Distributed Control Architecture

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ABSTRACT

Historically turbine engine performance has largely been determined by aero-mechanical innovations. Control systems, although critical to engine operation, have been designed to implement engine functionality rather than be a driving force behind their performance. This is a result of the natural incremental progression of technology which has seen controls evolve from complex mechanisms to the present day Full Authority Digital Engine Control (FADEC), also referred to as ECU (Engine Control Unit). As various engine technologies are implemented, there will be additional but not unforeseen pressure on control system design to meet new challenges. In current production engines, controls and accessories (C&A) account for approximately 15% to 30% of total engine weight, an equivalent percentage of acquisition cost, and are a major source of unscheduled maintenance. With the advent of new technologies and all else being equal, C&A will increase its footprint in all three metrics.

The transformation of engine control systems from centralized to distributed architecture is both necessary and enabling for future aeropropulsion applications. The continued growth of adaptive control applications and the trend to smaller, light weight cores is a counter influence on the weight and volume of control system hardware. A distributed engine control system using high temperature electronics and open systems communications will reverse the growing trend of control system weight ratio to total engine weight and also be a major factor in decreasing overall cost of ownership for aeropropulsion systems. The implementation of distributed engine control is not without significant challenges. There are the needs for high temperature electronics, development of simple, robust communications, and power supply for the on-board electronics.

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