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PI/PD Name: Joe F Thompson

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other _____
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☐

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project ☒

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Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.

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Black or African American. A person having origins in any of the black racial groups of Africa.
Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

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PI/PD Name: Geoffrey C Fox

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
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- ☐ Visual Impairment
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- ☐ Other _____
- ☐ None

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PI/PD Name: Mary F Wheeler

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

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COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 99-2

NSF99-29 **02/01/99**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

9975951

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
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646000819

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYMS(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Mississippi State University

AWARDEE ORGANIZATION CODE (IF KNOWN)

0024232000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

Sponsored Program Administration
Post Office Box 6156
Mississippi State, MS. 397626156

NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE

PERFORMING ORGANIZATION CODE (IF KNOWN)

ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE

IS AWARDEE ORGANIZATION (Check All That Apply)
(See GPG II.D.1 For Definitions) ☐ FOR-PROFIT ORGANIZATION ☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ WOMAN-OWNED BUSINESS

TITLE OF PROPOSED PROJECT **A Virtual Center for Components Technology in Geometry/Grid(MESH) Generation**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PREPROPOSAL NO., IF APPLICABLE
$ **3,000,000**	**36** months	**07/01/99**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG 1.A.3)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.D.1)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG II.D.10)
☐ NATIONAL ENVIRONMENTAL POLICY ACT (GPG II.D.10)
☐ HISTORIC PLACES (GPG II.D.10)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.12)
☐ GROUP PROPOSAL (GPG II.D.12)
☐ VERTEBRATE ANIMALS (GPG II.D.12) IACUC App. Date _____
☐ HUMAN SUBJECTS (GPG II.D.12)
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES _____
☐ FACILITATION FOR SCIENTISTS/ENGINEERS WITH DISABILITIES (GPG V.G.)
☐ RESEARCH OPPORTUNITY AWARD (GPG V.H)

PI/PD DEPARTMENT
NSF Engineering Research Center

PI/PD FAX NUMBER
662-325-7692

PI/PD POSTAL ADDRESS
Box 9627

Mississippi State, MS 39762
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Joe F Thompson**	**Ph.D.**	**1971**	**662-325-8278**	**joe@erc.msstate.edu**
CO-PI/PD **Geoffrey C Fox**	**Ph.D.**	**1967**	**315-443-2163**	**gcf@cs.fsu.edu**
CO-PI/PD **Mary F Wheeler**	**PHD**	**1971**	**512-475-8626**	**mfw@ticam.utexas.edu**
CO-PI/PD				
CO-PI/PD				

CERTIFICATION PAGE

Certification for Principal Investigators and Co-Principal Investigators:

I certify to the best of my knowledge that:

(1) the statements herein (excluding scientific hypotheses and scientific opinions) are true and complete, and
(2) the text and graphics herein as well as any accompanying publications or other documents, unless otherwise indicated, are the original work of the signatories or individuals working under their supervision. I agree to accept responsibility for the scientific conduct of the project and to provide the required progress reports if an award is made as a result of this application.

I understand that the willful provision of false information or concealing a material fact in this proposal or any other communication submitted to NSF is a criminal offense (U.S.Code, Title 18, Section 1001).

Name (Typed)	Signature	Social Security No.*	Date
PI/PD **Joe F Thompson**			
Co-PI/PD **Geoffrey C Fox**			
Co-PI/PD **Mary F Wheeler**			
Co-PI/PD			
Co-PI/PD			

SSN's are confidential and are not displayed *ON FASTLANE SUBMISSIONS*

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the individual applicant or the authorized official of the applicant institution is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding Federal debt status, debarment and suspension, drug-free workplace, and lobbying activities (see below), as set forth in Grant Proposal Guide (GPG), NSF 99-2. Willful provision of false information in this application and its supporting documents or in reports required under an ensuring award is a criminal offense (U. S. Code, Title 18, Section 1001).

In addition, if the applicant institution employs more than fifty persons, the authorized official of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of Grant Policy Manual Section 510; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflict which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Debt and Debarment Certifications

(If answer "yes" to either, please provide explanation.)

Is the organization delinquent on any Federal debt? Yes ☐ No ☒

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

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.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME/TITLE (TYPED) **Robert A. Altenkirch**		**01/29/99**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
601-325-7404	**robyn@spa.msstate.edu**	**601-325-3803**

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A VIRTUAL CENTER for COMPONENTS TECHNOLOGY in GEOMETRY/GRID(MESH) GENERATION

PROJECT SUMMARY

This project addresses the fact that geometry/grid(mesh) generation continues to remain a pacing infrastructure item limiting the efficacy of computational simulation in engineering analysis and design in industry, as well as in scientific investigation in general, and proposes the creation of a multidisciplinary and multi–university virtual center based fundamentally on network collaborative technology to address this pressing national problem through components technology. This virtual center will serve not only its primary purpose of advancing the state of the art in geometry/grid generation, but also will force advances in the implementation of collaborative research.

This virtual center can logically be initiated through the New Computational Challenges component of the NSF KDI Program, with its full operation then growing beyond the resources of that funding program.

Specifically, it is proposed to establish multidisciplinary effort in engineering and computer science among Mississippi State University, the University of Texas, and Syracuse University to develop components technology for geometry/grid generation to meet national needs in applications of computational science in scientific investigation and engineering design.

This virtual center will combine geometry/grid generation technology in a Java–based collaborative and distributed environment to develop elements of a toolkit/library for general use in a configurable mode.

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A	Project Summary (not to exceed 1 page)	1	
B	Table of Contents (NSF Form 1359)	1	
C	Project Description (including Results from Prior NSF Support) (not to exceed 15 pages) **(Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)**	4	
D	References Cited		
E	Biographical Sketches (Not to exceed 2 pages each)	6	
F	Budget (NSF Form 1030, including up to 3 pages of budget justification)	3	
G	Current and Pending Support (NSF Form 1239)	0	
H	Facilities, Equipment and Other Resources (NSF Form 1363)	0	
I	Special Information/Supplementary Documentation	0	
J	Appendix (List below.) **(Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)**		
	Appendix Items:		

*Proposers may select any numbering mechanism for the proposal, however, the entire proposal must be paginated. Complete both columns only if the proposal is numbered consecutively.

PROJECT DESCRIPTION

It is proposed to create a multidisciplinary and multi–university virtual center, based fundamentally on network collaborative technology, to address the pressing national cross–cutting need for usable and adaptable geometry/grid(mesh) generation through components technology.

The GOAL is to bring together researchers at three universities with particularly relevant expertise through collaborative technology to significantly advance geometry/grid(mesh) generation for computational simulation applicable in all areas of physical field phenomena.

The OBJECTIVE is to create a geometry/grid(mesh) toolkit/library based on components technology for general use in a configurable mode in a distributed environment.

The IMPACT will be significant advances in engineering analysis and design in industry, as well as in scientific investigation in general, through reduction in pre–processing setup person time and advancement of capability of geometry/grid(mesh) technology in computational simulation.

The FIT to the themes of the New Computational Challenges of the KDI Program is that geometry/grid(mesh) generation is cross–cutting enabling technology for computational simulation of complex systems and complicated phenomena, arguably a *computational engineering* Grand Challenge that must be met to enable Grand Challenges dealing with field equations involving boundary effects.

Background: the NEED

Over the years, there has been the irony of continual calls from industry for reduction in the person–time required for grid(mesh) generation but little initiative among the government funding agencies to support effort to achieve that end. That grid generation is a major pacing item (THE pacing item were it not for turbulence) in regard to the use of computational fluid dynamics (CFD) and other field simulations in engineering analysis and design in industry now embarrassingly has the status of a cliche.

But grid generation has never had a home or an advocate in the structures of NSF, NASA, DoD, DoE, or DARPA. Small projects in the area have been funded, but more to advance the mathematics or computer science issues involved than to develop systems for general and effective use. The concerted development needed to address these calls for progress might be considered the province of commercial software companies, but there the need for such grid systems has been lost behind the emphasis on CAD system development. So, in large measure, the Federal agencies have concentrated on funding solution development, and the software companies have concentrated on solid modeling, while grid generation – the essential link – has not gotten sufficient attention from either.

In 1998 Vijaya Shankar, William Hall, and S.V. Ramakrishnan of Rockwell Science Center, writing on "Quick–Turnaround Computational Simulation" in the January–March 1998 issue of IEEE Computational Science & Engineering, had this to say:

> The stage of preprocessing that takes a CAD drawing to a computational mesh is a major bottleneck in the simulation process ... half the total labor time.
>
> We must create better and faster geometry and grid setup and repair tools.

With two co–editors – Bharat Soni of Mississippi State and Nigel Weatherill of the University of Wales, Swansea – Thompson has recently produced the "Handbook of Grid Generation" published in 1999 by CRC Press. This handbook, with chapters written by geometry/grid experts from all over the world, provides a central source of best practices. In this handbook, Tim Gatze of Boeing, writing on industrial applications, has this to say:

> There are more new customers for CFD applications everyday, and for most of those applications, grid generation turn–around time is a limiting factor. Whoever can solve that problem will provide a great service to the CFD engineer.

And the report of the DoE/NSF National Workshop on Advanced Scientific Computing, hosted in July 1998 by the National Academy of Sciences notes the critical importance of geometry/grid generation:

> Solving many of the new, increasingly complex problems listed above will require advanced methods in geometry, mesh generation, and data assimilation.

This report then recommends that priority be given to four specific areas in regard to algorithm development, one of which is:

> Development of geometry and grid generation methods that deal with as many as one billion cells and that provide adaptability and front tracking.

Finally, also in 1998, there appeared the following comment from SIAM President John Guckenheimer of Cornell, in an article "Numerical Computation in the Information Age" in the March 1998 issue of Computing Research News and the June 1998 issue of SIAM News:

> Ironically, as numerical analysis is applied to larger and more complex problems, non–numerical issues play a larger role. Mesh generation is an excellent example of this phenomenon. Solving current problems in structural mechanics or fluid dynamics with finite difference or finite element methods depends upon constructing high–quality meshes of surfaces and volumes. Geometric design and constructing these meshes are typically much more time–consuming than the simulations that are performed with them.
>
> Thus, there is a continuing need for "precompetitive" research in this area.

The time is right now – convergence of critical, documented national need and available technology – for a concerted initiative in this precompetitive research to position US industry to effectively and efficiently utilize geometry/grid generation as the foundation for computational simulation in engineering analysis and design, and in scientific investigation, both in the interest of global competitiveness and in the interest of national security.

DESIDERATA

The major driving factors in comprehensive grid codes must first be automation and then graphical interaction. Since design is the paramount application, the efficacy of a grid code is measured primarily by the person–time it takes to generate a series of geometrically related grids for complex configurations. And the coupling with CAD systems on the front end, and with solution systems and visualization systems on the back end, must be smooth and effective. The ideal is not to make it easy for a person to generate a grid but rather to remove the person from the process – not to make it interactive, but to make it automatic, configurable, and adaptable.

Present grid codes enable and rely on extensive graphical user interaction rather than automation, and therefore require considerable user experience and effort. The goal of an automated grid generation system that will produce a suitable grid with little user interaction and effort has not yet been achieved in any current code, commercial or freeware.

And grid generation tools must be designed to be applied by design engineers rather than grid generation specialists. There is also the problem of the more powerful of these grid codes requiring considerable training and experience for effective use. This latter factor sometimes causes users to continue to use tools that are less powerful but familiar, in the press of time constraints to get solutions done, rather than moving to newer and more effective tools.

All of this argues for the creation of a toolbox/library for geometry/grid generation: a set of interfacing components that are reliable and readily usable which can be assembled and configured to effectively and efficiently address the demands of different applications and different users of computational simulation for engineering analysis and design in DoD, DoE, industry, and the computational science community in general.

This geometry/grid tookit/library should have the following characteristics:

- Based fundamentally on components technology.
- Object–oriented for modularity.
- Java–based for portability.
- Scalable parallel operation.
- Incorporation of existing useful components.
- Extendable to incorporate emerging technology.
- Automated operation, with user intervention.
- User–configurable for compatibility with applications.
- Operational in a networked distributed computing environment.
- Built–in web–based training facility and documentation.

And it should incorporate the following features:

- Interface with CAD systems, solution systems, and visualization systems.
- Internal CAD capability for geometry generation, repair, and modification.
- Block–structured grids: including overset and hybrid.
- Unstructured grids: both tetrahedral and hexahedral.
- Surface and volume grid systems.
- Quality assessment, display, and control.
- Dynamic adaptive coupling with solution systems.
- Macros, editing, and script–based operation capability.

This development is a major effort which will require the pooling of required expertise from several universities and coordination with potential users in industry and Federal labs. The foundation can be laid for this effort under KDI.

Proposed VIRTUAL CENTER of EFFORT

Since the scope of the effort required is broad, and the range of relevant expertise is distributed over the country, this national effort should be executed through a virtual center incorporating collaborative effort from the appropriate universities and Federal labs, interacting with industrial centers of effort.

Such a virtual center would be itself a manifestation of the nation's progress in high performance computing and communications, serving to provide a model for future collaborative efforts as well as the source of solution for the geometry/grid problem.

This development will combine the experience of the ERC at Mississippi State in the development of geometry/grid generation codes and their coupling into CFD and visualization systems, the experience of both the ERC and TICAM at Texas in block–structured and unstructured adaptive systems in parallel operation, and the experience of NPAC at Syracuse in building collaborative and distributed environments based on Java.

This geometry/grid toolkit/library will utilize TangoInteractive from NPAC at Syracuse to allow experts on geometry to assist users of packages by sharing tools, and will leverage techniques to get high performance in Java and linkage with national efforts in this area (the Java Grande Forum).

The development of this geometry/grid generation toolkit/library system in this virtual center will proceed as follows:

(1) Establishment of networked collaborative framework.

(2) Definition of all needed capability – with PACI/DoD/DoE/industry users.

(3) Encapsulation of all capability into components (objects/operations).

(4) Identification of existing components.

(5) Identification of components to be developed.

(6) Design of toolkit/library infrastructure and data structure.

(7) Design of documentation and training structure.

(8) Implementation.

These deliverables, with a significant operational portion of the geometry/grid toolkit/library, can be accomplished under this proposed three–year NSF KDI support. This will serve to establish the foundation upon which additional effort, supported at this virtual center by other Federal agencies and industry, can leverage this KDI effort to complete this toolkit/library.

In addition to the primary deliverable of the geometry/grid generation components technology, the collaborative technology that enables operation of this virtual center will also be of important impact and will be disseminated.

The three leaders of this proposed virtual center – Thompson, Wheeler, Fox – have been associated in partnership for the past three years in the DoD Programming Environment & Training (PET) Program supporting the DoD Major

Shared Resource Centers (MSRCs) in the DoD High Performance Computing Modernization Program. This proposed virtual center is thus a natural outgrowth from a working partnership already established among these leaders.

Other principal researchers to be involved in this effort are as follows:

Bharat Soni – ERC/Mississippi State

Yannis Kallinderis – TICAM/Texas

Marek Podgorny – NPAC/Syracuse

Other researchers from these and other universities will be added as needed.

In this collaborative effort, the three universities will assume component leadership roles as follows, with the NSF ERC at Mississippi State assuming overall project leadership:

ERC/Mississippi State :	block–structured and adaptive grid technology surface geometry representation technology
TICAM/Texas :	unstructured and adaptive grid technology domain decomposition and parallel construction
NPAC/Syracuse :	components technology and Java constructions networked TangoInteractive collaborative technology

The essential collaborative framework and initial design and development in this major effort can appropriately be done under the NSF KDI Program, reflecting the leadership role to be assumed by NSF in the new Federal initiative in Information Technology in the FY2000 Federal budget in response to the report of the President's Information Technology Advisory Committee (PITAC). Commensurate with NSF's leadership role, and the growing partnerships of NSF with DoE and DoD, initiation of this major effort under the NSF KDI Program can establish this virtual center and thus provide the foundation and framework for the necessary cross–cutting collaborative support and effort to address this persistent and pervasive national need in enabling technology.

Budget Explanation

The development of a full geometry/grid generation toolkit/library incorporating all potential user requirements and capabilities is anticipated to be beyond the funding limitations of the KDI Program. As has been noted, geometry/grid generation has suffered from lack of a support home in the Federal agencies. The KDI Program of NSF provides a logical foundation for this comprehensive development. Therefore the maximum KDI funding of $1M @ year for three years will be requested for this effort. Under this KDI funding, the collaboration technology enabling the operation of this virtual center will be put in place, the components technology framework will be established, the requirements and design of the toolkit/library will be established, and certain operational components of this toolkit/library will be developed and disseminated with documentation. All this will be delineated in the full proposal.

Since this will be truly a virtual center, funding will be split essentially equally among the three universities, with the three Co–PIs exercising continuously closely coordinated leadership via the collaborative technology.

Included in this budget will be the following at each of the three universities:

Co–PI (Thompson, Wheeler, or Fox)	20%
Faculty Researchers	2 @ 10%
Research Assistants/Programmers	2 @ 100%
Graduate Students	3

Travel

No funding will be requested for equipment.

Joe F. Thompson
William L. Giles Distinguished Professor of Aerospace Engineering
P. O. Box 9627, NSF Engineering Research Center
(601) 325–7299 Fax: (601) 325–7692
joe@erc.msstate.edu

Dr. Joe F. Thompson of Mississippi State, is a Distinguished Professor of Aerospace Engineering and was the founding director of the NSF Engineering Research Center for Computational Field Simulation at Mississippi State University. He led the formation of the multi–university team that teamed with Nichols Research and Raytheon/E–Systems to win the support contracts for Programming Environment & Training at three of the four DoD HPC Major Shared Resource Centers (MSRCs) as part of the DoD HPC Modernization Program, and now leads this team for the MSRC at the Army Waterways Experiment Station in Vicksburg, Mississippi. Dr. Thompson pioneered the area of numerical grid generation, essential to computational fluid dynamics and other areas of computational field simulation, for which he was recognized with the 1992 AIAA Aerodynamics Award, specifically for contributions "which have revolutionized computational aerodynamics for realistic configurations and complex flowfields". He is on the editorial board of the Journal of Computational Physics and other journals. In 1997, Dr Thompson was appointed by President Clinton to the President's Information Technology Advisory Committee (PITAC).

Education

PhD, Aerospace Engineering, Georgia Institute of Technology, 1971 (Advisor: James Wu)
MS, Aerospace Engineering, Mississippi State University, 1963 (Advisor: Joe Cornish)
BS, Physics, Mississippi State University, 1961, "Highest Honors"

Employment

Distinguished Professor, Department of Aerospace Engineering, Mississippi State University, 1988–Present

Interim Chief Information Officer, Mississippi State University, 1999–Present

Special Assistant to the Vice President for Research in Regard to High Performance Computing, Office of Research, Mississippi State University, 1995–1998

Academic Team Director, Programming Environment & Training, NSF Engineering Research Center for Computational Field Simulation, Mississippi State University (MSU, Illinois, Rice, Syracuse, Texas, Tennessee, Ohio State, Southern California, Jackson State, Clark–Atlanta) DoD High Performance Computing Major Shared Resource Center, Army Engineering Waterways Experiment Station, Vicksburg, MS, 1996–Present

Founding Director, NSF/Engineering Research Center for Computational Field Simulation, Mississippi State University, 1990–1995

Professor, Department of Aerospace Engineering, Mississippi State University, 1975–1988

Associate Professor, Department of Aerospace Engineering, Mississippi State University, 1970–1975

NSF Science Faculty Fellow, Georgia Institute of Technology, Atlanta, GA, 1968–1970

Assistant Professor, Department of Aerospace Engineering, Mississippi State University, 1964–1968

Aerospace Engineer, NASA Marshall Space Flight Center, Propulsion & Vehicle Engineering Division, Huntsville, AL, 1963–1964

National Committees

President Clinton's Information Technology Advisory Committee (PITAC) (1997–Present)
Computer Science & Mathematics Division Advisory Committee, Oak Ridge National Laboratory (1998–Present)
Climate Change Prediction Program Advisory Committee, Department of Energy (1998–Present)

Professional Activities

Editor:
Journal of Computational Physics (Editorial Board)
Handbook for Computer Science & Engineering (Editorial Board)
The Computational Fluid Dynamics Journal (Editorial Board)
Numerical Heat Transfer (Associate Editor)
Applied Mathematics and Computation (Senior Associate Editor) (1984–1994)

Five Related Publications

1. *Handbook for Grid Generation,* Joe F. Thompson, Bharat K. Soni, Nigel Weatherill (Eds), CRC Press, 1999.

2. *Handbook for Computer Science and Engineering* (Editorial Board, Editor for Computational Science Section), Allen Tucker (Ed.), CRC Press, 1997.

3. "A Survey of Grid Generation Techniques and Systems with Emphasis on Recent Development," J.F. Thompson and B. Hamann, *Surveys on Mathematics for Industry,*" Chp. 6, p. 289, Springer–Verlag, 1997.

4. Chrisochoides, N., Fox, G., and Thompson, J.F., "Menus–PGG: A Mapping Environment for Unstructured and Structured Numerical Parallel Grid Generation," *Contemporary Mathematics*, Volume 180, pp. 381–386, 1994.

5. Donohoe, J.P., Jiang, M.Y., Thompson, J.F., and Miller, D.B., "Computational Simulation of Electric Fields Surrounding Power Transmission and Distribution Lines," *The Applied Computational Electromagnetics Society Journal*, Volume 8, No. 2, pp. 4–16, 1993.

Five Other Significant Publications

1. Luong, P.V., Thompson, J.F., and Gatlin, B., "Solution–Adaptive and Quality–Enhancing Grid Generation," *Journal Of Aircraft*, Vol. 3, Page 2, 1993.

2. Thompson, J.F., "Grid Tracks", *Computational Aerodynamics: Past, Present & Future* (Honoring the 60th Birthday of Dr. Paul Rubbert), Seattle, WA, September 1997.

3. Jiang, M.–Y., Remotigue, M., Stokes, M. L. and Thompson, J.F., "EAGLEView: Grid Enhancement and Applications," AIAA–94–0316, *32nd Aerospace Sciences Meeting*, Reno, NV, January 1994.

4. Thompson, Joe F., "An Overview of the National Grid Project", *Third SIAM Conference on Geometric Design*, Phoenix, AZ, November 1993.

5. Thompson, J.F., "Grid Generation for Computational Field Simulation," *First ACM Workshop on Applied Computational Geometry,* Philadelphia, PA, May 1996.

Students Advised

Young–Mog Kim, PhD Dissertation, Mississippi State University, May 1993.
B. Jean, Masters Thesis, Mississippi State University, 1992.
P–H. Luong, PhD Dissertation, Mississippi State University, December 1991.
Fred T. Tracy, PhD Dissertation, Mississippi State University, August 1991.
Y–H. Yoon, PhD Dissertation, Mississippi State University, May 1991.

Total Graduate Students Advised through the Years: 29

Current Collaborations

DoD Programming Environment & Training (PET) support of three of the four DoD Major Shared Resource Centers (MSRCs) in the DoD High Performance Computing Modernization Program

Mary Wheeler, Tinsley Oden, Graham Carey – Texas
Geoffrey Fox, David Bernholdt – Syracuse
Ken Kennedy, Richard Hanson, Ehtesham Hayder – Rice
Charles Koelbel (now at NSF) – Rice
Larry Smarr, Polly Baker – NCSA, Illinois
Keith Bedford – Ohio State
Charles Bender – Ohio Supercomputer Center
Jack Dongarra, Shirley Browne – Tennessee
Willie Brown – Jackson State

Geoffrey Charles Fox
Professor of Computer Science
Syracuse University
Phone: (315) 443–2163, Fax: (315) 443–4741
gcf@nova.npac.syr.edu , http://www.npac.syr.edu,

Citizen Status

Permanent Resident Alien; Citizen of United Kingdom

Education

B.A. in Mathematics from Cambridge Univ., Cambridge, England (1961–1964)
Ph.D. in Theoretical Physics from Cambridge University (1964–1967)
M.A. from Cambridge University (1968)

Professional Experience

1990–	Professor of Computer Science, Syracuse University
1990–	Professor of Physics, Syracuse University
1990–	Director of Northeast Parallel Architectures Center
1979–1990	Professor of Physics, California Inst. of Tech.
1986–1988	Associate Provost for Computing, California Inst. of Tech.
1983–1985	Dean for Educational Computing, California Inst. of Tech.
1981–1983	Executive Officer of Physics, California Inst. of Tech.
1974–1979	Associate Professor of Physics, California Inst. of Tech.
1971–1974	Assistant Professor of Physics, California Inst. of Tech.
1970–1971	Millikan Research Fellow in Theoretical Physics, Caltech
1970	Visiting Scientist (April–May), Brookhaven National Laboratory
1969–1970	Research Fellow at Peterhouse College, Cavendish Lab.,Cambridge
1968–1969	Research Scientist, Lawrence Berkeley Lab., Berkeley, Calif.
1967–1968	Member of School of Natural Science, Inst. for Advanced Study, Princeton, New Jersey

Awards and Honors

Senior Wrangler, Part III Mathematics, Cambridge (1964)
Alfred P. Sloan Foundation Fellowship (1973–75)
Fellow of the American Physical Society (1990)

Journal Editorships

Principal: *Concurrency: Practice and Experience* (John Wiley, Inc.)
Physics and Computers (*International Journal of Modern Physics C – World Scientific*)
Associate: *Journal of Supercomputing*

Selected List of Publications

1. Fox, G.C., Johnson, M.A., Lyzenga, G.A., Otto, S.W., Salmon, J.K., Walker, D.W., *Solving Problems on Concurrent Processors*, Vol. 1, Prentice–Hall, Inc. 1988; Vol. 2, 1990.
2. Fox, G. C., Messina, P., Williams, R., *Parallel Computing Works!*, Morgan Kaufmann, San Mateo Ca, 1994.
3. Fox G.C., Furmanski W., "Computing on the Web, New Approaches to Parallel Processing, Petaop and Exaop Performance in the Year 2007," *IEEE Internet Computing* 1:2,38–46, 1997.
4. Fox G.C., and Podgorny M, "Real Time Training and Integration of Simulation and Planning using the TangoInteractive Collaborative System", in *Proceedings of International Test and Evaluation Workshop on High performance Computing*, July 1998, Aberdeen Maryland.
5. Fox, G.C.,Akarsu E., Furmanski W., Haupt T., "WebFlow — High–level Programming Environment and Visual Authoring Toolkit for High Performance Distributed Computing" in *Proceedings of SC98*, Orlando, November 1998.

6. Fox, G., Scavo T., Bernholdt D.,Markowski R.,McCracken N.,Podgorny M., Mitra D. and Malluhi Q., "Synchronous Learning at a Distance: Experiences with TangoInteractive", in *Proceedings of SC98*, Orlando, November 1998.

7. Fox, G. C. "Parallel Computing and Education," Daedalus, *Journal of the American Academy of Arts and Sciences*, Vol. 121, No. 1, pps 111–118, Winter 1992. C3P–958, CRPC–TR91123.

8. Fox G.C., Mills K., "InfoMall: An Innovative Strategy for High–performance Computing and Communications Application Development", *Internet Research*, 4:31– 45, 1994.

9. Fox, G. C. "Approaches to Physical Optimization," in *Proceedings of 5th SIAM Conference on Parallel Processes for Scientific Computation*, pp 153–162, March 25–27, 1991, Houston, TX, J. Dongarra, K. Kennedy, P. Messina, D. Sorensen, R. Voigt, editors, SIAM, 1992. C3P–959, CRPC–TR91124

10. Fox, G, Bozkus, Z., Choudhary, A., Haupt, T., and Ranka, S. "A Compilation Approach for Fortran 90D/HPF Compilers on Distributed Memory MIMD Computers," in *Proceedings of the Sixth Annual Workshop on Languages and Compilers for Parallel Computing*. Lecture Notes in Computer Science, Springer–Verlag, pp. 200—215. U. Banerjee, D. Gelernter, A. Nicolau, and D. Padua (editors).

Summary of Interests

See: http://www.npac.syr.edu/DC
Java based Computation: http://www.npac.syr.edu/projects/javaforcse
For education: http://www.webwisdom.org

Fox is an expert in the use of parallel architectures and the development of concurrent algorithms. He leads a major project to develop prototype high performance Java and Fortran compilers and their runtime support. NPAC has pioneered use of CORBA and Java for both collaboration and distributed computing. Fox is a proponent for the development of computational science and its follow on "Internetics" as an academic discipline and a scientific method. He has established at Syracuse University both graduate and undergraduate programs in these areas. All course have been made available on the Web and his research includes HPCC technology to support education at both K–12 and University level. His research on parallel computing has focused on development and use of this technology to solve large scale computational problems — such as numerical relativity and earthquake prediction. Fox directs InfoMall, which is focused on accelerating the introduction of high speed communications and parallel computing into New York State industry and developing the corresponding software and systems industry. A recent set of activities center on Web collaboration technology and its application to synchronous distance education.

Mary F. Wheeler
Department of Aerospace and Engineering Mechanics
Texas Institute for Computational and Applied Mathematics
SHC 414; C0200
University of Texas at Austin
Austin, Texas 78712
(512) 475–8625 (512) 471–0839 FAX: (512) 471–8694
mfw@ticam.utexas.edu

Education

Ph.D. (Department of Mathematics) Rice University, 1971
M.S. (Mathematics) University of Texas, 1963
B.A. (Mathematics) University of Texas, 1960

Professional Experience

Professor, The University of Texas at Austin, 1995–
Affiliated Senior Scientist, University of Houston, 1990–
Noah Harding Professor, Rice University, 1988–1990
M.D. Anderson Professor, University of Houston, 1988–1990
Assistant Professor, Rice University, 1973–1988

Honors and Awards

NORCUS Professorship, 1991–92, Phi Beta Kappa
National Academy of Engineering, Sigma Xi
Educator Award, American Women in Aerospace, 1997

Editorships

Editor: *Insitu, Numerical Algorithms,*
Numerical Methods in Partial Differential Equations
Managing Editor: *Computational Geosciences*

Memberships and Affiliations

Society of Industrial and Applied Mathematics
Society of Petroleum Engineers
American Women in Mathematics
Mathematical Association of America
American Geophysical Union

Five Related Publications

1. R. Glowinski and M.F. Wheeler, "Domain Decomposition and Mixed Finite Element Methods for Elliptic Problems," *Domain Decomposition Methods for Partial Differential Equations, SIAM,* Philadelphia, pp. 144–172, (1988).

2. T. Arbogast and M.F. Wheeler, "A Characteristics–Mixed Finite Element Method for Advection Dominated Transport Problems," *SIAM J. Numer. Anal*., vol. 32 no. 2, pp. 404–424, (1995).

3. L.C. Cowsar, J. Mandel, and M.F. Wheeler, "Balancing Domain Decomposition for Mixed Finite Element Methods," *Math. of Comp.* vol. 64, pp. 989–1015 (1995).

4. T. Arbogast, M.F. Wheeler, and Nai–Ying Zhang, "A Nonlinear Mixed Finite Element Method for a Degenerate Parabolic Equation Arising in Flow in Porous Media," *SIAM J. Numer. Anal*., vol 33 (1996).

5. T. Arbogast, M.F. Wheeler and I. Yotov, "Mixed Finite Elements for Elliptic Problems with Tensor Coefficients as Cell–centered Finite Differences," *SIAM J. Numer. Anal.* 34 (1997).

Five Other Significant Publications

1. C.N. Dawson, T.F. Russell, and M.F. Wheeler, "Some Improved Error Estimates for the Modified Method of Characteristics," *SIAM J. Numer. Anal*., 26, pp. 1487–1512, (1989).

2. T. Arbogast, C.N. Dawson, and M.F. Wheeler, "A Parallel Algorithm for Two Phase Multicomponent Contaminant Transport," *Applications of Mathematics*, 40, pp. 163–174 (1995).

3. R. Glowinski, W. Kinton, and M.F. Wheeler, "Acceleration of Domain Decomposition Algorithms for Mixed Finite Elements by Multi–level Methods," *Third International Symposium on Domain Decomposition Methods for Partial Differential Equations* (ed. R. Glowinski), SIAM, pp. 253–290, (1990).

4. H. Klie, M. Ramé, and M.F. Wheeler, "Hybrid Krylov Secant Methods for Nonlinear Equations Arising in Porous Media Applications," *Computational Methods in Water Resources XI*, Vol. 2. A.A. Aldama et. al., eds., Computational Mechanics Publications Southampton, U.K., pp. 467–481 (1996).

5. T. Arbogast, L.C. Cowsar, M.F. Wheeler, and I. Yotov, "Mixed Finite Element Methods on Non–matching Multiblock Grids," Submitted for publication.

Collaborators

Todd Arbogast	*UT–Austin*	Daene McKinney	*UT–Austin*
Steve Bryant	*UT–Austin*	Douglas Moore	*Rice U.*
Ashokkumar Chilakapati	*PNNL*	Tom Morgan	*ANL*
Mike Christie	*British Petroleum*	J. Tinsley Oden	*UT–Austin*
Lawrence Cowsar	*Lucent Technologies*	Joseph Pasciak	*Texas A&M*
Eduardo D'Azevedo	*ORNL*	Ron Peierls	*BNL*
Clint Dawson	*UT–Austin*	Gary Pope	*UT–Austin*
Leszek Demkowicz	*UT–Austin*	Bala Ramaswamy	*UC Santa Barbara*
Richard Ewing	*Texas A&M*	Marcelo Rame	*Landmark Graphics*
James Glimm	*SUNY–Stony Brook*	Kamy Sepehrnoori	*UT–Austin*
Roland Glowinski	*U. of Houston*	Robert Sharpley	*U. of South Carolina*
William Gray	*Notre Dame*	Barry Smith	*ANL*
Larry Lake	*UT–Austin*	Laura Toran	*Temple U.*
Brent Lindquist	*SUNY–Stony Brook*	Johannes Westerink	*Notre Dame*
		John Wheeler	*Consultant*

Advisees

Srinivas Chippada, Post–doc, 1995–1998. Fluent Technologies
Lawrence Cowsar, 1993. Lucent Technologies.
Joe Eaton, Ph.D. student
Carter Edwards, 1996. SNL
Phillip Keenan, Post–doc. 1992–1996. McKinsey & Co.
Hector Klie, Ph.D., 1996. Intevep
Monica Martinez, Ph.D., 1997. Stanford
Susan Minkoff, Post–doc 1995–1996. SNL
Jesse Money, Master¿s Degree, 1995. Northern Telecom
Victor Parr, Ph.D., 1995. Private Consultant
Fredrik Saaf, 1996. GeoQuest
Carol San Soucie Woodward, Ph.D., 1996. LLNL
Ivan Yotov, 1996. U of Pittsbrugh

Total number of students and postdocs: 19 Ph.D. and 30 M.A.

Ph.D. and Postdoctoral Advisors

Ph.D. Henry Rachford

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **Mississippi State University**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **Joe F Thompson**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-mos. CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Joe F Thompson - Distinguished Prof., ASE**	**7.20**	**0.00**	**0.00**	$ **96,987**	$
2. **Geoffrey C Fox - Professor, Computer Science**	**0.00**	**0.00**	**0.00**	**0**	
3. **Mary F Wheeler - Professor, ASE and Eng. Mech.**	**0.00**	**0.00**	**0.00**	**0**	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	**7.20**	**0.00**	**0.00**	**96,987**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**4**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**26.40**	**0.00**	**0.00**	**353,743**	
3. (**3**) GRADUATE STUDENTS				**113,490**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**564,220**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**132,034**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**696,254**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA AND U.S. POSSESSIONS)				**12,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
(**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,043**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**1,980,000**	
6. OTHER				**3,042**	
TOTAL OTHER DIRECT COSTS				**1,986,085**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**2,694,339**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **41.5% of MTDC, excludes tuition, includes 1st 25000 of each sub (Rate: 41.5000, Base: 736534)**					
TOTAL INDIRECT COSTS (F&A)				**305,661**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**3,000,000**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.D.7.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **3,000,000**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI / PD TYPED NAME & SIGNATURE*: **Joe F Thompson** DATE

ORG. REP. TYPED NAME & SIGNATURE* DATE

FOR NSF USE ONLY

INDIRECT COST RATE VERIFICATION

Date Checked	Date Of Rate Sheet	Initials - ORG

SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

**** C- Fringe Benefits**
Includes graduate student tuition.

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **Mississippi State University**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **Joe F Thompson**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-mos. CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Joe F Thompson - Distinguished Prof., ASE**	**7.20**	**0.00**	**0.00**	$ **96,987**	$
2. **Geoffrey C Fox - Professor, Computer Science**	**0.00**	**0.00**	**0.00**	**0**	
3. **Mary F Wheeler - Professor, ASE and Eng. Mech.**	**0.00**	**0.00**	**0.00**	**0**	
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	**7.20**	**0.00**	**0.00**	**96,987**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**4**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**26.40**	**0.00**	**0.00**	**353,743**	
3. (**3**) GRADUATE STUDENTS				**113,490**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**564,220**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**132,034**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**696,254**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA AND U.S. POSSESSIONS)				**12,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
(**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,043**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**1,980,000**	
6. OTHER				**3,042**	
TOTAL OTHER DIRECT COSTS				**1,986,085**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**2,694,339**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**305,661**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**3,000,000**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.D.7.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **3,000,000**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI / PD TYPED NAME & SIGNATURE*: **Joe F Thompson** DATE

ORG. REP. TYPED NAME & SIGNATURE* DATE

FOR NSF USE ONLY

INDIRECT COST RATE VERIFICATION

Date Checked	Date Of Rate Sheet	Initials - ORG

NSF Form 1030 (10/98) Supersedes all previous editions

C***SIGNATURES REQUIRED ONLY FOR REVISED BUDGET (GPG III.B)**