

Sustainable Aviation

T. Hikmet Karakoc · Tomislav Letnik ·
Maršenka Marksel · Ismail Ekmekci ·
Alper Dalkiran · Ali Haydar Ercan *Editors*

Emerging Trends in Electric Aviation


Proceedings of the International
Symposium on Electric Aviation and
Autonomous Systems 2022

 **SARES**
INTERNATIONAL SUSTAINABLE AVIATION
AND ENERGY RESEARCH SOCIETY


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Sustainable Aviation

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- Exploring the potential of integrating renewables within airports
- Sustainable infrastructure development under a changing climate
- Training and awareness facilities with aviation sector and social levels
- Teaching and professional development in renewable energy technologies and sustainability

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Preface

New fuel and propulsion technologies are being proposed to find suitable alternatives to fossil fuels and new green energy production methods, such as battery-powered and hydrogen-powered aircraft, hybrid systems, and synthetic fuels. Various processes can produce hydrogen, but achieving a low maximum take-off mass is the biggest challenge. Fuel cell aircraft have a low power-to-weight ratio, and the cost of depreciation, interest, and insurance is proportional to the price of the aircraft; also, a viable and environmentally friendly alternative to conventional aircraft, with safety considerations, regulatory issues, ground infrastructure, and government and public acceptance.

On the other hand, additive manufacturing, an umbrella term for different manufacturing methods, aims to manufacture complex three-dimensional shapes by adding materials successively and their sequential connection to each other. This technique may help to reduce and overcome power over weight problems of future aspects of electric aircraft. Topological optimization is a new technology that optimizes material layout within a given design space for a given set of loads, boundary conditions, and constraints. Additive manufacturing enables solutions to increase efficiency and reduce parts weight, but certification is challenging.

Nevertheless, it seems there will not be an alternative energy resource for fully electric aircraft for a midterm period than using the batteries. Moreover, resolutions on battery charging performance are moving forward. One of the performance issues for battery energy is discharging and charging. In order to fully discharge the batteries of an electric aircraft at minimum cruise power and examining the motor power periodically as well as battery temperature may become necessary on operations. Electric aircraft performance changes during a flight are different than what a pilot expects from a gasoline-powered aircraft, resulting in increased performance near the end of a flight but lower performance at lower battery SOCs.

Hybrid Electric Propulsion solutions are a viable turnaround for reducing emissions in general aviation by decoupling the Internal Combustion Engine from the propulsor to the electric aircraft and allowing for a combustion engine downsizing and operation in the best economy point. A serial hybrid propulsion system has been

implemented into a modern general aviation aircraft to demonstrate the possibility of a low fuel consumption two-seater. However, those solutions haven't been enlightened a revolutionary transition over power to weight dilemma.

Electrical aircraft's comparatively low energy storage capacity is the only serious obstacle to developing successful regional aircraft fleets and achieving zero-emission flight. The next-generation air passenger experience will begin with the development of these two major performance issues.

ISEAS '22, an international and multi-disciplinary symposium on electric aviation and autonomous solutions, was held online between July 19 and 21, 2022, to address electric aircraft systems and safe, reliable electric power in aviation. We have kindly invited academics, scientists, engineers, practitioners, policymakers, and students to attend the ISEAS symposium to share knowledge, explain new technologies and discoveries, and consider the future direction, strategies, and goals in maintenance. This conference featured keynote presentations by invited speakers and general papers in oral and poster sessions.

We want to thank Springer's editorial team for their support toward the preparation of this book and the chapter authors and reviewers for their outstanding efforts.

We would also like to give special thanks to the SARES Editorial office members for gathering these chapters, who are the heroes behind the veil of the stage. Dilara Kılıç played a significant role in sharing the load and managing the chapters with Sinem Can. Also, we thank Kemal Keles for his efforts in the long run for symposium author communications.

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Maribor, Slovenia
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Istanbul, Turkiye
Keciborlu, Turkiye
Eskisehir, Turkiye

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Ali Haydar Ercan

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Tomislav Letnik is Head of the Transport Economics Centre at the University of Maribor, where he has been a project manager since 2005. His work involves the management of several European and national projects in the field of logistics and transport economics. Dr. Letnik is also a Lecturer at the University of Maribor for courses on logistics, transport economics, investment decisions, and system theory. He holds a B.S. degree in Transport Engineering and has successfully concluded postgraduate studies at the University of Maribor.

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