University Turbine Systems Research Program

August 14, 2007

Dear Performing Member:

The enclosed RFP by the South Carolina Institute for Energy Studies (SCIES) in Clemson, South Carolina, is issued for your consideration. This RFP solicits research proposals for the University Turbine Systems Research (UTSR) program that is supporting the NETL Turbine Program. Consequently, the university research emphasis in the RFP reflects the goals of the NETL Turbine Program associated with use of hydrogen derived from syngas and coal syngas (HSG) as turbine fuels. Awards resulting from this RFP will be contingent on availability of DOE funding for the university program. Since the cooperative agreement between the DOE and SCIES is scheduled to end on December 31, 2008, awards under this RFP will require a new cooperative agreement and an increase in the cost ceiling for the current agreement.

Proposals in accordance with the instructions in the RFP must be received electronically by SCIES by close of business, **September 19, 2007**. Late proposals will not be considered. SCIES would appreciate return of the "Intent to Propose" form, Attachment D, by close of business, **September 3, 2007**. Return of this form will help SCIES plan an effective evaluation process.

Note that the RFP research topics are limited to those defined in Section 2.0. Two or three-year programs may be submitted, but three year projects must have a completed set of deliverables by the end of the second year. More details concerning three year projects are discussed in the RFP. It must be understood that funding for any awarded projects will be approved on an annual fiscal year basis. Prospective awardees will be selected by the Industrial Review Board in the fourth quarter of 2007. *Any new awards should be announced in the first four months of 2008 and the projects should begin at about the beginning of the summer term in 2008. Consequently, please use May 1, 2008 as the start date in developing the proposal budget.*

Teaming collaborations (with industry, DOE, DOD, NASA and other universities, including HBCU/ MI schools) are strongly encouraged to leverage the R&D expertise and facilities available throughout the country. Proposals should clearly identify all the participants in the planned program, but only one principal investigator may be named. An updated list of the UTSR Performing Member universities receiving the RFP is available at the SCIES web site (www.clemson.edu/scies) for your use in developing teaming arrangements.

SCIES encourages investigators to initiate an Undergraduate Fellowship Program within their proposed research activity. The undergraduate fellows should be an integral part of the research project. Student financial support may include fees for attendance at research workshops, the Turbine Program annual review meetings, and national gas turbine meetings.

Inquiries relative to the RFP will be received in accordance with the procedure defined in the RFP. After the cutoff date of September 3, 2007, no discussion with SCIES on prospective proposals will be permitted. **You are receiving the attached electronic version of the RFP as the point of contact at your institution for our university research program. No one else at your institution will be sent this RFP unless they specifically request it from our offices.** Consequently, please distribute the RFP to other interested faculty members and to your Office of Sponsored Programs. Thank you, and if your school submits a proposal this year, best wishes in the review process.

Sincerely,

Richard A. Wenglarz
Manager of Research
UTSR Program

1. If no proposals submitted under this RFP are of sufficient quality to justify funding, SCIES reserves the right to withhold funding for the FY2007 RFP.
2. If in the opinion of the Industrial Review Board, proposals submitted under this RFP do not qualify for funding, SCIES reserves the right to withhold new awards in FY 2008.
3. SCIES reserves the right to cancel this RFP at any time and not fund any proposals received as a result of this request.
4. Proposal shall have a maximum length of 23 pages; see paragraph 3.1 of the RFP. Endorsement letters from industry or of any kind will not be accepted.

# REQUEST FOR PROPOSALS

# ON

# UNIVERSITY TURBINE SYSTEMS RESEARCH

# RFP NO. UTSR 07-01B

**Issued**
**To**
**Performing Members of the University Turbine Systems Research Program**

**Issued**
**By**
**South Carolina Institute for Energy Studies**
**(SCIES)**
**386-2 College Avenue**
**Clemson, South Carolina 29634-5711**

**Program Funded**
**By**
**United States Department of Energy,**
**National Energy Technology Laboratory**
**(NETL)**
**and the**
**Industrial Review Board**

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## 1.0 INTRODUCTION

The DOE has launched several programs to develop turbine technologies for advanced power systems that operate with high hydrogen fuels (coal syngas and nearly pure hydrogen from gasified coal). The turbine technologies support a phased development of coal based power systems with increasing efficiency and emissions performance and decreased capital cost per kW output. The hydrogen fuel technologies are leading to FutureGen type power plants that can capture CO2 and produce hydrogen. These advancements involve a transition from turbines operating with syngas with properties of that produced at current IGCC plants to very high hydrogen content fuels derived from syngas to syngas burned in nearly pure oxygen using steam to control temperatures (oxy-fuel systems). The transition will require development of turbine combustion technologies for this variety of fuels and turbine hot section flow path aero/heat transfer and materials technologies to accommodate expansion gases that are not only increasingly hotter but also contain increasing levels of water vapor.

Although this transition might be expected to require cleaner turbine fuel gases with time, increased gas cleanup capabilities typically are at the expense of increased plant capital cost and higher pressure drops that decrease plant efficiency. Currently, the capital costs and efficiency of IGCC plants are deterrents to their widespread commercialization. Since the DOE goals are decreased capital costs per kW and increased efficiency for the advanced power systems compared to current IGCC plants, it would be beneficial to identify guidelines for gas cleanup performance that would facilitate specification of gas cleanup equipment that is sufficient, but not more than necessary, to protect the turbine flow path and provide outstanding emissions performance.

The following research topics are directed to obtaining fundamental information to aid in the development of the DOE advanced coal based turbine power systems. The emphasis is to understand the underlying factors affecting combustion, aero/heat transfer and materials experience for syngas used in current IGCC turbines and use that knowledge to design and conduct experiments and analyses to aid in turbine technology development for transition from coal syngas with current properties to nearly pure hydrogen fuels derived from coal syngas to syngas burned in oxygen. Some of these evaluations involve obtaining an understanding on how clean these various fuels must be for acceptable protection of the turbine flow path and outstanding emissions, without unduly incurring the capital cost and pressure drop efficiency penalties of more extensive gas cleanup systems than are needed.

This Request for Proposal (RFP) solicits responses from Performing Member Universities of the UTSR Program to build on their gas turbine/power generation experience and contribute to the DOE Turbine Program goals through accelerated research in areas of interest to the DOE and gas turbine industry. Universities that are not Performing Members may apply for UTSR Membership and their proposals will be considered if membership is accepted by the proposal due date. As in the past, awards under this RFP are contingent on future funding availability for the UTSR program administered by the South Carolina Institute for Energy Studies (SCIES). The current cooperative agreement between the DOE and SCIES is scheduled to end in December, 2008 and will require an extension to the period of performance and the cost ceiling to allow for any subawards under this RFP.

The proposals submitted in response to this solicitation should address the Technical Objectives specified in Section 2.0. In addition, university cost sharing on the proposed projects is encouraged**.** Proposals are solicited for either of two types of projects:

1) Projects up to two years in duration
2) Projects of three years duration

Requirements for projects are similar to those solicited in the past by the UTSR, except there are additional specifications (described later) on the deliverables in years two and three for proposed projects of the type 2). Research topics for projects are described in following sections 2.1 through 2.3.

## 2.0 TECHNICAL OBJECTIVES

This RFP is soliciting proposals targeting the research areas listed below. The following list addresses issues for hydrogen derived from syngas and coal derived syngas (HSG) used as turbine fuels. The research areas cover certain DOE Turbine Program topics in combustion, aerodynamics, heat transfer, and materials. The RFP topics are not prioritized—the number of proposals recommended for support will depend on the quality of proposals submitted and the availability of funds. Some topic areas *may not* have any proposals recommended for support. It is anticipated that any new awards resulting from this RFP will begin in May 2008. Two or three year programs may be submitted. However, three year proposed projects should be structured and budgeted to accomplish a completed body of research by the end of two years with additional task(s) to be started and completed in the third year.

Proposals are solicited that address technology needs of turbines operating with *high hydrogen and syngas* (HSG) fuels. The topics below consider DOE Turbine Program goals for HSG fuels. HSG fuels are a challenge because they have different and more variable combustible components (and combustion/emissions characteristics) than natural gas. Also, HSG fuels might contain limited levels of impurities (e.g., up to 100 ppm sulfur, 0.1 to 2 ppm particulate) thought to be detrimental to components in the turbine flow path. For the purposes of this solicitation, it should be assumed that the syngas and hydrogen derived from syngas has been cleaned with a cold gas cleaning system. Fundamental and basic research proposals are solicited to help define and address HSG fuels issues thought to impact the goal of designing robust turbines for HSG power plant environments.

### 2.1 Combustion Topics

Turbines currently operating with high hydrogen fuels and syngas use diffusion flame combustors with diluent (e.g., steam, nitrogen, or both) injection to lower combustion temperatures and thereby reduce NOx to a typical guaranteed range from 15 to 25 ppmv. For natural gas fuels, lean premixed combustors have been developed to produce guaranteed NOx emissions down to the about 9 ppmv. Similar developments are needed to adapt lean premixed combustion approaches to achieve low level emissions using high hydrogen fuels derived from syngas.

Formidable challenges to the development of lean premixed combustors for high hydrogen fuels derived from syngas result from their unique properties (e.g., high flame speed, high diffusivity, short ignition delay time, and wide explosive limits) and range of compositions (e.g., H2, CO,

$H_2O$). Also, the DOE goal for turbines using high hydrogen fuels is less than 2 ppmv NOx at 15% $O_2$ is significantly lower than now guaranteed for turbines operating lean premixed combustors with conventional fuels. Consequently, additional fundamental combustion experiments and modeling research are needed to advance lean premixed combustion approaches to produce guaranteed lower NOx emissions than achieved in the past but using fuels with more difficult and variable properties. For that purpose, the following research topics address the combustion and operability issues (blowout, flashback, dynamic stability, etc.) to achieve fundamental capabilities needed for the design of low single digit NOx emissions combustors that use high hydrogen fuels derived from coal syngas.

Proposed research should consider ranges in fuel compositions (corresponding to various gasification processes) and conditions (corresponding to different turbines) expected for syngas and high hydrogen fuels derived from syngas. If facilities used in the research can not replicate turbine combustor pressure and inlet temperature conditions, rationale must be provided for relating the experimental data and interpretations to the design of high pressure turbine combustors. Possible fuel compositions could range from 15 to 40% $H_2$, 20 to 45% CO with up to 25% $H_2O$ levels in the syngas and lower heating values in a range from 100 to 150 Btu/ft3. Combustor operating conditions for conventional turbine systems using air as the oxidant could range from 700 to 950 F inlet temperatures, 2300 to 2650 F outlet temperatures, and pressures from 15 to 25 atmospheres. Possible ranges in composition for hydrogen fuels produced from syngas could be from 50% $H_2$ to nearly pure $H_2$. Oxy-fuel combustion systems use oxygen as oxidant, steam for temperature control, and might produce turbo-machine expansion gases with temperatures as high as 3200 F.

Consequently, the following research topics are intended to provide insight and data for design of very low emission (NOx under 2 ppmv at 15% $O_2$) and stable combustors that could operate with the expected variety of HSG fuel compositions and operating conditions for future turbines.

**Topic 1: Mixing Processes**
Research is needed to better characterize, understand, and model the fuel profile and unmixedness using turbine appropriate pre-mixer approaches for operation with low molecular weight, high mass diffusivity fuel mixtures containing high hydrogen levels.

**Topic 2: Kinetics Data**
The existing data base for combustion kinetics needs to be extended to the full range of compositions expected for high hydrogen and syngas fuels and temperatures and pressures appropriate to turbine combustors. Kinetic data should represent one or more of the following:

i) $H_2$ and CO compositions over the ranges associated with syngas and high hydrogen fuels derived from syngas.
ii) Effects of residual $H_2O$ and $CO_2$ and other species in the fuel in the coupled kinetics of oxidation of $H_2$ and CO mixtures.

**Topic 3: Kinetics Models**
Improved experimentally verified reduced chemical kinetics models for high hydrogen fuel mixtures are needed to achieve combustion computational capabilities that are sufficiently accurate for combustor design at reasonable computation run times and costs. The kinetics models need verification for the range of combustion temperatures, pressures, and fuel compositions for high hydrogen fuels anticipated for future turbines.

**Topic 4: Dynamic Stability**
Experiments using high hydrogen fuels in lean pre-mixed combustors have shown significant dynamic stability issues. Furthermore, the different flame structure resulted in much higher frequency modes compared to the same premixed combustor operated with natural gas. Consequently, experiments with high hydrogen fuels and improved models are needed to:

i) Better characterize the basic physical and chemical driving parameters that determine when a flame is stable or unstable.
ii) Characterize the flame characteristics to adequately predict combustion dynamics for the design of lean, pre-mixed combustors operating with high hydrogen fuels.

**Topic 5: Enhanced Lean Pre-Mixed Approaches**
Research is needed to explore and quantify capabilities of potential supplemental approaches to further reduce NOx emissions (e.g., to 2 ppmv at 15% O2) from lean, premixed type combustion for fuels with high hydrogen content while addressing combustor operability issues (blowout, flashback, dynamic stability, etc.). Supplemental approaches might include use of diluents, axial staging, or exhaust gas recirculation.

## 2.2 Aero/Heat Transfer Topics

Low heating values typical of syngas and injection of diluents (to control combustion temperatures and therefore thermal NOx) have resulted in higher (up to 14%) mass flows through the turbine hot section of IGCC turbines than for the same model turbines operated with natural gas. This produces 20-25% higher turbine output power compared to natural gas but also tends to increase the heat transfer to the hot section vanes and blades. Where steam is used as a diluent to control NOx, the higher heat transfer properties for steam compared to air tends to additionally increase the heat load to hot section components. Accordingly, current IGCC turbines have been operated at reduced firing temperatures to maintain hot gas parts at temperatures similar to those of the same model turbines operated with natural gas. The progression from current syngas to high hydrogen fuels produced from coal syngas and oxy-fuels along with the usual increase in turbine inlet temperature through time to increase performance (power and efficiency) will tend to produce additional heat loads and aero/cooling requirements for hot section components. Also, limited turbine operation experience and past rig tests with alternate fuels containing ash impurities have shown that corrosion and deposition can be drastically higher for increased inlet temperatures because of higher levels of molten phases in the flow stream. Although increased gas cleanup in future plants will probably significantly reduce impurities entering the turbine, current experience has shown that even highly filtered ambient air can produce significant deposition (fouling) in compressors when molten phases exist at flow path conditions.

Consequently, additional research is needed to define the aero/heat transfer environments and accommodate higher heat loads under potential deposition/corrosion conditions in the hot section flow paths of turbines operating with coal syngas, future high hydrogen fuels derived from syngas, and oxy-fuels.

**Topic 1: Hot Gas Path Design**
Research is needed to identify and verify turbine flow passage features that enable cooling or aerodynamic designs that either:

i) have performance less sensitive to surface degradation due to deposition, erosion, and corrosion, or

ii) alleviate flow path deposition, erosion, and corrosion

Approaches such as fillet size and shape, end wall contouring, and tip clearance design that are explored for less sensitivity to surface degradations should also consider effects on passage aerodynamic efficiency and/or heat load to surfaces.

Approaches that are designed to lessen intensities of secondary flows in turbine airfoil passages would be beneficial in reducing the potential for end wall deposition, erosion, and corrosion due to secondary flow driven migration of gas stream particles to hub and tip regions. Although reduced secondary flows can also improve aerodynamic and cooling performance, emphasis in proposed research should evaluate and verify potential alleviation of concentration of impurities delivered to end wall regions which aggravates local degradation.

**Topic 2: Film Cooling and Innovative Cooling Approaches.**
Research is needed to identify and verify film cooling approaches (geometries, hole locations and patterns, etc.) that enable designs that sustain cooling effectiveness and passage aerodynamic efficiency through being relatively insensitive to degradation effects such as deposition, erosion, corrosion, or coating spallation.

Research that evaluates and verifies innovative surface cooling approaches that can reduce deposition, erosion, or corrosion effects is also desired.

Effects on cooling effectiveness should be at least analytically evaluated for a range of flow path heat transfer properties (e.g., resulting from different water vapor levels) associated with coal syngas, high hydrogen fuels derived from syngas, and oxy-fuels. Candidate cooling approaches to be explored should be first discussed with turbine suppliers to consider their manufacturability.

**Topic 3: Environments in Turbines Operating with Syngas and High Hydrogen Fuels from Coal**.
For turbines operating with syngas and high hydrogen fuels from gasified coal, relatively little is know about aero/heat transfer and impurity environments in their hot sections. The levels of water vapor in the hot section flow path affects both heat transfer to the expander airfoils and can increase the degradation (e.g., oxidation) of flow path materials. SOx and impurities that pass the plant cleanup systems can not only contribute to materials corrosion but also deposition on airfoils and their end walls that affect aerodynamic losses and heat transfer to their cooled surfaces and material temperatures.

The goal of this task is thermal-chemical analyses to better define the environments in the hot section of turbines that operate with syngas and high hydrogen fuels produced from coal gasification. This information can be used as input for the aero/thermal design of these turbines, aid in interpretation of aero/thermal and materials degradation experience in IGCC turbines, and also provide input conditions for aero/thermal and materials evaluations in other UTSR projects. The thermal-chemical analyses should consider non-equilibrium effects, for example by, eliminating candidate reactions with rate constants that would not enable the reaction products to be formed in the short residence time of the combustor and expander flow path. Input to the thermal-chemical analyses includes composition and flow rates of the fuel, oxidant (air or oxygen), and diluents (steam and/or nitrogen) into a representative turbine combustor. The input fuel composition includes baseline levels/composition data for impurities (sulfur, ash elements) measured in the syngas after gas cleanup at a syngas plant. After a baseline analysis, these parameters should be varied to represent a range of fuel feedstock and levels of syngas cleanup. Outputs from the thermal-chemical analyses are the composition, phases, and heat transfer properties for combustion products in the temperature/pressure regime in the stages of the turbine hot section. This includes the composition, levels, and state (gaseous, liquid, or solid) of impurities that could pass through the hot section flow path after combustion of the fuel. Levels and composition of liquid phase components in the turbine flow path are particularly important because molten phases are typically the primary contributors to component corrosion and are usually required for significant deposition to occur. Variation of the levels and composition of impurities (sulfur and ash elements) from the baseline values in the fuel gas should be explored to identify levels that reduce the potential for molten phases to exist in the hot section flow path and thereby provide insight for coal ash specifications or gas cleanup specifications to alleviate hot section corrosion and deposition. The analyses should also evaluate the effect of turbine inlet temperature on levels and composition of flow path molten phases to explore the potential for additional molten phases and possible increased corrosion and deposition in future higher inlet temperature (up to 2600 F) turbines operating with coal derived syngas and hydrogen fuel derived from syngas.

## 2.3 Materials Topics

Even though limited IGCC plant data on measured syngas impurities indicate lower levels of critical ash constituents (e.g., Na, K, Ca) than limits from turbine fuel specifications, greater materials degradation (corrosion, erosion, and deposition) has occurred in at least some IGCC plant turbines to date than for the same model turbines operated with conventional fuels such as natural gas. For properly designed and operated syngas cleanup systems, no forced turbine outages resulting from hot section materials degradation associated with syngas appear to be reported at IGCC plants. However, at least in some cases, hot section coatings, vanes, and blades have needed replacement during routine maintenance shutdowns at more frequent intervals than for natural gas fired turbines.

For example, analyses of IGCC turbine first rotor blades have shown that, at some locations, surface reactions were radically different in nature and more severe than typically observed in turbines operating with conventional fuels. These areas appeared to experience a combination of sulfidation and oxidation. However, the mechanisms leading to this attack are uncertain because partial pressures of sulfur containing gases in the syngas combustion products do not appear to be as high as required to produce materials sulfidation.

Also, TBC’s in IGCC turbines have experienced deposition and spallation and sometimes needed replacement at more frequent intervals than for natural gas fired turbines. Analyses have indicated that iron oxides (e.g., $Fe_2O_3$) have been primary constituents of deposits on the TBC’s, which also penetrated into the TBC porosity. The presence of other ash elements (e.g., Si, Al, Ca, Mg, Na, K and sulfate ions) has also been detected. These deposits are different in composition than deposits consisting of calcium, magnesium, aluminum, and silicon (CMAS) that have caused past degradation of airborne turbine TBC’s.

The following sequence of materials research topics are directed to first understanding the nature of degradations to date in IGCC turbines, identifying approaches to alleviate these degradations, and then using these insights as a starting knowledge base for evaluations of materials for turbines using higher hydrogen fuels derived from coal gasification and oxy-fuels.

**Topic 1: Mechanisms of Degradation and Resistant Syngas Turbine Materials**
Goals of this topic include identification of the specific mechanisms of degradation and development of an understanding of the critical aspects (e.g., critical impurities) of IGCC turbines flow-path environments that have contributed to and caused the atypical sulfidation/oxidation type degradation of alloys and environmental coatings experienced to date. Evaluation of materials and syngas impurity analyses described in the literature, interactions with materials experts at UTSR IRB companies, and additional university analyses of IGCC turbine parts (if available), should be explored to understand the degradation processes. Based on this understanding, laboratory experiments should be designed to replicate critical aspects (e.g., critical impurities and mechanisms) of the materials degradation experienced to date in order to then test alternate environmental coatings and alloys and determine those most resistant to syngas turbine environments.

The presence of water vapor can potentially affect the nature and growth rate of protective oxide scales. To evaluate conditions for future systems, additional experiments should explore the combined effects of impurities and water vapor at levels representative of the flow-path of higher temperature IGCC turbines (vicinity of 8.5%) and also higher water vapor levels for future turbines operating with high hydrogen fuels (vicinity of 17%).

**Topic 2: Degradation of IGCC Turbine TBC's From Deposits.**
Evaluation of IGCC turbine TBC analyses and syngas impurity analyses described in the literature, interactions with materials experts at UTSR IRB companies, and additional university analyses of IGCC turbine parts coated with TBC's (if available) should be explored along with initial laboratory experiments to identify the critical impurities and TBC degradation mechanisms. These evaluations should delineate the relative roles of chemical attack and mechanical effects (e.g., deposit penetration and expansion) from deposits that produced the degradation of TBC's to date in IGCC turbines. Experiments and/or analyses representing the thermal gradient through the turbine TBC's are preferred to represent turbine conditions such as the extent of deposit molten phase penetration into the porous TBC structure. Using the knowledge obtained from evaluation of IGCC turbine TBC degradation and the initial experiments/evaluations, a second set of experiments should be designed to select candidate TBC's (e.g., APS, EB-PVD, bond coat) and evaluate their relative performance in laboratory tests when exposed to deposits representative of those experienced to date in IGCC turbines.

The presence of water vapor potentially can potentially affect the nature and growth rate of the thermally grown oxide scale at the bond coat interface and also sintering of the YSZ coating. Consequently, experiments representative of future systems should explore the effects of deposits representative of those experienced to date in IGCC turbines combined with water vapor at levels representative of the flow-path of higher temperature IGCC turbines (vicinity of 8.5%) and also higher water vapor levels for future turbines operating with high hydrogen fuels (vicinity of 17%).

**Topic 3: Effects of Sulfur and Water Vapor on Alloys and Environmental Coatings.**
Future turbines that operate with syngas produced with $CO_2$ capture and oxy fuel turbines might operate with hot section gases containing very high water vapor levels (up to 85%) and limited gaseous sulfur (e.g., $SO_2$) levels. Because water vapor and sulfur affect the formation of oxide scales, there are likely bounds on combinations of water vapor, $SO_x$, and surface temperatures

for protective oxide scales to form on turbine materials. Consequently, experiments and analyses are needed to identify the acceptable operating ranges for SOx, and surface temperatures for current turbine alloys and environmental coatings for water vapor levels ranging up to 85%.

**Topic 4. Effects of Sulfur and Water Vapor on TBC's Coatings.**
The very high water vapor levels (up to 85%) and limited gaseous sulfur (e.g., SO2) levels for future turbines that operate with syngas produced with CO2 capture and oxy fuel turbines are also expected to affect thermal barrier coatings. Possible effects include altering the formation the thermally grown oxide scale at the bond coat interface and also the sintering of the YSZ. Consequently, experiments and analyses are needed to identify the acceptable operating ranges of SOx, and surface temperatures for candidate turbine TBC's (APS, EB-PVD, bond coats) for water vapor levels ranging up to 85%. These evaluations should explore operating bounds for water vapor, SOx, and surface temperatures considering the effects on both coating durability and thermal conductivity.

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*For research topics in sections 2.1 through 2.3, close collaboration is highly encouraged with the Industry Review Board R&D experts, DOE-NETL, Oak Ridge and other DOE National Laboratories, DOD and/or NASA to plan research tasks and utilize and leverage their R&D expertise and in-house testing facilities.

**Whenever possible, teaming with Historically Black Colleges and Universities and Minority Institutions (HBCU/MI's) is also encouraged. A partial list representing those schools that offer mechanical and/or chemical engineering programs is provided in Attachment C. Other HBCU/MI engineering schools may also participate if by chance they were omitted from our HBCU/MI list of engineering schools. Performing Member Universities may team with any HBCU/MI school of their choosing. Teaming with HBCU/MI's is encouraged but will not be a criterion for evaluation. Also, the HBCU/MI School does not have to be an UTSR Performing Member University. However, the university submitting the lead proposal must be a Performing Member.

*** Experimental verification is essential for viable technology transfer of project results to industry design staffs. Modeling and analytical work must be supported by relevant test data in coordination with industry OEM's and/or gas turbine users. Although development of new facilities is not prohibited, the effect of new facilities costs on remaining funds for research accomplishments will be considered in the proposal evaluations. Studies are preferred that parameterize effects as opposed to those that deal with very specific geometries of restricted use. Proposals must show well-planned programs and set reasonable objectives.

Other research issues and topics will likely be identified in future Workshops and by the DOE or industry. These areas may be addressed in future RFP's. The intent of the UTSR program is to emphasize the higher priority technologies first, as determined by the DOE and industry, followed by a broadening of this base over the life of the program as additional funding becomes available.

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## 3.0 PROPOSALS

3.1 GENERAL: Proposals should be submitted in accordance with the format specified in Paragraph 3.2. Proposal length shall not exceed twenty (23) pages which includes the cost statement, the abbreviated resumes, and list of relevant and most recent publications. The Appendix for any budget justification is not included in the page limit.

3.2 FORMAT: To assure proper and consistent evaluation, the proposals should follow the basic format outlined below. Suggestions for content of proposal Sections 1.0 through 6.0 are presented in Paragraphs 3.2.1 - 3.2.6.

| Section | Contents |
| --- | --- |
| Cover | Title of Research Project,<br>Designation of type of project; i.e., Two Year Project, or Three Year Project<br>Submitting Performing Member University,<br>Principal Investigator name, phone number, email address<br>Date,<br>In response to UTSR 07-01B |
| | Table of Contents<br>(Note: Page 1 begins with the Executive Summary; the Cover and Table of Contents are not numbered pages.) |
| 1.0 | Executive Summary |
| 2.0 | Introduction – uniqueness and benefits of idea/importance to the NETL Turbine Program<br>Background<br>Objectives |
| 3.0 | Statement of Work |
| 4.0 | Deliverables and Schedule |
| 5.0 | Performing organization(s)<br>Key personnel<br>Teaming arrangements<br>Experience<br>Facilities |
| 6.0 | Cost statement (See Attachment B-summary form)<br>*(maximum period of performance is 3 years; 3-year projects must have completed research results and cost statement for the end of 2 years, with additional third-year task(s) and cost statement)* |
| References | As required (Abbreviated list) |
| Appendices | As required (Appendix for any budget justification needs not to be numbered) |

3.2.1 EXECUTIVE SUMMARY: A concise strong summary of two pages or less should be prepared that briefly indicates the project objectives, approach to achieve the objectives, benefits of the work, participants and collaborations with industry, and value of the results to the DOE Turbine Program. The Executive Summary should also provide the project cost, list of deliverables, and project task schedule. ***Although collaboration with industry is highly encouraged, endorsement letters from industry (and any other agency) are not required and will not be accepted.* *Also, collaborations with Industrial Review Board (IRB) companies should not involve subcontracts or payments for any of those companies to conduct research in the proposed project.***

3.2.2 INTRODUCTION: The background leading up to the decision to propose the research selected should be explained. This strategy discussion should clearly support the objectives and results expected to be achieved, and logically lead to the detailed work statement that follows.

3.2.3 STATEMENT OF WORK: This section defines the specific work that is to be undertaken. Break the Statement down into Tasks that can be measured. Provide sufficient detail to permit understanding and justification of the proposed work. Be concise, but delineate the planned work so that the cost statement can be understood. Identify efforts that will be cost shared. (University cost sharing is not mandatory, but is encouraged.) Address turbine issues that each task will investigate, a possible backup plan if the idea fails, and the time that it will take to complete the investigation. Identify how the knowledge developed under each task will be used by industry to support the goals of the NETL Turbine Program. Identify the nature of the collaboration with industry in each task, where applicable.

For three year projects, the Statement of Work (and associated task discussions) should describe a research effort completed and reported by the end of the first two years with third year task(s) started and completed in that year.

The Statement of Work will be a part of the subcontract for any projects that receive awards in response to this RFP. Any substantive departure from the Statement of Work (e.g., major modification of a task, dropping a task, etc.) after award would require a subcontract mod and probably approval by the IRB. Consequently, include in the Statement of Work only specifics for which there is a high confidence of completion.

3.2.4 DELIVERABLES AND PROGRESS SCHEDULE: This section will form the basis for payments based on completed deliverables or progress reports. Since time is of the essence, an aggressive but realistic schedule will be favored in the selection. Deliverables shall be listed on a semi-annual basis at minimum. A Gantt type project schedule chart (which describes the time schedule for each task in the Statement of Work) is required.

3.2.5 TEAM QUALIFICATIONS: The importance of the synergy available from combining talents and facilities cannot be overemphasized. The experience and capabilities that are to be utilized should be well documented. Particular expertise in gas turbine technology should be highlighted. The Principal Investigator designated and other key personnel should be identified, along with their relationships to other participating organizations. If applicable, explain how you will interact and collaborate with industry, DOE, DOD, NASA, and/or other organizations, to help leverage, guide and benefit your research efforts.

3.2.6 COST STATEMENT: The cost statement should show annual expenditures and the total cost to complete the proposed work. Payments will be based on the deliverables and progress schedule presented in Paragraph 3.2.4. Identify each faculty member's contribution, and list the number and degree level of student participants. In the Appendix area, provide sufficient data to support purchased services, equipment, consumables, and other non-labor expenses. (Please use a format similar to Attachment B for the program budget summary. Keep any appendices as abbreviated as possible.) Undergraduate (junior, senior-level) UTSR Fellowship support is highly encouraged to be included within your proposed budget. <u>Budget appendices need not be numbered</u>.
*<u>NOTE</u>: Historically, the average annual cost for past AGTSR/UTSR research projects has been approximately $125K-$150K. The "cost/scope" of the proposal is a significantly weighted criterion in the proposal evaluation process.*

For this RFP, the maximum period of performance is 3 years. Three year projects should be organized to produce a completed set of research deliverables by the end of the second year with additional tasks started and completed in the third year. Proposals for 3-year projects should also provide separate budget summaries for the first two years and for the third year, both in a format similar to Attachment B.

3.2.6.1 INDIRECT EXPENSES: Only indirect overhead rates approved by the U.S. Government shall be applied.

3.2.6.2 FACILITIES: Proposals may request up to 10% of total budget for purchase of supplies and equipment and must justify requests for supplies and equipment. The DOE encourages that the specific facilities to be selected and applied to the research and development effort shall be existing at the participating organizations where the actual work shall be conducted. Cost-shared equipment with other government or private facilities will be considered in the cost/benefits evaluation of each project.

3.3 EXCEPTIONS, COMMENTS AND CLARIFICATIONS: Any deviations from the RFP should be specifically identified and justification provided.

3.4 PROPOSAL SUBMITTALS: Proposals are due at the SCIES by the close of business (4:30 p.m. EDT) on **<u>September 19, 2007.</u>** Electronic submissions by email are required.

3.4.1 LATE PROPOSALS: Late proposals will not be considered. The deadline is absolutely firm and enforced to the minute. **NO EXCEPTIONS CAN BE**

**MADE FOR EXTENUATING CIRCUMSTANCES**. Prepare your proposal carefully and submit early. Late proposals will be returned without consideration.

3.4.2 ELECTRONIC SUBMITTALS: An electronic copy of the proposal in PDF format must be submitted using the following email address: **UTSR-L@clemson.edu**. If you need to verify that SCIES has received the proposal, contact Kim at kafair@clemson.edu.

3.4.3 INQUIRIES: Questions related to the RFP may be addressed to Richard Wenglarz, Manager of Research, (rwnglrz@clemson.edu), or by calling (864) 656-2267 or by FAX (864) 656-0142. Inquiries must be received by **September 3, 2007.** Persons at UTSR universities that have submitted a Notice of Intent to Propose (see section 3.4.4) will be notified if an inquiry results in any substantive change in the RFP.

3.4.4 NOTICE OF INTENT TO PROPOSE: Performing Members should complete the form contained in Attachment D, indicating their intentions regarding submittal of a proposal. SCIES would like to receive this form by **September 3, 2007.**

## 4.0 CONTRACTS

4.1 AWARDS: Proposals selected for contract negotiations will be determined by the IRB and DOE, in accordance with the evaluation and other criteria and the available funding. Should a selected Performing Member fail to complete the contract negotiation phase, which includes the terms and conditions of the subaward, the IRB and DOE reserve the right to substitute another award. Funding is dependent upon available budget for the UTSR Program and approved obligations by DOE-NETL for each fiscal year. The current cooperative agreement between the DOE and SCIES is scheduled to end in December, 2008 and will require an extension to the period of performance and the cost ceiling to allow for any subawards under this RFP.

4.2 APPLICANTS: A purpose of this program is to enhance university capabilities in gas turbine technology; consequently, only applications from higher educational institutions will be considered for an award evaluation. Applicants must have the capability to accept Federal Funds. Other laboratories or suppliers should arrange for Awards through an appropriate Performing Member university. Appropriate documentation of such Award arrangements should be provided as the DOE and IRB reserve the right to approve or reject an award.

4.3 TERMS AND CONDITIONS: Model subcontracts will be prepared. The subcontracts, along with the cooperative agreement issued by DOE to SCIES, contain all the applicable flow-down provisions of the Federal procurement regulations (FAR's). A copy of the model subcontract will be issued to those Performing Members who have proposals selected for award. ***Attachment A does, however, include the required certification forms that must accompany all proposals submitted for review; these forms are not included in the proposal page count.***

4.4 RIGHTS TO DATA IN APPLICATION: Except for technical data so marked, which are asserted by the Performing Member as being proprietary data, it is agreed that as a condition of this award, and notwithstanding the provisions of any notice appearing on the application, the Government shall have the right to use, duplicate, disclose, and have others do so for any purpose whatsoever the technical data not identified as proprietary data and contained in the application upon which this award is based.

4.5 REPORTS: Semi-annual technical progress reports shall be submitted to the Program Manager, in addition to any documentation required for the deliverables identified below. Technical progress reports should be submitted electronically (MS Word file) with one paper copy. The semi-annual and final reports must follow a style guide that will be provided. The expected deliverables schedule is:

4.5.1 Semi-annual and final reports written according to a style guide.

4.5.2 Any computer programs (source code preferred) developed as part of the contract.

4.5.3 Project Fact Sheets prepared according to a style guide (to be provided) and submitted within 60 days of award and updated annually, typically for the UTSR Workshop.

4.5.4 Participation and presentation of project status and results to date at a UTSR workshop once a year. As to be specified by the Program Manager, participation may include a documented verbal presentation or a poster manned by the project PI.

4.5.5 Other reports as defined in the sub-award agreement. This may include a semi-annual, non-technical description of progress versus proposed task milestones and expenditures.

4.5.6 PUBLICATIONS: It is expected that DOE may sponsor contractor annual reviews at which Performing Members will present results of their work. For publication elsewhere, review from DOE and SCIES is required.

4.5.7 CORRESPONDENCE: Technical, administrative, and financial information shall be sent to the responsible offices as identified in the contract.

## 5.0 EVALUATION CRITERIA

The IRB will use the four factors described below in evaluating submitted proposals. The DOE has indicated that UTSR research should be relevant to HSG turbines. Consequently, proposals must have sufficient hydrogen fuel and syngas significance. The most important criterion under the Technical Significance category below is whether most of the proposed research addresses specific turbine issues that arise or are aggravated by use of HSG fuels. These are issues from use of such fuels that cause additional problems or degradation of turbine efficiency, power output, emissions, cost or life compared to operation with conventional fuels. For example, although any research that increases turbine efficiency could be regarded as beneficial to meeting the higher efficiency goals of the DOE Turbine Program, proposals should be more specific to HSG turbines than generally increasing turbine efficiency. For this example, proposed research should address specific issues for operation with HSG fuels that might adversely affect turbine efficiency (e.g., flow path degradation due to fuel impurities). The approximate weight percentage of each proposal evaluation factor is shown below. Questions listed are typical and are not intended to be all-inclusive. IRB ranking of proposals does not solely depend on the IRB proposal evaluation scores. Other factors such as IRB technical discussions, input from other industry and the DOE, DOD and NASA experts, and programmatic issues may impact the decision-making process.

45% TECHNICAL significance

How well does the proposed work address specific issues related to turbines using HSG fuels?

Has the research program been coordinated with industry?

How readily can the results be adapted by industry to the design of advanced HSG turbines?

What degree of innovation/originality/uniqueness has been proposed

How appropriate is a university setting for conducting the proposed research (i.e., would the proposed research be better performed in industry or elsewhere)?

25% VALUE/COST

Are the project breadth of scope and the expected results sufficient to justify the project cost? *How does the cost of the project compare to the average cost of past AGTSR/UTSR programs*?

Does the work cultivate student skills useful to the gas turbine industry?

Has effective use of existing facilities been made?

What steps will be taken to have the technology transferred to the industrial users?

10% TIMELINESS of results

Will intermediate technical data, analysis, test results, design tools, etc., be available for use by others in a timely manner?

20% QUALIFICATIONS and experience

What direct gas turbine and/or power generation experience do the participants have?

Has a strong collaborative team been assembled?

Will the resources to be applied be able to complete the work successfully, and on time?

Verbal debriefing sessions will be held at the request of the proposal PI after all award notifications have been released.

## 6.0 ATTACHMENTS

## ATTACHMENT A

### CERTIFICATIONS REGARDING LOBBYING; DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS; AND DRUG-FREE WORKPLACE REQUIREMENTS

Applicants should refer to the regulations cited below to determine the certification to which they are required to attest. Applicants should also review the instructions for certification included in the regulations before completing this form. Signature of this form provides for compliance with certification requirements under 34 CFR Park 82, "New Restrictions on Lobbying," and 34 CFR Part 85, "Government-wide Debarment and Suspension (Nonprocurement) and Government-wide Requirements for Drug-Free Workplace (Grants)." The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of Energy determines to award the covered transaction, grant, or cooperative agreement.

1. LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

2. DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

3. DRUG-FREE WORKPLACE

This certification is required by the Drug-Free Workplace Act of 1988 (Pub. L. 100-690, Title V, Subtitle D) and is implemented through additions to the Debarment and Suspension regulations, published in the Federal Register on January 31, 1989, and May 25, 1990.

*ALTERNATE I (GRANTEES OTHER THAN INDIVIDUALS)*

(1) The grantee certifies that it will or will continue to provide a drug-free workplace by:

(a) Publishing a statement notifying employees that the lawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the grantee’s workplace and specifying the actions that will be taken against employees for violation of such prohibition.

(b) Establishing a drug-free awareness program to inform employees about:

(1) The dangers of drug abuse in the workplace;

(2) The grantee’s policy of maintaining a drug-free workplace;

(3) Any available drug counseling, rehabilitation, and employee assistance programs; and

(4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will:

(1) Abide by the terms of the statement; and

(2) Notify the employer in writing of his or her conviction for a violation of criminal drug statute occurring in the workplace no later than 5 days after such conviction;

(e) Notifying the agency, in writing, within 10 calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant.

(f) Taking one of the following actions, within 30 days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted:

(1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;

(g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e), and (f).

(2) The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance:
(Street address, city, county, state, zip code)

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

☐Check if there are workplaces on file that are not identified here.

*ALTERNATE II (GRANTEES WHO ARE INDIVIDUALS)*

(1) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant.

(2) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to every grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

---

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above certifications.

| | |
|---|---|
| NAME OF APPLICANT | PR/AWARD NUMBER AND/OR PROJECT NAME |
| PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE | |
| SIGNATURE | DATE |

**ATTACHMENT B**

**PROPOSAL BUDGET**
**(3-year maximum period of performance)**
**(For 3-year projects, report budgets for years 1, 2 and 3 and on a separate sheet a combined 3 year budget)**

Organization:

Principal Investigator/Project Director:

| | | |
|---|---|---|
| A. | Personnel<br>1.<br>2.<br>3.<br>4. | $ |
| | Total Salaries and Wages: | $ |
| B. | Fringe Benefits: (______% x Base $______) | $ |
| C. | *Undergraduate Fellowship Support | $8K (maximum) per year |
| D. | Equipment: | $ |
| E. | Travel: (domestic only) | $ |
| F. | Materials/Supplies/Services: | $ |
| G. | Subcontracts: (to industry, etc.) | $ |
| H. | Other Direct Costs: (Specify) | $ |
| I. | Total Direct Costs: (A through G) | $ |
| J. | Indirect Costs: (Specify Rate & Base) | $ |
| K. | Total Project Cost: | $ |
| L. | University Cost Share | $ |
| M. | UTSR Cost (K minus L) | $ |

Note: Details/Justification of A, B, C, D, E, F, G, H, and L should be provided on separate pages. (Please be brief - these pages need not be numbered.)

*The inclusion of item "C" is highly recommended as it is considered part of the program educational mission. Include this item under salaries and wages if your university expends as such.

## ATTACHMENT C

Partial Listing of HBCU/MI Schools with Engineering Programs

HBCU Engineering Schools

1. Tuskegee University
College of Engineering, Architecture & Physical Sciences
Tuskegee AL 36088
Dean: Legand Burge, Jr.
lburge@tuskegee.edu
Telephone No: 334-727-8356

2. Florida AMU/FSU
College of Engineering
2525 Pottsdamer Street
Tallahassee, FL 32310-6046
Dean: Ching-Jen Chen
cjchen@eng.fsu.edu
Telephone No: 850-410-6439

3. Southern University
College of Engineering
324 P.B.S. Pinchback Hall
Baton Rouge, LA 70813
Chair: Samuel Ibekwe
ibekwe@engr.subr.edu
Telephone No: 225-771-4701

4. North Carolina A&T State University
1601 East Market Street
651 McNair Hall
Greensboro, NC 27411
Dean: Joseph Monroe
monroe@ncat.edu
Telephone No: 336-334-7589

5. Tennessee State University
3500 John A. Merritt Boulevard
Nashville, TN 37209
Dean: Decatur B. Rogers
drogers@tnstate.edu
Telephone No: 615-963-5409

6. Prairie View A&M University
P. O. Box 397
Prairie View, TX 77446-0397
Engrg. Head: Dr. Shield B. Lin
Shield Lin@pvamu.edu
Telephone No: 936-857-4023

7. Hampton University
School of Engineering & Technology
Hampton, VA 23668
Dean: Eric J. Sheppard
Eric.sheppard@hamptonu.edu
Telephone No: 757-728-6970

8. Howard University
2300 Sixth Street, NW
Washington, DC 20059
Chair: H. A. Whitworth
hwhitworth@howard.edu
Telephone No: 202-806-6600

9. Morgan State University
1700 E. Cold Spring Lane
Baltimore, MD 21251
Dean: Eugene M. DeLoatch
deloatch@eng.morgan.edu
Telephone No: 443-885-3231

10. Central State University
P. O. Box 1004
Wilberforce, OH 45384
Dean: Charles H. Showell
info@csu.ces.edu
Telephone No: 937-376-6441

MI Engineering Schools

1. California State University - LA
5151 State University Drive
Los Angeles, CA 90032
Dean: Kuei-wu Tsai
ktsai@calstatela.edu
Telephone No: 323-343-4490

2. City College of New York
140th & Convent Avenue
Steinman Hall 249/235
New York, NY 10031
Chair: Feridun Delale
delale@ccny.edu
Telephone No: 212-650-5224

3. Florida International University
University Park Campus, ESC 450
10555 W. Flagler Street, CEAS 2460
Miami, FL 33199
Dean: Vish Prasad
Vish.Prasad@fiu.edu
Telephone No: 305-348-2522

Updated 3/13/06

4. New Mexico State University
   Box 30001, Dept. 3450
   Las Cruces, NM 88003
   Head: Tom Burton
   tdburton@nmsu.edu
   Telephone No: 505-646-3502

5. Texas A&M University
   700 University Blvd., EC301F
   Kingsville, TX 78363
   Dean: William Heenan
   w-heenan@tamuk.edu
   Telephone No: 361-593-2001

6. University of Houston
   Department of Mechanical Engineering
   N207 Engineering Building One
   Houston, TX 77204-4006
   Chair: Matthew A. Franchek
   mfranchek@uh.edu
   Telephone No: 713-743-4502

7. University of New Mexico
   Farris Engineering Center, Room 107
   Albuquerque, NM 87131-1351
   Dean: Joseph L. Cecchi
   cecchi@umn.edu
   Telephone No: 505-277-1421

8. University of Texas - El Paso
   Engineering, Room E-230
   500 West University Avenue
   El Paso, TX 79968
   Dean: Barry A. Benedict
   babenedict@utep.edu
   Telephone No: 915-747-5604

9. University of Texas - San Antonio
   College of Engineering
   6900 North Loop 1604 West
   San Antonio, Texas 78249-0665
   Interim Dean: Mauli Agrawal
   Agrawal@utsa.edu
   Telephone No: 210-567-6495

## ATTACHMENT D

## NOTICE OF INTENT TO PROPOSE

Please complete the following:

UNIVERSITY NAME: ______________________________________________

______________________________________________________________

COORDINATING PI NAME: ________________________________________

______________________________________________________________

_____ We do intend to submit a proposal in response to RFP UTSR 07-01B.

_____ We do not intend to submit a proposal.

What specific research area in Section 2.0 will you be targeting? Will the proposal be for a two year project or three year project?

______________________________________________________________

______________________________________________________________

We plan to team with the following organization(s):

______________________________________________

______________________________________________

______________________________________________

Signed ___________________________ Date_____________________

Position Title ____________________________________________

Please return the form to this address by **<u>September 3, 2007</u>** (fax copy is acceptable).

Manager of Research, UTSR Program<br>
SCIES<br>
400 Klugh Avenue<br>
Clemson University<br>
Clemson, SC 29634-5180<br>
FAX: 864-656-0142