Testimony by:

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Joint Hearing on Small Business Technologies by the House Armed Services Subcommittee on Tactical Air and Land Forces and Projection Forces

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Chairman Weldon, Chairman Bartlett, Ranking Member Abercrombie, Ranking Member Taylor, and members of the House Armed Services Subcommittee on Tactical Air and Land Forces, and Subcommittee on Projection Forces, thank you for inviting me to testify before you here today at your hearing on small business technologies.

My name is Anthony C. Mulligan and I am the CEO of Advanced Ceramics Research, Inc., (ACR), of Tucson, Arizona. ACR is a successful small high technology company that through the support of the Department of Defense, and other Federal agencies, primarily the Office of Naval Research, NAVAIR, Army, and DARPA programs, has developed a family of ceramics, composites, and enabling manufacturing processes. While these new materials and process have already demonstrating strong commercial acceptance in private industry they have only begun to see marginal acceptance by Military Acquisition Programs.

ACR's Fibrous Monolith Composite Ceramics Technology was originally developed as a non-brittle replacement for metals used in components subjected to very high operating temperatures. Specifically to replace very expensive super metal alloys composed of materials such as Rhenium, Tungsten, Nickel, or Molybdenum. This offers valuable opportunities in applications such as rocket motor valves and thruster nozzles, turbine engine components, penetrator components, and cost effective composite machining tools.

This technology has had significant early commercialization.
Smith Tools International, one of the world's largest oil and gas drill bit producers, has demonstrated that drill bits with fibrous monolith coatings replacing their previous tungsten/diamond coatings can last up to three longer when drilling through hard rock formations. Under license, Kyocera Corporation's Tooling division in Japan is undergoing a major commercialization effort for using fibrous monolith technology for machine tools in non-U.S. markets.

ACR continues to work with military groups to apply fibrous monolith technology for decreased

cost and increased performance. ACR has been working with ONR and NAVAIR to develop fibrous monolith flame holder afterburner components for fighter aircraft. ACR has also been working with the Army Research Laboratories to develop fibrous monolith hypersonic penetrator fins. ACR has a Native American Joint Venture company called Advanced Ceramics Manufacturing (ACM) who has also been working with the Air Force to develop fibrous monolith deep earth penetrators.

Hypersonic Penetrator Test Fin Assembly using Fibrous Monolith Composite Ceramics.

ACR's Water Soluble Tooling developed under NAVAIR support has demonstrated tremendous cost savings over traditional metal tooling for a number of applications. In one case, ACR manufactured the tooling for a large carbon composite component for a cost of approximately $15,000. The customer who was a larger Defense Prime Contractor stated that comparable metal tooling would have cost over $1 million dollars to fabricate. In a second case, ACR fabricated tooling for about $5,000 which replaced traditional metal tooling costing nearly $150,000.

Customers include Lockheed, Alliant Techsystems, Boeing, Aero-Consultants, Cabo Yachts, BF Goodrich, Ferrari Automotive, Motorola Cell Phones, and in production with BMW automotive company. Our Aquacore and Aquacast products developed in this program were recipients of the 2001 R&D 100 award. While the Water Soluble Tooling NAVAIR program now has a $25 million Indefinite Deliverable / Indefinite Quantity contract, it is still receiving considerable resistance/difficulty in moving forward with the Joint Strike Fighter Program. Photo images of use of this technology in the high volume cost competitive automotive industry with BMW automotive and the motorcycle racing industry are shown below.

Automotive Air Dam Components manufactured by BMW shown on Floor in front of Car using Water Soluble Tooling Technology.

GP KAWASAKI ZX-RR - LIGHTER, STIFFER, FASTER!

Image: Courtesy of OCP Kunststofftechnik GmbH

OCP Kunststofftechnik GmbH (Lyss, Switzerland) manufactures a range of composite components for the GP Kawasaki ZX-RR, racing in the MOTO-GP 2005. Fairings, mudguards, tanks, air ducts and seat units are amongst the components manufactured by OCP - all using ACG LTM™317 tooling and VTM™260 series structural prepreg systems. (These systems have been specifically developed for out-of-autoclave processing). While all of the lighter weight composite components improve the bike's performance, the most significant contribution comes from the 100% carbon composite wheels. Manufactured by the same process, the wheels are both significantly lighter and stiffer than competitive magnesium wheels and add greatly to the bike's speed and manoeuvrability.

Racing Motorcycle Wheel manufactured in one piece using Water Soluble tooling.

Aircraft Door Panel made for Airbus Aircraft using Water Soluble Tooling.

A third technology under development at ACR is near net shape Ceramic Gel-casting, funded

under past Office of Naval Research and DARPA programs. This technology allows for relatively low cost direct forming of complex shaped monolithic and composite ceramic parts. ACR has transitioned this technology to its manufacturing partner, ACM, on the Tohono O'odham reservation. ACM has been able to cost effectively produce variety of complex geometry parts ranging from small four cycle unmanned aerial vehicle engines to large wear pads using for milling ores in the mining industry.

The combination of the above technologies of the new opportunity to drastically reduce the cost without volume dependency, decrease lead times, and provide improved performance for a wide range of military systems. For example an Unmanned Air Vehicle (UAV) structural airframe could be made in a single piece using this technology. This technology can also be applied to low cost, high performance, one piece composite Unmanned Underwater Vehicles (UUV's) and other complex weapon systems such as a one piece composite missile casing.

ACR is just one example of the small businesses that are succeeding in developing technologies and capabilities that can provide significant cost savings to a wide and diverse array of military weapon systems. The difficulty is how these new technologies developed by small businesses can be transitioned into military program offices and picked up by the prime contractors. There are currently very few mechanisms if any to help this technology transition happen quickly. Military program offices and large program offices do not have efficient methods to fold new technologies into programs once the program has been road-mapped and already started.

Thank you for the opportunity to speak here today.

Sincerely,

Anthony C. Mulligan