

Electric Drive Semiconductor Manufacturing (EDSM) Center

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Powerex, Inc.

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Project ARRAVT030

Timeline

- Project start date: 12 March 2010
- Project end date: 11 March 2012
- Percent complete: 60%

Barriers

- Equipment integration
- Material handling
- Agility to meet variety of products and industry standards
- Transition from prototype to production

Budget

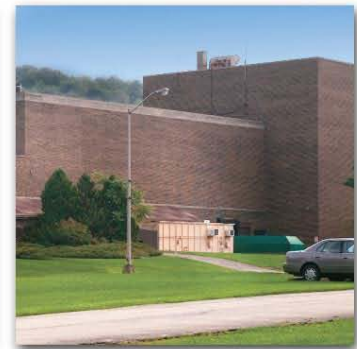
- Total project funding
 - DOE share: \$6,049,581.00
 - Powerex share: \$2,592,678.00

Partners

- No partners in grant award
- Leveraging existing customer and supplier relationships

POWEREX® Project Overview

- Powerex corporate offices in Youngwood, PA (near Pittsburgh)
- 250+ employees
- 120,000 square feet of facilities
- Design and manufacture
 - Rectifiers and Thyristors
 - Custom Modules
 - Integrated Power Products
- Markets Include: Automotive/vehicle, transportation, wind, power generation & distribution, motor control, energy conservation



Objective:

Powerex will modify its existing facility to house an integrated Electric Drive Semiconductor Manufacturing (EDSM) Center capable of producing over 100,000 electric drive semiconductor devices annually.

- **EDSM Facility** - Provide a facility capable of meeting all EDSM project objectives
- **Manufacturing Center** - Provide capability to produce, at a minimum, 100,000 electric drive semiconductor devices annually
- **Reliability Center** - Provide the capability to fully test and qualify semiconductor device performance and reliability
- **Prototype Center** - Provide the capability to develop new semiconductor device concepts through prototyping. This capability will reduce risk associated with new semiconductor device performance and reduce risk associated with high-volume manufacturing of new devices.

Phased into Existing Facility

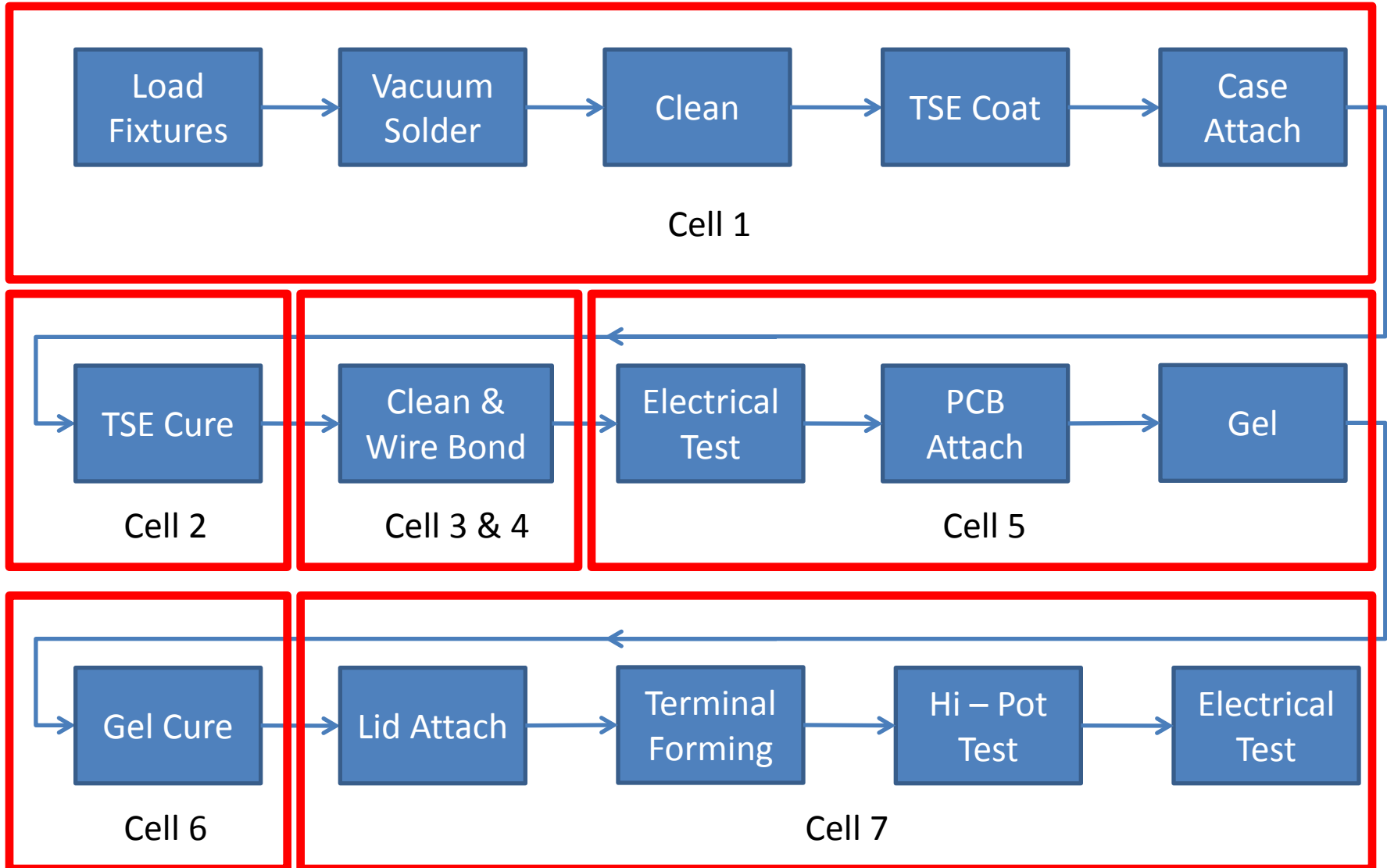
- Maintain continuity of current operations and reduce risk

Phases of Implementation

Combined to better accommodate ongoing plant operations

- **Phase 1**
 - Construct 3,000 sq ft class 10,000 clean room
 - Install & integrate highest risk manufacturing center equipment and processes
- **Phase 2**
 - Add 7,000 more sq ft to class 10,000 clean room; total 10,000 sq ft
 - Install the remaining manufacturing center equipment into the clean room
- **Phase 3**
 - Relocate existing prototype equipment into clean room
- **Phase 4**
 - Install reliability center equipment in space vacated by prototype equipment move
- **Phase 5**
 - Demonstrate capability through Low Rate Initial Production

POWEREX[®] Approach – Production Process



POWEREX Project Milestones

Milestone	Milestone Date
Clean Room Contract Awarded	June 1, 2010 Sept 15, 2010
Phase 1 Manufacturing Center Installation Complete	February 1, 2011
Phase 2 Manufacturing Center Installation Complete	Combined
Prototype Center Operational	June 1, 2011
Reliability Center Operational	June 1, 2011
Delivery of 10 LRIP Units	August 1, 2011
Initial Operational Capability/Project Complete	October 1, 2011
	November 1, 2011

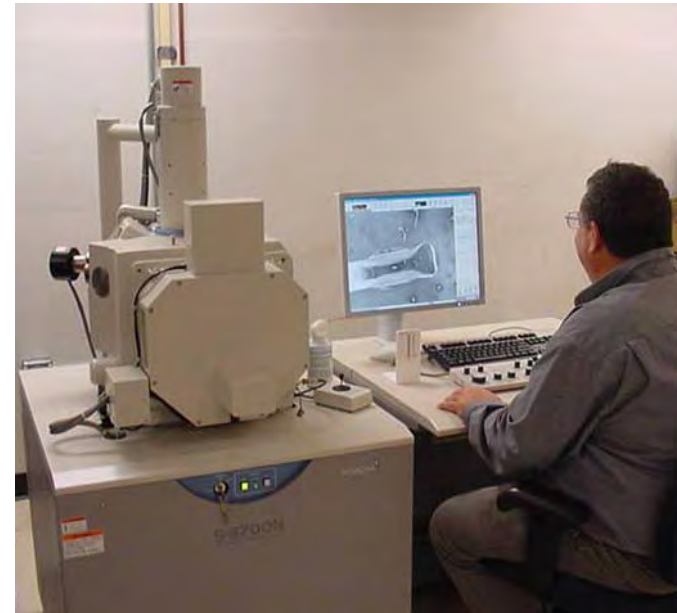
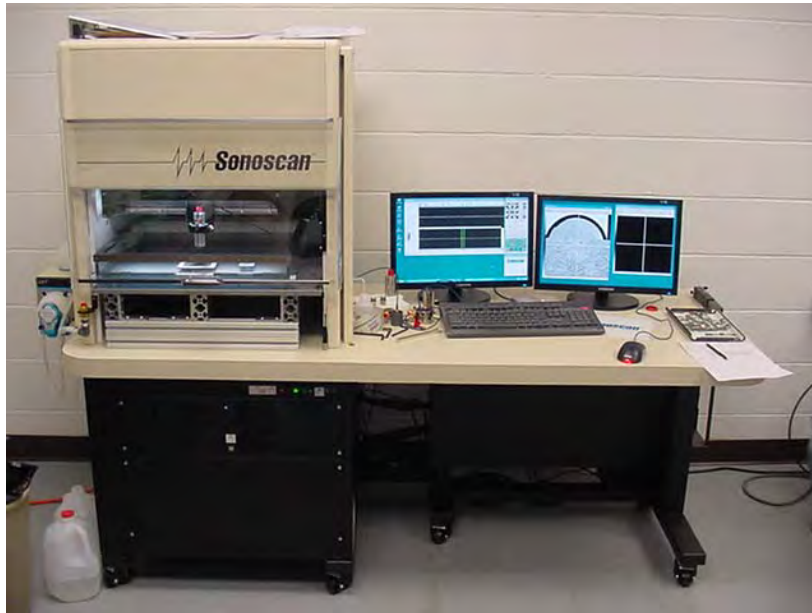
POWEREX[®] Technical Accomplishments

- Identified highest risk equipment and processes
- Successfully prototyped automated vacuum furnace
- Demonstrated utility of electron and acoustic microscopes in failure and reliability analysis
- Demonstrated key manufacturing processes (use of solder mask and dispensed solder paste, dispensed gels, advanced wire bonding programs)



POWEREX[®] Deployment Accomplishments

- Clean room installation nearly complete
- Almost all equipment purchased; most delivered
- Already using many new pieces of equipment in revenue production and analysis



POWEREX[®] Collaboration & Coordination

- No partners are directly involved in execution of grant
- Strong, collaborative partnerships with many critical material suppliers and service providers
- Long-standing relationships with many customers in electric drive industry
- Long-standing teaming arrangements with universities, federal agencies and companies engaged in state-of-the-art power module research

In 2011

- Complete clean room installation
- Install, test and integrate manufacturing equipment
- Relocate existing prototype equipment to clean room
- Install and test reliability center equipment
- Conduct Low Rate Initial Production (LRIP) to demonstrate capability

POWEREX® Project Summary

- Grant awarded in March 2010
- Objective: create capacity to design through prototyping, produce and test 100,000 semiconductor power modules annually
- 2-year phased approach to permit risk reduction and implementation in existing plant without impacting on-going production operations
- Project is meeting all technical goals on schedule and within budget
- Clean room nearly complete, most equipment purchased, key processes demonstrated, risks reduced