Electric Aircraft 2011-2021

This is the first and only report to analyse all forms of electric flying vehicle from robot insects to new solar airships, light aircraft and airliners and give timelines to 2021. It covers manned and unmanned aircraft, technology, funding, standards and other aspects for hybrid and pure electric versions across the world. Unusually, we compare what is happening in aviation with progress in land and water based electric vehicles that are in some ways further progressed yet use similar components and powertrains to achieve largely similar objectives.

authors:
Dr Peter Harrop and Dr Harry Zervos
Electric Aircraft 2011-2021

This is the world’s first report forecasting the global market for Aircraft design will never be the same again after the pressure to save the planet, reduce local noise, air and land pollution, reduce dependency on foreign oil and large areas of land for operations and to modernise industry or see it collapse. Belatedly, leaded fuel is being banned for aviation and considerable financial support is now available for the creation of new types of electric aircraft.

In this report we look at the considerable choices of component, system and structure for pure and hybrid electric aircraft, the huge number of projects and the few commercial successes. We examine what will happen over the next ten years. Unusually, we view all this in the light of what is being achieved in electric vehicles for land and water. What is the best selling electric aeroplane and what is the biggest development contract landed for electric aircraft? Why are microturbine range extenders so interesting and will there be a big retrofit market for electric drives in light aircraft? Where are fuel cells for aircraft headed and which types of traction battery are favoured and why? How do smart skin and multiple energy harvesting fit in? Which are the organisations to watch? It is all here.

This report is essential reading for chief executives, sales and marketing and business planning vice presidents and those in government, financial institution, consultants etc to understand electric aircraft and where they are headed. It has no equations, and covers the basics of battery, motor, supercapacitor, supercabattery, flexible solar cell, fuel cell and other components, so the non technical reader can learn a great deal. However, it progresses to compare such things as hybrid powertrain options for aircraft, preferred batteries to power aircraft, battery cathode, future shown shaded.

A comparison of potential electric traction motor technologies is given below. What is on the way in or out with traction batteries?

68 Lithium traction battery cell manufacturers, their chemistry, cell geometry and customer relationships (not necessarily orders)

Five ways in which a capacitor acts as the electrical equivalent of the spring
Examples of energy density figures for batteries, supercapacitors and other energy sources

Comparison of the three types of capacitor when storing one kilojoule of energy.

Pros and cons of supercapacitors as relevant to aviation

Multiple forms of energy management in aviation

Choices of flexible photovoltaics

Data for RQ-11A version of AeroVironment Raven

Probable timelines for electric aircraft, pure electric and hybrid combined, 2011-2021

FIGURES

Bionic Dolphin and Neckar Nymph

Gannet diving and planned Cormorant military spy plane/submarine

Puffin concept

Jaguar super car using electric drive with mini turbine range extenders –
anode and cell geometry, flexible printed photovoltaics chemicals for aviation and who is winning in electric aircraft and why – flight trials, development contracts, launch dates. The trend toward bigger batteries and various types of range extender is explained and the options appraised.

With the next generation of electric aircraft being designed from the ground up rather than shoehorned into existing airframes, we explain what will be possible with printed electronics including new components such as flexible, lightweight solar cells and new airframes and missions. Flying motorcycles, planes that dive to become submarines, huge solar powered radar airships through to retrofitting a Cessna are considered, with funding from a few thousand dollars to $30 million dollars on one project. Throughout, we benchmark best practice with land and water EVs, price premium and pay back elements with many comparison charts and figures.

To view FREE sample pages and the detailed table of contents please go to www.IDTechEx.com/evaircraft

lessons for aviation
- Hybrid technology evolving as traction batteries improve
- The convergence of hybrid and pure electric technologies
- OE electric aircraft configuration
- Multiple electric motors on a NASA solar powered, unmanned aircraft for the upper atmosphere
- The four Cri Cri electric motors
- Construction of a battery cell
- Approximate percentage of manufacturers offering traction batteries with less cobalt vs those offering ones with no cobalt vs those offering both. We also show the number of suppliers that offer lithium iron phosphate versions.
- Principle of PEM fuel cell
- PEM fuel cell in long endurance upper atmosphere unmanned aircraft
- Japanese ten meter long deep sea cruising fuel cell UAV, the URASHIMA, delivering formidable power
- Pilot plus payload vs range for fuel cell light aircraft and alternatives
- Total weight vs flight time for PEM fuel cell planes
- Boeing fuel cell powered FCD aircraft
- ENFICA FC fuel cell plane
- Skyspark in flight 2009
- Hydrogenius
- Principle of the creation and maintenance of an aluminium electrolytic capacitor
- Construction of wound electrolytic capacitor
- Comparison of construction diagrams of three basic types of capacitor
- Rechargeable energy storage - where supercapacitors fit in
- Energy density vs power density for storage devices
- Supercapacitor construction on left compared with supercabbattery on right, otherwise known as an asymmetric electrochemical double layer capacitor.
- Experience curve for new photovoltaic technologies
- Ubiquitous flexible photovoltaics
- Military deployment of solar/ fuel cell UAVs
- Helios
- SolarEagle
- Solar Impulse
- Solar impulse construction
- ETH Zurich solar powered unmanned aircraft for civil use.
- Green Pioneer
- Gossamer Penguin
- Néphélios planned solar airship
- Larry Mauro USA
- Test Flight of Soaring in 1994
- Design of Soaring
- Solar Flight
- Bubble Plane
- Solar and fuel cell powered airship concept
- Northrop Grumman hybrid airship
- Electraflyer Trike
- Electraflyer uncowed
- LaserMotive objectives illustrated
- A hybrid boat
- Lotus monoblock hybrid engine
- Adura MESA powertrain for buses and trucks employing Capstone turbine range extender
- The Bladon Jets microturbine range extender
- Twin Bladon jets in rear of Jaguar C-X75 concept supercar exhibited in 2010
- Planned Velozi supercar with miniturbine range extender
- GSE mini diesel driving a propeller
- Greg Stevenson (left) and Gene Sheehan, Feuling Team GFC contender, with GSE Engines.
- Block diagram of the Frank/Stevenson parallel hybrid system
- Ricardo Wolverine engine for hybrid UAVs
- Turtle Airship landed on water in concept drawing
- Glasscock hybrid set up for dynamometer testing
- University of Colorado hybrid aeroengine
- Electrified horse drawn carriages in 1900 were nothing like the cars that resulted later
- US Airforce interest in smart sensing skin for aircraft and aircrew.
- T-Ink printed and laminated overhead control console for an electric car
- T-Ink washable heated apparel based on printed elements
- Examples of SUAV rechargeable lithium batteries. Top: Flight Power “EVO 20” lithium polymer battery. Bottom: Sion Power lithium sulphur
- Aeroplanes but not as we know them - SPI electrical SUAV
- AeroVironment Raven
- Aqua Puma
- Rotomotion VTOL electrical UAV incorporating video camera, telemetry, auto takeoff and landing
- Examples of robot insects
- COM-BAT concept
- Military hummingbird
- AeroVironment Helios
- Global Observer first flight August 2010
- Odysseus self assembling unmanned electric UAV
- Sunlight Eagle
- Lockheed Martin morphing electric UAV
- Lockheed flying cameras based on tree seeds

AND MANY MORE
More from IDTechEx ...

New report  By Dr Peter Harrop and Raghu Das

Hybrid and Pure Electric Cars 2010 - 2020

www.IDTechEx.com/evcars

New report  By Dr Peter Harrop and Raghu Das

Electric Vehicles 2010-2020

www.IDTechEx.com/evvehicle

Free weekly news

ElectricVehiclesResearch.com
Subscribe now to Electric Vehicles Research for free weekly news from the Electric Vehicles industry.

Authors:

Dr. Peter Harrop is Chairman of IDTechEx Ltd. He has previously managed and chaired public and private organisations. He founded IDTechEx and consults internationally on Energy Harvesting, Printed Electronics, Electric Vehicles and RFID. [ p.harrop@IDTechEx.com ]

Dr Harry Zervos PhD is a technology analyst with IDTechEx. Harry received his degree in physics from the University of Athens, Greece, and went on to study materials science at Cranfield University, where he received his PhD. [ h.zervos@IDTechEx.com ]

To order: fax this sheet to +1 617 577 7810 (US) or + 44 (0) 1223 812400 (UK) or send to: IDTechEx Inc, Suite 0222, 222 Third Street, Cambridge MA 02142, USA or IDTechEx, Downing Park, Swaffham Bulbeck, Cambridge CB25 0NW, UK or email: info@IDTechEx.com or buy online: www.IDTechEx.com/evaircraft

ORDER FORM

Description               US $     £      €      ¥
Electric Aircraft 2011-2021 electronic copy   3750  1995  2895  415000
Printed and electronic copy       3995  2145  2995  455000

( All prices include postage and packing ) * Total

PAYMENT DETAILS (BLOCK CAPITALS ONLY)

1 Cheque or International Money Order, made payable to IDTechEx
2 Direct bank transfer available – please contact Margaret Bateman at m.bateman@IDTechEx.com
3 Visa        MasterCard        AMEX

Card Number ___________________ Expiry Date ___________________ 3 or 4 digit security code

Name of Card Holder _____________________________________________
Registered Address ____________________________________________

CONTACT DETAILS FOR REPORT DELIVERY

Name __________________________________ Position ___________________ Company ________________
Email __________________________________ Delivery Address ________________________________

Post/Zip Code ___________________ Country _________________________ Tel No ___________ Fax No ___________

TERMS & CONDITIONS

IDTechEx Ltd reserves the right to alter report content and price without notice. If you do not wish to receive industrial information / news / resources from IDTechEx please tick [ ] by email [ ] by mail

www.IDTechEx.com/evaircraft