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# A350 NLG

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Steering & Operating Noise

# LIEBHERR

Liebherr-Aerospace



# **AGENDA**

- **IMPACT FOR THE OPERATOR**
- **FIELD STATUS & OVERVIEW**
- **AFFECTED COMPONENTS**
- **INVESTIGATION AND ROOT CAUSE**
- **IN-SERVICE SOLUTION**
- **FINAL SOLUTION**
- **TIMELINE**

Steering Noise

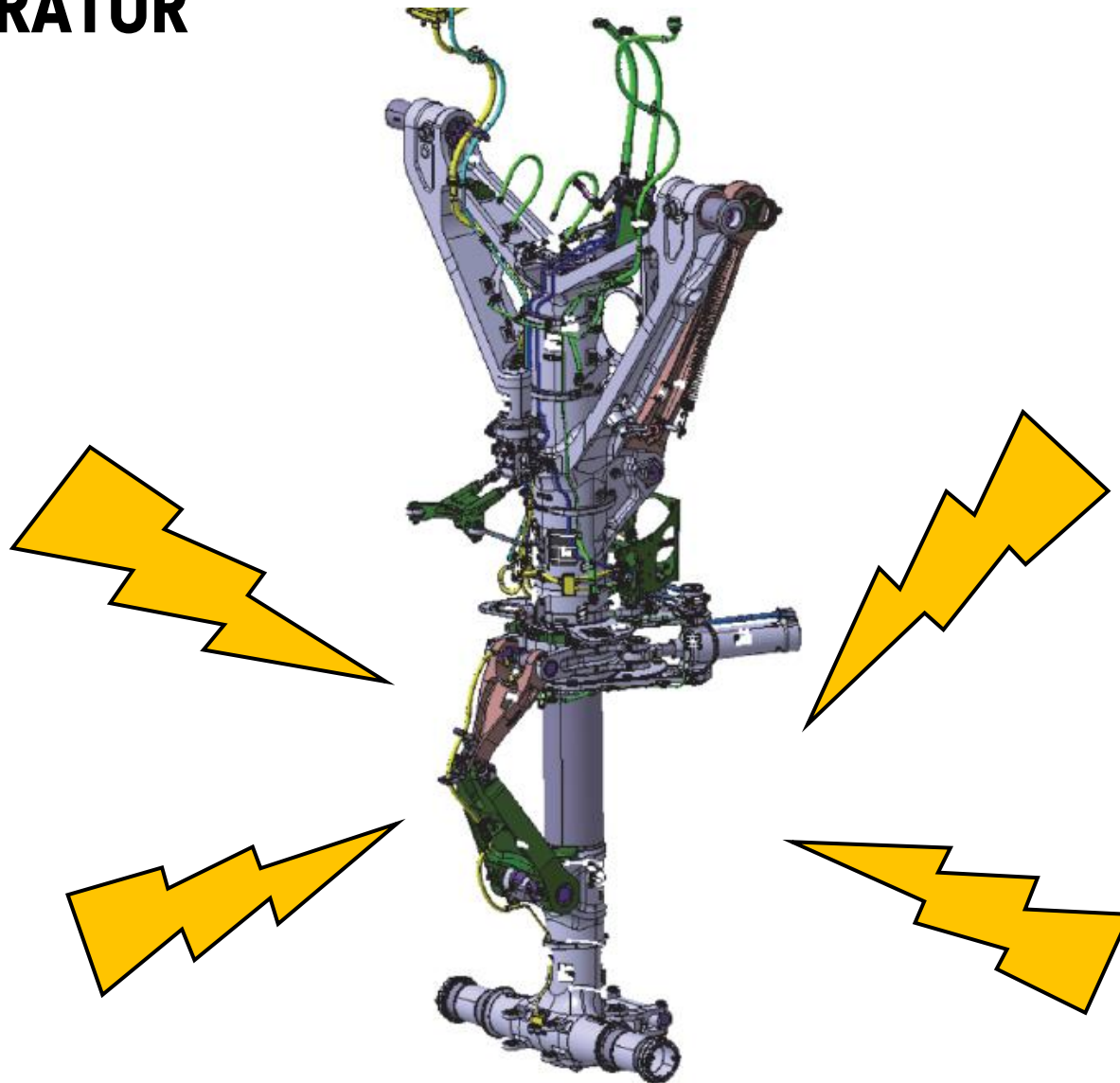
# IMPACT FOR OPERATOR

Noise during

**Taxiing**

**Take off**

**Landing**

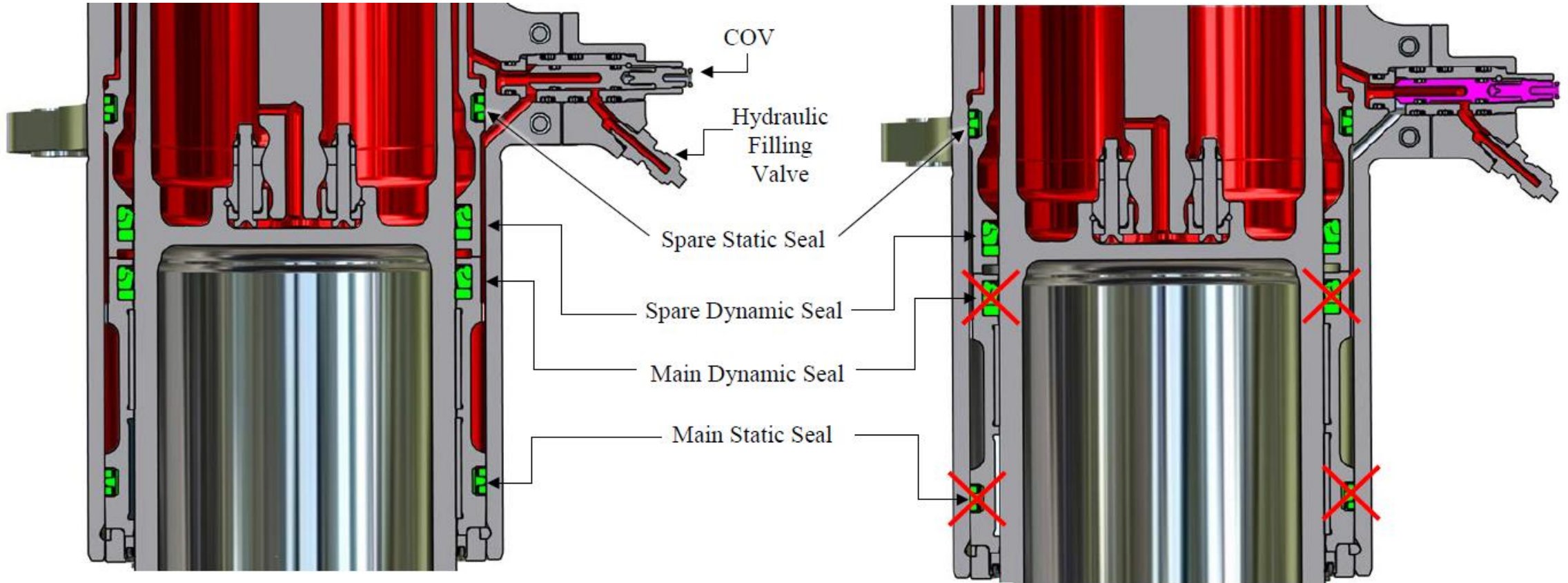


# FIELD STATUS & OVERVIEW

- 56 Aircraft were affected by noise
- 630 NLGs delivered ~ 9% noise
- Noise observed on PN: 6405 & PN: 5310 series (Common & EIS)
- Entry Into Service main fitting not affected (4816A0000-xx) (steel 300M carrier)

A/C Type	TechRequest	LLI Part Number	LLI Serial Number	First Occurrence Date	Current Seal Status (on Main or Spare)	First Flight	Cycles @ Occurrence Date	FH @ Occurrence Date	Status
-1000	80849257	6405A0000-01	LLI500105	February 2020	secondary	18/05/2018	1187	TBD	NLG REPLACED
-900	80849257	6405A0000-06	LLI000208	July 2020	primary	18/04/2017	1993	13829	NLG IN-SERVICE
-1000	80849296	6405A0000-06	LLI500156	September 2020	secondary	09/01/2019	1012	6972	NLG IN-SERVICE
-1000	80856599	6405A0000-01	LLI500109	November 2020	secondary	03/05/2018	~ 1500	TBD	NLG REPLACED
-900	80849445	5310A0000-06	LLI000177	November 2020	secondary	10/04/2017	~ 2900	TBD	NLG IN-SERVICE
-1000	80856593	6405A0000-01	LLI500177	December 2020	primary	15/02/2019	~ 1000	TBD	NLG IN-SERVICE
-900	N/A	5310A0000-06	LLI000177	January 2021	secondary	24/11/2017	TBD	TBD	NLG IN-SERVICE
-900	80892257	6405A0000-02	LLI500313	June 2021	secondary	27/08/2019	TBD	TBD	NLG IN-SERVICE
-900	80912134	TBD	TBD	June 2021	primary	12/12/2018	TBD	TBD	NLG IN-SERVICE
-1000	80927307	6406A0000-01	LLI500104	June 2021	secondary	16/02/2018	TBD	TBD	NLG IN-SERVICE
-1000	80932054	6405A0000-xx	TBD	June 2021	secondary	23/04/19	TBD	TBD	NLG IN-SERVICE
-900	N/A	4816A0000-06	TBD	June 2021	secondary	06/05/16	TBD	TBD	NLG IN-SERVICE
-900	N/A	4816A0000-06	4816A00LI000204	July 2021	TBD	11/05/17	TBD	TBD	NLG IN-SERVICE
-900	N/A	4816A0000-06	4816A00LI000226	April 2021	secondary	11/07/17	1919	17081	NLG IN-SERVICE
-900	80939048	TBD	TBD	July 2021	TBD	TBD	TBD	TBD	NLG IN-SERVICE
-900	80963144	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NLG IN-SERVICE
-900	80965180	TBD	TBD	September 2021	TBD	TBD	TBD	TBD	NLG IN-SERVICE
-900	80970105	TBD	TBD	September 2021	TBD	TBD	TBD	TBD	NLG IN-SERVICE
-900	80984168	TBD	TBD	Oct 2021	TBD	TBD	TBD	TBD	NLG IN-SERVICE
-900	80991208	TBD	TBD	November 2021	TBD	TBD	TBD	TBD	NLG IN-SERVICE
-900	TBD	4816A0000-06	4816A00LI000208	Februar 2018	TBD	TBD	2347	15198	NLG IN-SERVICE

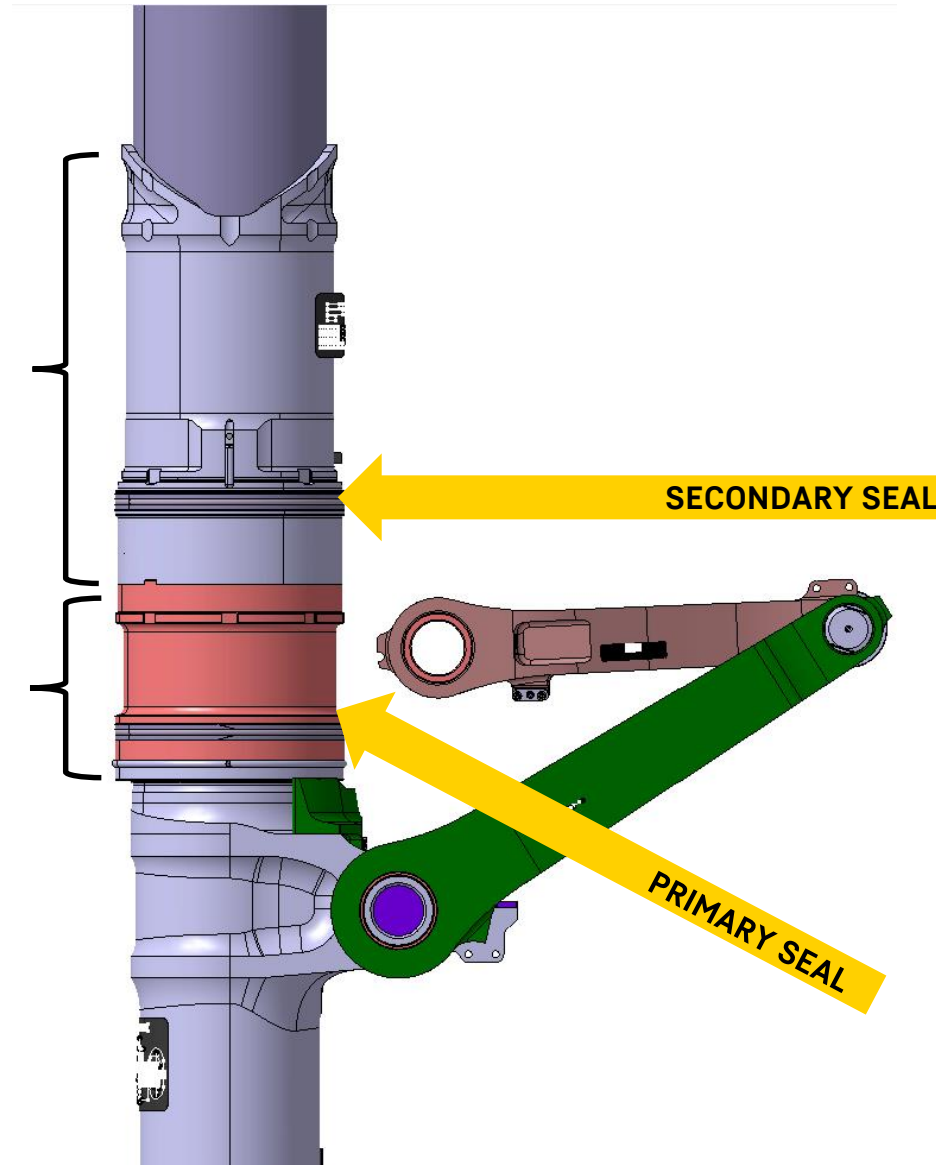
# AFFECTED COMPONENTS



## AFFECTED COMPONENTS

**Upper Carrier  
(Contains Secondary  
Sealing System)**

**Lower Carrier  
(Contains Primary  
Sealing System)**



Components in detail ref.:

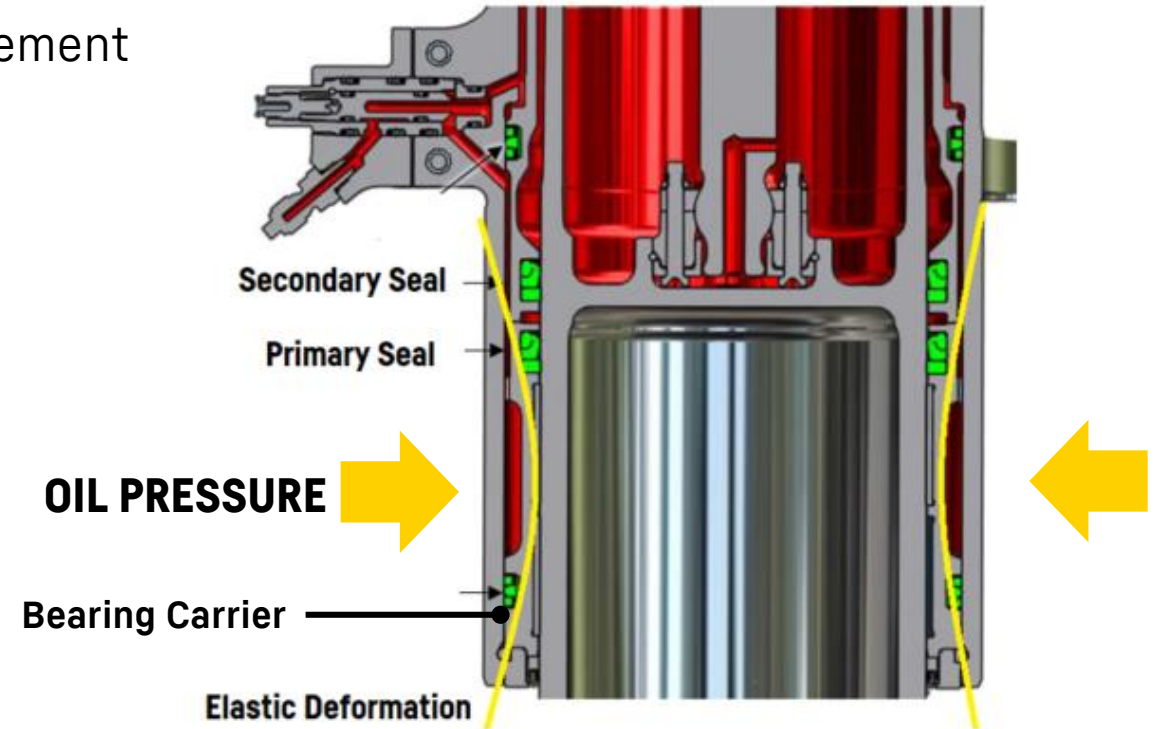
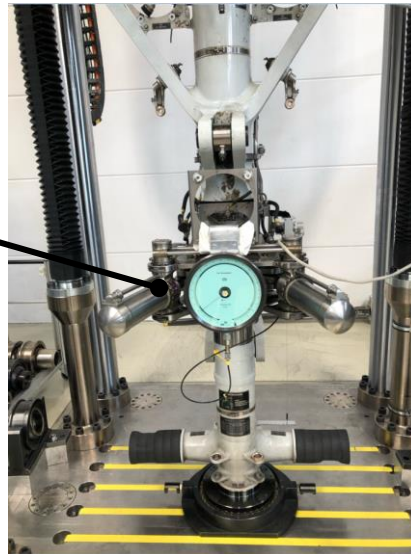
Liebherr CMM 32-22-01

Liebherr CMM 32-21-01

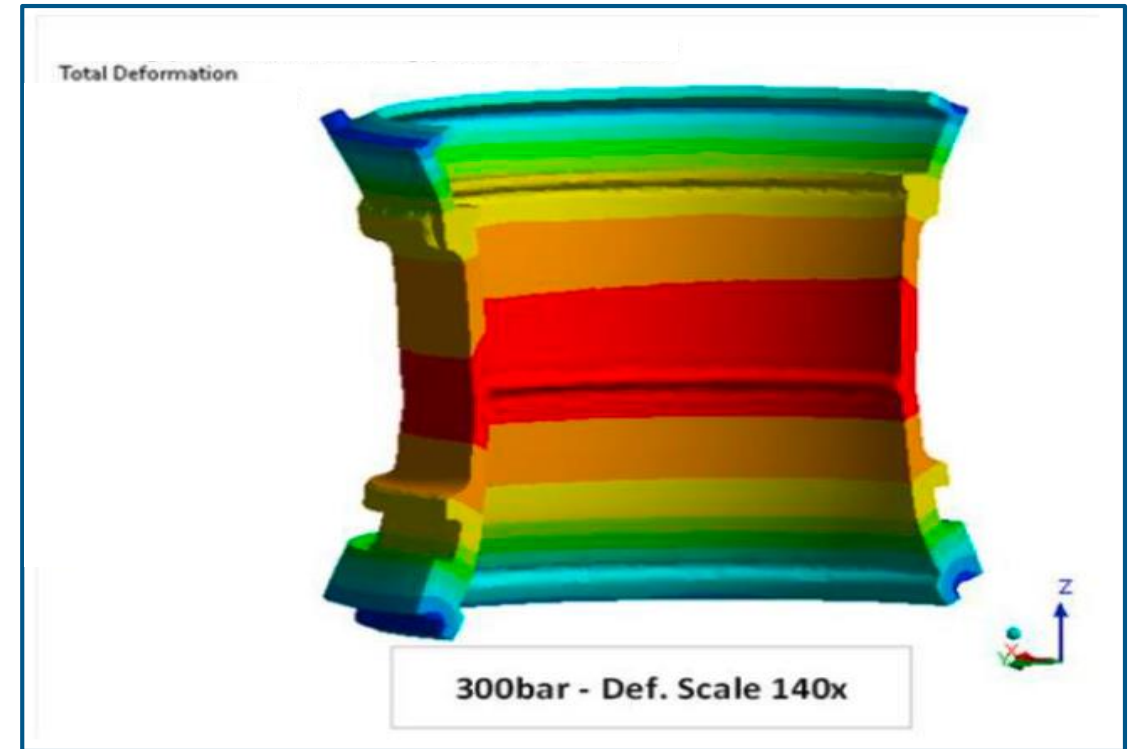
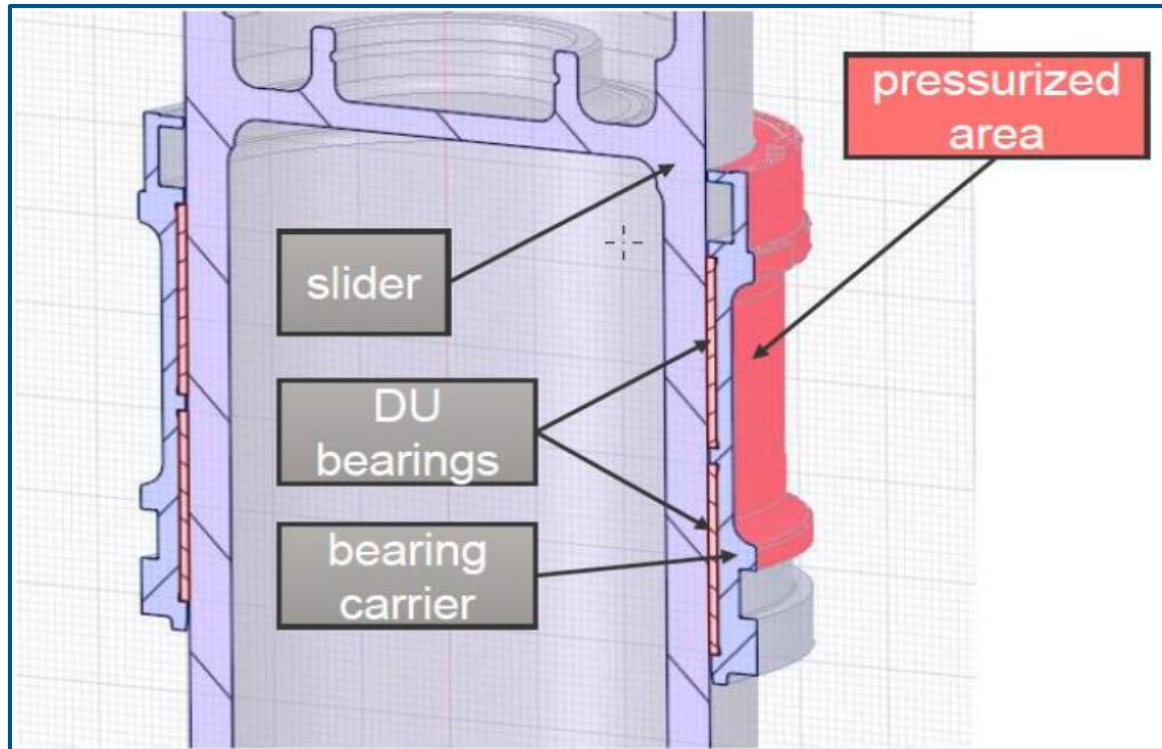
# INVESTIGATION AND ROOT CAUSE

- No noise / no elastic deformation on bearing carrier (A/C unloaded)
- Elastic deformation on bearing carrier with high oil pressure (A/C loaded)
- Noise confirmed for the investigated NLGs @ LLI Test Rig
- Noise confirmed for turning and/or damping movement

**OIL PRESSURE MEASUREMENT**



# Investigation



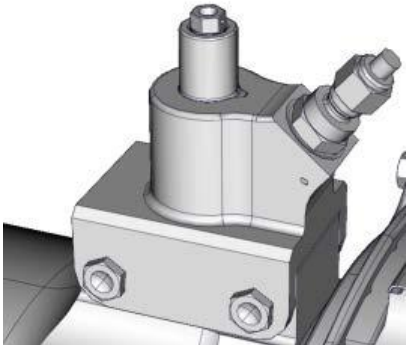


## IN-SERVICE SOLUTION

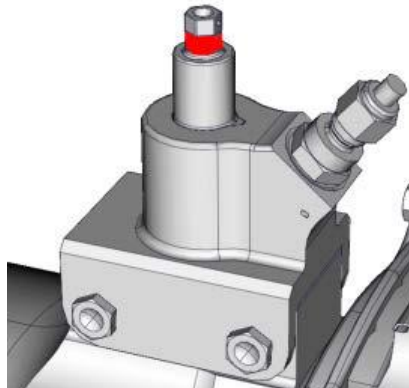
- Activation of secondary seal in weight off wheels conditions (on jacks) per MP Task **A350-A-32-21-73-02001-132A-A** , this restores nominal behavior.
- Ref. Airbus Technical Follow Up TFU No.: 32.21.00090

**ON JACKS ONLY !**

COV is NOT Activated = red mark is not visible



COV is Activated = red mark visible



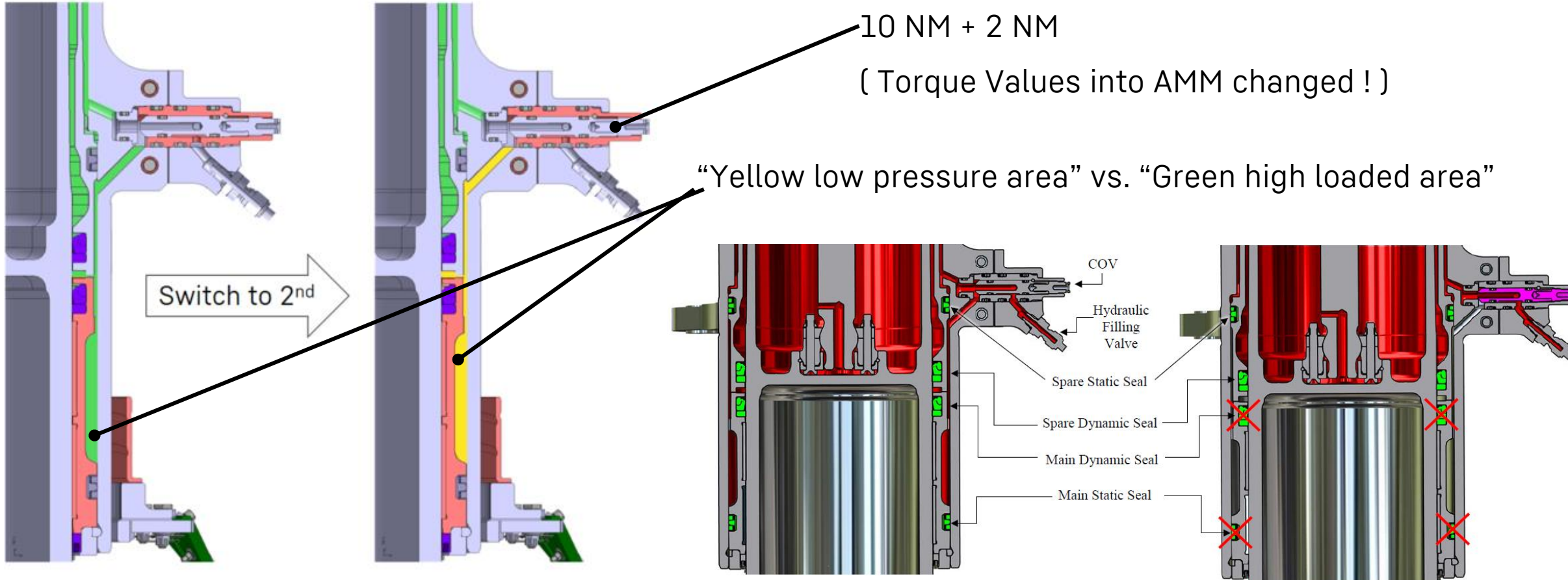
# IN-SERVICE SOLUTION

– **Switch to 2<sup>nd</sup> seal eliminates pressure effects**

10 NM + 2 NM

( Torque Values into AMM changed ! )

“Yellow low pressure area” vs. “Green high loaded area”

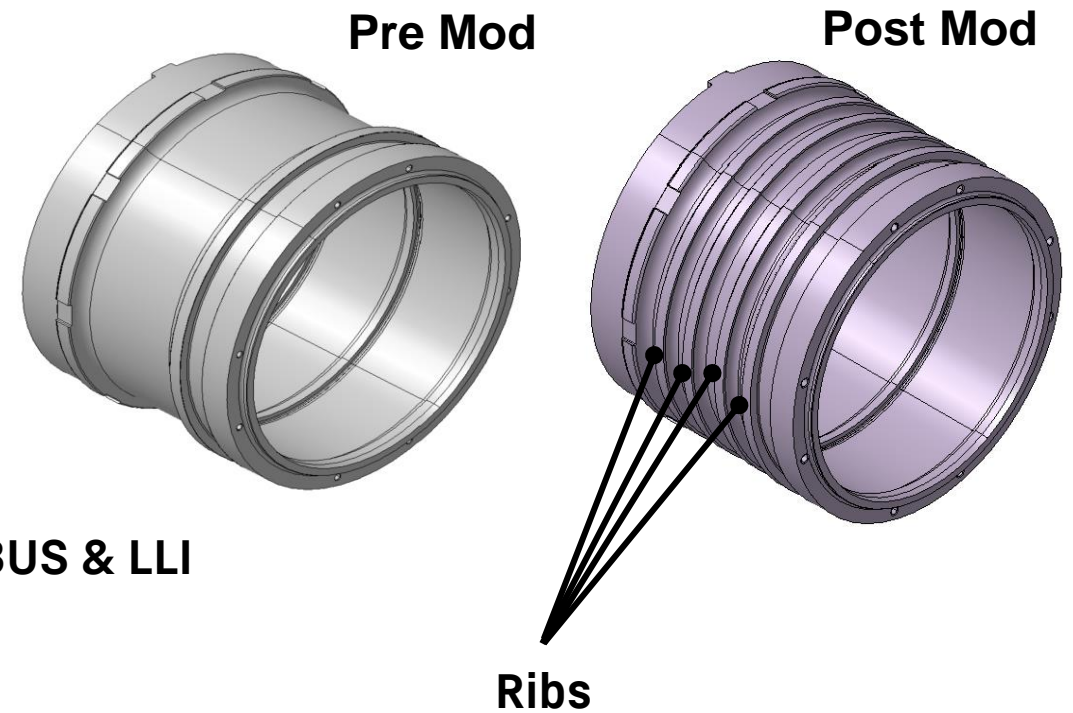


# FINAL SOLUTION

Modification of bearing carrier to minimize the load effect at “high compressions” SATs

Currently the following design options are in discussion:

- Change of bearing clearance (higher gap)
- Stiffening of bearing carrier (additional ribs)
- Material change for common gear carrier



**Modifications are currently under review between AIRBUS & LLI**

# TIMELINE

