

SUCCESS STORY

TOPIC NUMBER: N101-034

SBIR INVESTMENT: \$2,380,440

PHASE III FUNDING: \$6,687,278



AFFORDABLE BROADBAND HIGH SPEED RADOMES

These ceramic nose radomes improve RF performance, enable faster (hotter) flight profiles, and are significantly less expensive than the traditional composite radomes they replaced.

Rock West Composites

POC: Keith Loss
858-537-6260
San Diego, California 92154

<https://www.rockwestcomposites.com>

THE CHALLENGE

Supersonic air vehicles require nose radomes that can withstand high temperatures as well as have high RF transmission over wider radio frequency bandwidths. Typically nose radomes are built from solid laminate or monolithic ceramic materials which inherently have a very narrow frequency band over which they are RF transparent; they need to communicate or do other things by transmitting radio signals straight out the tip of the nose. The previous design did not have as good a performance as desired, and the materials were becoming obsolete. Innovative material and design solutions were needed to achieve low transmission losses for improved radome performance and to support supersonic capabilities at all altitudes, all at a lower cost. Additionally, the radomes needed to be environmentally stable in long term storage.

THE TECHNOLOGY

Under SBIR topic N101-034, Affordable Broadband Radome, Rock West Composites (Rock West) developed a new process to build ceramic radomes without requiring expensive precision machining that is typically required for such structures. These radomes are for targets the Navy uses to simulate enemy missiles and train against them. Rock West's radome design leverages a qualified ceramic matrix composite (CMC) as the outer shell that will withstand the aero-forces, high heat rates and other environments the radome will encounter. The addition of a tuning material to the inner surface achieved transmission over a broader range of wavelengths and high angles of incidence, creating a radome for high-speed flight profiles.

THE TRANSITION

Rock West has been awarded a multi-year Phase III SBIR Basic Ordering Agreement (BOA) for NAVAIR PMA-208, building ceramic nose radomes for the GQM-163A Supersonic Sea Skimming Target (SSST), also known as Coyote. Rock West is delivering multiple radomes per year to the Navy through a five-year BOA. The Navy supplies the radomes to Northrop Grumman's Launch and Missile Defense Systems in Chandler, Arizona, where Northrop Grumman builds the SSST.

THE NAVAL BENEFIT

Rock West's new ceramic nose radomes are being delivered to the Navy with no interruption to the overall SSST production program. The new radomes improve RF transmission, enable faster flight profiles, and are capable of higher temperatures for a significantly lower cost than the radomes they are replacing. A nose radome that can withstand the supersonic environment and have broader bandwidth inherently allows the sensor designer and the mission planner more flexibility in design of the antennas that can be included in the nose radome. A broader bandwidth radome also implies larger manufacturing tolerances because it will still transmit efficiently even if the as-built baseline shell is slightly de-tuned with respect to the nominal design, because each tuning layer is inexpensively customized to achieve best transmission at the specified frequencies. Larger manufacturing tolerances mean better affordability. Additionally, by including a structural CMC material that the U.S. Navy had already qualified for a production program, the risks and non-recurring development costs were kept lower. The CMC is the lowest cost qualified structural ceramic material available today, and the processes to achieve other attributes such as erosion protection were also fully developed and cost effective.

THE FUTURE

In addition to the contract for the current fiscal year, Rock West has been awarded a follow-on of an additional two contracts under N68335-21-F-0135 for \$2,141,312 for 2022 and \$2,210,025 for 2023. Material and process advances from the project may contribute to more durable affordable general purpose antenna radome covers with greater environmental stability. There is potential for dual use in the commercial space launch industry and potential to serve as enabling technologies in support of emerging supersonic transport aircraft.