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2019 Annals of MIRCE Science

"The goal of a scientist is to uncover new ideas, concepts and tools, practical or theoretical, that extend our understanding of the world around us and enable us to do new things. One must believe in what one is doing and stay the course. Now of course, in science one can ultimately prove the correctness of one's work by appeal to experiment and established theory. But even with this buttressing of one's ideas, acceptance can be a long and difficult road."

Richard F.W. Bader (1931 – 2012)
Grand Fellow of the MIRCE Akademy

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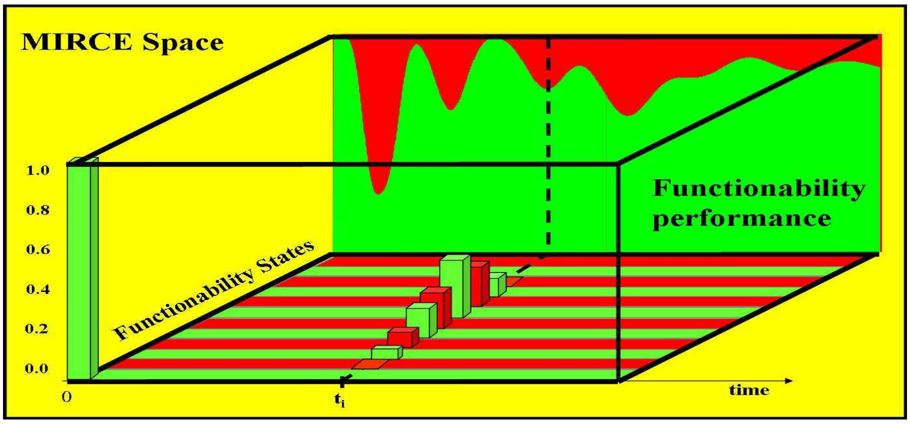
Content

MIRCE Science

The philosophy of MIRCE Science is based on the premise that the purpose of existence of any functionable system[1] is to do functionability work, which is considered to be done when the expected measurable function is performed through time, like miles travelled, units produced, energy supplied and similar. However, experience teaches us that at any instant of in-service life there is a probability of work being interrupted by occurrences of negative functionability events, resulting from failures of consisting components, natural causes, human actions or their interactions. For the work to be continued, humans undertake appropriate positive functionability actions, like: maintenance tasks, change of the mode of operation and similar must be performed. Thus, the life of functionable systems is a sequence of transitions through functionability states. Typically, functionability performance (the amount of work done and resources consumed to support operation and maintenance) becomes known through the end of the life statistics[2], which c ertainly could be change at that stage..

After five decades of systematic studies (practical and observational) of in-service behaviour of functionability systems and their performance Knezevic [1] has generated a body of knowledge, named MIRCE Science, which describes the motion of functionable systems through MIRCE Space[3]. Its axioms, equations and computational methods enable predictions of expected performance to be done, well before the design has been finalised, for each of physically feasible alternative. It is based on the scientific understanding of the physical mechanisms that generates the occurrences of functionability events, considered within a physical scale between 10^{-10} m (atomic scale) and 10^{10} m (solar system scale). These mechanisms, together with the human imposed rules, quantitatively define the expected functionability performance.



Reference: [1] Knezevic, J., The Origin of MIRCE Science, pp. 232, MIRCE Science, Exeter, UK, 2017, ISBN 978-1-904848-06-6

1 Functionable system is a set of the constituent things from natural and human worlds arranged to deliver at least one measurable function. [1]

2 Pan Am's Boeing 747, registration number N747PA, during the 22 years of in-service life, has delivered 80,000 hours of positive work (transported 4,000,000 passengers, burned 271,000,000 gallons of fuel) while receiving 806,000 man-hours of maintenance work (consuming: 2,100 tyres, 350 brake systems, 125 engines, among other parts.

3 MIRCE Space**:** a conceptual 3-dimentional space containing MIRCE Functionability Field, which is an infinite but countable set of all possible functionability states that a functionable system could be found in at any instance of calendar time and the corresponding probability of being in those states. [1]

Pitot Tube Blockage by Mud-dauber Wasp as a Mechanism of a Motion of an Aircraft through MIRCE Functionability Field

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Abstract

MIRCE Mechanics is the discipline of MIRCE Science that focuses on the scientific understanding and description of the phenomena that govern the motion of functionable system types though the MIRCE Functionability field [1]. A full understanding of the mechanisms that generate the motion is essential for the accurate predictions of the functionability performance of functionable system types using MIRCE Science. According to the 2nd Axiom of MIRCE Science the motion of a functionable system type through MIRCE Space is a result of imposed natural phenomena or human activities, which are jointly called functionability actions. Thus, the main objective of this paper is to address pitot tube blockage by mud-dauber wasps as a mechanism that influences the motion of an aircraft through the MIRCE Functionability Field. Although it is not a frequent and globally realised phenomenon, it is a physically observable one, which is experienced by aircraft on the ground in areas where these types of insects are present. The paper also presents a set of a possible prevention and management actions regarding this specific phenomena.

1. Introduction

2. MIRCE Science Fundamentals

3. Pitot Static System

3.1 Pitot Tube[4]
3.2 Airspeed indicator
3.3 Altimeter
3.4 Machmeter
3.5 Variometer

4.0 Airspeed Measurement on Airbus A330

5. Flight Control System on Airbus A330

6. Aircraft Maintenance Manual Parking Procedure for Airbus A330

7. The Observed Motion of A6-EYJ through the MIRCE Functionability Field

7.1 First Negative Functionability Action
7.2 Positive Functionability Actions after the First Rejected Take-off

[4] Henri Pitot, in 1732, invented Pitot tubes to measure the velocity of a flowing liquid or air.

10. Conclusions

The main objective of this paper is to address pitot rube blockage by mud-dauber wasps as a physically observed mechanism of the motion of an aircraft through the MIRCE Functionability Field.

Although not a frequently occurring phenomenon, it has been experienced by several aircraft on the ground in areas where these types of insects are present. Even further in a few occasions it caused fatalities. For example, all 189 people on board died of Birgenair Flight 301 from Puerto Plata in the Dominican Republic to Frankfurt, Germany, on 6 February 1996. The B757-200 operating the route crashed shortly after take-off. The cause of crash was pilot error after receiving incorrect airspeed information from one of the pitot tubes, which investigators believe was blocked by a wasp nest built inside it. The aircraft had been sitting unused for two days without the Pitot tube covers in place. [3]

The paper has clearly demonstrated that airlines and operators should assess and monitor the risk of any obstruction to their aircraft's Pitot probes at the airports where they are based or operating to. Airports should an active role by collaborating with their operators to manage airport hazards and communicate on any of the mitigations in place.

Finally, where there is an identified risk of Pitot obstruction due to sand, dirt, dust or insect nesting activity, the operator should be obliged applying a specific policy to use Pitot covers for aircraft on the ground regardless of the lengths of turn-around times.

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Glare as a Mechanism of the Motion of an Aircraft through the MIRCE Functionability Field

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Abstract

MIRCE Mechanics is the discipline of MIRCE Science that focuses on the scientific understanding and description of the phenomena that govern the motion of functionable system types though the MIRCE Functionability Field [1]. A full understanding of the mechanisms that generate the motion is essential for the accurate predictions of the functionability performance of functionable system type. According to the 2nd Axiom of MIRCE Science the motion of a functionable system type through MIRCE Space is a result of imposed natural phenomena or human activities, which are jointly called functionability actions. Thus, the main objective of this paper is to address glare as an observed physical phenomenon in aviation that can contribute to fatigue, due to the frequency with which the pilot's eyes must adapt from cockpit to exterior, from near to far, from dark to light. Although it is not a frequently manifested catastrophic event, direct or reflected glare is a physically observable phenomenon, which has been attributed to impact directly on the performance of humans involved in flying aircraft and operating them on the ground. The paper also presents a set of possible preventions and management actions that could be taken to reduce the consequences of glare on the safety of flying.

The main objective of this paper was to address glare as a physical mechanism of the motion of an aircraft through the MIRCE Functionability Field. [1] Although it is not a frequently manifested catastrophic phenomenon, glare is a physically observable event, which has been attributed to impact directly on the performance of humans involved in flying aircraft and operating them on the ground [2, 3, 4, 5].

Glare as a physical mechanism is briefly explained in the paper together with all three types of its manifestation, namely: blinding (or reflected), disability and discomfort, considering their main characteristics and potencial impact on pilots and air traffic controller. These effects can result in prolonged visual impairment and be extremely hazardous to pilots in flight who require optimum vision all the time.

Pilots are exposed to various meteorological conditions while in-flight that may increase glare and limit visibility and contrast. They are often subjected to direct and indirect sunlight, which can act as an intense source of glare. Furthermore, while flying at high altitude pilots may be exposed to darkened skies above and bright reflected light from the clouds beneath. Physiologically the contours of the human face serve to protect the eyes from bright light coming from above, but not from below.

It has been pointed out in the paper that in many instances the accident report concluded that the glare effects were intensified by inadequately maintained windscreens. Dirt, scratches and pitting in a windscreen scatter the sunlight and further reduce a pilot’s ability to see the external environment clearly.

While solar power panels provide a useful means to generate a “clean” energy for many communities nobody expected that it will pose a potential hazard in the form of glare to the aviation community. In USA the Aviation Safety Reporting System (ASRS), receives more than thousand reports weekly from pilots flying from the northeast to the southwest about the brightness of this solar farm, according to the organisation’s website.

This paper clearly confirms that glare from natural sunlight and other sources has caused visual impairment of pilots while operating aircraft and has contributed to the transition of an aircraft from positive to negative functionability state, resulting in the reduction or potentially cessation of the functionability work done.

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Emergency Oxygen Provision as a Mechanism of the Motion of an Aircraft Through MIRCE Functionability Field

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MIRCE Mechanics is the discipline of MIRCE Science that focuses on the scientific understanding and description of the functionability actions that govern the motion of functionable system types though the MIRCE Functionability Field (MFF) [1]. A full understanding of the mechanisms of these actions is essential for the accurate predictions of the functionability performance of functionable system types using MIRCE Functionability Equation. Thus, the main objective of this paper is to address a provisioning of emergency oxygen as a mechanism of a motion of an aircraft through MFF generated by the observed physical phenomena or human activities. Some of them are briefly described and analysed in the paper. Based on the evidence available recommendations for the reduction of the probability of occurrence of negative functionability events of the emergency oxygen provision are presented.

7. Conclusions

8. References

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Fireless, Burning Smell Driven, Mayday Landings of Commercial Aircraft as a Mechanisms of Motion in MIRCE Mechanics

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According to Knezevic the purpose for the existence of any functionable system[5] is to do functionability work. The work is done when the expected measurable function is performed through time. [1] However, experience teaches us that expected work is frequently beset by the occurrences of undesirable interruptions like component failures, natural phenomena or human actions, some of which result in hazardous consequences. MIRCE Mechanics is a body of knowledge that focuses on the scientific understanding and description of the mechanisms that generate undesirable in-service interruptions. Thus, the main objective of this paper is to examine the mechanism that generated undesirable in-service interruption to 32 flights, on 16th October 2017, within UK airspace. After fireless burning smoke/fumes were felt in their cockpits the flight crew went to oxygen and declared either a PAN-PAN or a MAYDAY landing. The first event took place around 0622 during departure from Liverpool causing the aircraft to declare mayday landing and return back to land. It was followed by clusters of affected aircraft in the Channel Islands, Liverpool, Manchester and London, later in the day. Although this is one of an extremely rear observed event, its mechanism had to be understood, as if repeated, it will generate the motion of an aircraft through MIRCE Functionability Field and impact its functionability work done and resources consumed. Inspections of aircraft involved and the analysis of the meteorological conditions in Europe have revealed that the burning smell did not result from a failure of any component, but it was as a result of smoke and dust carried in the atmosphere from North Africa and Iberia. Satellite imagery from the European Organisation for the Exploitation of Meteorological Satellites [6] (EUMETSAT) verified this theory. Potencial actions for reducing the impact of this functionability mechanism are presented.

1.0 Introduction

2. MIRCE Science Fundamentals

3. Monday 16 October 2017

3.1 Dublin Airport, Ireland

3.2 Manchester Airport, England

3.2.1 EasyJet

3.2.1.1 Alicante – Manchester Flight

[5] According to Knezevic [1], functionable system type is “a set of mutually related entities put together to do a functionability work in accordance to physical laws and given functionability rules.”
[6] EUMWTSAT in an intergovernmental organisation created through an international convention agreed by a current total of 30 European Member States,

3.2.1.2 Manchester – Hamburg Flight

3.2.2 Flybe
3.2.3 Jet2

3.3. Liverpool Airport, England
3.4 Guernsey Airport
3.5 Jersey Airport
3.6 Hawarden Airport, Chester, England
3.7 At the End of the Day

4.0 The Source of Fireless Burning Smell

4.1 UK Met office Report on 17th October 2017
4.2 EUMETSAT Confirmation

5.0 What Could Be Done?

5.1 Pilots Demand New Cabin Air Filters on Commercial Aircraft
5.2. Inclusion of Information to flight crews on the presence of smoke in the atmosphere from ground fires in SIGNET[7]
5.2.1 *SIGMET*
5.2.2 The Recommendation to ICAO

6. Conclusions

7. References

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Impact of High Altitude Ultraviolet Radiation on Functionability of Flight Crews

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Abstract

The philosophy of MIRCE Science is based on the premise that the purpose for the existence of any functionable system is to do functionability work. The work is done when the expected measurable function is performed through time. In MIRCE Science a flight crew is considered as an element of a flying system type. MIRCE Mechanics is a part of MIRCE Science that focuses on the scientific understanding of the mechanisms of the interactions between functionability elements and the consequences on functionability performance. The research performed shown that pilots and flight crews on aircraft is twice as likely as the general population to develop life-threatening melanoma skin cancer. On average, those who developed melanoma were 42% more likely to die compared with the general population. With progress in aviation technology, aircraft will fly longer and at higher altitudes attracting more and more passengers demanding more and more flights. Hence, the main objective of this paper is to investigate the mechanism of interactions between the high altitude ultraviolet radiation on functionability of flight crew.

1. Introduction

2. Ultraviolet Radiation

2.1 Ionisation
2.2 Ultraviolet Effects
2.3 Environmental factors that influence the UV level
2.4 Ozone depletion and UV radiation level

3. Impact of UV radiation on life on earth

3.1 Some effects of UVB radiation on the biosphere
3.2 Impact of UV radiation on human skin
3.3 Molecular mechanisms of ultraviolet radiation carcinogenesis
3.4 Impact of UV radiation on human vision

4. Impact of UV radiation of flight crew

5. UV radiation and aircraft windscreen

6. Impact of long term UV exposure on the eyes of the flight crew

7. Sunglasses as Eyesight Damage Prevention

8. Conclusions

The philosophy of MIRCE Science is based on the premise that the purpose for the existence of any functionable system is to do functionability work. The work is done when the expected measurable function is performed through time. In MIRCE Science a flight crew is considered as an element of a flying system type. MIRCE Mechanics is a part of MIRCE Science that focuses on the scientific understanding of the mechanisms of the interactions between functionability elements and the consequences on functionability performance.

The information presented in the paper has shown that ultraviolet radiation is an invisible enemy, to human eyes, that can cause long-lasting and potentially deadly consequences for pilots and crewmembers who are repeatedly exposed to higher levels of both UVA and UVB and for longer periods than those working on the ground. These exposure time risks will, for some flight crew, shorten their career span, requiring more pilots to be trained by the operators and potentially lead to future compensation claims for workplace induced illness. Pilots, especially those operating aircraft at high altitudes, need to have suitable protection to mitigate these risks, which have been shown, based in the information obtained from the literature available that pilots and flight crews on aircraft are twice as likely as the general population to develop life-threatening melanoma skin cancer. On average, those who developed melanoma were 42% more likely to die compared with the general population.

With continuous progress in aviation technology, aircraft will be flying longer and at higher altitudes attracting more and more passengers demanding more and more flights. Hence, the main objective of this paper was to highlight the potential impact of high altitude ultraviolet radiation exposure and the increasing risk factors on the functionability of flight crews in commercial aviation over the lifetime of the flight crew.

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Troubleshooting as a Mechanism of Motion of Functionable System through MIRCE Functionability Filed

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Abstract

The purpose of a paper is to address the troubleshooting, an activity performed by maintainers to identify failed component or module, as a mechanism of the motion of a functionable system through the MIRCE Functionability Field. For effective maintenance troubleshooting, as one of the main drivers of the "speed" of moving through negative functionability state, is essential element of any corrective maintenance task. To successfully perform troubleshooting tasks maintainers must possess both the knowledge and skills to find and fix problems efficiently. Many years of research have demonstrated that it is much easier to and learn manual skills than troubleshooting skills. The paper clearly demonstrates that troubleshooting is a complex subject as it is driven by both sides of equation, namely system designers that conceive troubleshooting processes and maintenance managers that manage them during the in-service life of functionable systems.

1. Introduction

2. MIRCE Mechanics Overview

3. Corrective Maintenance Task as a Negative Functionability Action

4 Troubleshooting Activities

5. Troubleshooting constraints

6. Reducing Troubleshooting Errors

6. 1 Proceduralisation of Troubleshooting
6.2 Incorrectly Identified Failures
6.3 Simulation-Oriented Computer-Based Instruction
6.4 Practice
6.5 Context-specific knowledge

7. Conclusions

The purpose of a paper is to address the troubleshooting, an activity performed by maintainers to identify a failed component or module, as a mechanism of the motion of a functionable system through the MIRCE Functionability Field. For effective maintenance troubleshooting, as one of the main drivers of the "speed" of moving through negative functionability state, is essential element of any corrective maintenance task. To successfully perform troubleshooting tasks maintainers must possess both the knowledge and skills to find and fix problems efficiently

Troubleshooting is a form of problem solving, applied to the motion of functionable systems through MIRCE Functionability Field. It is a logical, systematic search for the source of a problem in order to solve it, and return a system to PFS again. Troubleshooting is needed to the symptoms. Determining the most likely cause is a process of elimination – eliminating potential causes of a problem. Finally, troubleshooting requires confirmation that the solution applied has return a system into positive functionability state.

In general, troubleshooting is the identification of “trouble" in the functionable system type caused by any NFA whatsoever. The problem is initially described as symptoms of malfunction, and troubleshooting is the process of determining and remedying the causes of these symptoms.

Numerous years of research have demonstrated that it is much easier to teach and learn manual skills than troubleshooting skills. The paper clearly demonstrates that troubleshooting is a complex undertaking as it is driven by both sides of the equation, namely the design office that conceive troubleshooting processes and maintenance departments that deals with them during the life of a functionable system.

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