

TOPICAL REPORT

AVIATION

Gain insight and keep up-to-date with the latest publications carefully selected by the library from credible sources in academic publications, industry & market research and scientific & industry news. If you have any sources to suggest for our report please [let us know](#).

[view past reports](#)

[subscribe to others](#)

[unsubscribe](#)

news

academic

reports

AVIATION



Reach for the sky: The next generation of aviation

"The next generation of aviation is here and now. From upcoming electric aircraft to retrofitting new hybrid engines, new technology will soon be taking to the skies and a new initiative is here to help.

With recent technologies such as sustainable fuel, retrofitting engines, and new aircraft design continuing to develop, the aviation industry is entering a new era. These new technologies are transforming the aviation space, connecting people, providing services, and delivering goods. From drones to electric regional aircraft, the sector is evolving every day."

Source: Airport Technology

CAAS launches first safety charter for Singapore aviation sector

"The Civil Aviation Authority of Singapore (CAAS) on Monday (Mar 7) launched a safety charter to uphold standards as the travel industry recovers from the impact of the COVID-19 pandemic.

The Charter for a Strong and Positive Safety Culture in Singapore is the first of its kind for the aviation sector here. The launch took place at the annual Aviation Safety Forum at the Pan Pacific Hotel.

AVIATION



Determinants and strategies behind commercial airports' performance in general aviation

"Although general aviation has become increasingly important for commercial airports to diversify aeronautical activities and improve overall performance, little empirical research has been devoted to the topic so far...First, a panel data analysis was carried out on all the 44 Italian commercial airports that have operated general aviation flights over the period 2007–2018, to understand which variables have an effect on general aviation traffic. Second, a qualitative investigation was used to highlight how airport companies that have achieved success exploit these variables to outperform competitors. The combination of both quantitative and qualitative data, and the patterns observed across cases, led to the presentation of eight theoretical propositions, which were summarized in a preliminary model."

Source: Elsevier

Japanese aviation market performance during the COVID-19 pandemic - Analyzing airline yield and

AVIATION



The Aviation Industry Leaders Report 2022: Recovery Through Resilience

"We are delighted to present you with our Aviation Industry Leaders Report 2022: Recovery through Resilience. The report captures the views of industry leaders across the leasing, airline and banking markets and includes input from rating agencies and analysts covering the sector. Our report last year looked at the devastation that COVID-19 had wreaked on the aviation sector, as it dealt with the largest exogenous shock the industry has ever faced, resulting in a collapse in global air travel. The hope at this time last year was that the expected global vaccine rollout would help drive a sharp recovery and that the stickiness of investors to the aviation sector would remain strong. A lot of these hopes have come to pass, but challenges still abound."

Source: KPMG

Effects of Novel Coronavirus (COVID-19) on Civil Aviation: Economic Impact Analysis 1 March 2022

"The COVID-19 impact on world scheduled passenger traffic for year 2020 (estimated actual results), compared to 2019 levels:- Overall

"Recognising various safety-related challenges posed by the COVID-19 pandemic, the charter expresses the shared commitment by leaders in the sector to jointly uphold safety standards and strengthen safety culture in their respective organisations as air travel recovers," said CAAS in a news release."

Source: Channel News Asia

AEROSPACE ENGINEERING



Airbus to use its A380 to test hydrogen propulsion systems

"The European aircraft manufacturer Airbus has revealed that it will use the A380 as a test bed aircraft for its ZEROe project, which aims to develop a zero-emission aircraft by 2035. The Airbus A380 flight demonstrator with hydrogen propulsion systems is expected to fly around 2025.

The manufacturer believes that this technology could be a game changer for commercial aviation as the industry seeks ways to make flying emissions-free."

Source: Aero Time

Pratt & Whitney to develop hydrogen propulsion systems

"The manufacturer says the project could be a "breakthrough" technology for commercial aviation as the industry seeks ways to make flying more sustainable.

As part of the DoE's Advanced Research Projects Agency-Energy (ARPA-E), the company will develop a Hydrogen Steam Injected, Inter-Cooled Turbine Engine (HySIITE).

The new hydrogen-powered engine will utilize liquid hydrogen combustion and water vapor recovery. The HySIITE engine will burn hydrogen in a thermodynamic engine cycle that incorporates steam injection and reduces emissions of greenhouse gases."

Source: Aero Time

GE Aviation and Boeing partner to test hybrid electric systems

"GE Aviation and Boeing have partnered to test hybrid electric propulsion systems through ground and flight demonstrations using a Saab 340B aircraft and CT7-9B turboprop engines.

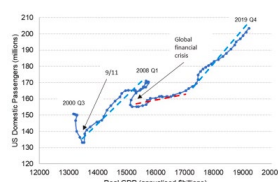
According to the press statement, Boeing and its subsidiary Aurora Flight Sciences will provide GE Aviation with aircraft modification, system integration and flight-testing services.

competition in the domestic market

"The Japanese aviation market experienced significant changes in the past decade, with a few entrant low-cost carriers (LCCs) changing the duopoly by the two dominant full-service airlines (FSAs) of Japan Airlines and All Nippon Airways. However, the major disruptions caused by the COVID-19 pandemic might change industry development trajectory. This study provides an updated review of the development and performance assessment of the Japanese domestic market, with a focus on the effect of the COVID-19 pandemic on airlines' capacity, frequency, yield and competition using data from 2019 to 2020. Special efforts are dedicated to investigating whether there is significant asymmetry between FSAs and LCCs across different types of routes. Our empirical results suggest that the pandemic did impose significant negative effects on airline yield, scheduled seats and frequency. Such effects were different across mainline vs. regional routes, with FSAs still maintaining much of their dominance."

Source: Elsevier

AIR TRANSPORT MANAGEMENT



How do changes in economic activity affect air passenger traffic? The use of state-dependent income elasticities to improve aviation forecasts

"This paper explores the causal relationship between income and air travel demand to provide insights for the future growth of the aviation industry, with particular focus on the recovery period after a crisis. Using US data, we estimate the long-run and short-run income elasticities of air passenger demand and we estimate how they vary over the business cycle. We find that long-run income elasticities are lower than short-run elasticities and that the short-run elasticities are lower during the recovery period following an economic downturn. A reduction in income elasticity of demand during the recovery period is consistent with an increase in precautionary savings. We then apply our results to IMF economic forecasts, and our analysis suggests that a return of the air traffic to its pre-crisis levels would be slower than the return of economic activities to their levels."

reduction of 50% of seats offered by airlines – Overall reduction of 2,703 million passengers (-60%)– Approx. USD 372 billion loss of gross passenger operating revenues of airlines The COVID-19 impact on world scheduled passenger traffic for year 2021 (preliminary estimates), compared to 2019 levels:– Overall reduction of 40% of seats offered by airlines – Overall reduction of 2,201 million passengers (-49%) 5– Approx. USD 324 billion loss of gross passenger operating revenues of airlines."

Source: ICAO

Charting the European Aviation recovery: 2021 COVID19 impacts and 2022 outlook

"2021 was the year aviation hoped to get back on its feet after the catastrophic pandemic impacts of 2020. This Think Paper uses our unique network data to show the cumulative impacts of this year's partial recovery on all aspects of European aviation. Mass vaccinations and the EU Digital COVID Certificate helped drive a strong summer traffic bounce that has endured despite Omicron and rising infection levels, proving the sector's resilience as we enter 2022."

Source: Eurocontrol

Global Commercial Regional Aviation Growth Opportunities

"Saturated air traffic demand in developed regions where aviation penetration is high creates the need for an adjacent market. Globally, the COVID-19 pandemic has forced governments and aviation stakeholders to rethink their strategies and mitigate risks associated with their dependence on international travel and tourism. Airports are considered strategic economic activity hubs and investment hotspots, offering new revenue streams through increased demand for regional connectivity. Establishing efficient regional connectivity could act as a feeder for existing airlines. Having efficient and affordable network connectivity drives regional passenger traffic. Regular flights to key areas are appealing to passengers, such as major cities and emerging business hubs. Regional airports play a vital role in advancing and ensuring equal regional growth in a country, especially in areas with limited transportation access. Regional airports need to attract essential carriers to improve their network, increase air traffic, and broaden passenger access to more areas. Governments can incentivize small aviation participants to explore regional connectivity through viability gap funding and provide subsidies for the initial years and costs of operation

The program hopes to conduct ground and flight tests in the mid-2020s. Hybrid electric propulsion system tests will be done at Aurora's headquarters in Manassas, Virginia, the United States."

Source: Aero Time

Tiny probes could sail to outer planets with the help of low-power lasers

"The researchers performed calculations to show that even lasers with powers of about 100 kW and array sizes of about a meter could power a 1-gram probe at velocities far exceeding the current record, with only minutes to hours of laser illumination. According to their calculations, the lasers could maneuver small probes between different Earth orbits in only a day, which is not possible with current electrical and chemical rockets. The team determined that the best materials for the laser sails, which allowed high reflectivity and rapid cooling, were silicon nitride and boron nitride structured at the nanoscale."

Source: American Chemical Society

Owl wing design reduces aircraft, wind turbine noise pollution

"Researchers used the characteristics of owl wings to inform airfoil design and significantly reduce trailing-edge noise. The team used noise calculation and analysis software to conduct a series of detailed theoretical studies of simplified airfoils with characteristics reminiscent of owl wings. They applied their findings to suppress the noise of rotating machinery. Improving the flow conditions around the trailing edge and optimizing the shape of the edge suppressed the noise."

Source: American Institute of Physics

BIOENGINEERING



Study illuminates how tiny flies solve complex navigational challenges

"The research, carried out by Paloma Gonzalez-Bellido, Mary Sumner, and Trevor Wardill of the University of Minnesota's College of Biological Sciences, and Sam Fabian of the Imperial College London Department of Bioengineering, focuses on the aerial feats of a miniature robber fly known as a gnat oger — adults are tiny, just 7 mm in length on average. Native to North and South America,

Source: Elsevier

A case study on the effect of meteorological events on the efficiency of flight training organization

"Purpose

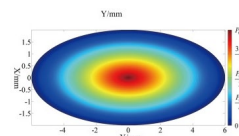
The purpose of this study is to determine the meteorological events that affect flight training to make the training flight more efficient in a flight training organization (FTO) and to examine the effects of these events on FTO.

Design/methodology/approach

Within the scope of this study, the flight training given at Eskisehir Technical University Pilotage Department (ESTU-P) is discussed, and the effect of meteorological events on flight training in this FTO is evaluated."

Source: Emerald Insight

ENGINEERING



Theoretical investigation and implementation of nonlinear material removal depth strategy for robot automatic grinding aviation blade

"Due to the requirements of manufacturing accuracy and surface quality consistency, which will influence the dynamic properties and service cycle of aircraft engines, the high-precision material removal depth model is urgently needed for robot automatic grinding aviation blade system. This research developed a novel material removal depth (MRD) model to ensure quantitative grinding depth point by point for robot automatic grinding aviation blade. Firstly, the relationship between contact stress and contact force is developed based on simulation and theoretical derivation, and the contact contour is further investigated by the experiments. Then, the nonlinear material removal depth model is established to predict grinding depth according to Preston equation. Meanwhile, multiple linear regression method is introduced to analyze parameters of material removal depth model. The previous researches show that grinding parameters have strong correlation with MRD, especially for the non-negligible contact force consideration."

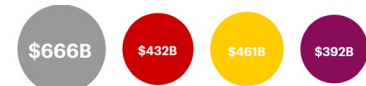
Source: Elsevier

Study of the Creation of Aircraft Structural Smart-Materials

of airports and airlines for sustainable regional development."

Source: Frost & Sullivan

FORECAST



Air Travel Forecast: When Will Airlines Recover from Covid-19?

"Here are the latest developments as of January 2022.

- The Covid-19 Omicron variant's surge continues to stall the travel recovery. We're now projecting global airline revenue for 2022 to reach \$432 billion in the baseline recovery scenario, representing 65% of 2019's revenue (see panel 1 above). By the end of the year, global air travel demand could recover to 84% of 2019 levels in the baseline scenario (see panel 2).
- We anticipate intraregional travel to pick up in Europe and North America during the spring and summer, similar to the pattern in 2020 and 2021 (see panel 3)."

Source: Bain & Company

A resilient airline industry emerges but not without its challenges

"The report highlights the following key 2022 predictions for the airline industry:

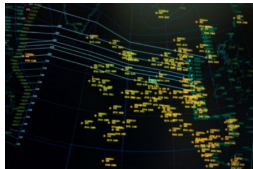
- Most of the world will transition to treating COVID-19 as endemic rather than a pandemic
- Orders and deliveries of new fleet will both increase, ending 2022 close to pre-COVID-19 levels
- Lessors will once again finance over 50% of new deliveries
- Further lessor platform consolidation and acquisitions will occur and several new entrant lessors will launch
- The combination of a strong US Dollar, rising interest rates, inflation and oil price increases will create headwinds
- Sustainability will remain a driving force for airlines, Original Equipment Manufacturers (OEMs), investors and financiers, becoming more widely embedded in company strategies and policies."

Source: PwC

the gnat ogre is known for its ability to pursue and capture other insects in flight with extreme precision. It's remarkable enough that this insect's tiny brain can steer it to catch an object on the move. Even more remarkable is that it can avoid running into obstacles at the same time. The researchers set out to investigate how the tiny fly combines the two sets of brain-to-muscle instructions."

Source: University of Minnesota

PLANE TRACKING TECHNOLOGY



How satellite plane-tracking tech is changing flying across the North Atlantic

"That has now changed thanks to satellite technology. Since 2019, NATS has been working with Aireon to use satellites to track ADS-B signals sent out by aircraft. This means that controllers can receive aircraft position updates every seven to eight seconds, rather than every 14 minutes, over the Atlantic."

"Previously, you were almost always working on out-of-date data. When space-based ADSB was turned on, suddenly, you're spotting everything that's happening quickly," Young says.

The technology has transformed the way that Oceanic controllers work and allowed them to reduce the separation between aircraft on the Atlantic down to 14 nautical miles, from the previous 40nm.

The reduced separation minima means airlines can request more random, or individual routes, outside of the track system."

Source: Aero Time

AIRLINES



OPINION: Four Strategies to Help Airlines Manage and Mitigate Supply Risks

"While it may be an understatement to say that the airline industry is exposed to volatility, it is fair to say that the latter half of the last decade was a time of relative plenty. The COVID-19 pandemic and its cataclysmic impact on demand swiftly reversed that. But now, as demand recovers, the after-effects of

Based on Evaluation of Strength Properties

"An obligatory condition for creating a competitive aircraft (AC) is to ensure low operating costs by reducing downtime and rational organization of maintenance and repair through continuous monitoring, diagnosis, and prediction of the AC condition. For monitoring, diagnosing, and predicting aircraft condition in recent decades the list of parameters recorded on board is continuously expanding. Great prospects in this direction are associated with the creation and implementation of so-called smart materials that can monitor their condition and even actively resist damage. This article presents results of research showing the fundamental possibility of constructing a strain curve for structural metal based on hardness measurement by ultrasonic contact impedance. During performance of experiments on aluminium alloy AMg6 samples a correlation relationship is established for strength properties obtained on the basis of a stress-strain curve with hardness values during tests that make it possible to evaluate material condition with a complex stress-strained state."

Source: Springer Link

Computational aeroacoustics of rotor noise in novel aircraft configurations: A lattice-boltzmann method-based study

"The accurate and reliable prediction of the aerodynamic noise sources of open rotors and ducted-fans in electric Vertical Take-Off and Landing (eVTOL) and non-conventional aircraft configurations is a challenging task from a computational perspective. Indeed, such propulsive systems can often operate in highly distorted and non-homogeneous flows, with the rotating blades interacting with strongly non-uniform and turbulent flows; and/or experience phenomena related to low Reynolds numbers and boundary-layer transition, due to the relatively small diameters and blade tip speeds. While analytical, semi-empirical and low-fidelity numerical models can provide quick and computationally inexpensive predictions, their results are often not fully reliable and their state-of-the-art requires a further development step to properly address the problem of rotor noise prediction in non-conventional aircraft and rotorcraft. On the other hand, Navier-Stokes based scale-resolving approaches such as Large Eddy Simulation (LES) have the capability to capture most of the aforementioned phenomena, but at

Outlook for the global airline industry - Asian Aviation

"Financial performance will be worse and more varied this year than we expected in our December forecast, because of difficulties in controlling the virus variants and slower vaccination in some regions: • Net post-tax losses forecast at \$47.7bn in 2021 (was \$38bn in the December forecast). Operating margin -9.4% (was -7.1%). • N American airlines better than previously forecast at \$5bn loss (was \$11bn) due to domestic recovery. Europe worse at \$22bn loss (was \$12bn) after \$35bn loss in 2020, because of slower vaccination and less relaxation of international travel restrictions. Other regions slightly worse, due to weaker international travel. • Q4 2020 losses larger than anticipated in December, so 2020 net post-tax losses now \$126.4bn (was \$118.5bn)."

Source: IATA

the pandemic and a confluence of macro factors create the next major headwind for the world's airlines: supply challenges."

Source: Aviation Today

Why the Latest 5G Rollout is Making Airlines Nervous

"5G in the C-band frequency range can interfere with aircraft altimeters, which help pilots see better when visibility is low.

For that reason, a new rollout of the wireless technology caused airlines to cancel or delay flights across the U.S. this week.

C-band 5G bridges the gap between low-band 5G and high-band 5G for "an optimal mix of fast speeds and broad coverage."

Source: Popular Mechanics

SUSTAINABLE AVIATION



Chemists Just Figured Out a Way to Turn CO2 Into Jet Fuel

"Between the COVID-19-related decline in air travel and increased scrutiny on airplane fuel consumption, it's been a rough time for airlines. But in new research, scientists from the University of Oxford offer a novel way to turn waste CO2 into usable hydrocarbons—and even into jet fuel. The secret is a complex chemical catalyst, made by blowing up elements and using materials like citric acid or even regular household flour as catalyst fuels."

Source: Popular Mechanics

From the streets to the stratosphere: Clean driving technology enables cleaner rocket fuel

"A chemical used in electric vehicle batteries could also give us carbon-free fuel for space flight, according to new UC Riverside research. In addition to emission reductions, this chemical also has several advantages over other types of rocket fuels: higher energy, lower costs, and no requirement for frozen storage.

The chemical, ammonia borane, is currently used for storing the hydrogen in fuel cells that power electric vehicles. UCR researchers now understand how this combination of boron and hydrogen can release enough energy to also launch rockets and satellites.

"We are the first to demonstrate that in addition to electric vehicles, ammonia borane can be used to make rockets go too, under the right

a prohibitive computational cost for a routine employment in the design stages of such innovative vehicles."

Source: TU Delft

Flight Mechanics and Performance of Direct Lift Control: Applying Control Allocation Methods to a Staggered Box-Wing Aircraft Configuration

"The objective of the present dissertation is to show how redundant control surfaces can be exploited to shape an aircraft dynamic behavior and obtain desired flight mechanics performance. This is achieved by introducing novel approaches and methods for flight mechanics and control, mainly revolving around original implementations of traditional formulations of the Control Allocation (CA) problem. Control surfaces and, more in general, control effectors are defined as redundant if they are capable to independently control the same motion axis of the aircraft.

Redundant effectors can be linked together, and to the pilot input, in many ways according to different optimality criteria and/or performance objectives. In particular, the research presented in this dissertation focuses on the possibility to achieve Direct Lift Control (DLC)."

Source: TU Delft

Augmenting effectiveness of geared turbofan engines by dual stage radial blisks

"Purpose

This study aims to propose a novel configuration for turbofan engine inlets to increase the overall effectiveness of the engine.

Design/methodology/approach

Conventional fan has been split radially into two blisk stages, namely, core blisk and bypass blisk. The two blisks are driven by a common shaft but rotate at two different revolutions per minutes (RPMs) on the same plane of rotation simultaneously through a planetary gear mechanism. To avoid any mechanical contact between the two stages, a minimum optimum distance is kept between them."

Source: Emerald Insight

Design Methodologies for Composite Structures in Aircraft Engines

"Recently there have been many successful attempts to implement the use of fiber-reinforced composite structures in the commercial aircraft engines. The author has been part of these efforts while working in the aviation industry. This article describes these efforts to design, analyze, manufacture, and implement the

conditions," said Prithwish Biswas, UCR chemical engineer and first author of the new study. Their demonstration has now been [published](#) in The Journal of Physical Chemistry C." Source: University of California - Riverside

PHYSICS



Into the vortex: Supercomputers help scientists probe vortices and turbulence

"The subject of vortices might seem esoteric. But their impact does make headlines, as seen recently in an outbreak of tornadoes, swirling vortices that killed at least 80 people across eight U.S. states in December 2021. Scientists today still don't fully understand the dynamics of vortices, chaotic but coherent patterns common in nature that are also exemplified by hurricanes, eddies in a stream of air or water, aerodynamic drag, fuel combustion, and more.

Supercomputer simulations are helping scientists peer deeper into the mysterious characteristics of vortices and turbulence, in recent studies by Texas Tech University scientists. A possible application of their research could help improve fuel efficiency for cars and help develop energy-saving aircraft designs, and more."

Source: University of Texas at Austin, Texas Advanced Computing Center

Development of a lithium-air battery with an energy density over 500 wh/kg

"Researchers have developed a lithium-air battery with an energy density over 500Wh/kg -- significantly higher than currently lithium ion batteries. The research team then confirmed that this battery can be charged and discharged at room temperature. In addition, the team found that the battery developed by the team shows the highest energy densities and best cycle life performances ever achieved. These results signify a major step toward the practical use of lithium-air batteries."

Source: National Institute for Materials Science, Japan

eVTOL



Joby eVTOL aircraft prototype crashes during testing

"Joby Aviation, one of the leading companies in the development of air taxi services, reported that one of its

composite structures inside the low-pressure and low-temperature zones of the engine. Very innovative out-of-the-box design methodologies were used to design these components. These efforts elaborate on the design, optimization, and improvement of composite fan blade, composite fan platform, and composite booster blade inside the engine. It focuses on structural design, the aerodynamic efficiency, and specific fuel consumption improvement efforts along with the usual reduction of weight targets. This work successfully demonstrates the systematic steps in design and implementation like preliminary coupon-level simulations, coupon-level manufacturing, coupon/prototype testing, and final part-level simulations followed by part test."

Source: Springer Link

Experimental analysis of friction stir welded aviation grade AA8090 joints using Taguchi orthogonal array

"Purpose

This paper aims to predict the performance of friction stir welded AA8090 joint.

Design/methodology/approach

In the present study, Al-Li AA8090 plates are butt joined using friction stir welding (FSW). The experiments are designed and optimized using a Taguchi-orthogonal array. The experiments are conducted at three different process parameters, i.e. tool rotational speed (TRS), tool transverse speed (TTS) and dwell time (DT). The ultimate tensile strength (UTS) and microhardness (MH) are considered as response parameters. In addition, a statistical tool (ANOVA) is used to check the adequacy of experiment results."

Source: Emerald Insight

Development of innovative technologies for manufacturing of certified narrow body aircraft composite flap

"Fiber-reinforced polymer composites perfectly meet the basic requirements of aircraft flaps being weight reduction critical for fuel saving and increased payload. New technologies have been designed and developed to increase competitiveness in the use of composite materials by ensuring a continuous manufacturing process, a streamlined and balanced flow of activities, synchronized as much as possible with customer and market demand, reducing material scraps and non-value-added activities.

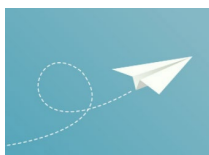
Resin excess, tool mark-offs, out of tolerance dimensions are potential

prototype aircraft suffered an accident during testing. On February 16, 2022, the company filed a report with United States Securities and Exchange Commission, providing some details about the event.

The report states that "earlier today one of its remotely piloted, experimental prototype aircraft was involved in an accident during flight testing at our remote flight test base in California. There were no injuries".

Source: Aero Time

AERODYNAMICS

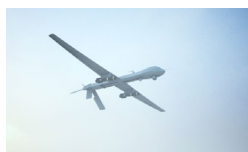


For New Insights into Aerodynamics, Scientists Turn to Paper Airplanes

"A series of experiments using paper airplanes reveals new aerodynamic effects, a team of scientists has discovered. Its findings enhance our understanding of flight stability and could inspire new types of flying robots and small drones."

Source: New York University

UAV



Successes in conflict and new anti-radar features signal the future of drone warfare

"At the 2022 Singapore Airshow, on February 15, Israel Aerospace Industries (IAI) unveiled its latest model of loitering munition – the Harpy NG (New Generation). Loitering munitions are similar to drones, but are themselves the weapon; they fly to a target's destination, loiter in the air searching and once a target is located it strikes – similar to a missile or conventional munition."

Source: Aerospace Technology

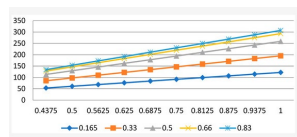
Extending the Battery Life of Small Drones to Strengthen Security on U.S. Border

"The E-line system charges the drones during their surveillance, enables a continuous and seamless flight over the border and eliminates the need for battery charging stations. Continuous monitoring sends live information about different locations of the borderline to the designated control centers, helping enhance border security and reducing the necessity of systems operated by people."

defects generated during the hand lay-up process of the skin manufacturing of composite flap. Innovative technologies for manufacturing of certified narrow body aircraft composite flaps have been designed and developed in order to achieve the best quality of the product and the program ramp-up."

Source: IOP Science

OPTIMIZATION

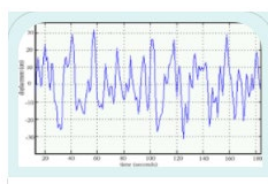


Method for Calculating the Required Number of Transport Vehicles Supplying Aviation Fuel to Aircraft during Combat Tasks

"During aircraft flights, combat readiness and the supply system affecting it are essential issues. The basic items of supply during the implementation of tasks are combat assets and aviation fuel. Effective management of the flow of required products, as well as the reliability of vehicles and the availability of crews contribute to the quality of task performance. The components that make up this quality in military operations are measured by readiness. In real-life operations, the number of vehicles supplying aircraft with aviation fuel is determined for safety and reliability with an surplus related to the number of flight support facilities. This paper develops a method for determining the minimum number of vehicles required to supply aircraft (sp) with aviation fuels. The developed method was verified by a numerical example illustrating its application in practice. Additionally, a detailed analysis of its application was carried out in relation to potentially 50 possible scenarios of combat task execution, with a number of assumptions fulfilled."

Source: MDPI

INTELLIGENT CONTROL FUNCTION



Systematic fuzzy Navier–Stokes equations for aerospace vehicles

"Purpose

To prove the effectiveness of the proposed design method, this study aims to propose the Fisher equation

"This work provides an optimization model to determine the optimal number of drones, the optimal length of the E-line, and the optimal location of the E-line system required for border surveillance," said Lim."

Source: University of Houston

and temperature cooling fins that control high-speed aerospace vehicles.

Design/methodology/approach

A new approach whereby the control of aerospace vehicles can be achieved by fuzzy controller and appropriate Navier–Stokes equations in this article. The design of the controller based on models of Navier–Stokes equations simplified complex mathematical simulations and approximations."

Source: Emerald Insight

SUSTAINABLE AVIATION

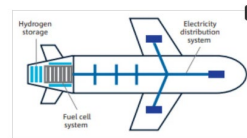


Figure 9. Fuel cell placement in aircraft fuselage [64]

Sustainable Aviation— Hydrogen Is the Future

"As the global search for new methods to combat global warming and climate change continues, renewable fuels and hydrogen have emerged as saviours for environmentally polluting industries such as aviation. Sustainable aviation is the goal of the aviation industry today. There is increasing interest in achieving carbon-neutral flight to combat global warming. Hydrogen has proven to be a suitable alternative fuel. It is abundant, clean, and produces no carbon emissions, but only water after use, which has the potential to cool the environment. This paper traces the historical growth and future of the aviation and aerospace industry. It examines how hydrogen can be used in the air and on the ground to lower the aviation industry's impact on the environment."

Source: MDPI

Review: The Effects of Supersonic Aviation on Ozone and Climate

"When working towards regulation of supersonic aviation, a comprehensive understanding of the global climate effect of supersonic aviation is required in order to develop future regulatory issues. Such research requires a comprehensive overview of existing scientific literature having explored the climate effect of aviation. This review article provides an overview on earlier studies assessing the climate effects of supersonic aviation, comprising non-CO₂ effects. An overview on the historical evaluation of research focussing on supersonic aviation and its environmental impacts is provided, followed by an overview on concepts explored and construction of emission inventories. Quantitative estimates

provided for individual effects are presented and compared. Subsequently, regulatory issues related to supersonic transport are summarised. Finally, requirements for future studies, e.g., in emission scenario construction or numerical modelling of climate effects, are summarised and main conclusions discussed."

Source: MDPI

Selection of microalgae strains for sustainable production of aviation biofuel

"This study develops and applies the PROMETHEE-GAIA method as a new tool to select microalgae strains for aviation fuel production. Assessment involves 19 criteria with equal weighting in three aspects, namely biomass production, lipid quality, and fatty acid methylester properties. Here, the method is demonstrated for evaluating 17 candidate microalgae strains. *Chlorella* sp. NT8a is assessed as the most suitable strain for aviation fuel production. The results also show that unmodified biofuel from the most suitable strain could not meet all jet fuel standards. In particular, microalgae-based fuel could not satisfy the required density, heating value and freezing points of the international jet fuel standards. These results highlight the need for a broad action plan including improvement in the processing or modification of biofuel produced from microalgae and revision of the current jet fuel standards to facilitate the introduction of microalgae-based biofuel for the aviation industry."

Source: Elsevier

Jet-setting during COVID-19: Environmental implications of the pandemic induced private aviation boom

"The COVID-19 pandemic has changed the nature of air travel throughout the world. One notable change in air travel is the significant increase in the use of private aviation relative to commercial air travel. Although some of the initial environmental impacts of COVID-19 transportation disruptions have been previously examined, little attention has been given to changes in private aviation usage. In general, there is a lack of academic literature that addresses private aviation operations and its impact on emissions. The purpose of this study is to fill that gap by analyzing the environmental implications of the COVID-19 induced shift toward private aviation in the U.S. We find that the number of private aviation flights in the U.S. increased by 20% after the beginning of the pandemic, which resulted in an increase of CO₂-equivalent emissions

by 23%. Further, analyses of long-run scenarios suggest that overall private air travel emissions will likely exceed 770 megatons of CO₂-equivalent in the next three years."

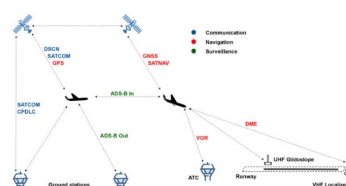
Source: Elsevier

Willingness-to-pay for carbon dioxide offsets: Field evidence on revealed preferences in the aviation industry

"Voluntary offsetting of flight-related emissions is an important cornerstone of passengers' individual efforts to contribute to climate change mitigation. Hence, many scientific studies have tried to assess people's willingness-to-pay to offset their own flight-related carbon emissions. Up-to-date, these studies are overwhelmingly grounded in hypothetical stated-preference approaches, with very limited knowledge about external validity. Here, we report on an observational field study involving a final sample of 63,520 bookings made with a European airline, allowing us to gauge actual willingness-to-pay for carbon dioxide compensation in a revealed-preference approach. Our pre-registered study shows that the median willingness-to-pay to voluntarily offset a ton of carbon dioxide from flight-related emissions is zero, with the mean willingness-to-pay being around 1 EUR. Aggregated voluntary willingness-to-pay thus dramatically falls short of current prices to offset carbon dioxide, for example through the EU-ETS."

Source: Elsevier

CYBERSECURITY



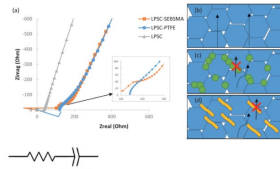
Cyber security challenges in aviation communication, navigation, and surveillance

"As the aviation sector becomes digitized and increasingly reliant on wireless technology, so has its attractiveness to cyber attackers including nation-state actors and terrorists. For example, vulnerabilities in the broad range of interconnected devices and (sub)systems, their implementations, as well as design flaws, can be exploited to carry out nefarious activities. Therefore, in this paper we review the existing literature to understand the diverse attack vectors associated with communication, navigation, and surveillance systems, and how some of these security issues can be mitigated. Although a number of

survey and review articles have analyzed various wireless technologies in aviation, to the best of our knowledge, no work has systematically analyzed them from communication, navigation and surveillance perspectives collectively."

Source: Elsevier

ELECTRIC AVIATION



Practical considerations in designing solid state Li-S cells for electric aviation

"The development of high-energy, high-safety, and high-power batteries beyond electric automotive standards is critical for future electric aviation applications. Non-volatile solid-state electrolytes (SSE) offer many promising advantages over traditional flammable liquid electrolytes. SSE may become an enabling technology for certain battery chemistries by preventing detrimental interactions that occur with liquid electrolytes, for example preventing dissolution of lithium-sulfur intermediates common in traditional liquid organic solvents. However, significant manufacturing challenges must be overcome before the adoption of such technology. One of the main challenges is the fabrication of sufficiently thin electrolyte layer to maximize specific energy of the solid-state cell. In this work we first show the feasibility in the assembly of an all solid-state battery via the development of composite SSE with ionic conductivity above 0.2mS/cm and thicknesses on the order of 40 micron through a tape-casting technique."

Source: Elsevier

Accelerated and Adaptive Power Scheduling for More Electric Aircraft via Hybrid Learning

"In recent studies, the power scheduling in More Electric Aircraft (MEA) has been formulated as a mixed-integer quadratic programming (MIQP) problem. Many model-driven methods, such as branch-and-bound algorithms, are advocated to solve it. However, these methods are often prone to considerably high complexities, which makes real-time processing a problem. In this paper, a two-stage hybrid learning-based optimization approach is proposed to address this challenging issue. In the first stage, the task of optimizing integer variables is

considered as a multi-label classification problem, which is solved by a data-driven method, i.e., ensemble deep neural networks (EDNNs). In the second stage, with the obtained integer solutions, the problem is transformed into a quadratic programming (QP) problem that can be quickly solved by model-driven numerical optimization methods. Through this two-stage approach, the model-driven and data-driven methods can compensate each other so that the real-time and optimal scheduling requirements are simultaneously met."

Source: IEEE Xplore

UAV

$$\begin{bmatrix} \dot{\phi} \\ \dot{\beta} \end{bmatrix} = \begin{bmatrix} 0 \\ \frac{g}{V} \sin \phi \cos \alpha_{trim} + \frac{g S C_Y(\beta)}{m V} \end{bmatrix} + \begin{bmatrix} 1 & \tan \alpha_{trim} \cos \phi \\ \tan \alpha_{trim} & -1 \end{bmatrix} \begin{bmatrix} \dot{\alpha} \\ \dot{\beta} \end{bmatrix}$$

Adaptive block backstepping control for a UAV performing lateral maneuvers under lateral c.g. uncertainty

"Purpose

Unmanned aerial vehicles (UAVs) have wide applications in surveillance and reconnaissance without risking human life. Due to unbalanced payload distribution or in-flight deployment, UAVs may undergo lateral center of gravity (c.g.) variations resulting in an asymmetric dynamic having significant longitudinal and lateral/directional coupling and hence more pronounced nonlinearity. Therefore, automatic control of UAVs becomes extremely difficult when it is forced to perform maneuvers under such imbalance in lateral mass distribution. The purpose of this paper is to design adaptive nonlinear control so that the UAV can perform some useful lateral/directional maneuver under lateral c.g. uncertainty."

Source: Emerald Insight