Roland Berger

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Pace of progress quickens for electrical propulsion in aircraft

London, July 18, 2018: Electrical propulsion in aerospace is set to bring low-noise, low-emission, and potentially even safer hybrid-electric flight to market within the next 15 years. The pace of development is quickening: With roughly 100 different aircraft programs in development, the number of projects has increased by more than 30 percent since 2017. Once technological and regulatory hurdles are overcome, electrical propulsion will have a wide-ranging impact on business models, aircraft architecture, and even city planning, according to the Roland Berger "Onwards & Upwards" the latest trends in electrical propulsion (Download study here).

Large-scale commercial aircraft flying with lower emissions and less noise, island-hopping for environmentally aware tourists in small, electrically propelled aircraft, or "air taxis" autonomously flying in urban environments opening up the third dimension to commuters: these are some of the visions and commercial applications behind a growing number of developments in electrical propulsion in the aerospace industry.

The study shows that a confluence of technological developments, investment from new entrants, and activity by major aerospace incumbents is giving the market a boost. "Electric propulsion is ushering in an age of innovation in aerospace and aviation of a type not seen for decades," says Roland Berger Partner Robert Thomson. "Often venture-backed and developed in an agile way, many projects will fail, but some may succeed," adds Nikhil Sachdeva, Senior Consultant at Roland Berger and co-author of the study.

Electrical propulsion could help to reduce aviation's share of carbon dioxide emissions, but with dire consequences for aircraft lessors

The requirement to reduce emissions has been a major force driving change in the automotive industry. In this study, Roland Berger models the share of carbon dioxide emissions that will be generated by aviation in 2050. Given projected growth in air travel, aviation will be contributing 10% of global CO2 emissions by 2050 with conventional propulsion systems, while if other industries achieve their CO2 reduction targets, this figure could be as high as 24%.

Electrical propulsion could help constrain aviation's CO2 emissions to current levels of 2-3% of global emissions, but this will only happen with a complete retirement and replacement of today's fleet. Such an eventuality would present immense challenges for the aircraft leasing industry, with residual values of today's aircraft falling sharply, and require a massive investment by aircraft OEMs and suppliers to design, develop and produce an entire replacement fleet of new, electrically-propelled aircraft.

A future jostle for supremacy between aircraft OEMs, engine companies, and electrical systems suppliers

Some of the current research programs have three types of participants: an aircraft OEM, an engine company, and an electrical systems supplier. This tripartite alliance, necessary in the early stages of development, may give way to a competition between the parties for control of the electrical propulsion system – for instance:

- Will the propulsion system continue to be certified as a separate system, sustaining the power of the engine company?
- Or will embedded propulsion systems become an integral part of the aircraft, and fall under the remit of the aircraft OEM?
- Or will the complexity of the electrical system (generators, power electronics, motors, cables and controls) result in an electrical systems company controlling the system integration?

Either way, the implications for engine companies are challenging – a gas turbine in a hybrid-electric propulsion system could be far simpler and cheaper than today's complex aero-engines, and may require far less of the maintenance activity that is so profitable for an engine company today.

Timing of the adoption of electrical propulsion presents a dilemma for aircraft OEMs

Roland Berger's survey of about 40 aerospace and defense professionals revealed that 2032 is the average year when the first >50 seats hybrid-electric aircraft will enter fare-paying passenger service. The early 2030s is also when most industry observers expect the OEMs to bring into service replacements for current major narrowbody aircraft.

If hybrid-electric propulsion is sufficiently mature by this stage for a 50 seat aircraft to be in service, will the OEMs want to adopt this technology for their new narrowbody aircraft, or will they opt for conventional propulsion systems? "Aircraft OEMs will soon have to make the choice of whether to invest USD 15-20 bn in a new narrowbody aircraft using conventional propulsion systems, which may quickly become obsolete, or to take the risk to bring a new propulsion technology to market," adds Thomson.

An opportunity for China?

China is investing heavily in automotive electrification, with around 50% of all electric vehicles manufactured worldwide in 2017 being produced in China, and the country being responsible for over 95% of global electric bus sales. In both of these vehicle types, local Chinese content is mandated by the Chinese authorities, generating economies of scale in battery and motor production for Chinese companies, and taking advantage of China's possession of the world's largest reserves of rare earth metals. If China were to adopt the same coordinated approach to electrically-propelled aircraft, the results could be very challenging for established Western aerospace companies.

Interviews with leading industry figures

During the compilation of the study, Roland Berger interviewed a range of leading aerospace and aviation industry figures, including:

- Johan Lundgren, CEO of easyJet
- Ashish Kumar, Founder and CEO of Zunum
- Andreas Thellmann, Project Executive for Urban Air Mobility at Airbus

- Professor Ric Parker, Chairman of the Board at Clean Sky Joint Undertaking
- Professor Pat Wheeler, Head of Electrical & Electronic Engineering at Nottingham University

Their views are reproduced in the study.

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