Statement to the House Armed Services Committee's
Subcommittee on Tactical Air and Land Forces
(Small Business Innovative Technologies and Research)
By
Mr. Enrique J. Enriquez
President, Locust USA

Mr. Chairman, Ranking member, and members of the Committee, I am honored to be before you today on a topic that is very important to my company, and probably many other small companies. My name is Enrique J. Enriquez; I am the president of Locust USA, which is located in Miami, Florida. I have over 20 years experience with leading edge manufacturing entities such as Rolls Royce Ltd., Miami where I was in charge of Engineering Systems Developments and worked as a Project Leader on the manufacturing of the Sapphire Project (Star Wars) satellite structure. I pioneered CAD/CAM/CAE and was a CAD/CAM consultant for 10 years at Coulter Corporation a 6000 employee market leader in hematology equipment. I am an associate professor at the University of Miami and Florida International University. My responsibilities at Locust USA, Inc. include Technology Directive, Industrial Partnerships, Customer Relations and Corporate Finances.

I will tell you a little about my company, Locust USA, Inc. was founded in 1999 to develop and market advanced technology very small, high-speed turbine engines for the UAV/UGV, Extended Range Missiles, General Aviation, and Power Generation markets. Locust is a synergistic affiliation of three established South Florida companies, R.A. Microjets, Inc. (RAM) of Medley, Florida, Pegasus Engineering Services, Inc. of Juno Beach, Florida, and Mark Two Engineering, Inc. of Miami, Florida. Each has unique background and experience in the design and manufacture of turbine engines and other high technology components.

RAM was established in 1994 and was the world's premier manufacturer of low-cost model aircraft turbine engines. Their engines have been widely accepted by the model aircraft community with nearly 1000 engines sold over a five-year period. RAM has developed and successfully marketed 5 different models of turbojet engines from the 6 lb. Thrust Ram 350 to the 48 lb. thrust Ram 2000. In 2002, the owners of RAM decided to exit the model aircraft turbine engine business. Locust USA has picked up much of that work, although it is not a core business for Locust USA.

Pegasus Engineering was established in 1994 as a woman-owned high technology engineering services firm as the vehicle to retain an extensive cadre of high caliber engineering talent made available from the extensive early retirements and corporate downsizings carried out at Pratt & Whitney and other aerospace companies across the country. Pegasus propulsion designers and technologists have an average of 30+ years of experience in gas turbine systems.

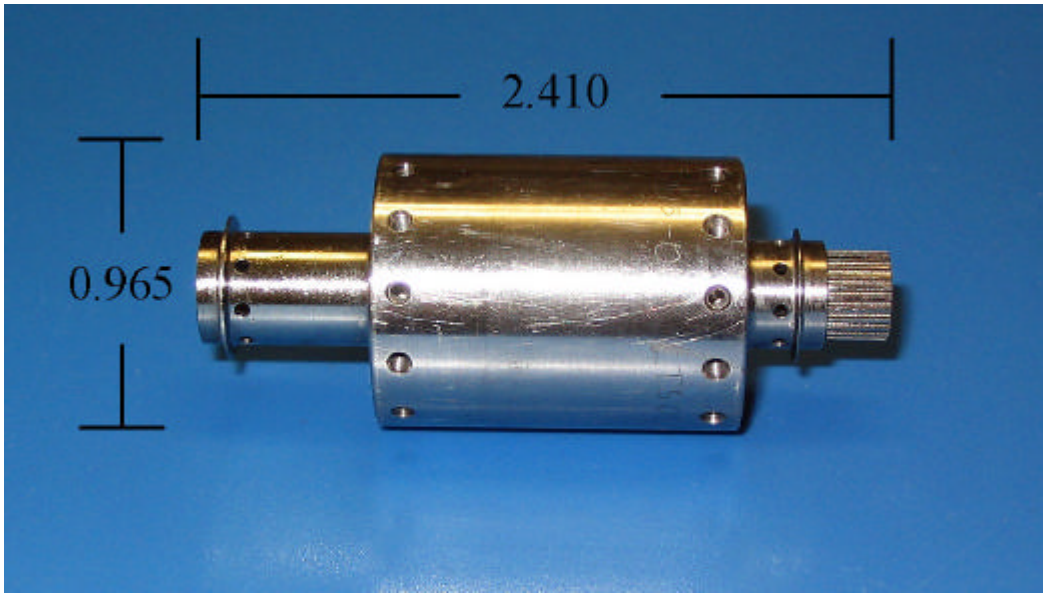
Mark Two Engineering, Inc. a company I co-founded in 1996 as an innovative manufacturing source specializing in creating complex models, prototypes and hard-to-

build parts for the biomedical, automotive and aerospace industries. Through a major capital investment and human resource development program, Mark Two has developed an unmatched CAD/CAM capability fully integrated with Pro Engineer™

The integration of these three team members (now two) into Locust, which have "*cutting edge*" technology, has already demonstrated large synergistic benefits as the development time for a new Locust engine has been reduced from the normal multi-year time period to only months. The L50 turbojet that was created for the model aircraft community was modified into a 50 hp turboshaft/turboprop by designing and adding a power turbine and gearbox. The time from design concept to a running engine was only 4 months. Today, Locust USA is able to initiate a new advanced technology engine design and enter initial engine testing in less than 18 months.

For the past four years, Locust customers have been the Army and DARPA. Army programs are mostly turboshaft engines for potential application to UAVs, ranging in power from 40 hp to just above 150 hp. The DARPA sponsored development is for the 5hp to 22hp turboelectric engines. We are not ignoring the other Services, at the present we have proposals into the Navy, but decisions on contract award have not been made as of this date. Our engines feature high-speed starter/generators that are capable of producing 2KW to 15KW in electrical power. In this regard, Locust has operated high-speed rigs to as high as 240,000 RPM. One such design was operated for the required 100 hours at 191,000 RPM. Our highest operating engine speed to-date is 140,000 RPM.

I mention these speeds because they are very important to our work. Most gas turbine engines in the field today are operating at speeds of about 70,000 RPM or less, but the laws of physics require our small engines to run at much greater speeds. There is a good and a bad side to the high speeds. The good part, you can rotate electric generator rotors at these high speeds to generate electrical power at greatly reduced size/weight. As an example, this rotor



is capable of developing about 4KW running at 190,000 RPM. Our new engine and generator, to do this, will weigh less than 10 pounds, operating with heavy fuels (jet fuel that is available on the battlefield). All of our engines run only with heavy fuels. To do the same with today's available equipment, will require a generator alone that will be several times the weight of our complete engine package, and the complete package will weigh several hundred pounds. What does all this mean to our Armed Forces? Lightening the Force.

Now the bad (but it's only a challenge to our team) side of higher speeds, shaft dynamics (critical speeds and vibration of rotating components), couplings that transfer the power of the engine to what the user wishes to accomplish, such as rotating a propeller, and reducing these high speeds to a usable speed for our customers. These challenges are real, difficult, and to our knowledge, not accomplished by others. We feel that we have the solutions in hand at this time. In part we were able to accomplish this by a series of small contracts, and especially, funding from the Congressionally mandated Small Business Innovative Research (SBIR) program.

Looking ahead we are concerned about the survival of some of the small key companies that we rely on for castings and bearings that are crucial to our products. As a small business, and now dealing with small numbers of units, we are having difficulty in locating companies that are willing to just talk to us, most large companies will not even listen to what our needs are. We have found a few small companies that are located in Florida, Pennsylvania, and California that are willing to work with us. They have done an excellent job for us, but in some cases we are seeing signs of distress with a few companies, their current business base is dwindling and may force them to exit the business.

So far I have spoken about issues that we are resolving; there are a few areas that we cannot fix by ourselves. One such area is related to military requirements for heavy fuel burning engines as they may apply to UAVs. The military has clearly established their need for heavy fuel burning engines for UAVs, but industry has been slow to respond to this need. In the small size range that we are working in, the military requirements are in place requiring heavy fuel burning engines; however, these requirements are being placed on the aircraft developer. The expectation is that they will deliver a product that has that capability; I have not seen that milestone accomplished. There are a few reasons for it:

- Airframe companies are not in the engine business, plus they lack the specific propulsion expertise. The Military Services have the expertise, and work directly with the propulsion industry.
- The usual approach has been, to develop a diesel engine, but in the meantime use a gasoline engine. Problems develop in the airframe side of the program requiring resources to fix. Propulsion suffers again and heavy fuel engines are not adequately pursued.

The Military Services learned many years ago how to resolve this problem. Practically every military aircraft flying today has a Government Furnished Engine (GEE). This takes the responsibility away from the airframe developer and places it in the hands of

the Services and the propulsion industry, where it should be. I believe this approach must also be used for UAVs if we are going to achieve heavy fuel burning engines in a timely fashion in order to assure that the warfighter's needs are met.

I want to thank you for inviting me here, and for listening to my comments. I will be glad to try to answer any questions that you may have.