
Foreword

The safety of aircraft engines has reached a high degree. However, the ever-increasing number of aircraft necessitates continual effort in order to reduce the absolute number of engine problems. This book is intended to give professionals who deal with the safety of turbine aircraft engines an overview of engine-related problems. The reader should become able to recognize the complex relationships that are typical for the subject matter, and be able to ask the right questions, provide correct answers, and be able to analyze these properly.

In my opinion, there is no better approach than the analysis and evaluation of incidents relating to safety, since the maxim „learn from damage“ still holds true. I have asked myself how it might be possible to impart this experience, which can only be gained from actual practical work in the field. Therefore, I have attempted to take examples from technical literature and analyze and explain them, relying on many years of practical experience and an understanding of the technical backgrounds.

This particular type of book was chosen in order to increase the effectiveness of the learning progress, present the complex relationships in an understandable manner, and motivate the reader. It relies to a large degree on visual depictions and is similar to overhaul manuals used in turbine engine-related fields. Concise explanations and labels based on my experience and evaluations of the subject matter of diagrams are intended to pique the readers interest. This may be the first time that the familiarity of current generations with comics as an explanatory media has been applied to a comprehensive technical text.

The possibility, that I may have misinterpreted documents in individual cases and/or that flawed or vague data may have influenced the analysis of factors, cannot be absolutely ruled out. In case the reader has any evidence pertaining to actual cases dealt with in this book, I will do my best to incorporate this into later editions.

I thank my wife Dr. Daniela Rossmann for her years of patient understanding and support, and also for her many helpful recommendations concerning design. This book would never have been possible without her support.

Axel Rossmann

Contents

Foreword

1. Introduction

2. Trends and Statistical Observations

3. Superordinate Issues

4. Aircraft Accident Investigation

4.1 Reports

4.1.1 Recommendations for Evaluating Reports

4.2 Operating Data

4.2.1 Recommendations for Incorporating Operating Data

4.3 Reconstruction

4.3.1 Recommendations for Reconstructing Damage Processes

4.4 Reproduction

4.4.1 Recommendations for Reproducing Damage

4.5 Damage Sequences

5. External Factors

5.1 Weather

5.1.1 Rain

5.1.1.1 Measures Against Problems due to Water Ingestion

5.1.2 Hail

5.1.2.1 Measures Against Problems due to Hail

5.1.3 Lightning

5.1.3.1 Measures Against Lightning Damage

5.1.4 Ice

5.1.4.1 Measures Against Ice Damage

5.1.5 Surrounding Temperatures

5.1.5.1 Measures Against Damage due to Surrounding Temperatures

5.1.6 Turbulence

5.1.6.1 Measures Against Damage due to Turbulence

-
- 5.2 Foreign Object Damage (FOD)
 - 5.2.1 Damage due to (non-biological) Foreign Objects
 - 5.2.1.1 Fundamentals and Damage Mechanisms
 - 5.2.1.2 Ingestion of Foreign Objects
 - 5.2.1.3 Foreign Object Types
 - 5.2.1.4 Measures Against Foreign Object Damage
 - 5.2.2 Bird Strikes
 - 5.2.2.1 Bird Strike Damage
 - 5.2.2.2 Bird Strike Damage Processes
 - 5.2.2.3 Constructive and Technological Influences on Bird Strike Behavior
 - 5.2.2.4 Measures Against Bird Strike Damage
 - 5.3 Erosion
 - 5.3.1 Erosion Mechanisms
 - 5.3.2 Erosion Damage
 - 5.3.3 Measures Against Erosion Damage
 - 5.4 Corrosion
 - 5.4.1 Corrosion without Mechanical Loads
 - 5.4.1.1 Corrosion Fundamentals
 - 5.4.1.2 Corrosion Damage
 - 5.4.1.3 Measures Against Corrosion Damage
 - 5.4.2 Stress Corrosion Cracking (SCC)
 - 5.4.2.1 Fundamentals of Stress Corrosion Cracking
 - 5.4.2.2 Damage due to Stress Corrosion Cracking
 - 5.4.3 Corrosion Fatigue
 - 5.4.3.1 Fundamentals of Corrosion Fatigue
 - 5.4.3.2 Damage due to Corrosion Fatigue
 - 5.4.4 Hydrogen Embrittlement
 - 5.4.4.1 Fundamentals of Hydrogen Embrittlement
 - 5.4.4.2 Damage due to Hydrogen Embrittlement
 - 5.4.4.3 Measures Against Damage due to Hydrogen Embrittlement
 - 5.4.5 Hot Gas Corrosion
 - 5.4.5.1 Fundamentals of Hot Gas Corrosion
 - 5.4.5.2. Damage due to Hot Gas Corrosion
 - 5.4.5.3 Measures Against Damage due to Hot Gas Corrosion
 - 5.5 Special Media (Unusual Influences)
 - 5.5.1 Measures for Preventing Unusual Influences

Index
