## Nondestructive Evaluation of the J-2X Direct Metal Laser Sintered Gas Generator Discharge Duct

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The J-2X program at NASA's Marshall Space Flight Center (MSFC) procured a direct metal laser sintered (DMLS) gas generator discharge duct from Pratt & Whitney Rocketdyne and Morris Technologies for a test program that would evaluate the material properties and durability of the duct in an engine-like environment. DMLS technology was pursued as a manufacturing alternative to traditional techniques, which used off nominal practices to manufacture the gas generator duct's 180 degree turn geometry. MSFC's Nondestructive Evaluation (NDE) Team performed radiographic, ultrasonic, computed tomographic , and fluorescent penetrant examinations of the duct. Results from the NDE examinations reveal some shallow porosity but no major defects in the as-manufactured material. NDE examinations were also performed after hot-fire testing the gas generator duct and yielded similar results pre and post-test and showed no flaw growth or development.

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