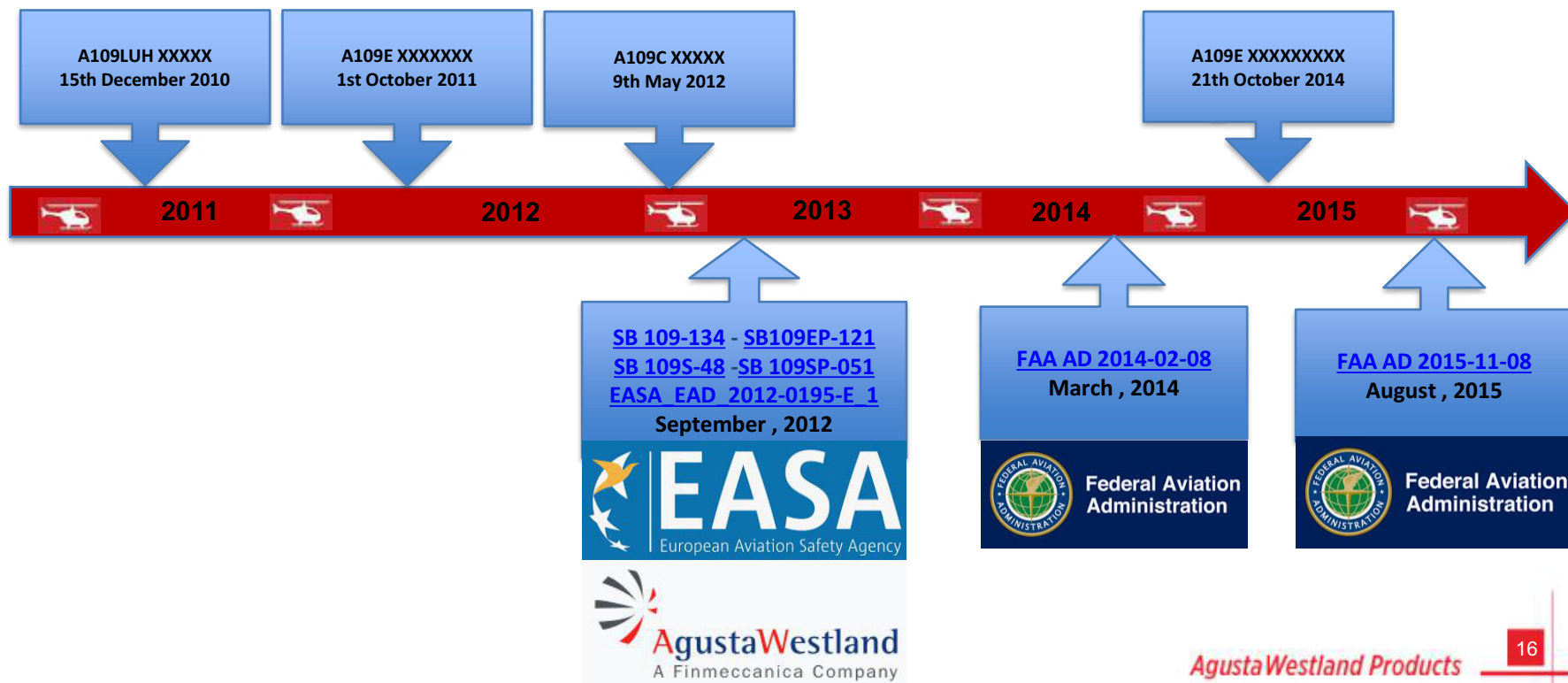
Comments to Corrective actions

- **EASA has not changed any of the requirements in its AD, and LHD has not revised its service information because the cause of the occurrence has been deemed to be consistent with poor maintenance tasks accomplishment.**
- The detailed LHD failure analysis investigation has been focused on These main findings:
 - signs of seizure on the threads of the Support Bearing Sleeve Assy and on the threads of the Locking Nut
 - a worn footprint on the bottom surface of the Locking Nut
 - presence of metallic material and poor cleaning on the treaded zones
- The seizure signs were consistent with the tightening phase. As a consequence of the seizure, the resultant tightening torque resulted insufficient in packing together the Nut-Sleeve-Duplex assembly. The seizure in fact might have led to a gap remaining between the Nut and the Duplex outer ring or insufficient torque to guarantee the correct assembly under operating vibration environment.

Comments to Corrective actions

- The significant quantity of Loctite® found on the Locking Nut threads, compared to the one found inside the Support Bearing Sleeve Assy, suggested a poor cleaning of the Locking Nut before assembling. The Loctite® mixed with metallic material from wear could be cause one side of the observed seizure, and on the other of an insufficient friction and torque retention. **The cleaning of the threads is a task prescribed by the MM.**
- The locking wires failure has been considered subsequent to the tightening torque loss and caused by the vibrations.
- **The poor surface and cleaning preparation leading to the seizure has been the most probable cause of the occurrence.**
- **The MM assemble procedure has been validated and found correct and adequate to identify an incorrect assembly of Support Bearing Sleeve Assy, Duplex Bearing and Locking Nut group.**

TIME LINE



Possible Next Steps for the Investigation

- Evaluation of the Maintenance Records to verify when and how the last maintenance task on the Ring Nut and the Bearing was performed;
- Verification of the Correct Installation of the Duplex Bearing in the Housing and Slider Group;
- Evaluation of the holes for signs of lock wires installation (2 positions);
- Evaluation of presence signs of seizure on the threads of the Support Bearing Sleeve Assy and on the threads of the Locking Nut;
- Verification of worn footprint presence on the bottom surface of the Locking Nut;
- Verification of Loctite presence.
- Verification of correct cleaning an assembly process.