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14. ABSTRACT Due to a critical need for the development of hightemperature conformal antennas to enable hypersonic flight (in excess of MACH 4), Alliant Techsystems (ATK) is evaluating materials for forming these complex shapes. The objective of this project was to develop a conformal antenna solution to meet the demands of aerodynamic heating. The development of two formulations of HotBlox with ideal dielectric properties of 2.0 and 4.0 and development of a process for molding the parts to near net shape were focused on. Most importantly, one component must have a dielectric constant twice that of the other component. The NCDMM provided program management and lessons learned from working with ATC on earlier HotBlox projects that recommended further application of this material.					
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Low Cost, High-Temperature Conformal Antennas

NCDMM Project No. 06-0111-09

PROBLEM / OBJECTIVE

Due to a critical need for the development of high-temperature conformal antennas to enable hypersonic flight (in excess of MACH 4), Alliant Techsystems (ATK) is evaluating materials for forming these complex shapes. One material found to be acceptable is American Technical Coatings (ATC) HotBlox material. This material is known to withstand the high-temperatures, but does not possess the necessary dielectric property requirements for the antenna to function properly.

The conformal antenna is comprised of two (2) parts. Each part contains very thin cross sections, which present problems during machining. See Figure #1.



Figure #1: Two Piece Conformal Antenna

One of the main benefits of HotBlox technology is the materials ability to be injection or compression molded into near net shapes that require no further machining after the sintering process. ATC was able to verify this in this project.

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ACCOMPLISHMENTS / PAYOFF

Process Improvement

By utilizing the benefits of HotBlox injection molding technology, lower costs, higher production rates, and higher acceptance rates will be achieved over machining the pieces from ceramic blocks. Machining time of each element consisting of two parts is estimated at eight hours. The current molding process of each element is less than two hours. This was accomplished by modifying a compression mold supplied by ATK. Additional time saving will be achieved by implementing injection molding for the HotBlox material.

Implementation and Technology Transfer

With the distinct advantage of molding HotBlox to near net shapes, ATC was able to develop a compression molding process capable of producing the two conformal antenna parts. The technology learned throughout this development can be adapted to a future injection molding process.

In addition, after extensive testing of numerous formulations at (ATK), formulations with dielectric constants of 2.5 and 5.0 meet the requirements. Further testing will continue to achieve the ideal dielectric constants of 2.0 and 4.0.

Expected Benefits

Based on 2000 missiles and a shop rate of \$62.50/Hr, machining 17,600 elements would cost \$8.8M; molding 17,600 elements reduces the cost to \$2.2M resulting in a cost saving/avoidance of \$6.6M per 2000 missiles.

TIME LINE / MILESTONE

Start Date.....September 06
End DateJune 07

PROJECT FUNDING

NCDMM Funding.....\$40K

PARTICIPANTS

American Technical Coatings (ATC)
Alliant Techsystems, San Diego (ATK)
NCDMM

For additional information about the NCDMM visit our website at www.ncdmm.org