Active

Project #: C-36-573          Cost share #:          Rev #: 6
Center # : 10/11-6-P5219-0A0          Center shr #:          OCA file #:
                                                            Work type : INST
Contract#: NGT-51154          Mod #: ADM. REVISION          Document  : GRANT
Prime   #:                                                  Contract entity: GTRC

Subprojects ? : N                                          CFDA: 43.002
Main project #:                                            PE #:


Project unit:          COMPUTING          Unit code: 02.010.300
Project director(s):
   SCHWAN K          COMPUTING          (404)894-2589


Sponsor/division names: NASA                    / HEADQUARTERS/WASHINGTON, DC
Sponsor/division codes: 105                     / 002


Award period:     930915     to     970930   (performance)     971130   (reports)

Sponsor amount          New this change               Total to date
     Contract value          0.00                     66,000.00
     Funded                  0.00                     66,000.00
Cost sharing amount                                        0.00

Does subcontracting plan apply ?: N

Title: INTERACTIVE PROGRAM STEERING OF HIGH PERFORMANCE PARALLEL SYSTEMS


                    PROJECT ADMINISTRATION DATA

OCA contact: Jacquelyn L. Bendall          894-4820

 Sponsor technical contact               Sponsor issuing office

DEBORAH GLASCO                           ADRIENE WOODIN
(202)358-1531                            (202)358-0412

NASA HEADQUARTERS                        SAME
CODE FEH                                 HEADQUARTERS ACQUISITION DIVISION
WASHINGTON, DC 20546                     SAME


Security class (U,C,S,TS) : U          ONR resident rep. is ACO (Y/N): N
Defense priority rating   :               supplemental sheet
Equipment title vests with:   Sponsor          GIT
  "USE OF TRAINING GRANT FUNDS TO PURCHASE EQUIPMENT IS STRICTLY PROHIBITED"
Administrative comments -
  ADMINISTRATIVE MODIFICATION ISSUED TO EXTEND PERIOD OF PERFORMANCE VIA NASA
  APPROVAL TO SEPTEMBER 30, 1997 WITH NO ADDITIONAL FUNDS.

Closeout Notice Date   05-JAN-1998

Project Number C-36-573                 Doch Id       36813

Center Number 10/11-6-P5219-0A0

Project Director SCHWANS, KARSTEN

Project Unit  COMPUTING

Sponsor  NASA/HEADQUARTERS/WASHINGTON, DC

Division Id     3382

Contract Number NGT-51154               Contract Entity GTRC

Prime Contract Number

Title   INTERACTIVE PROGRAM STEERING OF HIGH PERFORMANCE PARALLEL SYSTEMS

Effective Completion Date   30-SEP-1997 (Performance) 30-NOV-1997 (Reports)

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| Closeout Action: | Y/N | Date Submitted |
|---|---|---|
| Final Invoice or Copy of Final Invoice | Y | |
| Final Report of Inventions and/or Subcontracts | Y | |
| Government Property Inventory and Related Certificate | N | |
| Classified Material Certificate | N | |
| Release and Assignment | N | |
| Other | N | |

Comments

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Distribution Required:

| | |
|---|---|
| Project Director/Principal Investigator | Y |
| Research Administrative Network | Y |
| Accounting | Y |
| Research Security Department | N |
| Reports Coordinator | Y |
| Research Property Team | Y |
| Supply Services Department/Procurement | Y |
| Georgia Tech Research Corporation | Y |
| Project File | Y |

NOTE:  Final Patent Questionnaire sent to PDPI

# Georgia Institute of Technology

Office of Grants and Contracts Accounting
Risk Management

July 14, 1998

NASA Washington Headquarters
Graduate Student Researchers Program
CODE FEH
Attn: GSRP Manager
Washington, DC 20546

Reference: NASA - Grant NGT-51154
Final Federal Cash Transactions
Report (SF-272)

Dear Madam/Sir:

Enclosed is the final Federal Cash Transactions Report (SF-272) for NASA - Washington Headquarters Grant NGT-51154 with Georgia Tech Research Corporation/Georgia Institute of Technology. This report is for the period September 15, 1993 through September 30, 1997. Should you have questions, please contact Dale C. Turner of this office, (404) 894-5521.

Sincerely,

Charles J Duhy
Director

CTD/dct

Enclosure

c:       Mr. Eric Trevena, COC, 0280
         Ms. Danielle Herrmann, OCA, 0420
         Ms. Wanda Simon, OCA, 0420
         NASA Headquarters, Close-out Section,
          Code HWG-1, Washington, DC 20546-0001
         File: C-36-573/11-6-P5219-0A0

# FEDERAL CASH TRANSACTIONS REPORT

**FINAL**

(See Instructions on the back. If report is for more than one grant or assistance agreement, attach completed Standard Form 272-A.)

1. Federal sponsoring agency and organizational element to which this report is submitted

NASA - WASHINGTON RESEARCH CENTER

| 2. RECIPIENT ORGANIZATION | | |
|---|---|---|
| Name : GEORGIA TECH RESEARCH CORPORATION GEORGIA INSTITUTE OF TECHNOLOGY | | |

| | 4. Federal grant or other identification number | 5. Recipient's account number or identifying number |
|---|---|---|
| | NGT-51154 | C-36-573/P52190AO |

Number and Street : P.O. BOX 100117

| 6. Letter of credit number | 7. Last payment voucher number |
|---|---|

Give total number for this period

| 8. Payment Vouchers credited to your account | 9. Treasury checks received (whether or not deposited) |
|---|---|

City, State and ZIP Code: ATLANTA, GA 30384

| 10. PERIOD COVERED BY THIS REPORT | |
|---|---|

3. FEDERAL EMPLOYER IDENTIFICATION NO. 58-0603146

| FROM (Month, day, year) | TO (month, day, year) |
|---|---|
| 09/15/93 | 09/30/97 |

| 11. STATUS OF FEDERAL CASH (See specific instructions on the back) | | |
|---|---|---|
| a. Cash on hand beginning of reporting period | $ | 0.00 |
| b. Letter of credit withdrawals | | 66,000.00 |
| c. Treasury check payments | | 0.00 |
| d. Total receipts (Sum of lines b and c) | | 66,000.00 |
| e. Total cash available (sum of line a and d) | | 66,000.00 |
| f. Gross disbursements | | 66,000.00 |
| g. Federal share of program income | | 0.00 |
| h. Net disbursements (Line f minum line g) | | 66,000.00 |
| i. Adjustments of prior periods | | |
| j. Cash on hand end of period | $ | 0.00 |

| 12. THE AMOUNT SHOWN ON LINE 11J, ABOVE, PRESENTS CASH REQUIREMENTS FOR THE ENSUING    0 Days | 13. OTHER INFORMATION | |
|---|---|---|
| | a. Interest Income | $ |
| | b. Advances to subgrantees or subcontractors | $ |

14. REMARKS (Attach additional sheets of plain paper, if more space is required)

Questions concerning this report should be directed to: Dale C. Turner (404) 894-5521.

| 15. CERTIFICATION | | | |
|---|---|---|---|
| I certify to the best of my knowledge and belief that this report is true in all respects and that all disbursements have been made for the purpose and conditions of the grant or agreement | AUTHORIZED CERTIFYING OFFICIAL | SIGNATURE | DATE REPORT SUBMITTED 7/13/98 |
| | | TYPED OR PRINTED NAME AND TITLE CHARLES T. DUFFY, DIRECTOR GRANTS AND CONTRACTS ACCOUNTING | TELEPHONE (Area code, Number, Extension) (404) 894-2629 |

THIS SPACE FOR AGENCY USE

272-102

C-36-573

1

## I. Student Information

Name: (Mr./Ms.)

Vetter       Jeffrey       S
Last          First          MI

Birth Date: 10/21/66

Birthplace: Winchester, Virginia

Home Address: 28428 GT Station
Atlanta, GA 30332

Home Phone: 404/607-7861

Target Degree: ___MS ___MS/PhD (joint) _x_PhD

Discipline: Computer Science

Department: College of Computing

Campus Address: 801 Atlantic Drive

Mail Code: 0280

University: Georgia Institute of Technology

Street Address: _____

City, State, ZIP: Atlanta, GA 30332-0280

Campus Phone: 404/894-9389    Fax No.: 853-9378

E-Mail: vetter@cc.gatech.edu

Undergraduate GPA: 3.3    Out Of: 4.0

Discipline: Computer Engineering

Graduate GPA (If Applicable): 3.9    Out Of: 4.0

Discipline: _____

*I certify that I am a citizen of the United States and that I am or will be a full-time graduate student at the university during the period covered by this proposal.*

Signature _____    1/24/95

## II. Faculty Advisor Information

Name: Karsten Schwan

Department: College of Computing

Campus Address: 801 Atlantic Drive

Mail Code: 0280

University: Georgia Institute of Technology

Street Address: _____

City, State, ZIP: Atlanta, GA 30332

Campus Phone: 894-2589

Fax Number: 853-9378

E-Mail: schwan@cc.gatech.edu

Signature: _____  Date: 1/20/95

## III. Official Responsible for Committing Institution

Name: Janis L. Goddard

Title: Contracting Officer

University: Georgia Tech Research Corporation

Street Address: Georgia Institute of Technology

City, State, ZIP: Atlanta, Georgia 30332-0420

Campus Phone: (404) 894-4817

Sign: _____  Date: 1/30/95

## IV. Proposal Information

Type of Proposal: ☐ (1) New  ☐ (2) Second Year  ☒ (3) Third Year

If Renewal, Designate Grant No.: NGT- 51154    Proposed Start or Renewal Date: September 15, 1995

Expected Graduation Date: Summer of 1996    Budget Amount $22,000

Proposal Title Interactive Program Steering of High Performance Parallel Systems

Time Spent at NASA Center during past year: 1 weeks 0 months

## V. Submission Information

☒ Headquarters          ☐ Nasa Centers

___ Astrophysics              ___ Ames/Dryden (ARC/DFRF)
X__ Information Systems        ___ Goddard (GSFC)
___ Solar System Exploration  ___ Jet Propulsion Lab (JPL)
___ Space Physics             ___ Johnson (JSC)
___ Life Sciences             ___ Kennedy (KSC)
___ Microgravity              ___ Langley (LaRC)
___ Earth Sciences            ___ Lewis (LeRC)
                              ___ Marshall (MSFC)
                              ___ Stennis (SSC)

Center Technical Advisor: _____

Other Facilities to which this proposal is being submitted: _____

## VI. Proposal Checklist

☐ Original Proposal and 9 Copies

☐ Budget Form

☐ University Certifications
  •Debarment and Suspension
  •Drug Free Workplace

☐ Signed Advisor Evaluation or Letter of Recommendation

☐ Transcripts

## VII. NASA Use Only

☐ Org/Cpys .

☐ BdgtFrm

☐ UCert

☐ SAE

☐ T

# NASA GSRP Summary of Research Progress:
# Interactive Program Steering of High Performance Parallel Systems

**Jeffrey Vetter**
*Georgia Institute of Technology*

*January 1995*

First, I provide a short description of my research in interactive program steering. Second, I summarize my accomplishments for the previous year. Finally, I outline several goals for the coming year. Page 2 provides the complete citations for the mentioned publications.

*Interactive program steering* permits researchers to monitor and guide their applications during runtime. Interactive steering can help make end users more effective in addressing the scientific or engineering questions being solved with these programs, and it may be used to improve the performance of complex parallel and distributed codes. In an effort to experiment with the necessary functionality of an interactive program steering system, I have designed and implemented Progress. Progress is a toolkit for developing steerable applications. Users instrument their applications with library calls and then steer parallel applications with Progress' runtime system. Progress provides *steerable objects* which encapsulate program abstractions for monitoring and steering during program execution. Once created, steering objects are known to and manipulated by Progress' two components: (1) a server executing in the same memory space as the target program and capable of inspecting and manipulating program state, and (2) a potentially remote client providing command and graphical interfaces. Developers instrument their applications with the Progress toolkit library to create and maintain these steering objects. The server maintains information about the steering objects and performs steering actions on the application. This toolkit provides sensors, probes, actuators, function hooks, complex actions, and synchronization points. Progress' server is built on a Mach-compatible Cthreads library; it is a general toolkit for use with a variety of multithreaded, C programs executing on multiprocessors. Progress has been applied to several large-scale parallel application programs, including a molecular dynamics code and an N bodies simulation. It is currently being merged with a complex global atmospheric modeling code.

Over the past year, I have made good progress on my GSRP research proposal as well as other educational goals. Below is a concise list of last year's accomplishments:

♦ Passed depth exam milestone for my Ph.D.
♦ Preparing my thesis proposal for Q1 1995.
♦ Completed prototype system for interactive program steering of parallel systems.
♦ Submitted [Vetter95] describing my prototype system for interactive program steering.
♦ Published [Gu94], a literature review of interactive program steering.

♦ Submitted [Bergman95] describing my efforts to parallelize a spectral element method CFD application. This research was performed jointly with Harris Bergman, a Georgia Tech biomedical engineering Ph.D. student.
♦ Published [Eisen94] outlining opportunities in high performance computing.
♦ Collaborating with members of another NASA-sponsored team investigating parallelization, visualization, and interactivity of an atmospheric modeling simulation. I intend to use this 'real' application as a testbed for my interactive steering research.
♦ Published [Gu95] to document my group's efforts in on-line monitoring of parallel programs.
♦ Attended NASA GSRP Symposium in Washington, D.C.
♦ Attended Supercomputing 94 in Washington, D. C.

As with any basic research, I spent several quarters investigating other group's work in interactive program steering as well as designing and implementing a prototype system. At this stage of my research, I am positioned to evaluate my current prototype, outline improvements to the prototype, and seek additional applications for testing my design.

My research and educational goals for the coming year are summarized below.

♦ Successfully propose my thesis topic and prepare a defense of research for approximately Q1 1996.
♦ Continue developing my prototype system into a stable, portable platform for a variety of scientists.
♦ Develop an advanced user interface for the steering system. Current dataflow systems, such as AVS and SGI Iris Explorer, do not lend themselves well to interactivity with visualized data.
♦ Outline the necessary functionality for an interactive program steering.
♦ From the perspective of interactive program steering, create a 'wish list' of compiler and operating systems features that would enhance the functionality of current high performance computing.
♦ Continue developing parallel and distributed applications, such as the parallel CFD application, to remain 'in touch' with the current state of high performance computing and for testing my system.

*I would again like to thank* NASA for sponsoring my research for 1994. I certainly appreciate your aid and I hope to continue working with you throughout my career.

[Vetter95]      (Submitted): Jeffrey Vetter and Karsten Schwan. "Progress: a Toolkit for Interactive Program Steering." International Conference on Parallel Processing 95 (ICPP95), August 1995.

[Bergman95]  (Submitted): Harris Bergman, Jeffrey Vetter, David Ku, and Karsten Schwan. "Development Of A Parallel Spectral Element Method Code Using SPMD Constructs." Parallel Computational Fluid Dynamics 95 (PCFD 95), July 1995.

[Eisen94]       Greg Eisenhauer, Weiming Gu, Thomas Kindler, Karsten Schwan, Dilma Silva, and Jeffrey Vetter. "Opportunities and Tools for Highly Interactive Distributed and Parallel Computing." *Proceedings of the Workshop on Debugging and Tuning for Parallel Computing Systems*, October 1994.

[Gu95]          Weiming Gu, Greg Eisenhauer, Eileen Kraemer, Karsten Schwan, John Stasko, Jeffrey Vetter, and Niru Mallavarupu. "Falcon: On-line Monitoring and Steering of Large-Scale Parallel Programs." *Proceedings of FRONTIERS 95*, February 1995.

[Gu94]          Weiming Gu, Jeffrey Vetter, and Karsten Schwan. "An Annotated Bibliography of Interactive Program Steering." *ACM SIGPLAN Notices* 29(9):140-148, September 1994.

[Ribarsky94] William Ribarsky, Jack Tumblin, Gregory Newton, Robert Nowicki, and Jeffrey Vetter. "GLYPHMAKER: An Interactive, Programmerless Approach for Customizing, Exploring, and Analyzing Visual Data Representatives." Tech report GIT-GVU-93-26, Graphics, Visualization, and Usability Center, Georgia Tech. April 1994.

## NASA Graduate Student Researchers Program
## Budget Information

**I. Student Stipend** (Maximum of $16,000)                          $ 16,000

$4000/quarter for 4 quarters

**II. Student Allowance** (Itemize if necessary)

Travel
   Flight to Washington from Atlanta             $   350.00
   Hotel (2 nights)                                  100.00
   Miscellaneous                                     100.00

Tuition Allowance ($2100/quarter for 4 quarters)    $8400.00

Student Allowance                    $   3,000
(Maximum of $3,000)

**III. University Allowance** (Itemize if necessary)

Travel
   Flight to Washington from Atlanta             $   350.00
   Hotel (2 nights)                                  100.00
   Miscellaneous                                     100.00

Tuition carryover from Part II                   $  2450.00

University Allowance                 $  3,000
(Maximum of $3,000)

**Total Requested**                  $  22,000
(Maximum of $22,000)

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

Applicants should refer to 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 31 U.S.C. §1352, "New Restrictions on Lobbying," and 15 CFR Part 26 "Government-wide Debarment and Suspension (Non procurement) and Government-wide Restrictions for Drug-Free Workplace (Grants)." The certifications shall be treated as material representation of fact upon which reliance will be placed when the Department of Commerce determines to award the covered transaction, grant, or cooperative agreement.

## 1. LOBBYING

As required by §1352, Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over $100,000, the applicant certifies that:

(a) 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, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;

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

(c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts) 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 §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

As required by Executive Order 12549, Debarment and Suspension, and implemented under 15 CFR Part 26, for prospective participants in primary covered transactions.

## A. The applicant certifies 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 three-year period preceding this application 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, forger, bribery, falsification or destruction of records, making false statement, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph 2.A(b) of this certification; and...

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

## B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

## C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion — Lower Tier Covered Transactions (Subgrants or Subcontracts)

(a) The prospective lower tier participant certifies, by submission of this proposal, that neither it not its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

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

## 3. CERTIFICATION REGARDING DRUG-FREE WORKPLACE REQUIREMENTS

### • GRANTEES OTHER THAN INDIVIDUALS

**A. The grantee certifies that it will provide a drug-free workplace by:**

(a) Publishing a statement notifying employees that the unlawful 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 of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction;

(e) Notifying the agency within ten days after receiving notice under subparagraph (d) (2) from an employee or otherwise receiving actual notice of such conviction;

(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;

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).

**B. The grantee shall insert in the space provided below the site(s) for the performance or work done in connection with the specific grant:**

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

_____

_____

_____

_____

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

### • GRANTEES WHO ARE INDIVIDUALS

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.

---

As the duly authorized 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 |
|---|---|
| Jeffrey S. Vetter | "Interactive Program Steering of High Performance Parallel Systems" |

| PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE |
|---|
| Janis L. Goddard, Contracting Officer |

| SIGNATURE | DATE |
|---|---|
|  | 20 January 1995 |

Georgia Institute of Technology
College of Computing
Atlanta, Georgia 30332-0280
(404) 894-3152
Fax: (404) 853-9378

Karsten Schwan
schwan@cc.gatech.edu
...!{decvax,hplabs}!gatech!cc!schwan
(404) 894-2589

January 24, 1995

NASA

To Whom It May Concern:

This note is to certify that Jeffrey Vetter is making excellent progress in his academic and research programs at Georgia Tech. Specifically, with his NASA funding, Jeffrey has been able to define and carry out an aggressive research program in his area of PhD study. His achievements during the past year include:

- Evaluation of a prototype interactive application and of graphical interfaces to this application.

- Generalization from one prototype to the design and implementation of a system for on-line program steering: Jeffrey built a steering library and evaluated it with a sample parallel code. He has written up this work and submitted it for publication at appropriate conference outlets (we are now also working on a journal paper).

- Ongoing work on developing graphical interfaces for program steering, mainly based on Motif.

- Integration of his work with that of other project members, so that his results become more broadly relevant to actual large-scale systems and applications. Specifically, his steering library and interfaces are now being integrated with the Falcon system for on-line program monitoring, portable across a variety of shared memory and (soon) distributed memory platforms. This permits him to take advantage of additional tools for program monitoring available in Falcon and of a large-scale parallel atmospheric modeling code we are developing jointly with space scientists. In addition, in his future work, he will take advantage of data visualization and program animation tools available via that project.

- Contribution to group efforts: co-author of several research papers submitted and published this year.

- Attendance of Supercomputing'94, where he presented some of his work in a booth.

- Published a review paper on program steering.

In summary, Jeffrey is making excellent progress with his research and his academic program (concerning the courses he needs to take and his preparation for the next exam in our graduate program). I strongly recommend that you continue his research funding.

Sincerely,

Karsten Schwan
Associate Professor

# Georgia Tech

**Georgia Institute of Technology**
College of Computing
Atlanta, Georgia 30332-0280
(404) 894-3152
Fax: (404) 853-9378

Karsten Schwan
schwan@cc.gatech.edu
http://www.cc.gatech.edu/fac/karsten.schwan
(404) 894-2589

December 16, 1997

NASA

To Whom It May Concern:

This note is to certify that Jeffrey Vetter has completed his NASA funded research program with excellent results at Georgia Tech. Specifically, with this funding, Jeffrey has been able to define and carry out an aggressive research program in his area of PhD study. His achievements during the past year include:

- Development of two interactive applications in conjunction with researchers at Los Alamos Laboratories.

- Development of a fairly mature system for interactive program steering and its evaluation with said applications.

- Submission of a conference paper (to IPPS 98), presentation of a conference paper at IPPS 97, submission of a journal paper (to IEEE Software), interactions with potential end users at Los Alamos, Georgia Tech, and at NCSA, and attendance of Supercomputing 97.

- Defense of his PhD thesis in Dec. 1997, which expected completion of his thesis by March 1998.

In summary, Jeffrey has made excellent use of his NASA scholarship. In fact, if all scholarships from NASA achieve these types of results, then this is an excellent program!

Sincerely,

Karsten Schwan
Professor

During my tenure as a NASA GSRP fellow, I accomplished several goals that are listed below. I have accepted a post doctoral associate position at the University of Illinois at Urbana-Champaign to continue research in high performance computing.

1. Publications

  (a) Book chapters

     i. G. Eisenhauer, W. Gu, T. Kindler, K. Schwan, D. Silva and J.S. Vetter (1996). "Opportunities and tools for highly interactive distributed and parallel computing." Debugging and Performance Tuning for Parallel Computing Systems. Editors: M. Simmons, A. Hayes, J. Brown and D. Reed. IEEE Computer Society Press: 245-77. (Also printed in Parallel Computer Systems: Performance Instrumentation and Visualization. Editors: R. Koskela and M. Simmons. ACM Press.)

  (b) Journal articles

     i. J.S. Vetter and K. Schwan (1997). High performance computational steering using an interpretive language. Submitted for publication.

     ii. B. Schroeder, G. Eisenhauer, K. Schwan, J. Heiner, P. Highnam, V. Martin and J.S. Vetter (1997). From interactive applications to distributed laboratories. Accepted for publication.

     iii. W. Gu, G. Eisenhauer, K. Schwan, and J.S. Vetter (1997). Falcon: on-line monitoring and steering of parallel programs. Submitted for publication.

     iv. J.S. Vetter (1997). "Computational steering annotated bibliography." SIGPLAN Notices 32(6):40-4 (June 1997).

     v. W. Gu, J.S. Vetter and K. Schwan (1994). "An annotated bibliography of interactive program steering." SIGPLAN Notices 29(9): 140-8.

  (c) Conference papers

     i. J.S. Vetter and K. Schwan (1997). Monitoring assertions: general techniques for managing application-specific instrumentation. Submitted for publication.

     ii. J.S. Vetter (1997). Characterizing steering feedback in computational steering systems. Submitted for publication.

     iii. G. Eisenhauer, B. Schroeder, K. Schwan, V. Martin and J.S. Vetter (1997). Dataexchange: high performance communication in distributed laboratories. Proc. Ninth Int'l Conf. Parallel and Distributed Computing Systems (PDCS 97).

     iv. J.S. Vetter and K. Schwan (1997). High performance computational steering of physical simulations. Proc. IPPS 97, pp. 128-32.

     v. J.S. Vetter and K. Schwan (1996). Models for computational steering. Proc. Int'l Conf. on Configurable Distributed Systems.

     vi. H.L. Bergman, J.S. Vetter, K. Schwan and D. Ku (1995). Development of a parallel spectral element code using SPMD constructs. Proc. Parallel CFD: Implementations and Results Using Parallel Computers.

     vii. H.L. Bergman, J.S. Vetter, K. Schwan and D. Ku (1995). Design of a parallel computational fluid dynamics code on a shared memory architecture. Proc. 1995 ASME Int'l Mechanical Engineering Congress and Exposition.

     viii. W. Gu, G. Eisenhauer, E. Kraemer, K. Schwan, J. Stasko and J.S. Vetter (1995). Falcon: on-line monitoring and steering of large-scale parallel programs. Proc. Frontiers '95.

     ix. J.S. Vetter and K. Schwan (1995). Progress: a toolkit for interactive program steering. Proc. 1995 Int'l Conf. Parallel Processing.

  (d) Technical reports and other publications

     i. J.S. Vetter (1998). Ph.D. Thesis, College of Computing, Georgia Institute of Technology.

     ii. B. Schroeder, G. Eisenhauer, K. Schwan, J. Heiner, V. Martin, S. Szou, J.S. Vetter, R. Wang, F. Alyea, B. Ribarsky and M. Trauner (1997). Framework for collaborative steering of scientific applications. Science Information Systems Newsletter, IV(40), pp. 19-23.

    iii. J.S. Vetter (1996). Magellan reference manual. College of Computing, Georgia Institute of Technology, Atlanta.

    iv. W. Ribarsky, J. Tumblin, G. Newton, R. Nowicki and J.S. Vetter (1994). Glyphmaker: an interactive, programmer-less approach for customizing, exploring, and analyzing visual data representatives. Graphics, Visualization, and Usability Center, Georgia Tech.

2. Program committees

  (a) HICSS mini-track on Computational Steering (1998), Co-chair with Dr. Eileen Kraemer.

3. Invited talks

  (a) Computational Steering with Magellan.

    i. Technische Universitat Munchen, Institut Fur Informatik (Apr. 1997).

    ii. University of Illinois at Urbana-Champaign (Mar. 1997).

    iii. Argonne National Lab (Feb. 1997).

    iv. University of Texas at Austin (Dec. 1996).

    v. Los Alamos National Lab (Dec. 1996).

  (b) Paradyn on ASCI-Blue, Los Alamos National Lab (July 1997).

  (c) Programming SMPs with Threads, Los Alamos National Lab (Sep. 1996).

  (d) Steering an Atmospheric Simulation, NSF Advisory Board, Georgia Tech (May 1996).

  (e) Interactive Computational Steering, Los Alamos National Lab (Feb. 1996); NASA GSRP Symp. Poster (May 1995); NASA GSRP Symp. Poster (May 1995).

  (f) FALCON: monitoring and steering toolkit (Poster), Supercomputing 94 (Nov. 1994).

4. Professional Activities

  (a) Member: IEEE, IEEE Computer Society, IEEE TCOS, ACM, ACM SIGPLAN, ACM SIGMETRICS, SIAM, American Association for the Advancement of Science.

  (b) Referee: Software–Practice and Experience; HICSS mini-track on computational steering (1998); Int'l Parallel Processing Symp. (1997); SIGMETRICS Symp. on Parallel and Distributed Tools (1996); Int'l Conf. on Parallel Processing (1995).

  (c) Proposals:

    i. LANL ASCI Alliance Proposal. Submitted L3 proposal in October, 1996.

    ii. NASA software grant for access to 5 different software packages through NASA cosmic software center.

    iii. NASA JPL computing grant funded 256 units for Cray T3D.

    iv. NCSA computing grant funded 400 units for SGI PowerChallenge cluster.

5. Professional experience during GSRP

  (a) Research Assistant. Los Alamos National Lab, Los Alamos, New Mexico.

  (b) Graduate Research Assistant. College of Computing, Georgia Institute of Technology, Atlanta, Georgia.

6. EXPERIMENTAL SOFTWARE SYSTEMS RESEARCH

  (a) Magellan (Georgia Tech): Magellan is my second generation system for interactive computational steering of high performance parallel applications. Magellan's primary contributions to computational steering is its use of a language, named ACSL, for flexible, high-performance steering as well as support for hierarchical control of the runtime steering system . Magellan is currently over 30,000 lines of C and C++ code.

(b) Falcon (Georgia Tech): Falcon is a application-specific performance monitoring and steering toolkit developed at Georgia Tech. Falcon consists of several components that allow users to instrument their application, gather data, and, then, visualize and interact with this data. I helped create the initial steering mechanisms for Falcon.

(c) Paradyn (University of Wisconsin at Madison): At LANL, I am importing Paradyn for use on the ASCI Blue Mountain systems by porting it to SGI systems in the interim. Paradyn is a performance monitoring tool that allows dynamic instrumentation of applications at runtime. The object file editing uses trampoline code segments dynamically to help minimize the performance perturbation on target applications.

(d) Data Exchange (Georgia Tech): Data Exchange is a component of Falcon that allows users to build dynamic networks of heterogeneous platforms. Data Exchange is a communications support library layered on top of PBIO. In particular, Data Exchange provides support for establishing communication between agents, resolving differences between data formats used by multiple agents, forwarding data from agent to agent, and processing data within an agent. In order to address dynamic client connection and data flow management, Data Exchange provides support for a publish/subscribe communications model. I helped develop the Data Exchange prototype.

(e) AIMS (NASA Ames): At LANL, I imported AIMS 3.0 from NASA Ames for performance monitoring of message passing applications. I also initiated the effort to integrate AIMS with the PTOOLS Message Queue Manager for runtime visualization of messages and message queue status.

(f) Progress (Georgia Tech): Progress was my first generation computational steering system. The major contributions of this system to my thesis work were the concept of software actuators and the client/server architecture. Magellan supersedes the Progress system.

(g) Parallel Computational Fluid Dynamics (Georgia Tech): With the devoted involvement of biomedical researchers at Georgia Tech-Harris Bergman and David Ku-I helped parallelize a spectral element code for the KSR-2 64-processor supercomputer using single-program, multiple data constructs. Little of the sequential code had to be modified for shared memory execution because of the natural domain decomposition inherent in the spectral element method. The parallel code was tested on two unsteady flow problems including a 3-D coronary bifurcation.

(h) Glyphmaker (Georgia Tech): Glyphmaker is a scientific visualization tool developed at Georgia Tech under the supervision of Dr. Bill Ribarsky that allows non-computer scientists to interactively create three dimensional visualizations of arbitrary application data. Users bind various dimensions of their application data to various parameters on a standard set of glyphs, such as spheres, cones, cubes, and vectors; then, they can visualize application time-steps. With this capability, it was easy for domain-specific scientists to experiment with and explore alternative visualizations of their application data. I helped develop the interactive manipulators to select, focus, and filter visualized data within the Glyphmaker render.