

Air Force

SBIR

# Impact



**Company:**  
Technical Directions Inc.

**Location:**  
Ortonville, Michigan

**Employees:**  
3

**President:**  
Vern Brooks

**Project Officer:**  
Lt. John Mehrman, AFRL  
Munitions Directorate,  
Eglin AFB, FL

## Small, Low-cost Turbojet Propulsion System for Miniature Munitions



### Air Force Requirements:

The Air Force required a propulsion system for miniature munitions that would have sufficient power and efficiency to complete a search and destroy mission with a limited fuel load. Requirements for the propulsion system included:

- Very low cost
- Easy starting
- No lubricating oils required
- Cool exterior
- Compact configuration
- Integral generator

### SBIR Technology:

Using a unique base engine technology and Phase I and II SBIR contracts, Technical Directions Inc. (TDI) developed a turbojet engine-generator (Model – TDI-J45G) that meets the requirements. TDI has combined design and manufacturing technologies with high production automotive turbocharger rotating components, to produce an engine system that has a low production cost and a low installation cost.

Windmill cranking and starting is a benefit that results from an easy starting engine system, and the TDI technology permits low speed ignition with engine-assisted acceleration to operating speeds. The fuel metered to the engine cools and lubricates the internal components of the engine with the secondary benefit of pre-warming the fuel for rapid and complete combustion upon arrival in the combustion chamber. This unique system takes full advantage of all of the hydrocarbons carried onboard the vehicle to contribute to the mission duration and range.

**For more information on this story, contact Air Force TechConnect at 1-800-203-6451 or at [www.afrl.af.mil/techconn/index.htm](http://www.afrl.af.mil/techconn/index.htm)**

The TDI-J45G engine outer housing is surrounded in cool air from the compressor to maintain the relatively cool engine exterior that permits the engine to be installed close to other critical and heat sensitive components within the airframe. Engine components are combined into a configuration that provides a very short package that allows room onboard for additional payload or fuel storage. The combination of compact engine and the minimum of engine accessory equipment allocate more space for other critical mission related components onboard.

An integral engine-driven generator will provide all of the electrical power necessary onboard the vehicle on demand, at the proper voltage, for whatever the mission demands. This SBIR technology has created a unique power system configuration for expendable vehicles that changes the propulsion rules for low cost, single mission, miniature weapon systems.

#### **Company Impact:**

Recent wind tunnel starting tests have confirmed the self-starting capabilities of the TDI-J45G engine system at all altitude and vehicle speed conditions within the required flight envelope. Pending full system qualification will permit a flexible supplier-based production operation to be put into place that can meet the supply demands of the Air Force along with other defense and commercial requirements. This base engine technology created with a combination of inter-company and SBIR resources has permitted the creation of a family of engines ranging from 30 to 100 pound thrust.

TDI sees numerous commercial applications for their engine technology. With electric utility deregulation, co-generation, emergency, and distributed electrical power systems are presenting new alternatives for businesses and consumers to insure the adequate availability of electrical power.

#### **Company Quote:**

"The SBIR program has provided an opportunity for a very small company to change the propulsion rules in this field where larger companies have abstained. This program is an excellent example of the technology stimulus that was desired in the creation of the SBIR concept. The company size is not an indication of the innovative potential."

Vern Brooks, PE  
President, Technical Directions Inc.

#### **Air Force SBIR Project Officer Quote:**

"This small engine development effort is crucial to the powered miniature smart munitions systems being developed by AFRL/MN at Eglin AFB, Florida. Development of an engine that can "windmill start", and not require a separate oil lubricating system or oxygen assist for sustained operations is truly a significant technological breakthrough."

Lt. John Mehrman, AFRL/MNAV  
PLOCAAS Propulsion Program Manager

# SBIR

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