

Development of High-Temperature Superconducting CORC® Power Cables for Use on Electric Aircraft

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Abstract – Electric power systems on future twin aisle electric aircraft require high-temperature superconducting (HTS) dc cables capable of delivering up to 50 MW of power. Conductor on Round Core (CORC®) power cables under development at Advanced Conductor Technologies (ACT) could provide such power when combining high operating currents in the order of 5 kA with an operating voltage of 10 kV. An overview of the development of CORC® dc power cables with fault current limiting capabilities for shipboard and electric aircraft applications is provided. High current operation of a 10-meter long 2-pole CORC® dc power cable, cooled with helium gas, clearly shows the benefits of operation at reduced temperatures of 20–60 K, which is a temperature window that may be easily accessible in the presence of liquid hydrogen fuel. Continuous operation of a helium gas cooled CORC® cable with compact terminations containing current leads to room temperature with integrated helium gas heat exchangers will also be outlined. A major challenge in development of high power CORC® cables is to provide them with a voltage rating as high as 12 kV when cooled with helium gas. The latest results of CORC® cable dielectrics development will be highlighted. Integration and safe operation of high-current superconducting cables in electric aircraft is a major challenge, especially when considering potential operation at relatively high voltage and as fault current limiter. We will highlight some of these challenges and discuss how they need to be addressed on a system level. Initial results of the CORC® dc and ac busses being developed for the Airbus ASCEND demonstrator will also be presented.

Keywords (Index Terms) – CORC® cable, superconducting power cables, electric aircraft, electric ship

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