

Superconductivity for Electric Systems 2006

Project Summary

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| YOUR ORGANIZATION: | American Superconductor |
| PROJECT TITLE: | Development of a Pre-Commercial Long Length HTS Cable System Operating in a Power Transmission Grid |
| PRESENTERS: | James Maguire American Superconductor Frank Schmidt, Nexans Tom Welsh, LIPA Shawn Bratt, Air Liquide |
| FY 2005 FUNDING: | \$8.2M |
| FY 2006 FUNDING: | \$5.0M |
| START/COMPLETION DATES: | 3/18/03 to 12/31/07 |

Overall Project Purpose and FY 2006 Objectives: The purpose of this project is to develop and demonstrate a transmission voltage high temperature superconductor cable in operation on a utility grid. The project culminates in the operation of a 600 meter long 138KV, 2,400 amp cable which will be installed and operate in the Long Island Power Authority (LIPA) high voltage transmission system. The cable system must also survive a 69,000 amp major fault and operate during many of the through fault scenarios that are foreseen for the site chosen. Also being developed under this project is the methodology to monitor off line or through faults and then provide a signal to the protection circuit should the magnitude or duration of through faults reach a point where the cable could be damaged by a subsequent major fault.

The project objective is twofold, first to identify the issues and concerns that need to be addressed to allow HTS cable to be safely and effectively operated at transmission voltages in the grid, and secondly to develop, design, produce and operate this HTS cable system. The partners and roles in this project are as follows: American Superconductor is the prime contractor, providing project management, technical input and also supplying the HTS wire for the cable. Nexans is the cable and termination supplier, providing the development engineering and qualification of the cable, cable cryostat, and terminations. Air Liquide is the cryogenics partner providing the refrigeration system modifications (this project reused the Detroit/Pirelli refrigerator), system engineering and installation support. LIPA is the host utility providing the site engineering and preparation as well as guidance to the design and testing of the cable system.

As HTS cables continue to advance towards acceptance by US utilities the importance of understanding the issues that surround the integration of these cables into the grid grows. This project aims not only to develop the first of its kind 600 meter long, transmission level voltage HTS cable, but also to develop the necessary tools for the integration into the grid. Once the cable system and integration tools are developed then these high power cables can be deployed to act as a tool to allow utilities to move much larger quantities of power at any given voltage level than is possible today. This translates into easier permitting, smaller rights of way, and smaller substations.

FY 2006 Results and Accomplishments: During GFY 2006 the project team has or will have completed the following tasks:

- Cable and Terminations
The design and qualification of the HTS cable on a short (30 meter) one phase test loop is being completed. This qualification includes the cable and two outdoor terminations for operation in the LIPA grid at 138 KV. Specific testing includes voltage withstand, BIL, and load cycle. Manufacturing of the HTS cable assembly has started in the Nexans factory in Norway and the procurement of the terminations is also underway.
- Refrigeration System
This project is reusing the refrigeration system from the DTE/Pirelli project and the upgrades for this system are also complete the major components for the refrigeration system are at LIPA and currently being integrated onto the site.
- Site Preparation
The site work is also underway with the refrigeration system enclosure being complete and installed, the foundations for the tanks complete, and the foundations for the terminations being poured. The interconnecting trenching is also being installed at this time.

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The major milestones met this fiscal year are:

- Completion of the fault and contingency analysis
- Completion and shipment of all of the HTS wire
- Qualification of the HTS cable system for 138 KV operation
- Qualification of the terminations for operation at 138 KV (underway)
- Beginning of the manufacturing of the cable
- Completion of the refrigerator upgrade and equipment fabrication
- Site preparation for the cable and terminations underway

FY 2007 Plans and Expectations: The milestones for the next fiscal are as follows:

- Complete the fabrication of the cable
- Fabricate Cryostat (with cable core in-situ)
- Fabricate terminations
- Complete site preparations
- Install and operate refrigeration system
- Install and energize cable system

While the installation and integration of the cable system in the LIPA grid will be a significant effort, all of the key technical barriers have already been overcome in this government fiscal year.

Research Integration: This project does not have any externally funded research components