Tech Briefs
ARMY RESEARCH LABORATORY

ARL supporting MIT effort to develop gas microturbine engines

ARL's vision is a laboratory preeminent in key research areas of science and engineering relevant to land warfare. A staff widely recognized as outstanding. A partner within the defense community, close to Army users and seen by them as essential to their missions. An "intellectual crossroads" for the technical community, intensively interacting with academe, industry, and other government laboratories in the U.S. and abroad.

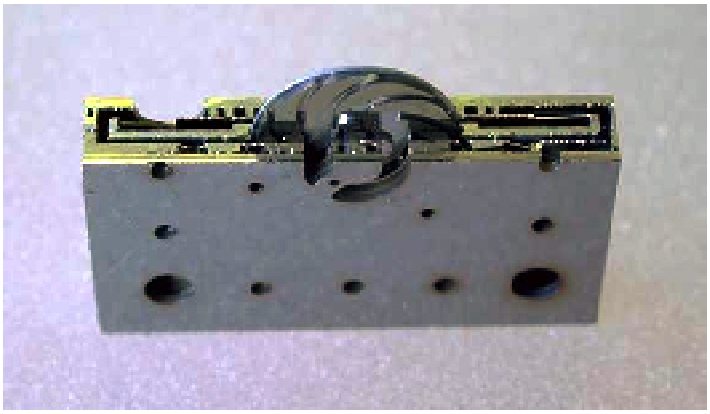
Gas turbine engines power the Army's Apache helicopters and M1A2 Abrams tanks. But someday, a gas turbine engine might replace the batteries to power your portable radio or CD player: a microturbine. In the future, the individual soldier's equipment, as well as commercially available items, might also be powered by a gas turbine engine: a microturbine.

The Massachusetts Institute of Technology, working with ARL support through the Army Research Office, is working to develop such an engine. Microturbines represent an innovative approach to providing a power source that potentially has some five to 10 times the energy density of batteries. The concept relies on two key ideas.

First, the energy obtained from a liquid hydrocarbon fuel burned in air is roughly 100 times the energy of a similar weight of batteries.

Second, the same microfabrication technology developed to make computer chips can be used to fabricate microturbines, conceivably at similar affordable costs.

Although there are many technical hurdles to building such devices the first 5 years of the microturbine program conducted at MIT have demonstrated numerous successes, such as spinning turbines at speeds up to 1.4 million RPM.



Cross-section of a laboratory prototype

If microturbines are able to reach projected efficiencies of 10 percent, then a two-d pound container of fuel could provide more electrical energy than seven BA5590 batteries, which together weigh more than 15 pounds. The Army is interested in microturbines to power the individual soldier's equipment.

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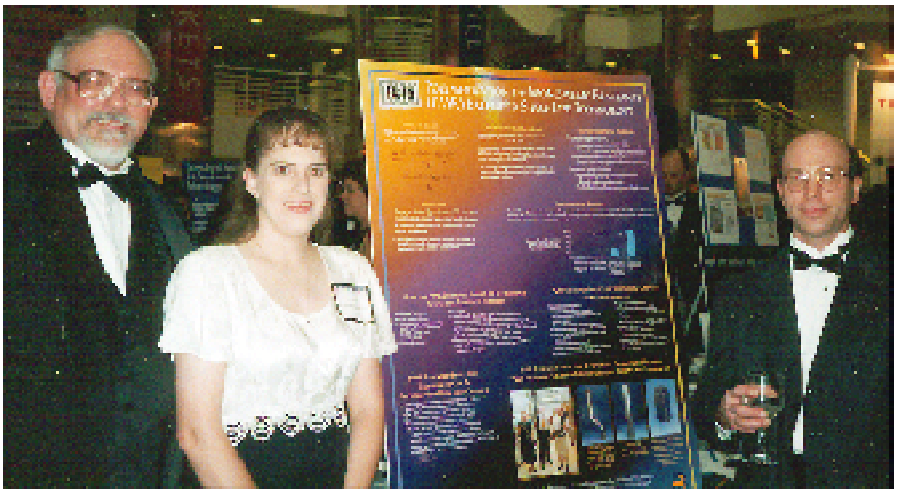
ARL engineer, contractors share R&D 100 Award

An ARL/NASA contractor research team invented a chemical method that significantly extends the storage shelf life of polymerization of monomeric reactants (PMR) solutions and prepregs.

The PMR extended shelf life technology was named among the 100 most significant new technological developments of 2000 by R&D magazine in their annual R&D 100 competition. These products are selected based on their "technological significance" over competing products and technologies by a select group of technology specialists and the editors of R&D magazine.



The invention was accomplished by Dr. William B. Alston, a materials research engineer, with ARL's Vehicle Technology Directorate at NASA Glenn Research Center, Cleveland. The contractors are Daniel A. Scheiman, Dynacs Engineering, and Dr. Gloria S. Sivko, Ohio Aerospace Institute; all assigned to the NASA Glenn Polymers Branch of the NASA Glenn Materials Division.

The invention they developed (Alston is the principal inventor), PMR Extended Shelf Life Technology, provides a dramatic (up to 30 fold) improvement in the three-week maximum shelf life of PMR monomer solutions and prepregs. This improvement was accomplished without adversely affecting processability, high temperature-long term (600o, 1000hr.) thermo-oxidative stability, and retention of mechanical properties of PMR composites.

PMR composite materials represent the state-of-the-art for high temperature fiber reinforced polyimide composites for over two decades, having ultimately achieved usage in ducts and external components of military and commercial jet engines and even to an engine access door for the space shuttle main engine. The superior performance of PMR at prolonged high temperature environments, during which other polymer composites fail, even makes PMR the ultimate choice for many non-aerospace applications requiring moderate cost/high performance, high temperature polymeric structural composites.

The Vehicle Technology Directorate is collocated and shares facilities with NASA at both the NASA Langley Research Center, Hampton, Virginia and NASA Glenn Research Center, Cleveland, Ohio sites through an Army-NASA agreement that also provides for joint programs and projects.

Photo, from left: Dr. William B. Alston, Dr. Gloria S. Sivko, and Daniel A. Scheiman,

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Survivability/lethality director honored for leadership with Presidential Rank Award

Dr. James J. Wade, Director of ARL's Survivability and Lethality Analysis Directorate (SLAD), was honored with a prestigious Presidential Rank Award for Meritorious Executives during a ceremony at the Pentagon.

Wade has been SLAD's director since it was formed in 1992 and has successfully created a highly productive organization that is making very significant contributions to the Army. Under his leadership, SLAD has become an essential and integral part of the Army's materiel acquisition process.

SLAD has helped make many systems more survivable and effective including Patriot, Abrams, Bradley, Javelin, BAT, Blackhawk and Apache.

Each year, the federal government recognizes and celebrates a small group of career senior executives with the Presidential Rank Award. Winners of this prestigious award have demonstrated their ability to lead a government that delivers great service, fosters partnerships and community solutions to achieve results, and continuously pushes itself to get the job done more effectively and efficiently.

There are two categories of awards, Distinguished Executives and Meritorious Executives.

Dr. James J. Wade

Award winners are chosen through a rigorous selection process. They are nominated by their agency heads, evaluated by boards of private citizens, and approved by the President. The evaluation criteria focus on the executive's leadership in producing results.

Research aimed at stronger vehicle structures

An ongoing ARL/NASA collaborative program is addressing deficiencies in composites reliability and durability to enhance vehicle structural integrity. The need for the Objective Force to be more deployable, agile, survivable and mobile with a smaller logistic footprint, will require dramatic increases in vehicle reliability and durability.

ARL is expanding its initiative in those areas to provide materials and structures technologies that will enable design and manufacture of lighter, more durable, and highly reliable combat vehicles in less time. A major effort is currently underway with the U.S. helicopter industry to develop improved failure criteria for composites. The results will provide advanced rotor hub designs that extend reliability and reduce maintenance costs. The cost of maintenance is a large share of the Army budget. A focused science and technology program in ultra-reliability will reduce those costs. The payoff will be significant reductions in logistics support and the corresponding ability to perform specified wartime missions without system failures.

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Laboratory establishing new technology alliances

ARL will award contracts in May covering five areas of technical research under its new Collaborative Technology Alliances (CTA) program.

The new program will continue the successful Federated Laboratory process that will conclude during FY 2001. The "FedLab" combined government, industry, and academia research efforts under a cooperative agreement. CTA will expand upon FedLab by updating the three existing consortia and adding two additional ones. It will also improve the process in several ways:

* The period of performance will be extended.

* Other government agencies will be invited to join the alliances and participate as partners in the research.

* Greater emphasis will be placed on transitioning results of the research by joining a task order type contract with the cooperative agreements that will be awarded.

The five alliances will focus on advanced sensors, advanced decision architectures, communications and networks, robotics and power and energy.

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ARL TechBriefs is published quarterly by the External Affairs Office as an unofficial publication of the U.S. Army Research Laboratory, 2800 Powder Mill Road, Adelphi, Md., 20783-1197.

ARL TechBriefs
Vol. 4, No.2

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