

TECHNICAL PROGRESS REPORT

Quarterly

Reporting Period start date: January 1, 2000

Reporting Period end date: March 31, 2000

Principal Author: Dr. Lawrence P. Golan

Date report was issued : May 2000

DOE Award No. DE-FC21-92MC29061

Submitting Organization:
South Carolina Institute for Energy Studies
Advanced Gas Turbine Systems Research Program
Clemson University Research Foundation
386-2 College Ave
Clemson, SC 29634-5712

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Technical Quarterly Progress Report
Advanced Gas Turbine Systems Research
Cooperative Agreement DE-FC21-MC29061

January 1, 2000 to March 31, 2000

ABSTRACT

The activities of the Advanced Gas Turbine Systems Research (AGTSR) program are described in the quarterly report. As this program administers research, we have included all program activity herein within the past quarter dated. More specific research progress reports are provided weekly at the request of the AGTSR COR and are being sent to NETL. As for the administration of this program, items worthy of note are presented in extended bullet format following the appropriate heading.

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EXECUTIVE SUMMARY:

MEMBERSHIP

- AGTSR received no new industrial or university membership applications or inquiries this quarter. This is as expected.
- All companies sitting on the AGTSR Industrial Review Board have been billed for their 2000 membership fee. As of March 31, 2000, the following companies have submitted payment: Solar (full member), Southern Company Services, and Parker Hannifin (associate members).
- A completely revised AGTSR Performing Member Notebook was released at the end of March. This release occurred much ahead of schedule.

ADMINISTRATION

- The AGTSR Program Manager Search Committee conducted its final on-site interview on January 17, 2000. Shortly after the final interview, the committee met and unanimously selected Dr. Richard Wenglarz for the position. After necessary approval from DOE, Dr. Wenglarz was extended an offer and accepted the position. Dr. Wenglarz is expected to begin work at SCIES on or about April 15, 2000. Dr. Wenglarz' resume is attached.
- On February 28, 2000, SCIES issued a revised budget request to NETL for the AGTSR program. The revised budget request increased AGTSR funding for CY2000 to \$3.6M. This revision was for \$600K more than the NETL previously approved \$3M budget. Specifically, the \$600K increase would be used to:
 - 1) Fund the last two of seven research subawards previously put on hold due to budget restrictions. The approved research program based on RFP 1999 is shown on Figure 1.

Figure 1

AGTSR 1999 Research Program

SCHOOL/PI	TECHNICAL OBJECTIVE
Purdue University*	"Measurements for Improvement Understanding

<i>J.P. Gore</i>	of Combustion Dynamics in Lean Premixed Gas Turbine Combustor Flames”
Texas A&M <i>J. C. Han</i>	“Rotating and Stationary Rectangular Cooling Passages Heat Transfer and Friction and Turbulators and Dimples”
University of California—Irvine <i>Scott Samuelsen</i>	“Correlation of Ignition Delay with Fuel Composition and State for Application to Gas Turbine Combustion”
University of Connecticut <i>Nitin Padture</i>	“Advanced Thermal Barrier Coatings for Industrial Gas Turbine Engines”
University of North Dakota <i>Forrest Ames</i>	“Characterization of Catalytic Combustor Turbulence and Its Influence on Vane and Endwall Heat Transfer and Endwall Film Cooling”
University of Washington <i>Philip Malte</i>	“The Stages of Pre-vaporizing-Premixing Injector: High Pressure Evaluation”
Virginia Commonwealth University <i>Daniel Dorney</i>	“Improved Performance and Durability in Gas Turbines Through Airfoil Clocking and Hot Streak Management”

(*) High Risk

- 2) Fund the 2nd or 3rd years of existing research projects from RFP 98-01 and RFP 97-01 at 100% rather than 90% as stated in the October request.
 - 3) Increase the student internship.
 - 4) Target AGTSR success projects for accelerated transition to industry. This would provide for continuation of the existing research program “add-on” feature and/or establish a new industrial cost share opportunity.
- At the request of NETL, AGTSR provided information to the Institute for Complex Engineered Systems at Carnegie Mellon University to assist in formulating thoughts for a center for advanced simulation at CMU for the NGT-AGTSR program.
 - All AGTSR literature including Workshop Proceedings, Research Project Final Reports and Journal articles have been submitted to Parsons for inclusion in their work to develop an archivable ATS literature base. Approximately 10,000 pages of literature have been sent to Parsons. AGTSR continues to update the internal literature list to maintain the “living document.”
 - All other administrative functions proceeded with no observed difficulties

TECHNOLOGY TRANSFER (Workshops and Education)

- The ATS Economic Impact Study prepared by the Windsor Group, Inc. was released. The final report included comments from the IRB. The distribution for this report was limited to IRB companies and NETL. Based on the assumption in the report, it was estimated that *“an aggregate customer savings of \$2,073 million would have been realized by 2010 assuming an average natgas cost of \$3 per million BTU in today’s dollars. Fuel savings would be significantly higher in the following 10 years as the machines continue to be installed and operated. Using a real discount rate of 8%, the net present value of energy savings over the coming 10 years would be \$1,095 million. Expanding to a 20-year horizon (most GTs will have a service life beyond 10 years), the total net present value of fuel savings equals \$3.5 billion.*

There is, of course, another companion benefit to the development of more efficient gas turbines and that is one of No_x emission reductions. The current and subsequent models of ATS-enhanced machines have a program goal of 9 ppm No_x emissions versus current machines in the 25 to 50 ppm range depending upon machine size, configuration, duty cycle and segment. The annual No_x emissions reduction by the year 2010 due to the penetration of ATS-enhanced machines would be 145,000 short tons, or 35% from the base case. For the decade, a cumulative reduction of 620,000 short tons was calculated. Using appropriate unit value for such reductions from the EPA suggests that the value of NO_x reductions is slightly less than 15% of the NPV in fuel savings for the decade.”

- The workshop sites, dates and topics for CY2000 have been selected as:
 - Combustion—September 6, 7, 8, 2000, at the Radisson Berkeley Marina, hosted by University of California, Professor Bob Dibble
 - Aero-Heat Transfer—October 11, 12, 13, 2000, at the University of Minnesota Gateway facility, hosted by Professors Robert Goldstein and Terry Simon

The agendas for these workshops are now being developed.

- As approved in the October 1999 IRB meeting, Virginia Tech, under the direction of Professors Thole and Vandsburger, is preparing an AGTSR proposal for establishing a “new” Ph.D. program. The program would be geared for the individuals preparing for a career in industry and involve multiple universities in the education process. A proposal for a trial program is expected in August 2000.
- The application deadline for the Industrial Internship Program was March 15, 2000. By the closing date, a limited number of applications were received. However, after that date, several undergraduates applied. Both “types” of student applications were submitted to IRB companies for selection. AGTSR expects to position the students in May.

EXPERIMENTAL:

No experimental data to include from the administration of this program. At the request of the AGTSR COR, weekly research progress reports are being sent to NETL

RESULTS AND DISCUSSION:

RESEARCH

- At the request of the AGTSR COR, weekly research progress reports are being sent to NETL.
- Verbal debriefings of the AGTSR research proposals not selected for funding continued. The debriefings are held at the request of the proposal's PI.
- All existing research subcontracts proceeded as scheduled with no observed problems. A listing of all active research subcontracts is attached as Figure 2.
- One subcontract "add-on" request was received from Northwestern University. The request was distributed to the IRB for vote. A decision is expected in May 2000.
- Research topics for RFP 2000 were requested from the IRB. As many suggestions as feasible were incorporated into the preparation of the RFP that is expected to be released in May.

CONCLUSION

- This quarter ended with continued success in the administration of the Advanced Gas Turbine Systems Research Program. At the request of the AGTSR COR, weekly research progress reports are being sent to NETL. Individual conclusions on those projects are included at that time.

REFERENCES

- All references to specific projects are included at the end of each projects specific progress report. At the request of the AGTSR COR, weekly research progress reports are being sent to NETL. Individual reference listings on those projects are included at that time.