

TOPICAL REPORT

AVIATION

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Trial to use cleaner aviation fuel in Singapore to begin in 2022

"The aviation industry in Singapore is piloting the use of cleaner fuels in planes next year.

The trial to use lower-carbon fuels will be run by the Civil Aviation Authority of Singapore (CAAS), Singapore Airlines (SIA) and Singapore's investment company Temasek.

CAAS said in a statement on Saturday (Nov 13) that the pilot programme will run for a year, and producers and suppliers of sustainable aviation fuel have been invited to present their plans on delivering cleaner fuels."

Source: The Straits Times

GE to break up into 3 companies focusing on aviation, health care and energy

"U.S. industrial giant [General Electric](#) will split into three companies following years of seeing its stock underperform, the company announced Tuesday.

The company will be divided into separate units focused on aviation, health care and energy. GE plans to spin off the health-care unit by early 2023 and the energy unit by early 2024, the company said in a news release.

AVIATION



Fig 3.2 The Lulian jet (Lulian, n.d.-a)

New Frontiers in Aviation: Supersonic, Space Travel and Drones

"This chapter addresses three areas of future technologies in aviation: supersonic aircraft, space tourism and drone technologies. Supersonic travel is not entirely novel to aviation as its roots begin in the 1960s and continued until the turn of the millennium. However, new avenues are being explored to develop and re-introduce the concept of supersonic travel. Space tourism is a potential new market for travellers, with first companies already trialling products. However, the technological implementation and the price of space travel are uncertain. Meanwhile, the prospects of drones are promising with many fields offering potential applications of drones. One of the areas is passenger transport, where drones could help transform urban and intercity transport with drone taxis. Again, there are certain obstacles to be cleared, especially in terms of trust, before drones can be deployed for passenger transport."

Source: Springer Link

AVIATION WHITE PAPER



White Paper: Assessment of the R&D Needs for Electric Aviation

"The world of aviation has seen a growing revolution in the last five years with the transition of jet engines to electric motors driven by declining costs and performance improvements of lithium-ion batteries. Electric propulsion offers numerous advantages, including lower fuel and maintenance costs, decreased noise and air pollution and unique aircraft designs.

Estimates suggest that a new mode of aviation services called Urban Air Mobility, or sometimes Advanced Air Mobility, will be a \$9 billion market by 2030 and could be an \$80 billion market by 2040. But how do we get to this electrified future? A forward-thinking white paper released by the Argonne Collaborative Center for Energy Storage Science (ACCESS) outlines a clear set of battery requirements and research and development needs to accelerate the commercialization of electric propulsion—from air taxis in the near-term to 737 class aircraft in the long-term."

Source: Argonne National Laboratory

AVIATION INDUSTRY

ECONOMIC REPORT

GE shares, which were already up 55% over the last 12 months, rose more than 2% on Tuesday even as the broader market pulled back."

Source: CNBC

Rethinking urban mobility: Next generation of CityAirbus

"Imagine arriving at the airport after a long haul flight, but instead of hailing a cab on your own as you normally would do, you hop into a fully electric flying vehicle that is readily available at the airport's vertiport. It looks like a quiet hi-tech crossover between a jet and a helicopter. In the vehicle, there are other passengers who are also taking this urban flight to complete the final leg of their journey.

The fully electric vehicle takes off and flies through the city, keeping a safe distance from other urban air vehicles and city infrastructure such as power lines and skyscrapers. As you get closer to your destination, the vehicle automatically knows where to stop and vertically lands to safely drop you off before taking the remaining passengers to their destinations. This is the future of integrated urban transportation."

Source: EuroNews

AEROSPACE ENGINEERING



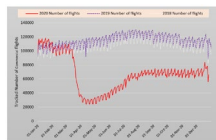
A computationally quick approach to predict molten droplet solidification on a solid surface

"Gas turbine engines in planes provide the required thrust by sucking in air, heating it to very high temperatures in a combustion chamber, and finally exhausting it at high velocities. As they operate, small inorganic particles such as volcanic ash get sucked in along with the air. These particles melt in the high-temperature zones in the combustion chamber and solidify onto the cooler zones in the engine such as the turbine blades. Over time, these droplets solidify and accumulate on the surface of the gas turbine, deforming the blades and blocking cooling holes, which deteriorates the performance and the life of the engine."

Source: EurekAlert!

New engine design could muffle roar of fighter jets

"Aerospace engineers at the University of Cincinnati have come up with a new nozzle design for F-18 fighter planes to dampen the



COVID-19 pandemic and prospects for recovery of the global aviation industry

"The COVID-19 pandemic ushered a wave of economic decline across the world due to disruptions in the supply and demand chain for the travel market. This study examines potential recovery pathways from the global aviation industry following the severe negative impacts of the COVID-19 pandemic. Using archival and secondary data mainly from Flightradar24, ICAO, IATA and EUROCONTROL, the study found that the pandemic inflicted a heavy toll on global aviation, which resulted in ratings downgrades, liquidation and bankruptcy of several airlines and airports due to severe cash burn instigated by travel restrictions. Although the industry is opening up, the recovery process seems much slower than anticipated, which could see more jobs and airlines failing in the absence of relevant support. The study recommends that as the sector opens up, it does so in a responsible manner, which puts measures that protect travellers, reduce costs, increase efficiency, and ensure a quality customer experience anchored on employees' health and customer safety. Recovery should also occur with the view to build back better in line with the provisions of the Sendai Framework for Disaster Risk Reduction and at the same time responding to the dictates of Agenda 2030 on sustainable development goals (SDGs)."

Source: Elsevier

From the Aviation Value Chain to the Aviation System

"The aviation value chain is made up of different sub-industries that range from aircraft manufacturers over technical support to airlines. Each of these sub-industries face different pull and push effects which are interdependent and influence their decisions and actions. Coupled with the interrelations of the different spheres within the aviation value system, and the market environment, a system approach is useful to map the aviation industry. Each sub-industry faces different degrees of profitability which depend on the entry barriers and the natural market power. This explains why airlines see narrower profit margins while airports or leasing companies face higher profits."

Source: Springer Link



Economic Performance of the Airline Industry

"Key Points • Airline industry is recovering gradually from COVID-19 but RPKs are still estimated to be only 40% of pre-crisis levels in 2021. • Air cargo has recovered above 2019 levels and is expected to be strong in 2022 with the support of strong global trade. • Vaccines will allow some governments to relax restrictions and support global travel to reach 61% of 2019 levels in 2022. • The industry is forecast to make net losses of \$52 billion this year, cutting these losses to \$12 billion in 2022. • Airlines are forecast to cut costs by 31% in 2021 vs 2019. As the traffic recovery continues airlines will face cost pressures. • Airlines continued to receive life support from their governments, totaling \$243 billion since the beginning of the pandemic. • Airline financial performance is expected to recover in all regions in 2022. North America is expected to turn to profitability in 2022."

Source: IATA

FORECAST



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

"Here are the latest developments as of November 2021.

- This year's global airline revenue is expected to land near the 2020 total, a disappointing outcome for a year that began with optimism for a faster travel rebound based on the arrival of Covid-19 vaccines. Since our previous forecast, the projected global revenue for 2021 in the baseline recovery scenario continues to drop, falling an additional \$5 billion, to \$230 billion. That would represent just 34% of the industry's total revenue in 2019 (see panel 1 above). Last year's global airline revenue totaled 33% of 2019's revenue."

Source: Bain

GROWTH OPPORTUNITIES



deafening roar of the engines without hindering performance. Distinguished professor Ephraim Gutmark, an Ohio Eminent Scholar, and his students in UC's College of Engineering and Applied Science designed and tested the new nozzles on 1/28th-scale jet engines in his aeroacoustics lab.

The interior of the nozzles features triangular fins like rows of shark teeth that significantly reduced jet engine noise in UC lab tests. The project is a collaboration between UC, the U.S. Naval Research Laboratory and NAVAIR Pax River. This fall NAVAIR will test the UC designs and performance on F-18 Super Hornets, the tactical fighter plane used by the U.S. Marines and Navy."

Source: University of Cincinnati

AVIATION AND PHYSICS



Icarus can fly high and save on wax too

"Commercial flight crews do not usually appear in Greek mythology, but they have to work with the occupational hazard of aviation radiation exposure. Aviation guidelines aim to mitigate the effects of radiation, mainly caused by galactic cosmic rays and solar energetic particles, or SEP. The fluxes in the former are stable and predictable: dose rates are no higher than 10 μ Sv/h at the normal flight altitude of 12 km. But in the case of SEP, does the frequency of detected solar flares justify the costs of countermeasures? Current mitigation procedures instruct planes to lower altitude or change or cancel flight paths altogether, significantly raising expenses.

A research team led by Kyoto University's Yosuke Yamashiki set out to answer this question by assessing eight flight routes during five ground level enhancements, or GLE: unpredicted radiation spikes recorded by ground-based detectors."

Source: Kyoto University

SUSTAINABLE AVIATION



U.S. airlines and Amazon join push to reduce aircraft emissions

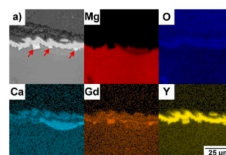
"The World Robotics report shows that Europe is the region with the highest

Determinants of blockchain adoption in the aviation industry: Empirical evidence from Korea

"Recently, blockchain technology has gradually been used in the logistics and supply chain sector. However, research related to blockchain applications in aviation remains in its infancy. This research provides actionable insights into the determinants of blockchain adoption in the aviation industry. The technology acceptance model is applied to explain the aviation industry's intention to adopt blockchain technology for potential applications and future improvements. Six factors are developed by reviewing the literature. Moreover, a two-step structural equation modeling approach with confirmatory factor analysis is used to analyze the research data and test hypotheses in this study. Results reveal that tracking and tracing, digitalized management, air traffic management, regulatory governance and industry standards, and technological improvements and optimization on efficiency exert a positive influence on intention to use blockchain."

Source: Elsevier

MANUFACTURING



Novel magnesium alloy containing Y, Gd and Ca with enhanced ignition temperature and mechanical properties for aviation applications

"Novel Mg-4.5Gd-3.4Y-2.6Ca (wt%) alloy is designed as a light-weight material for manufacturing aircraft parts. The alloy is characterized by good mechanical properties and exceptionally high ignition temperature, which is a critical safety measure. The material was prepared by casting and subsequently processed by extrusion at temperatures of 350 $^{\circ}$ C and 400 $^{\circ}$ C. The effect of extrusion on the microstructure, mechanical properties and ignition temperature is studied. The obtained results indicated a substantial effect of the extrusion temperature on the average grain size, the recrystallized fraction and texture formation. Microstructure condition directly affected the tensile and compressive behaviour with an observed average

Global Next-generation Commercial Aircraft Growth Opportunities

"The COVID-19 pandemic had a devastating effect on the global aviation industry. Passenger traffic plummeted to 66% in 2020 from 2019 levels. The recovery of the industry to 2019 levels is expected only towards the end of 2023 or early 2024. Original equipment manufacturers (OEMs) have faced significant challenges. The two market leaders, Airbus and Boeing, reported notable reductions in their operating revenues for the commercial aircraft segment (approximately 38% and 50%, respectively). New orders and deliveries were badly affected, contributing to the financial losses of 2020. Currently, with travel restrictions lifting across the world and airlines slowly resuming operations in key routes, demands from OEMs are on the rise. With airline operations focusing on short/medium-haul routes as they emerge from the pandemic, narrow-body aircraft, perfect for these routes, are in demand. These routes are critical for the airline industry's recovery from the impact of COVID-19. Business aviation has seen significant changes in recent years with advancements in technologies (for example, electric and hydrogen propulsions as alternatives to more traditional propulsion systems) enabling the industry to be more sustainable and environmentally friendly."

Source: Frost & Sullivan

US Commercial Unmanned Aerial Systems (UAS) Growth Opportunities

"This Frost & Sullivan research service focuses on the US commercial unmanned aerial system (UAS) market. The base year for spending information is 2020, and example market participants and market size estimates for 2021 are provided. This study discusses market participants, customers, and government agencies that influence the industry. The various UAS platform types are outlined by their design and use segment. Also included are insights on the software and services essential to the US UAS market. In addition, market applications, growth opportunities, industry participants, technology trends, and market drivers and restraints are discussed. The COVID-19 pandemic response has highlighted many applications for commercial UAS. These use cases have helped the general public and the media to become more aware of the many benefits that leveraging UAS technology can bring to the commercial market. In particular, business-to-business applications and

robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR's video news about Europe in one minute."

Source: Reuters

Carbon Offsets Remain Critical To Neutrality for Now

"While the hope in the coming decades is to move away from carbon offsets in favor of use of sustainable aviation fuel (SAF), electric, hydrogen, or other options, 4Air president Kennedy Ricci called these credits an important tool in the effort to move toward business aviation's carbon-neutrality goal. "There's no silver bullet within the challenges we face," Ricci said on Wednesday during AIN's Building a Sustainable Flight Department forum. "Each one of these technologies will have a place....[and] an incremental benefit that will play a role in 2050."

Source: Aviation International News

What are sustainable aviation fuels and could they change the future of flying?

"Flying is responsible for 2.5 per cent of the world's CO2 emissions, so reducing its climate impact is crucial to mitigating climate change. Despite the problem's importance, most people have barely been heard of one of the biggest innovations in recent years to reduce flight emissions. Sustainable aviation fuel - or SAF - is the umbrella term for the creation of jet fuel from sources other than fossils."

Source: EuroNews

New alloys could reduce air travel's carbon footprint

"College of Engineering researchers James Coakley and Giacomo Po are helping to develop a new class of refractory alloys that would increase aircraft engine efficiency and lower CO2 emissions. Delegates at the high-stakes COP26 climate summit who are devising new strategies to lower global levels of greenhouse gases would be wise to address a major source of CO2 emissions that made it possible for many of them to travel to the summit: planes. In 2019 alone, CO2 emissions from all commercial operations totaled 918 million metric tons, with 85 percent of those emissions coming from passenger transport, according to the International Council on Clean Transportation."

Source: University of Miami

Aviation's contribution to present-day human-

tensile yield strength of 302 MPa and 272 MPa for materials extruded at 350 °C and 400 °C, respectively. Both conditions featured a high ignition temperature of ≈ 1100 °C, which was attributed to the synergic effect of Y, Gd and Ca oxides, with the dominant effect of Y2O3. The achieved combination of enhanced mechanical properties and the ignition temperature makes this novel alloy a prominent candidate for aircraft applications."

Source: Elsevier

ELECTRIC AVIATION

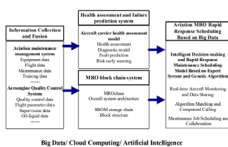


"Practical considerations in designing solid state Li-S cells for electric aviation"

"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. With Li/Al alloy as the anode and TiS2 as the active cathode material, the resultant solid-state battery with a thin electrolyte layer and excellent cathode-electrolyte interface represents a prototype vision on a potential solid-state cell required for electric aviation."

Source: Elsevier

BIG DATA



UAS delivery advantages have become well known."

Source: Frost & Sullivan

Global Commercial Aircraft Maintenance, Repair, and Overhaul (MRO) Growth Opportunities

"This study analyses the global commercial aircraft maintenance, repair, and overhaul market, providing a forecast of the kind of recovery the market can expect after the COVID-19 pandemic and beyond. The aircraft segments considered for this report are wide-body, narrow-body, and regional aircraft. The aftermarket is segmented into component MRO, line maintenance, airframe heavy maintenance, modifications, and engine overhaul. The report analyses the MRO value chain, with each segment further explained with respect to markets (to capture key stakeholders), cost structure, and the different constituents of the supply chain. The study identifies the top trends impacting the industry, like MRO investments in new technologies, and examines the type of investments expected during the forecast period. Another key trend in this market is mergers and acquisitions, which are important indicators of industry consolidation, especially during the post-COVID-19 recovery period (slated to be between 2023 and 2024)."

Source: Frost & Sullivan

induced global warming is 4% and will increase over the next 30 years should pre-Covid growth resume

"Aviation is responsible for more global warming than implied by its carbon footprint alone. According to new research published today, aviation could consume up one-sixth of the remaining temperature budget required to limit warming to 1.5°C by 2050. The article, published in Environmental Research Letters, suggests that emissions produced by the aviation industry must be reduced each year if the sector's emissions are not to increase warming further."

Source: EurakAlert!

Computational discovery of complex alloys could speed the way to green aviation

"Computational materials science experts at the U.S. Department of Energy's Ames Laboratory and their collaborators have identified the source of and the way to tune the strength and ductility of a class of materials called high-entropy alloys. The discovery may help power-generation and aviation industry develop more efficient engines, reducing fuel consumption and carbon emissions.

High-entropy alloys are composed from four or more different elements, and often have many desirable properties-- they are lightweight, strong, ductile, corrosion resistant and ideal for energy-generation applications in extreme environments, like aviation."

Source: EurakAlert!

Plant-based jet fuel could reduce emissions by 68%

"If we can secure feedstock supply and provide suitable economic incentives along the supply chain, we could potentially produce carinata-based SAF in the southern United States," said Dwivedi, associate professor in the [Warnell School of Forestry and Natural Resources](#). The aviation industry emits 2.5% of all carbon dioxide emissions nationwide and is responsible for 3.5% of global warming. "Carinata-based SAF could help reduce the carbon footprint of the aviation sector while creating economic opportunities and improving the flow of ecosystem services across the southern region."

Source: University of Georgia

AEROSPACE ENGINEERS

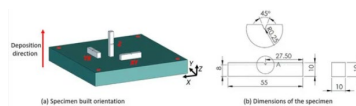


Rapid Response Maintenance Based on Intelligent Early Warning Technology for Health Status of Aviation Equipment

"On the basis of systematic research on the status quo of rapid response maintenance at home and abroad, this paper constructs a three-in-one MRO rapid response plan for aviation equipment, including fault prediction, early warning and maintenance by using modern information technology such as big data and artificial intelligence, through collecting the relevant data of aviation equipment maintenance support in an all-round way, according to the information collection and fusion of aviation equipment, health evaluation and fault prediction, MRO block chain system and the process of aviation MRO rapid response maintenance based on big data. The plan provides technical guidance for the military to carry out aviation equipment maintenance support."

Source: Atlantis Press

ENGINEERING



Towards Qualification in the Aviation Industry: Impact Toughness of Ti6Al4V(ELI) Specimens Produced through Laser Powder Bed Fusion Followed by Two-Stage Heat Treatment

"Laser powder bed fusion (L-PBF) has the potential to be applied in the production of titanium aircraft components with good mechanical properties, provided the technology has been qualified and accepted in the aviation industry. To achieve acceptance of the L-PBF technology in the aircraft industry, mechanical property data needed for the qualification process must be generated according to accepted testing standards. The impact toughness of Ti6Al4V extra low interstitial (ELI) specimens, produced through L-PBF followed by annealing, was investigated in this study. Charpy impact testing complying with American Standard Test Method (ASTM) E23 was performed with specimens annealed and conditioned at low temperature. On average, the toughness recorded for the specimens with 3D-printed and machined V-notches was 28 J and 31 J, respectively. These results are higher than the 24 J required in the aerospace industry. Finally, fractographic analyses of the fracture surfaces of the specimens were performed to determine the fracture

Aerospace engineering student recognized for work to reduce emissions

"Windsor native and Ryerson University masters candidate Madeline McQueen is flying high as the only Canadian to have earned a seat alongside 19 of the world's top science, technology, engineering or math students, according to a prestigious aviation magazine."

Source: Windsor Star

University of Toledo engineer awarded \$2.5 million to advance smart materials for aerospace systems

"An engineering professor at The University of Toledo who was the first to make 3D objects with smart materials that can change form while retaining similar atomic structure, then snap back to their original shape when activated by heat is getting millions in federal funding to apply his expertise toward next-generation medical devices, airplanes and drones."

Dr. Mohammad Elahinia, Distinguished University Professor, director of the Institute for Applied Engineering Research and chair of the UToledo Department of Mechanical, Industrial and Manufacturing Engineering, has received \$2.5 million to collaborate with the U.S. Department of Energy's Oak Ridge National Laboratory on a U.S. Department of Defense project to develop high-temperature shape memory alloys for 3D printing of advanced defense and aerospace functional components that could lead to smaller, lighter aircraft."

Source: EurekAlert!

ELECTRIC AIRCRAFT



All-electric aircraft from Rolls-Royce completes maiden flight in Britain

"[Rolls-Royce's](#) first all-electric aircraft has completed its maiden flight, soaring across skies in the U.K. for around 15 minutes this week."

In a statement, the company said the aircraft's trip on Wednesday marked "the beginning of an intense flight-testing phase" that would involve the collection of performance data on its electrical power and propulsion system.

According to Rolls-Royce, the airplane — dubbed the "Spirit of Innovation" — utilized a 400 kilowatt electric powertrain "with the most power-dense battery pack ever

mechanism of the Ti6Al4V(ELI) impact specimens."

Source: MDPI

Feasibility study on machining extra-large aspect ratio aviation deep-hole Ti6Al4V part with axial ultrasonic vibration-assisted boring

"Deep-holes are typical parts of aircraft structures, which is difficult to be machined. Boring assisted with ultrasonic vibration-assisted cutting has been proved to greatly enhance machining performance, especially for Ti6Al4V aviation alloy. This paper focuses on the machining extra-large aspect ratio (exceeding 20) of Ti6Al4V aviation deep-hole with the axial ultrasonic vibration-assisted boring (AUVB) method. First, the kinetics of the AUVB process is analyzed and a retrospective of its separation cutting feature is provided. Subsequently, a multi-stepped cantilever beam model of boring bar is established to analyze its static rigidity and dynamic stability. The aperture error is deduced, and then size coefficient is put forward to represent the static rigidity of the boring bar, which is inversely proportional to the diameter. In addition, two different vibration cases, namely modal-coupling vibration and regenerative vibration are considered for dynamic stability analysis. Next, the morphology of bored surface is analyzed, and the geometric height of peaks formed by AUVB and CB are calculated. Phase shift $\varphi = \pi$ is suggested for obtaining a better surface in AUVB. Finally, the feasibility of AUVB on the machining of extra-large aspect ratio Ti6Al4V titanium alloy aviation deep-hole is verified through systematic experiments."

Source: Springer Link

A Comprehensive Numerical Analysis of the Scavenging Process in a Uniflow Two-Stroke Diesel Engine for General Aviation

"The scavenging process of two-stroke engines plays a fundamental role in cylinder flow patterns and in the overall engine performance. In this work, 3D CFD simulations of the scavenging in a uniflow, two-stroke, compression ignition engine for general aviation, named GF56, have been performed by using a 3D finite-volume FANS equations solver with k- ϵ closure. The GF56 engine consists of six cylinders, separated into two quasi-symmetric banks. Both the right and the left banks, together with the corresponding cylinders, are carefully analyzed. Charging and trapping efficiencies are computed as a function of the delivery ratio for

assembled for an aircraft." Eventually, the firm wants the aircraft's speed to exceed 300 miles per hour."

Source: CNBC

Electric Airplanes Won't Make Much of a Dent in Air Travel for Decades to Come

"Exaggeration has become the default method for news reporting, and the possibility of commercial electric flight has been no exception, with repeated claims that these new planes will utterly change how we live.

In 2017, Boeing and JetBlue funded [Zunum Aero](#), a U.S. company that promised nothing less than transforming air travel with short-haul electric planes capable of carrying 12 people—and doing it by 2022. Two years later Boeing [declined to continue funding](#) the project.

At the Paris Air Show in June 2019, the CEO of Eviation introduced [Alice](#), a nine-seat commuter plane that had two pusher motors on the wing tips—a highly questionable design—and said, "This is not some future maybe.... It's operational." It was not. The first flight did not take place as advertised, and in 2021 the motors were relocated aft on the model fuselage."

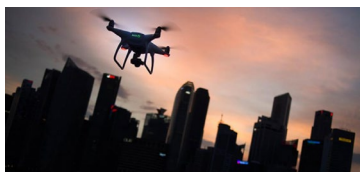
Source: IEEE Spectrum

New Zealand strait crossed for first time by electric plane

"As he made history by becoming the first person to fly across New Zealand's Cook Strait in an electric plane, Gary Freedman thought it only fitting that the first thing he saw when approaching the Wellington coastline was the rotating blade of a wind turbine producing renewable energy. Freedman's 40-minute solo flight in the small two-seater came 101 years after the first person flew a conventional aircraft over the body of water that separates the South Pacific nation's two main islands."

Source: TechXplore

UAV



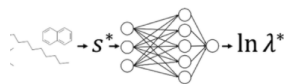
Real-time drone intent monitoring could enable safer use of drones and prevent a repeat of 2018 Gatwick incident

"The researchers, from the University of Cambridge, used a combination of statistical techniques and radar data to predict the flight path of a drone, and whether it intends to enter a

different mass flow rates entering into the plenum, and the influence of the exhaust pressure and of the cylinder's location in the bank are analyzed. The results show that the fresh air trapped during the scavenging process is quite similar for each cylinder of the right bank and it is about 92% of the in-cylinder mass. The cylinder's location in the bank by itself slightly affects the scavenging performance, whereas the pressure profile at the outlet section has a major role. The design of the intake ports is fundamental for establishing the in-cylinder flow field and a new ports configuration is proposed to enhance the swirl ratio and, consequently, the scavenging performance with high delivery ratios."

Source: MDPI

ARTIFICIAL INTELLIGENCE



Aviation Turbine Fuel Thermal Conductivity: A Predictive Approach Using Entropy Scaling-Guided Machine Learning with Experimental Validation

"Although typical aircraft fuel thermal management analysis relies upon temperature-dependent thermodynamic and transport properties of aviation turbine fuel, the variation in properties associated with compositional variation in fuels and the subsequent impacts on system performance are not well established. With this in mind, the present work aimed to develop a predictive model of aviation turbine fuel thermal conductivity which utilized only compositional (hydrocarbon) and state (temperature and pressure) inputs and had errors within the bounds of typical uncertainty of the associated test data (3%). A novel modeling approach was developed to predict thermal conductivity using pseudo-component entropy scaling techniques with a machine learning-developed intermediate step in the overall model. Simple hyper-parameter optimization techniques were developed to promote model stability, computational efficiency, and long-term repeatability of the novel architecture."

Source: ACS Publications

Classification and Analysis of Go-Arounds in Commercial Aviation Using ADS-B Data

"Go-arounds are a necessary aspect of commercial aviation and are conducted after a landing attempt

restricted airspace, for instance around a civilian airport. Their solution could help prevent a repeat of the Gatwick incident, as it can spot any drones before they enter restricted airspace and can determine, early, if their future actions are likely to pose a threat to other aircraft.

This new predictive capability can enable automated decision-making and significantly reduce the workload on drone surveillance system operators by offering actionable information on potential threats to facilitate timely and proportionate responses.

Real radar data from live drone trials at several locations was used to validate the new approach. Some of the results will be reported today (15 September) at the [Sensor Signal Processing for Defence Conference](#) in Edinburgh."

Source: University of Cambridge

'Safer, more efficient and less labour intensive': Drones to be used to conduct building facade inspection

"How does one begin to inspect the facade of a 37-storey building, such as The Gateway, the pair of towering skyscrapers located along Beach Road?

For now, physically and without a drone. But the use of drones will soon be encouraged for facade inspections to make the process "safer, more efficient and less labour intensive", as part of the ongoing transformation efforts for the Built Environment sector, announced the Building and Construction Authority (BCA) on Thursday (Oct 21)."

Source: Channel News Asia

has been aborted. It is necessary to conduct go-arounds in the safest possible manner, as go-arounds are the most safety-critical of operations. Recently, the increased availability of data, such as ADS-B, has provided the opportunity to leverage machine learning and data analytics techniques to assess aviation safety events. This paper presents a framework to detect go-around flights, identify relevant features, and utilize unsupervised clustering algorithms to categorize go-around flights, with the objective of gaining insight into aspects of typical, nominal go-arounds and factors that contribute to potentially abnormal or anomalous go-arounds. Approaches into San Francisco International Airport in 2019 were examined. A total of 890 flights that conducted a single go-around were identified by assessing an aircraft's vertical rate, altitude, and cumulative ground track distance states during approach. For each flight, 61 features relevant to go-around incidents were identified. The HDBSCAN clustering algorithm was leveraged to identify nominal go-arounds, anomalous go-arounds, and a third cluster of flights that conducted a go-around significantly later than other go-around trajectories. Results indicate that the go-arounds detected as being anomalous tended to have higher energy states and deviations from standard procedures when compared to the nominal go-arounds during the first approach, prior to the go-around."

Source: MDPI

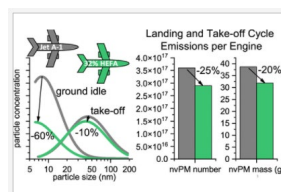
Research on Civil Aviation Passenger Question Intention Recognition Based on Text Classification Method of Self-attention and Deep Neural Network

"To solve the information loss and raise the accuracy of intention recognition of civil aviation travel question answering (QA) system, a hybrid model that is based on Self-attention Mechanism, convolutional neural network (CNN) and long-short term memory network (LSTM), namely SACL is proposed based on considering the characteristics of passenger travel questions. Firstly, Web Crawler is used to obtain the common questions of passenger travel in civil aviation airport to obtain a data set, and get the Word Vector Matrix after data preprocessing. Then the Word Vector Matrix of question is input into the serial structure of CNN and attention mechanism to obtain the Feature Vector that contains the local information of the question, and input the Word Vector Matrix of question into LSTM to get the Feature

Vector containing the Global Structure Information of the text. The two Feature Vectors are spliced for getting the feature representation of the text, and then input it into the fully connected neural network and softmax layer to get the text classification of the question. The gradient descent method (GDM) is used as the algorithm of training, and the classification data of the model are compared with four models."

Source: Springer Link

SUSTAINABILITY



Reduction of Nonvolatile Particulate Matter Emissions of a Commercial Turbofan Engine at the Ground Level from the Use of a Sustainable Aviation Fuel Blend

"Nonvolatile particulate matter (nvPM) emissions from aircraft turbine engines deteriorate air quality and contribute to climate change. These emissions can be reduced using sustainable aviation fuels (SAFs). Here, we investigate the effects of a 32% SAF blend with fossil fuel on particle size distributions and nvPM emission indices of a widely used turbofan engine. The experiments were conducted in a test cell using a standardized sampling and measurement system. The geometric mean diameter (GMD) increased with thrust from ~8 nm at idle to ~40 nm at take-off, and the geometric standard deviation (GSD) was in the range of 1.74–2.01. The SAF blend reduced the GMD and GSD at each test point. The nvPM emission indices were reduced most markedly at idle by 70% in terms of nvPM mass and 60% in terms of nvPM number. The relative reduction of nvPM emissions decreased with the increasing thrust. The SAF blend reduced the nvPM emissions from the standardized landing and take-off cycle by 20% in terms of nvPM mass and 25% in terms of nvPM number. This work will help develop standardized models of fuel composition effects on nvPM emissions and evaluate the impacts of SAF on air quality and climate."

Source: ACS Publications

Can Lower Carbon Aviation Fuels (LCAF) Really Complement Sustainable Aviation Fuel (SAF) towards EU Aviation Decarbonization?

"The present work provides an analysis of the potential impact of

fossil-based Low Carbon Aviation Fuels (LCAF) for the European aviation sector, with a time horizon to 2050. LCAF are a crude-derived alternative to kerosene, offering some Green House Gas (GHG) savings, and have been defined by ICAO as eligible fuels for mitigating the environmental impact of aviation. A methodological framework to evaluate the EU technical potential for LCAF production is developed, based on data on crude utilization for jet fuel production in EU refineries, relevant carbon intensity reduction technologies, market prices, and aviation fuel volumes. Two different baselines for fossil-derived kerosene carbon intensity (CI) are considered: a global figure of 89 gCO₂e/MJ and an EU-27-specific one of 93.1 gCO₂eq/MJ. Three scenarios considering increasing levels of CI reduction are then defined, taking into account the current and potential commercial availability of some of the most relevant carbon intensity reduction technologies."

Source: MDPI

Global biorenewable development strategies for sustainable aviation fuel production

"Over the coming years, the world is projected to witness an upsurge in "drop-in" aviation biofuel production as part of the renewable energy and bioeconomy developments. This paper presents a comprehensive review of the current status of biojet fuel development and uptake in global commercial aviation industry, including state-of-the-art certified technologies (i.e. Fischer-Tropsch (FT); hydroprocessed esters and fatty acids (HEFA); alcohol-to-jet (ATJ); and hydroprocessing of fermented sugars (HFS)); potential feedstock that can be deployed; a comparison of techno-economic and environmental performances of biojet fuel production routes; airlines' commitment in promoting higher biofuel uptake; and global initiatives and policies. This review shows that the HEFA route using oil-based crops is best performing in terms of lowest production cost and greenhouse gas emissions, however it is in competition with the existing road transport biofuel market. Lignocellulosic biomass and waste feedstock should be promoted in view of replacing food/feed crops which have high indirect land use change emissions."

Source: Elsevier

CORSIA: The first internationally adopted approach to calculate life-cycle GHG emissions for aviation fuels

"The aviation sector has grown at a significant pace in recent years, and despite improvements in aircraft efficiency, the sector's impact on climate change is a growing concern. To address this concern, the International [Civil Aviation](#) Organization (ICAO) established the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to help reduce aviation greenhouse gas (GHG) emissions. This paper presents a methodology agreed by the 193 ICAO member states to evaluate the life-cycle GHG emissions of sustainable aviation fuels (SAFs), in the CORSIA system. The core life-cycle assessment and induced land use change values of SAFs are presented to determine the GHG savings of certified pathways. The paper aims to present that a number of SAFs can yield significant life-cycle emission reductions compared to petroleum-derived jet fuel. This implies the potentially major role of SAFs in reducing aviation's [carbon footprint](#)."

Source: Elsevier

Efficiency and Sustainability of Regional Aviation on Insular Territories of the European Union: A Case Study of Public Service Obligations on Scheduled Air Routes among the Balearic Islands

"Mediterranean islands of the European Union (EU) have traditionally suffered from a lack of regularity in supplying public transportation due to the high seasonality of the demand for scheduled transport services. The insular fact forces people and goods to be carried either by sea or air, and therefore needs to actively stimulate interest in operating specific routes by proper carriers. As regional economies on insular territories also have a tight dependence on tourism, it is vital to achieve an appropriate balance between the need for effective public transportation and sustainable means of transport. This paper aims to provide an approach to the Public Service Obligation (PSO) system imposed on air routes serving the regional transport needs of the Balearic Islands. This study has analyzed data relating to freight and passenger traffic in the period between 2004 and 2019 from scheduled air services linking Palma de Mallorca with Ibiza and Menorca, as well as those between Menorca and Ibiza, and to their respective short-sea links. Results obtained in the research suggest that PSO impositions, together with significant improvement in the resident subsidy schema (from 50% to 75%), have

recently led to a sharp increase in the demand for passenger air services on these routes; thus, avoiding the tender for the award of a public contract."

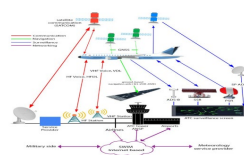
Source: MDPI

Decarbonising the critical sectors of aviation, shipping, road freight and industry to limit warming to 1.5–2°C

"Limiting warming to well below 2°C requires rapid and complete decarbonisation of energy systems. We compare economy-wide modelling of 1.5°C and 2°C scenarios with sector-focused analyses of four critical sectors that are difficult to decarbonise: aviation, shipping, road freight transport, and industry. We develop and apply a novel framework to analyse and track mitigation progress in these sectors. We find that emission reductions in the 1.5°C and 2°C scenarios of the IMAGE model come from deep cuts in CO₂ intensities and lower energy intensities, with minimal demand reductions in these sectors' activity. We identify a range of additional measures and policy levers that are not explicitly captured in modelled scenarios but could contribute significant emission reductions. These are demand reduction options, and include less air travel (aviation), reduced transportation of fossil fuels (shipping), more locally produced goods combined with high load factors (road freight), and a shift to a circular economy (industry). We discuss the challenges of reducing demand both for economy-wide modelling and for policy."

Source: Taylor & Francis

RISK MANAGEMENT



Studying Cybersecurity in Civil Aviation, Including Developing and Applying Aviation Cybersecurity Risk Assessment

In addition to the importance of safety in civil aviation, the significance of cybersecurity in the aviation sector cannot be ignored, and this fact has often been highlighted owing to frequent cyber-attacks that denigrate victim(s) and also lead to political and economic controversies. Cybersecurity has recently received a major boost, with the shift of air navigation facilities from analog ground-based systems to digital space-based systems to accommodate the tremendous growth in air traffic density...This

paper therefore presents a systematic qualitative and quantitative cybersecurity risk assessment methodology for legacy and next-generation critical infrastructure in aviation systems, such as air-ground communication, radio navigation aids, aeronautical surveillance, and system-wide information management (SWIM). Our analysis shows that the communication, navigation, and surveillance systems with the highest risk levels are very-high frequency voice communication, satellite-based navigation, and automatic dependent surveillance-broadcast, respectively, while those with the lowest risk levels are controller-pilot data link communication, ground-based radio navigation aids, and secondary surveillance radar, respectively."

Source: IEEE Xplore

Risk Management in Aviation

"Risk Management is a process based on the systematic collection and analysis of all relevant risks facing a company. Risks are particularly present in the aviation industry and therefore necessitates a special emphasis on a comprehensive Risk Management. The quality of the Risk Management is shaped by the enterprise culture and starts at a Board level. By integrating a Safety Management System, the operational area of the Corporate Risk Management can be further improved. It is important to realise that Risk Management is opportunity management too, where potential improvements need to be actively identified. For aviation companies it makes sense to take out a Director's and Officer's Insurance (D&O) to insure the management against any financial liabilities resulting from damage claims. However, these are expensive and require a time-consuming evaluation."

Source: University of St Gallen

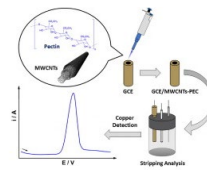
The Holy Grail of Aviation: Risk, Safety and Security

"Risk, safety and security are vital structural conditions to conduct safe and smooth air transportation. The concept of risk is multidimensional and its perception differs among passengers. To ensure the safety and security in aviation, measures are set up on global, regional and local scales. This chapter presents new approaches in the aviation system that manage risk, safety and security. On a regulatory level, safety management systems (SMS) are mandated by ICAO for all players within the aviation industry. However, an SMS needs to be accompanied by a safety culture that embraces the

values needed for the SMS to succeed in identifying and rectifying problems. Therefore, important aspects surrounding an encouraging safety culture need to be considered."

Source: Springer Link

AVIATION BIOKEROSENE



A carbon nanotubes-pectin composite for electrochemical determination of copper in aviation biokerosene by anodic stripping voltammetry

"This work reports the development of a simple, sensitive and low-cost electroanalytical method for copper determination in aviation biokerosene using an electrode modified with a composite made up of multi-walled carbon nanotubes and pectin. The proposed electrode was characterized by cyclic voltammetry, electrochemical impedance spectroscopy, scanning electron microscopy and RAMAN spectroscopy. Using square wave anodic stripping voltammetry, the method developed presented a linear working range of 1.0×10^{-8} to 1.0×10^{-6} mol L⁻¹. The limits of detection and quantification obtained for this methodology were 9.0×10^{-9} mol L⁻¹ and 3.0×10^{-8} mol L⁻¹, respectively. The proposed electrode experienced no interference from matrix effect when applied for copper determination in aviation biokerosene."

Source: Elsevier

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