VER THE LAST FEW DECADES, THERE HAS BEEN TREMENDOUS progress in the efforts to move toward More Electric Aircraft (MEA). Many subsystems that previously ran using hydraulic, mechanical, and pneumatic systems have been fully or partially replaced with electrical systems. One of the drastic changes in some commercial transport aircraft has been the elimination of the integrated drive generator (IDG). The IDG had been used to change the variable speed of the jet engine to constant speed via mechanical means. This system provided constant frequency and constant voltage to the aircraft bus. In some of the most recent commercial transport aircraft, including the Boeing 787 and Airbus A380, the main engine generator is directly coupled to the jet engine via a gearbox. Hence, the frequency of the electrical power in the aircraft’s power busses is proportional to the engine speed. The frequency variation range at the engine generator output is set to a desired value depending on the engine design, e.g., between 350 and 800 Hz, depending on the engine design. The ac voltage produced by the generator is regulated at a fixed value, such as 115 or 230 Vac, using a generator-control unit. This paves the way for a constant-voltage and variable-frequency power bus. Hence, many current loads that have run at a constant 400 Hz in the traditional aircraft with IDGs would now require additional provisions to convert power from one form to another, i.e., ac–dc and dc–ac.

Another example of the expanding use of electrical systems is the elimination of the use of bleed air for environmental control systems. Environmental control systems are used to achieve passenger comfort by regulating the cabin temperature and pressure. Bleed air had been obtained from one of the compressor stages of the main engine; however, in the Boeing 787, instead of tapping

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into the bleed air from the engine, a set of compressors using electric power is used to regulate the temperature and pressure in the cabin. Thus, the pneumatic system and air ducts from the engine have been eliminated for this system. However, because the regulation of cabin temperature and pressure requires a large amount of electric power, the onboard power generation had to be significantly increased for the main engine generators. Another interesting feature of the Boeing 787 is the use of electrical power to start the main engine, as opposed to the use of compressed air from the auxiliary power unit, ground cart, or the other main engine. The electric start of the main engine eliminates other pneumatic systems in the aircraft as well.

This is just one example of transitioning from pneumatic systems to electric systems in newer aircraft. There are many other hydraulic, mechanical, and pneumatic systems in aircraft that have undergone similar transitions to More Electric Systems.

In this issue, we have three feature articles. The first article, “The More Electric Aircraft,” reviews the various MEA architectures for power generation and their utilization in aircraft using electrical actuation systems.

The second article, “Selecting the Best Electric Machines for Electrical Power-Generation Systems,” details high-performance electric generators for More Electric Architectures in aerospace. An in-depth overview is given for the selection criteria of generators using key characteristics and requirements for aerospace applications.

The third article, “Propulsion Powertrain Simulator,” describes the simulator for a future turboelectric distributed propulsion aircraft. A subscale experimental system to emulate the power distributed from the turbine to the propulsive fan is presented.

This issue’s “Technology Leaders” and “Viewpoint” columns also focus on the challenges and trends of the MEA.

For this special issue, we have tried to include different kinds of articles covering a wide range of topics related to MEA. If you wish to submit an article or if you identify a specific topic that you would like to be addressed in future issues, please contact us at electrification@ieee.org.

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