Aerospace Electrification Event, Hosted by ATI and WMG

Challenge session: Systems integration

The session was facilitated by Sarabpal Bhatia, E-Fan X R&T Coordination Manager at Airbus, Dave Rawlins CTO of the WMG centre High Value Manufacturing Catapult, with key contributions from Paul Harris, Chief of Technology - Intelligent and Optimised Systems, Rolls-Royce.

Outline

The last major disruption in air travel was the gas turbine and, from that, the industry learned that integration of the whole system is essential and no single company can do this on their own! The ideal scenario for systems integration development is to prove on small platforms, smaller aircraft, before scaling to mass air travel. Electrification will bring a revolutionary change in technology for aerospace, and it will not be possible in all cases to draw on years of evolutionary experience gained through previous air travel. Industry very much needs to start again from the fundamentals and work their way up.

A number of challenges were identified by the group, including:

- Robust system architecture selection, including new system design tools for electric architectures.
- Research and testing infrastructure for systems and sub-systems.
- System control and health management, including predictive maintenance.
- Power distribution networks.
- Maintenance, Repair and Operations (MRO) requirements, including ensuring ground maintenance and crew safety when working with high voltages.
- Systems simulation.

The group then prioritised the top three challenges and discussed ways to address them and next steps.

Challenge 1: Airframe integration

The first challenge identified by the group was airframe integration, that is, the collaboration between the system OEMs and the part component suppliers. The group identified that roadmaps need to be created at a detailed level, right down to individual parts (ancillaries) and not just at current overarching technical levels. The industry also require a better understanding of UK capability and where gaps exist. Moving forward, strategic collaborative research projects could close these technology gaps.

For true sustainability, lifecycle of the airframe also needs to be considered, this can be achieved through manufacturing,production and MRO integration.

Lastly, it was noted that superconductivity can be used as an enabler for the whole aircraft, as can use of multi-materials and clever use of material science technologies.

Challenge 2: Thermal management

The second challenge identified was thermal management – the integration of thermal systems and the impact on aircraft. For this challenge, it will be important to bring learning across from other industries, for example the role of cryogenics (hydrogen) in the space industry. However, we cannot

rely on technology transfer alone, more studies are required particularly in heat exchange technology. This could include research into using the aircraft surface or structure for rejecting heat or looking into how thermal cycling drives aircraft design.

In order to accelerate thermal management technologies in aerospace, there needs to be a removal of commercial boundaries and barriers for existing subsystems. A complete rethink of how thermal management systems can be developed for the future needs to be encouraged.

Challenge 3: System safety and reliability

The last major challenge identified by the group was that of system safety and reliability. Safety is today demonstrated to certification authorities through lessons learned. However, it would be more beneficial to use advanced simulation and digital twin technologies to demonstrate safety as this would drive standards much more efficiently.

There is an opportunity to reassess safety standards, which would enable acceleration of electrification developments without making air travel less safe. Specific roadmaps for safety, reliability and certification should be developed in collaboration with experts. This would sit alongside the technology roadmap and allow the aerospace community to demonstrate safety compliance targets from now until 2035.

The last point to be raised was that of public perception, novel systems and technology changes in the industry mean that the public will demand higher safety and reliability than ever before and this expectation needs to be communicated and managed across the supply base.