

Scramjet Flight Testing Techniques

# Innovative Testing Techniques Accelerate Hypersonic Technology Development



## Technology and Innovation

Imagine economical air travel and propulsion at hypersonic speeds. This has long been a common goal for military and commercial applications. Scramjet (supersonic combustion ramjet) propulsion technology—currently in development and testing by the military and a variety of contractors—offers the promise of hypersonic (i.e., highly supersonic) flight (including rockets and projectiles) at speeds beyond Mach 7, or seven times the speed of sound. One of the difficulties in developing and testing scramjet technology, however, is the fact that test vehicles must themselves be accelerated to a minimum speed of Mach 5 before the scramjet engine will ignite. This makes flight testing both a logistical and a financial challenge.

Under this DARPA SBIR, ATK GASL pioneered two new approaches to scramjet flight testing, ScramFire and FASTT (Freeflight Atmospheric Scramjet Test Technique). With ScramFire, the company developed a gun-launching system for Scramjet projectiles that advanced technology performance beyond what had been previously achieved. FASTT uses an unguided ballistic launch trajectory that is nearly as effective but significantly less expensive than a traditional guided flight.

The net result is that these two technologies move scramjet prototypes to flight testing earlier in the development process, shortening the path to military transition and saving



money. According to the company, these savings typically amount to a 10- to 100-times reduction in flight test costs.

Current customers include:

- DARPA
- Air Force Research Laboratory
- Office of Naval Research
- NASA

ATK GASL also built the first airframe-integrated scramjet engines to be flight tested at hypersonic speeds in 2004, on NASA's X-43A experimental aircraft.

## Joint Collaborations

This DARPA SBIR allowed ATK GASL to transition from its ground test technology roots to a hypersonic propulsion development and flight test organization, raising its profile in the industry. This increased profile led to a recent invitation for ATK GASL to bid

Two ATK GASL applications aid the development of hypersonic propulsion technology



Testing the Scramjet technology

as a propulsion prime contractor by major airframe companies.

For its ScramFire gun-firing development effort, the company signed a cooperative research and development agreement with the U.S. Army Armament Research, Development and Engineering Center (ARDEC) to co-develop a hardened, stable projectile design.

## Lessons Learned

- Be aware that transitioning innovations to the customer may be more difficult than anticipated.
- To ensure a commercially viable solution at the end of the project, have a vision for the company that includes transition to a military product.
- Start the process of getting end-user sponsorship early—a sponsor is necessary for ultimate success.

## Economic Impact

GASL was purchased by Allied Aerospace in 1999, and subsequently purchased by ATK in 2003. The valuation of GASL in both acquisitions was significantly enhanced by the work completed under this DARPA SBIR program. In addition, the SBIR attracted sponsor funding from ARDEC and the Office of Naval Research.

Phase III funding has been obtained from ONR, ARDEC, and DARPA. During this phase, requirements will be developed for scramjet technology in the military, thus helping the further transition to product.

## About the Company

ATK GASL is located in Ronkonkoma, New York, and it currently employs 170 people. The company is a provider of research, development, test and evaluation services to the aerospace industry, specializing in development of advanced high speed aeropropulsion systems and low emission gas turbine engines.

The company operates six wind tunnels and two shock tunnels on its premises, capable of simulating atmospheric flight environments at speeds from approximately 2,000 mph to 17,500 mph, as well as static engine test stands. It also provides CAD design services, machining and assembly on-site for engine test rigs and related prototype hardware. ■



From left, Eugene Day, Ed Poole and Greg Wurst prepare for a scramjet flight test

## Company Information

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