Organization:	**Los Alamos National Laboratory**
Project Title:	**Design and Development of a 100 MVA HTS Generator**
Presenters:	Eric Schmierer (LANL)
FY 2005 Funding:	$ 215 K*

Project Purpose and FY 2006 Objectives: General Electric's Global Research in Niskayuna, N.Y., will design and develop a 100 MVA class high temperature superconducting generator, with designs through 250 MVA. The HTS rotor will be capable of retrofitting into existing generators. LANL continued work on a CRADA with GE to provide assistance in several technology areas. The CRADA between GE and LANL was prematurely ended at the end of the 2nd quarter due to GE's decision to put the project into standby. Funding for the work was therefore ½ of the full year $430k.
For FY 2006 LANL will:

- acquire rotating heat pipe data and compare to detailed model
- modify apparatus to test closed loop, passively pumped cooling experiment, acquire data and compare to model
- complete measurements of AC loss and over current situations and compare to model predictions
- assess impact of 2nd generation HTS conductor on generator design
- transient and steady state thermal analysis of refrigeration system as needed

FY 2006 Performance/FY 2006 Plans:
For FY 2006, LANL acquired data for the rotating heat pipe up to 1200 rpm. Preliminary studies of ac losses/overcurrents were performed numerically, and rotation effects in baseline coolant system were characterized using computational fluid dynamics. The completion of these and other tasks was prevented due to the premature ending of the CRADA with GE.

FY 2006 Results:
LANL conducted several valuable studies during the past review period in regard to thermal refrigeration costs and efficiency.
Rotating Heat Pipe Development: The rotating heat pipe experiment was conducted with rotation speeds up to 1000 rpm. Results were compared to the full Navier-Stokes model developed at LANL. Specific areas of the model went through thorough assessment and modifications were made. Results indicated that the model is predicting the heat pipe performance well and demonstrate the low thermal gradients possible with the heat pipe.
AC Loss/over current testing: ac losses: The first phase was to estimate the AC losses numerically in the coil from exciter harmonics and the 60 Hz fault current scenario. AC loss characteristics of an individual stainless steel clad BSCCO tape were studied with intent on characterizing 'critical' positions inside the overall coil cross-section. Numerical results were completed for single wire and a method for coil analysis was determined. The ac loss/overcurrent apparatus was assembled however experimental measurements scheduled to follow were not performed due to premature end of the CRADA.
Thermal Modeling of Refrigeration and Cooling System: LANL assisted GE with steady state analysis of rotor cooling and baseline refrigeration system by performing CFD analysis of the coolant path and investigating the affect of rotation on heat load. Preliminary simulations of coolant loop to verify heat due to flow work on helium were completed.
Closed, Passively Cooled Loop Testing: Incomplete due to end of CRADA.
2nd Generation HTS Conductor Impact: Incomplete due to end of CRADA.

Research Integration: LANL held teleconferences with GE staff to ensure that efforts were in accord with project objectives. LANL participated in the GE generator Preliminary Design Review. A summation of rotating heat pipe development results was submitted and accepted to the 9th AIAA/ASME Thermophysics and Heat Transfer Conference. LANL continued interactions with University of New Mexico's Prof. Razani on the heat pipe, and LANL student Todd Jankowski submitted PhD thesis to committee based on these studies. A patent is pending on the heat pipe development.