



Bearing Failure Analysis

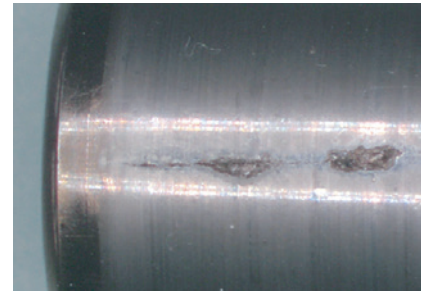
Lufthansa Technik operates a one-stop shop for MRO Laboratory Services covering analytical investigations across all aviation materials and substances. With bearings playing a vital role in all aircraft systems, bearing failure analysis can be essential for system reliability and safety.

A typical aircraft contains a large number of bearing systems of different kinds. A variety of damage and bearing failures can occur during operation. The Lufthansa Technik Central Laboratories Service Team specializes in the failure analysis of aircraft materials and component types. By comprehensively evaluating aged, defective and damaged aircraft bearing parts, the metallurgical analysis lays bare all the facts necessary to ascertain the likely root cause of the failure mechanism. At the same time advice is given on how to prevent future damage.

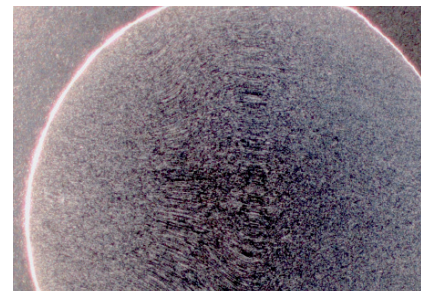
The Lufthansa Technik Central Laboratories Service Team possesses extensive know-how and several decades' experience of failure analysis ever since the beginning of the jet age. Drawing on a wealth of experience of typical features of bearing failures, the root cause of the failure can be attributed, for example, to improper bearing assembly or maintenance, a production or manufacturing problem or specific aircraft operating conditions.

With its metallographic and technological equipment, the expert team performs high-quality investigations in accordance with specific Lufthansa Technik and pertinent international standards. The bearing failure analysis consists of all the steps required to identify typical causes of failure, such as fatigue, fracture, corrosion, erosion, deformation or wear. In co-operation with Lufthansa Technik's Aircraft Fluid Monitoring Laboratory even the interaction with the lubricant and its condition are considered as part of the analysis.

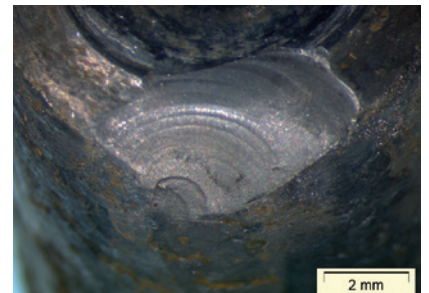
An extract from the destructive and non-destructive test and examination methods used in a bearing failure analysis for the purposes of determining the root cause of failures is provided below.



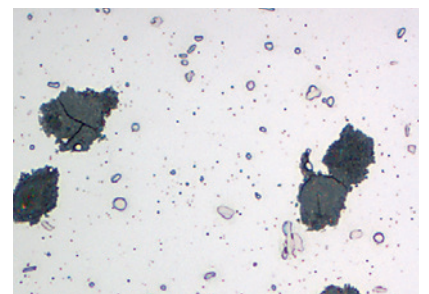
Spallation effects on surface



Bearing ball forging structure (potential fabrication defect)



Fatigue fracture of the outer race



Non-metallic material inclusions

Contact

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Examinations	Specifications
<p>1. Material composition and identification</p> <p>Lufthansa Technik is able to identify the composition of metallic and plastic/composite materials using several methods:</p> <ul style="list-style-type: none"> • Energy Dispersive Analysis by X-ray (EDX) • Optical Emission Spectroscopy (OES, ICP-OES) • Fourier Transformation Infrared Spectroscopy (FTIR) for non-metal bearing components or residuals 	<p>The complete bearing – preferably with the relevant oil sample – is requested for the initial system inspection and sampling.</p>
<p>2. Material condition</p> <p>To evaluate the material condition Lufthansa Technik performs various tests, such as:</p> <ul style="list-style-type: none"> • Hardness tests or micro-mechanical tests • Metallographic examination • (if necessary and available: Fluid analysis) 	<p>Lufthansa prepares laboratory samples of the bearing parts to perform the mentioned investigations.</p>
<p>3. Component failure, surface and profile</p> <p>To investigate the material surface and profile, Lufthansa Technik uses a range of microscope equipment from light-optical technologies to Scanning Electron Microscopy (SEM) in combination with other metallographic examinations to:</p> <ul style="list-style-type: none"> • identify relevant surface profiles, • achieve a high-resolution documentation of fracture structures, • evaluate the fine granulation, phase distribution 	<p>Lufthansa Technik prepares laboratory samples of the bearing for investigation.</p>
<p>4. Failure report and documentation</p> <p>In the last step Lufthansa Technik provides a detailed failure report.</p>	<p>The report correlates findings and provides conclusive results, and if applicable, recommendation.</p>

How-to guide	Shipping address:	Required information:
<p>If you are interested in trying our service, we suggest that you proceed as follows:</p> <ol style="list-style-type: none"> 1. Contact our Laboratory Service team for any question regarding your component and tribological system failure. 2. We will send you an estimate of the cost of performing your individual failure analysis. 3. We recommend that your samples are firmly sealed and clearly labelled. The checklist below may help you with preparing the component shipment. 	<p>Lufthansa Technik AG Laboratory Services Bearing Failure Analysis Department HAM TQ/M-M Building 250, Room 241/Bhf. 36 Weg beim Jäger 193 22335 Hamburg, Germany</p>	<ul style="list-style-type: none"> • Customer/operator/part number • Aircraft registration • Engine type (if applicable) • Engine S/N (if applicable) • Bearing position (e.g. bearing#4, AGB bearing) • Bearing P/N and S/N • Failure history <p>if available:</p> <ul style="list-style-type: none"> • Related tribological oil/grease sample • Excerpt of relevant CMM <p>Supplementary:</p> <ul style="list-style-type: none"> • Purchase Order • Contact information incl. e-mail address