INDUSTRIALIZATION OF CERAMIC MATRIX COMPOSITES FOR AEROSPACE APPLICATIONS

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The development of aircraft engines with higher efficiencies and performance has often been driven by key innovations in high temperature materials. Ceramic materials provide very high temperature capability and light weight and were first introduced as thermal barrier coatings in aircraft engines. A newer generation of engines have, for the first time, ceramic composites in the hot sections.

Certified by the Federal Aviation Authority and European Aviation Safety Agency (EASA) in May of 2016, more than 100,000 CMC shrouds have been produced and they have already surpassed several million hours of flight time in commercial LEAP engines. GE Aviation has also certified the largest aircraft engine in the world— the GE9X—which has five CMC parts throughout the engine hot section. These parts include one combustor inner liner and one outer liner, as well as HPT Stage 1 shrouds and nozzles, plus HPT Stage 2 nozzles. CMCs also are being incorporated into the architectures of the next generation advanced military and commercial engines to enable increased thrust and reduced specific fuel consumption.

A key to successful introduction of these ceramics components in engines is the ability to translate these innovations from laboratory to pilot scale and ultimately to production volumes. This talk will outline some of the key challenges unique to scale up of high performance ceramics.