

Stress, Pressure and Fatigue on Aircraft Maintenance Personnel

Luis F. F. M. Santos^{1,2}, R. Melicio^{2,3,4}

Abstract – This paper focuses on an analysis of the stress, the pressure and the fatigue as part of the Dirty Dozen and Human Factors procedures. An online international survey has been carried out to ascertain the professional levels of the fatigue, the stress and their pressure exposure. This work is a contribution to the aeronautical safety in order to alert authorities about the stress, the pressure and the fatigue that aircraft maintenance personnel suffers. Safety is the main driver in aviation related professions. Maintenance related personnel is constantly subjected to several external circumstances that might originate errors in the performance or evaluation in maintenance related tasks. Authorities have clearly regulated flight crew and air traffic controllers working and resting periods, but maintenance personnel regulations do not reflect the same procedures. The Aeronautical industry 4.0 with the upcoming digital transformation will increase the safety margin and it will reduce the aircraft maintenance ground time. Copyright © 2019 Praise Worthy Prize S.r.l. - All rights reserved.

Keywords: Maintenance, Human Factors, Stress, Fatigue, Pressure, Aviation, Annex 19, Dirty Dozen, Part-145, Part-M, Safety

Nomenclature

MOM	Maintenance Organization Manual
EASA	European Aviation Safety Agency
ICAO	International Civil Aviation Organization
FAA	Federal Aviation Administration
LAM	Linhas Aéreas de Moçambique
AOG	Aircraft on Ground
SMS	Safety Management System
FRMS	Fatigue Risk Management System

1. Introduction

Air transport is considered to be the safest method of transport [1], [2], due to the close interaction between aeronautical authorities, aviation industry (aircrafts), operators and aircraft maintenance industry [3]. As aircrafts become more reliable, humans have played a progressively more important causal role in aviation accidents [4]. Hence, aviation safety is the major concern and it is one of the principal drive factors of the civil aviation industry and regulatory purposes. Since the beginning of air transport, the need of rules and regulations have driven the aviation industry towards safer, and more reliable technologies and procedures.

The aircraft maintenance is a complex system, that requires sustained coordination, communication and cooperation between different work groups and teams including the aircraft maintenance and the airline, in order to ensure safety and efficient operations (minimizing error) [5]. Aircraft maintenance is highly regulated, safety critical, complex and competitive. There is the need to develop innovative solutions to address

process efficiency without compromising safety and quality [5], particularly with regard to the work hours of maintenance personnel. It is not proper to talk about safety if the Flight Crew rests for 12 hours while the maintenance team works 16 hours or more. In [6] the aviation safety depends on minimizing error in all the facets of the system. While the role of flight deck human error has always received much emphasis, recently, more attention has been directed towards reducing human error in maintenance and inspection. Aviation maintenance and inspection tasks are part of a complex organization, where individuals perform different tasks in an environment with time pressures, sparse feedback, and sometimes difficult ambient conditions. These situational characteristics, in combination with generic human erring tendencies, result in different forms of error. In [7] a study on the mental workload in pilots is conducted. It shows a method to evaluate the mental distress and its affect on the eye pupils. This study has brought new insights to the pilot's performance during high mental workload. In [5] authors have also confirmed that aircraft maintenance is a highly regulated, safety critical, complex industry currently facing unprecedented challenges. Pressure is on aircraft manufacturers, from their customers, to design aircraft with pushed out maintenance schedules. The first key factors to improve flight safety has been introduced by ICAO, and it leads the industry to the development of methods to eliminate the accidents/incident common causes, such as the introduction of better technology, aircraft redundancies and systems compartmentalization and segregation. With these developments, together with organizational and human factors, the aviation industry has performed an

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Countersinking Handbook LaRoux K. Gillespie, 2008 Providing discussions of cutter material variations and options feeds speeds and coolants tool holders and applications this text discusses the side effects of countersinking including stress risers It contains case histories practical tips and information to make process selection easier Damage and Fracture Mechanics Taoufik Boukharouba, Mimoun Elboujdaini, Guy Pluvinaige, 2009-08-09 The First African InterQuadrennial ICF Conference AIQ ICF2008 on Damage and Fracture Mechanics Failure Analysis of Engineering Materials and Structures Algiers Algeria June 1 5 2008 is the first in the series of InterQuadrennial Conferences on Fracture to be held in the continent of Africa During the conference African researchers have shown that they merit a strong reputation in international circles and continue to make substantial contributions to the field of fracture mechanics As in most countries the research effort in Africa is und taken at the industrial academic private sector and governmental levels and covers the whole spectrum of fracture and fatigue The AIQ ICF2008 has brought together researchers and engineers to review and discuss advances in the development of methods and approaches on Damage and Fracture Mechanics By bringing together the leading international experts in the field AIQ ICF promotes technology transfer and provides a forum for industry and researchers of the host nation to present their accomplishments and to develop new ideas at the highest level International Conferences have an important role to play in the technology transfer process especially in terms of the relationships to be established between the participants and the informal exchange of ideas that this ICF offers *BASF Handbook on Basics of Coating Technology* Artur Goldschmidt, Hans-Joachim Streitberger, 2003 The new Handbook on Basics of Coating Technology is a classic reference recently updated with 18 years worth of new technology standards and developments in the worldwide coating industry This is an indispensable reference for anyone in the industry Whether you are involved in traditional processes or the most innovative this handbook will be a critical addition to your daily routine Full of color images graphs and figures the handbook comes complete with standard tables general classification figures definitions and an extensive keyword index Both engineers and technicians will find the answers they need within its pages Instead of solving problems after the fact this handbook helps avoiding them in the first place saving time and money This reference also gives beginners and practically oriented readers a journey through the different coating segments clearly illustrated with lots of pictures It also outlines the social changes in the industry concerning environmental compatibility and toxicology which have seriously affected product development **Aerospace Health and Safety: Today and the Future** Irina Mordukhovich, Mardi A. Crane-Godreau, Eileen Mcneely, Christopher Scheibler, 2023-11-20 Aviation plays vital roles in commerce defense science and leisure travel Irrespective of the purpose of flight crew and passengers are challenged by exposure to a variety of environmental conditions that can differ widely from work and travel environments on the surface of the Earth With anticipated changes in aviation and space technology new challenges to health and safety of crew and passengers can be

expected In this Research Topic we welcome contributions from those whose work and interests are relevant to the health and safety of crew and passengers This includes but is not limited to health and safety professionals FAA examiners corporate medical officers aerospace and occupational physicians physiologists military and scientific team members public health professionals as well as engineers who are tasked with crew and passenger health and safety design projects While 4.1 billion passengers fly on commercial airlines annually and this figure is even higher when taking into account privately owned aircraft and military flight for the most part aviation is safe Passengers do arrive at their destinations with little concern to their own well being and flight is generally well tolerated However older flyers people with diagnosed or undiagnosed preexisting disease and other vulnerable passengers such as young children and pregnant women may be at risk of complications and crew may be at special risk due to the frequency and duration of their many flight related exposures Health and safety issues for crew and passengers include but are not limited to potentially severe circadian rhythm disruption potential health effects of low level cosmic ionizing radiation exposure at altitude reduced oxygen delivery and tissue hypoxia at cabin pressurization cabin air contamination by engine gases toxic materials used in uniforms and some cabin seat materials occupational noise pesticides used for cabin disinsection lack of adequate crew rest on layovers or between flights cardiovascular demands of flight and effects of flight related dehydration the current absence of screening protocols especially in the context of a rising number of elderly and vulnerable flyers lack of healthy nutrition at airports and in flight availability of food and hydration as well as adequate cabin temperature under delay conditions effects of alcohol use on flight related physiological and behavioral health risks anxiety and psychological distress associated with air travel the effects of long haul or ultra long haul flights on thromboembolic events as well as smoking cessation efforts and related psychological outcomes job related stress and harassment among crew Cosmic ionizing and non ionizing radiation exposure have drawn attention as have historic exposures of crew and passengers to second hand cigarette smoke The threat of political and interpersonal violence and altercations involving aviation cannot be overlooked On board medical emergencies run a wide gamut and the capacity to respond becomes more problematic as the duration of flights becomes longer or in the case of flight over oceans and the poles In addition in flight and post flight embolisms and myocardial infarctions are more prevalent than might be expected We hence encourage manuscripts that address in flight medical response including the capabilities on different types of aircraft on potential interventions by crew and medical volunteers In addition aviation as a vector for the carriage of disease is a significant concern to public health and security of populations world wide and we welcome submissions regarding infectious disease epidemiology and medicine as it relates to air travel Insects and occasional unplanned travel by birds and rodents can present additional public health concerns We are approaching an era where space travel may soon be increasingly common Future flights for near Earth orbit by leisure travelers and as well as travel to the moon and Mars raise a host of new questions with health and safety implications What are the proposed health

and safety accommodations going to be Who will be allowed to travel Perhaps the most interesting question is who will make the rules **Federal Register** ,2013-04 Innovation for Sustainable Aviation in a Global Environment Dietrich Knörzer,Joachim Szodruch,2012 Jointly organised by the European Commission and the Centre for the Development of Industrial Technology in Spain CDTI the Aeronautics Days sixth edition Aerodays 2011 was held on 30th 31st March and 1st April 2011 in the Palacio Municipal de Congresos of Madrid It brought together 1400 delegates policy makers aerospace manufacturers engineers researchers and customers to report and discuss the challenges and solutions for creating greener safer secure and competitive solutions for aeronautics and air transport in Europe Highlights included Flightpath 2050 Europe s vision for future aviation The present book published by the European Commission brings together about 80 papers selected by a Scientific Advisory Committee with the intention to make broadly known the main themes and issues addressed on the occasion of this Convention Given the strategic importance of the latter these post conference proceedings constitute a reference document providing an overview on aeronautical research within Europe more particularly devoted to Commission supported programmes and networks **Scientific and Technical Aerospace Reports** ,1995 *Introduction to Air Law* Pablo Mendes de Leon,2022-08-11 The world of aviation has moved on rapidly since the appearance of the ninth edition of this pre eminent resource five years ago Those developments pertain to market access and market behaviour by air carriers including competition new perceptions of safety and security among others in relation to transparency of accident investigation and cybersecurity case law in the area of airline liability with new cases from the United States product liability and insurance the United Kingdom and elsewhere the growing importance of environmental concerns the rights and obligations of passengers also in the context of unruly passengers and innovative methods for financing aircraft Special attention has been paid in this edition to regional integration movements especially in Europe affecting the mentioned subjects The book s extensive references to other sources in the field have been expanded and updated by the author and experts in specialised areas The present edition addresses the following topics the regulatory framework governing the operation of air services including the principle of sovereignty in national airspace the distinction between State and civil aircraft dispute settlement in international civil aviation economic regulation of international air transport services including the establishment of air services agreements inter airline cooperation in the context of competition law regimes liability of the various service providers in particular airlines and related insurance coverage the promotion of safety standards criminal acts affecting the safety of aviation the role of international and regional organisations with particular reference to that of the European Union liability of the aircraft manufacturer for equipment and financial and security interests in mobile equipment The many practitioners officials business people and academics with a professional interest in aviation law will appreciate this new edition as one of the fundamental works in the field and newcomers will discover an incomparable resource This eleventh edition is ready to be of unmatched service to any practising member of the air law community

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Munroe, Akshay Vithal, 2024-11-01 Supersonic Effects on Rivets introduces aerospace components such as rivets used in subsonic and supersonic hypersonic aircraft It investigates the various alloys used to manufacture rivets fasteners and the heat treatment of those alloys Providing background on commercial subsonic and supersonic and military subsonic and supersonic hypersonic aircraft the book discusses selecting materials rivet arrangement skin friction drag effects estimating temperature thermal properties and fatigue testing of aerospace rivets It includes real world case studies on aircraft failures due to incorrect design and failure mechanisms of aerospace rivets Lessons learnt from the failures of the iconic Concorde Space Shuttle Columbia and American Airbus A300 600 Flight 587 are also deliberated upon Laboratory research including future recommendations are presented The book will be useful for military applications commercial aircraft practicing

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Table of Contents Airbus Fatigue Manual

1. Understanding the eBook Airbus Fatigue Manual
 - The Rise of Digital Reading Airbus Fatigue Manual
 - Advantages of eBooks Over Traditional Books
2. Identifying Airbus Fatigue Manual
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Airbus Fatigue Manual
 - User-Friendly Interface
4. Exploring eBook Recommendations from Airbus Fatigue Manual
 - Personalized Recommendations
 - Airbus Fatigue Manual User Reviews and Ratings
 - Airbus Fatigue Manual and Bestseller Lists
5. Accessing Airbus Fatigue Manual Free and Paid eBooks
 - Airbus Fatigue Manual Public Domain eBooks
 - Airbus Fatigue Manual eBook Subscription Services

- Airbus Fatigue Manual Budget-Friendly Options
- 6. Navigating Airbus Fatigue Manual eBook Formats
 - ePub, PDF, MOBI, and More
 - Airbus Fatigue Manual Compatibility with Devices
 - Airbus Fatigue Manual Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Airbus Fatigue Manual
 - Highlighting and Note-Taking Airbus Fatigue Manual
 - Interactive Elements Airbus Fatigue Manual
- 8. Staying Engaged with Airbus Fatigue Manual
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Airbus Fatigue Manual
- 9. Balancing eBooks and Physical Books Airbus Fatigue Manual
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Airbus Fatigue Manual
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Airbus Fatigue Manual
 - Setting Reading Goals Airbus Fatigue Manual
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Airbus Fatigue Manual
 - Fact-Checking eBook Content of Airbus Fatigue Manual
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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