

**FY2008 Superconductivity for Electric Systems Peer Review  
Project Summary Form**

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<b>PROJECT TITLE:</b>	Advanced Cable Research
<b>ORGANIZATION:</b>	LANL
<b>PRESENTERS:</b>	Steve Ashworth, LANL
<b>FY 2008 FUNDING:</b>	\$300K

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**Overall Project Purpose and Objectives:**

The purpose of this project is to examine innovative designs for hts power cable designs, cooling and cryogenic systems. In 2008 we have focused on a novel cooling system design which we feel could significantly reduce the cost and complexity of the refrigeration system for hts cables, as well as allowing greater distances between refrigeration systems in long cables.

**2008 Approach and Results:**

A new design of cable cooling system has been introduced by LANL. This is termed 'distributed cooling' and no longer requires a sub-cooled liquid to be pumped along the cable, but uses a two phase cooling system. This uses the latent heat as the cooling mechanism within the cable.

The engineering aspects of this design were first investigated by numerical modeling: firstly at the system level (estimating the liquid and vapor flow properties for a cable of given length, heat loss and dimensions to ensure a 'reasonable' solution exists). Secondly we considered the details of heat transfer within the cable, this focused our attention on fluid flow through pores and the efficiency of cooling by spray boiling as controlling parameters. We carried out a number of 'bench top' experiments to investigate flow through pores to confirm our assumptions in the simulations.

The positive results from these models and experiments led to designing, building and testing a 100 foot 'dummy' hts cable. This 'dummy' contains no superconductor, but is in a long 'cable' cryostat which contains a heat load, the distributed cooling system and thermometry. One significant aspect of the cooling system is that from the outset we considered manufacturability of the critical components of the distributed cooling system.

**2009 Plans and Expectations:**

In 2009, assuming encouraging results from the present set of experiments continue, we plan to request funds to construct a significant length (>50m) hts cable system at LANL cooled using this system. The exact design and scope of this demonstration is yet to be determined and will depend on funds available. The cable itself will be obtained through a collaborative partnership, and will not form the focus of the work, the cooling system will be designed and built at LANL.

This cooling system allows us to consider novel cable system designs, we plan to look at cable designs to take full advantage the possibilities offered.

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**Technology Transfer, Collaboration, Partnerships:**

This is a new technique for cooling superconducting cables, and to date has not been publicly disclosed in order to maintain the integrity of the intellectual property. From this point forward we will be actively seeking to transfer this to industry.