3D – Airfoil Inspection (3DAI)

PROBLEM / OBJECTIVE

The current processes for inspecting complex airfoil designs are too slow for full rate/surge production or efficient maintenance operations. Engines have hundreds of airfoils, consisting of organic matrix composites, ceramic matrix composites and cast alloys, and they are inspected at an average rate of one hour per airfoil using current, Coordinate Measuring Machine (CMM) methods. Conversely, the 3DAI system expedites the inspection process by scanning the airfoil and creating an associated point cloud. The point cloud, which is developed from the inspection data, undergoes comparison to the CAD file of the part. Error maps representing the differences between the CAD dimension and the point cloud are then compared and used to identify part locations shown to be outside of tolerance bands. The overall aim of the 3DAI implementation is to accelerate—by means of a 90% reduction in airfoil inspection time—the rate at which weapons systems are fielded. Meeting this goal translates to decreasing the airfoil inspection period from 1 hr per airfoil to <6 min per airfoil.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

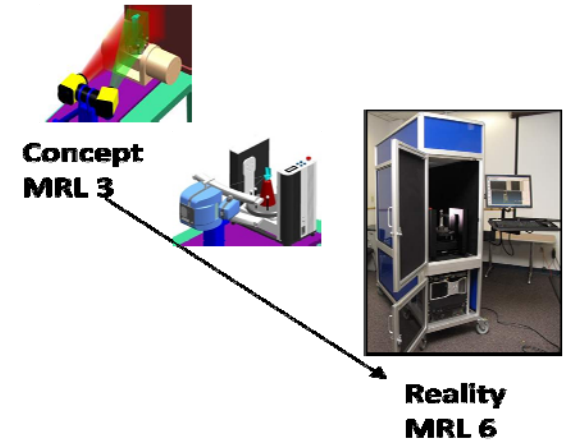
- The 3DAI system has achieved 2 - 4 min airfoil inspection times (93-96% reduction).

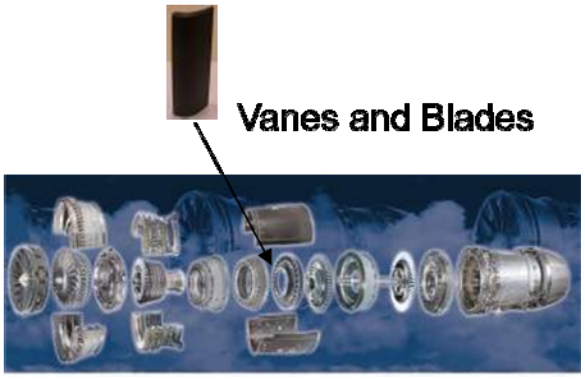
Implementation and Technology Transfer:

- Turbine engine manufacturers of both commercial and military applications have had repeated follow-up system demos. The system has been included on manufacture bid lists and multiple systems are being considered for acquisition in the near term.

Expected Benefits and Warfighter Impact:

- The cost avoidance projected for this reduction amounts to $26 million — a figure encompassing 1,500 afterburning turbine engines rated for 29,000 lbs of thrust.
- Additional advantages afforded by the technology include reduced airflow variation (which could also enable decreases to total cooling flow), increased engine efficiency, lower fuel consumption, and potentially longer component service life due to better control of cooling at critical locations.





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