FINAL CRADA REPORT

Date: 06/28/2010

CRADA Number: **0201301**

CRADA Title: **Low Emission Advanced Power Cycle**

CRADA Start/End Date: Start 2/23/2004; End 6/30/2008

Argonne Dollars: $369,900
Participant Dollars: $1,234,000

Argonne PI: Dr. Adrian Tentner

Industrial Partner: Dr. Anthony Dean, GE Global Research Center.
One Research Circle, Niskayuna, NY 12309

DOE Program Manager: James Noble, IPP

Summary of Major Accomplishments:

Today's gas turbines are based on the Brayton Cycle in which heat is added to the working fluid at constant pressure. An alternate approach, the Humphrey cycle, provides a higher theoretical thermal efficiency by adding heat at constant, or near constant volume. A few practical examples of such engines appeared in the mid 1900's, but they were largely superseded by the Brayton engine. Although the conventional gas turbine has been developed to a high level of efficiency and reliability, significant improvements in performance are becoming increasingly costly to obtain. Efficiencies of compressors, turbines and combustors are approaching theoretical limits. Cooling and materials technologies continue to improve but higher cycle temperatures may be limited by NOx emissions. While heat exchangers, intercoolers and other features improve cycle efficiency they add significantly to the cost, weight and volume of the basic engine and for flight applications may always be impractical.

For these reasons there has been renewed interest in recent years in the constant volume Humphrey cycle focusing mainly on pulsing systems in which heat is added by a rapid series of detonations. Variations on this basic scheme are being evaluated for aircraft propulsions systems.

General Electric has established a joint program with several Russian organizations to explore devices based on pressure rise combustion cycle and to make fundamental measurements of detonation properties of mixtures of hydrocarbon fuels and air. Under GE funding and direction,