

# 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 98-2					<b>FOR NSF USE ONLY</b>	
CISE-REU NSF 96-102					NSF PROPOSAL NUMBER	
FOR CONSIDERATION BY NSF ORGANIZATIONAL UNIT(S) (Indicate the most specific unit known, i.e., program, division, etc.)						
CISE-REU						
DATE RECEIVED	NUMBER OF COPIES	DIVISION	FUND CODE	DUNS # (Data Universal Numbering System)	FILE LOCATION	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN) 38-138127 (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input checked="" type="checkbox"/> A RENEWAL OR <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)		
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE Hope College			ADDRESS OF Awardee ORGANIZATION, INCLUDING ZIP CODE Department of Computer Science Hope College Holland, MI 49422-9000			
AWARDEE ORGANIZATION CODE (IF KNOWN)						
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING ZIP CODE			
PERFORMING ORGANIZATION CODE (IF KNOWN)						
IS Awardee ORGANIZATION (Check All That Apply) (See GPG II.D.1 For Definitions) <input type="checkbox"/> FOR-PROFIT ORGANIZATION <input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS						
TITLE OF PROPOSED PROJECT Computer Science Research Experience for Undergraduates						
REQUESTED AMOUNT \$146,700	PROPOSED DURATION (1-60 MONTHS) 36 months			REQUESTED STARTING DATE February 1, 1998		
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.A.3)				<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.12) IACUC App. Date _____		
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.D.1)				<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.12) Exemption Subsection _____ or IRB App. Date _____		
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG II.D.10)				<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES _____		
<input type="checkbox"/> NATIONAL ENVIRONMENTAL POLICY ACT (GPG II.D.10)				<input type="checkbox"/> FACILITATION FOR SCIENTISTS/ENGINEERS WITH DISABILITIES (GPG V.G.)		
<input type="checkbox"/> HISTORIC PLACES (GPG II.D.10)				<input type="checkbox"/> RESEARCH OPPORTUNITY AWARD (GPG V.H)		
<input type="checkbox"/> SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.12)						
<input type="checkbox"/> GROUP PROPOSAL (GPG II.D.12)						
PI/PD DEPARTMENT Computer Science		PI/PD POSTAL ADDRESS Department of Computer Science Hope College Holland, MI 49422-9000				
PI/PD FAX NUMBER (616) 395-7123						
NAMES (TYPED)	Social Security No. *	High Degree, Yr	Telephone Number	Electronic Mail Address		
PI/PD NAME Herbert L. Dershem	271-40-8660	PhD, 69	(616) 395-750	dershem@cs.hope.edu		
CO-PI/PD						
CO-PI/PD						
CO-PI/PD						
CO-PI/PD						
<b>NOTE: THE FULLY SIGNED CERTIFICATION PAGE MUST BE SUBMITTED IMMEDIATELY FOLLOWING THIS COVER SHEET</b>						
*SUBMISSION OF SOCIAL SECURITY NUMBERS IS VOLUNTARY AND WILL NOT AFFECT THE ORGANIZATION'S ELIGIBILITY FOR AN AWARD. HOWEVER, THEY ARE AN INTEGRAL PART OF THE NSF INFORMATION SYSTEM AND ASSIST IN PROCESSING THE PROPOSAL. SSN SOLICITED UNDER NSF ACT OF 1950, AS AMENDED.						


## 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	Date
PI/PD Herbert L. Dershem		9/12/97
Co-PI/PD		
Co-PI/PD		
Co-PI/PD		
Co-PI/PD		

### 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, drugfree workplace, and lobbying activities (see below), as set forth in the *Grant Proposal Guide (GPG)*, NSF 98-2. Willful provision of false information in this application and its supporting documents or in reports required under an ensuing 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. Conflicts 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

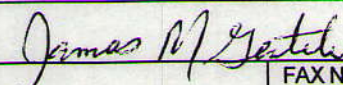
This certification is required for an award of a Federal contract, grant or cooperative agreement exceeding \$100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

#### 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, and 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 of Lobbying Activities," 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) James G. Gentile, Dean of the Natural Sci. Div.		9/12/97
TELEPHONE NUMBER (616) 395-7190	ELECTRONIC MAIL ADDRESS gentile@hope.edu	FAX NUMBER (616) 395-7923

# REU PROJECT SUMMARY FORM

## NSF RESEARCH EXPERIENCES FOR UNDERGRADUATES PROGRAM

Type all entries. See page at left for instructions and codes to be used in filling out this form.

1. Major Field: Computer Science 2. Highest Degree Code: B
3. Subfields: \_\_\_\_\_ 4. Focus Code: IID
5. Audience Code(s): WM 6. Scope Code: N 7. Type of Project: SI
8. Name of Institution: Hope College 9. Inst. Code: PRIV
10. Name of Principal Investigator: Herbert L. Dershem Tel.No. 616-395-7508
11. Name of Student Recruitment Point-of-Contact: Herbert L. Dershem
- SRPOC Tel.No.: 616-395-7508 SRPOC e-mail address: dershem@cs.hope.edu
12. Project Title: REU: An Undergraduate Research Participation Program in Computer Science
- \_\_\_\_\_
13. Number of Students Involved: 8 per year 14. Activity Period: S
15. Other Institutions Involved: One faculty member from another institution will be invited to mentor undergraduate research projects as a part of this program. Five students per year from other institutions will participate

### 16. Summary of Proposed Work:

The REU program at Hope College is designed to provide talented undergraduates with a meaningful research experience that will encourage them to consider a career in computer science research. Our goal is to expose the students to the techniques, attitudes, and rewards of computer science research and to provide encouragement and direction in the pursuit of such a career. We will strongly recruit women and minority students to our program. Hope College Computer Science faculty will mentor this undergraduate research. In addition, a faculty mentor will be selected from another institution where the infrastructure is lacking for strong undergraduate research. Eight participants will be selected each year, three from Hope College, two from the outside faculty mentor's institution, and three from other institutions. Those students will work for ten weeks during the summer in close collaboration with a faculty mentor. Students will have the opportunity to use the Hope College Computer Science SUN SPARCstation network. Areas of research include parallel algorithms, system development environments, human-machine interface, algorithm animation, and programming languages. The students will perform independent research, give oral presentations on their work, attend workshops on graduate school, prepare scientific papers, and present their work at seminars at their home institutions and national and regional meetings.

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B Table of Contents (NSF Form 1359)	1	
C Project Description (including Results From Prior NSF Support) (not to exceed 15 pages) <b>(Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	12	
<input type="checkbox"/> Please check if Results from Prior NSF Support already have been reported to NSF via the NSF FastLane System, and list the Award Number for that Project		
		NSF Award No.
D References Cited	0	
E Biographical Sketches (Not to exceed 2 pages each)	5	
F Summary Proposal Budget (NSF Form 1030, including up to 3 pages of budget justification)	5	
G Current and Pending Support (NSF Form 1239)	2	
H Facilities, Equipment and Other Resources (NSF Form 1363)	0	
I Special Information/Supplementary Documentation	1	
J Appendix (List below) <b>Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)</b>	0	
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.

## C. Project Description

### 1 Introduction

Hope College is a four-year liberal arts college with enrollment of approximately 2800. The Science Division at Hope College is one of the strongest divisions of its kind at any four-year college. Hope College was the site of the national meeting of the Council on Undergraduate Research in 1992 and is the recipient of a recent major grant from the Kellogg Foundation to help improve K-8 science and mathematics education as well as grants from Sherman Fairchild Foundation and the Kresge Foundation to fund major equipment purchases.

The faculty and administration of Hope College believe research participation by undergraduates to be a critical component in the training of future scientists. All of the science departments at Hope College offer independent study programs involving student research for which academic credit is awarded. Outstanding majors are encouraged to continue their research on a full time basis during the summer months.

Hope College has a long tradition of undergraduate research in the sciences. In the period of 1991-95, Hope placed 22nd among all baccalaureate colleges in the undergraduate origin of science Ph.D.'s. Hope was 3rd among baccalaureate colleges in total awards from the National Science Foundation in 1996-97.

The Computer Science Department has become a part of this tradition. A recent study indicated that Hope was the third most productive institution in Computer Science research from among the 48 institutions in the "Oberlin group" as measured by publications in the period 1977-1987. During the 16 year period from 1981-1997, the Computer Science Department graduated 225 majors. Of those, 42 attended graduate or professional school and 179 participated in a Research/Independent Study course during the academic year.

Hope College strongly encourages faculty/student collaborative research. Undergraduate research with NSF support was carried out by more than 100 students during the summer of 1997 in the departments of Computer Science, Physics, Mathematics, Biology, and Chemistry. Institutional support for collaborative research outside of the sciences has increased by the establishment of a President's Discretionary Fund for this purpose.

### 2 Objectives and Intended Impact

The objectives of this project are:

- to support and enhance the undergraduate research program of the Hope College Computer Science Department
- to provide a model for Computer Science undergraduate research for other primarily undergraduate institutions
- to encourage and support undergraduate research at institutions that presently lack the infrastructure to support such research
- to encourage and motivate undergraduate participants to pursue careers in Computer Science research
- to increase the number of undergraduates from groups underrepresented in Computer Science research to consider such careers

As a result of this project, we expect that the Computer Science undergraduate research program at Hope College will continue to grow in both size and effectiveness. We also expect that as a result of their participation, the student and faculty participants in this program will play a role in increasing the presence and importance of undergraduate research at many other institutions, and as a result, the entire Computer Science academic community will benefit.

### 3 RESULTS FROM PRIOR NSF SUPPORT

Grant Number: CDA-9200118 Amount of Award: \$86,550 Support Period: April 1, 1992 to September 30, 1995	Grant Number: CDA-9423943 Amount of Award: \$114,393 Support Period: March 1, 1995 to February 28, 1998
Title: REU: An Undergraduate Research Participation Program in Computer Science	

### 3.1 General Results

With support from the National Science Foundation, Hope College has hosted a Computer Science REU site program each of the summers from 1992-1997. During this time, REU has supported 36 participants, 6 each summer, while an additional 10 participants have been supported by other funds. These additional funds have come from a variety of sources in the form of grants awarded to the faculty and the institution. Sources include NASA, NSF RUI, Pew Memorial Trust, Howard Hughes Foundation, and the United States Air Force. The student participants have completed 22 projects that are listed later in this proposal.

The table below shows the status in August, 1997, of the 40 individuals who participated in the Hope College Computer Science summer research programs from 1992-97:

Attending graduate school	13
Employed	16
Still an undergraduate	11

Graduate schools attended by project alumni include Duke, Clemson, Illinois, Michigan State, Utah, Texas A&M, Michigan, Colorado, and William & Mary. Among the present employers of project alumni are Bell Labs, Evans & Sutherland, Crowe Chizek, Microsoft, Ford, UsAir, and Macromedia.

From 1991-97, the Hope College Computer Science REU project has had only limited success in recruiting participants from underrepresented groups. Twenty percent of the participants have been women and only one participant of the 40 has been a member of a minority ethnic group. This has been in spite of effort on the part of the project director to recruit such students. Each year, at least half of the positions offered to non-Hope College students were offered to females. In 1997, 30% of the applications received were from members of minority groups. Unfortunately, it has proven difficult to convert these applicants into participants. We have noticed, that the rate of acceptance of offers to participate is much lower from members of these underrepresented groups, making it much more difficult to realize a higher level of participation. Regardless of our limited success, we find the level of interest from students in these groups to be encouraging, and we plan to continue to strive for greater participation through the strategies described in the next section of this proposal.

### 3.2 Recruitment

In late January or early February of each year, announcements of the summer's REU program are distributed. Mailings are sent to computer science department chairs at colleges and universities throughout the United States. In addition, announcements are sent to Minority Affairs Officers at large universities throughout the midwest. Announcements are also placed on the comp.edu Usenet news group and on the ACM SIGCSE mail list server. Chairs of computer science departments at over 50 predominantly minority institutions are contacted individually via email to especially encourage their students to apply. At the same time, an announcement is distributed in all computer science classes at Hope College. The application numbers for the six years of summer undergraduate research supported by the above two grants are given in the following table:

Application Profile	1992	1993	1994	1995	1996	1997
External applicants	82	59	65	67	57	62
External participants	3	3	3	3	3	2
Hope applicants	7	11	12	17	15	17
Hope participants	3	3	3	3	3	4
Other undergraduate researchers	2	3	2	2	0	1

### 3.3 Projects

Each summer, the participants were present on the Hope College campus for ten weeks of research. The projects and their participants are summarized below: (\* indicates the participant was supported by non-REU funds.)

1992

**An Object Oriented Application/Programmer Interface for Network Programming**

Faculty Mentor: Shirley Browne

Undergraduate Researchers: Jennifer Howell, Ming Shu\*, Robert Wohlfarth

**Using the Computer to Visualize and Simulate Models of Abstract Models of Computation**

Faculty Mentor: Herbert Dershem

Undergraduate Researchers: Brett Folkert, Ryan McFall

**Photosynthesis: An Object Oriented Test Bed for Parallel Ray Tracing**

Faculty Mentor: Gordon Stegink

Undergraduate Researchers: Eric Matthews, Mike Shield

1993

**AdaVision and THREADS: Algorithm Animations and Experimental Laboratories for Teaching a Data Structures Course in Ada**

Faculty Mentor: Herbert Dershem

Undergraduate Researchers: Wendy Barth, Cheri Bowsher, Bob Chen\*

**The Genetic Algorithm Parallel Programming Project**

Faculty Mentor: Gordon Stegink

Undergraduate Researchers: Russell Nelson, Bryan Showers

**An Empirical Case Study of Software Integration Techniques**

Faculty Mentor: Michael Jipping

Undergraduate Researchers: Jonathan Beard\*, Michael Crider\*, Serge Hallyn, Nicholas Rahn

1994

**Creating an Integrated Concurrent System Design Environment**

Faculty Mentor: Michael J. Jipping

Undergraduate Researchers: Mike Crider\*, Serge Hallyn\*, John Duperon, Heather Mintz

**Algorithm Visualization and Animation**

Faculty Mentor: Herbert L. Dershem

Undergraduate Researchers: Cheri Bowsher, Darrick Brown

**Electric Darwinism: Finding an Ideal Path Using Genetic Algorithms**

Faculty Mentor: Gordon A. Stegink

Undergraduate Researchers: Deborah Kaplan, Nick Slager

1995

**Evaluating Parallel Software Design Tools**

Faculty Mentor: Michael J. Jipping

Undergraduate Researchers: John Duperon and Jeff Oegema\*

**Comparison of the Use of Ada 95 to C++ for the Development of Object-Oriented Programs**

Faculty Mentor: Herbert L. Dershem

Undergraduate Researchers: Manuel Calderon and Andrew Van Pernis\*

**Construction of an Operating Systems Laboratory**

**Faculty Mentor: Michael J. Jipping**

**Undergraduate Researchers: Darrick Brown and Michael Crider**

**Dynamic Updating and Dynamic Visualization of Large Voronoi Diagrams**

**Faculty Mentor: Gordon A. Stegink**

**Undergraduate Researchers: Robert Powell and Dan Toth**

1996

**Building a Networking Laboratory**

**Faculty Mentor: Michael J. Jipping**

**Undergraduate Researchers: Michael Thelen and Victor Polites**

**Java-Oriented Test Harness**

**Faculty Mentor: Herbert L. Dershem**

**Undergraduate Researcher: Marvin Malkowski**

**Java-Based Object-Oriented Fraction Visualization**

**Faculty Mentor: Herbert L. Dershem**

**Undergraduate Researcher: Marsha Janjecic**

**A JDBC Implementation for Sybase**

**Faculty Mentor: Ryan McFall**

**Undergraduate Researcher: Kathryn Boner**

**Foundations of a Pascal to Java Compiler**

**Faculty Mentor: Ryan McFall**

**Undergraduate Researcher: Jason Bucata**

1997

**Visualization in Java**

**Faculty Mentor: Herbert L. Dershem**

**Undergraduate Researcher: James VanderHyde**

**Educational Animations of Algorithms**

**Faculty Mentor: Herbert L. Dershem**

**Undergraduate Researcher: Peter Brummund**

**Dynamic Anomaly Detection in Java**

**Faculty Mentor: Michael J. Jipping**

**Undergraduate Researchers: Michael Bradshaw, Nathan Oostendorp, and Anita Van Engen\***

**Persistent Annotation of HTML Documents**

**Faculty Mentor: Ryan McFall**

**Undergraduate Researchers: Daryl Blood and Jeff Penney**

In addition to the research work that was carried out, the following activities were also held in some or all of the summers:

- Weekly seminars where students present their research work
- Field trip to a University graduate computer science department
- Weekly seminar for preparation for the computer science GRE examination
- Field trip to computer trade show when one is in the area

- Faculty-led workshops on topics that are pertinent to all projects
- Workshop on how to give technical presentations

Students are required to make a formal final presentation of their research during the final week of the project and to submit a final research report. In addition, all students are required to submit an electronic poster of their research. These posters are then placed on the World Wide Web.

### 3.4 Post-Summer Results: Presentations and Papers

(\* indicates undergraduate co-author)

#### 3.4.1 Papers presented

- McFall\*, R. 1992. Using the Computer to Visualize and Simulate Abstract Models of Computation. Pew Midstates Consortium Undergraduate Research Symposium. Grinnell, IA., October
- Shu\*, M. 1992. An Object-Oriented Application/Programmer Interface. Pew Midstates Consortium Undergraduate Research Symposium. Grinnell, IA.
- Matthews\*, E. and M. Shield\*. 1992. Photosynthesis: An Object-Oriented Test Bed for Parallel Ray Tracing. Argonne Symposium on Undergraduate Research. Argonne, IL.
- Howell\*, J., R. Wohlfarth\*, and M. Shu\*. 1993. An Object-Oriented Application/Programmer Interface for Network Programming. Symposium on Applied Computing. Indianapolis, IN.
- Engel, G., H. Dershem, R. McFall\*, A. Lopez, and S. Wiltz. 1993. Research Experience for Undergraduates Panel. SIGCSE Technical Symposium on Computer Science Education. Indianapolis, IN.
- Nelson\*, R. and B. Showers\*. 1993. The Genetic Algorithm Parallel Programming Project. Pew Midstates Consortium Undergraduate Research Symposium. Chicago, IL.
- Barth\*, W. and C. Bowsher\*. 1993. AdaVision and THREADS: Algorithm Animations and Experimental Laboratories for Teaching a Data Structures Course in Ada. Argonne Symposium for Undergraduate Research. Argonne, IL.
- Dershem, H. 1993. Algorithm Animation for Data Structures. United States Air Force Academy Computer Science Colloquium. USAF Academy, CO.
- Jipping, M., S. Hallyn\*, M. Crider\*, N. Rahn\*, and J. Beard. 1993. An Empirical Case Study of Software Integration Techniques. NASA Langley Space Flight Center Symposium. Langley, VA.
- McFall\*, R. and H. Dershem. 1994. Finite State Machine Simulation in an Introductory Lab. SIGCSE Technical Symposium on Computer Science Education. Phoenix, AZ.
- Dershem, H., Barth\*, W., Bowsher\*, C., and D. Brown\*. 1996 "Data Structures with Ada Packages, Laboratories, and Animations," First Annual Australasian Conference on Computer Science Education, Sydney, AU.
- Penney\*, J. and D. Blood\*. 1997. Persistent Annotation of HTML Documents. Pew Midstates Undergraduate Research Symposium. Chicago, IL

#### 3.4.2 Papers Published

- Howell\*, J., R. Wohlfarth\*, and M. Shu\*. "An Object-Oriented Application/Programmer Interface for Network Programming," Proceedings of the 1993 Symposium on Applied Computing, 1993.
- McFall\*, R. and H. Dershem. "Finite State Machine Simulation in an Introductory Lab," SIGCSE Bulletin, 26,1 (1994), pp. 126-130.
- Dershem, H., Barth\*, W., Bowsher\*, C., and D. Brown\*. "Data Structures with Ada Packages, Laboratories, and Animations," Proceedings of the First Australasian Conference on Computer Science Education, Sydney, Australasian, July 3-5, 1996, pp. 32-38.
- Van Engen\*, A., Bradshaw\*, M., and N. Oostendorp\*. "Extending Java to Support Shared Resource Protection and Deadlock Detection in Threads Programming", submitted to Crossroads, August, 1997.
- Dershem, H. and P. Brummund\*. "Tools for Web-Based Sorting Animation," submitted to Proceedings of SIGCSE Symposium, August, 1997.
- Dershem, H. and J. Vanderhyde\*. "Java Class Visualization for Teaching Object-Oriented Concepts," submitted to Proceedings of SIGCSE Symposium, August 1997.

### **3.4.3 Panels on Undergraduate Research**

Dershem, H., with Engel G., McFall\*, R., Lopez, A., and S. Wiltz\*. "Research Experiences for Undergraduates," Twenty-fourth SIGCSE Technical Symposium on Computer Science Education, Indianapolis, IN, March, 1993.

Dershem, H., with Bard, G., and D. Berque. "Finding and Developing Research Experiences for Undergraduates in the Small College Setting," Third Annual CCSC Midwestern Conference, Greencastle, IN, October, 1996.

Dershem, H., with Sanders, D., Eller-Meshreki, R., and G. Pitts. "Undergraduate Research - Welcome to the 21st Century," Twenty-eighth SIGCSE Technical Symposium on Computer Science Education, San Jose, CA, February, 1997.

## **4 NATURE OF STUDENT ACTIVITIES**

### **4.1 Student Involvement**

The student participants in this project will be expected to spend a minimum of 40 hours per week for 10 weeks on the research project to which they are assigned. Each student will be assigned a faculty mentor, two or more students being assigned to each mentor and working as a team. Early in the program, the students will work closely with their mentors, but as they gain experience they will be encouraged to work more independently. Each student will do library research in addition to the laboratory research so that they become familiar with techniques for searching and using research literature.

### **4.2 Student Orientation**

The P.I. will serve as the program coordinator and will be responsible for all of the administrative details including housing arrangements, stipend payments, mentor assignments, scheduling of starting dates for students, the seminar program, organizing social activities, and submission of progress reports. It will be particularly important for the P.I., with assistance from the Hope College student participants, to provide an orientation to the campus and the department for the non-Hope student participants. All students will receive an orientation to the departmental laboratory facilities, both hardware and software, and the library facilities, particularly the use of various research tools.

During the orientation period, each mentor will also provide her students with the particular information needed to carry out the assigned project.

### **4.3 Weekly Seminars**

Each week a seminar will be held which will be attended by all students and faculty. Early in the project period, each student or team will present one seminar describing the nature of the problem being investigated and a proposed research plan. At the end of the project period, each student will present the results of the research project.

In addition to these student presentations, other seminars will include faculty presentations on research methods, technical writing, and the use of various computer resources. Also, Hope alumni who are currently attending graduate school in Computer Science will present seminars and informally meet with the research students to describe the nature of graduate study in Computer Science. When possible, this meeting will be held on the campus of a graduate school.

### **4.4 Research Projects**

The problems described below represent research interests of Hope faculty that could be made available to undergraduate students as research projects in this program. Each project describes how a student could meaningfully participate and is designed to require the student to apply experience and information gained in formal classroom instruction.

**Project 1: Algorithm and Code Animations on the Web****Herbert L. Dershem**

Many algorithm and code animations have been developed as a result of previous undergraduate research. The web presents a new environment for making these animations available. Web-based adaptations will be developed of previous coordinated algorithm and code animations involving trees and strings. Techniques for automating animations by automatically generating them from source code will be studied.

**Project 2: Implementing Concurrency Anomaly Prevention in C++ and Unix Threads****Michael J. Jipping**

This project will extend previous work on the prediction and detection of concurrency anomalies from the language Java to the Unix and C++ programming areas. This will implement detection methods as parallel threads that monitor concurrent activity and detect when concurrent threads will damage a shared resource. We will be spending time with both threads programming and anomaly detection methods.

**Project 3: Implementing Parallel Software Design Tools****Michael J. Jipping**

This project will focus on integrating design tools for parallel programs into a workable software development environment and demonstrating the usefulness of this environment. Specifically, we will build prototype design tools and evaluate these tools for usability, accuracy, and fitness for existing environments.

**Project 4: Using readability measures to estimate software complexity****Herbert L. Dershem**

Previous student research has developed several measures of software complexity based on formulas used to estimate the readability of English text. This project would extend the work done in the following ways: (1) obtain empirical data based on comparisons of new metrics with traditional metrics on sample software; (2) experiment with changes in parameters in the readability metrics to further refinement their accuracy; and (3) implement parsers to evaluate these metrics in a variety of languages.

**Project 5: Exploration and Refinement of Direct Manipulation Selection Mechanisms****Kevin Denelsbeck**

While much work has been done in determining the usability of common kinds of user-interface selection mechanisms (such as menus, buttons, and dialog boxes), some issues remain unclear. How big should radio buttons be? What is the optimal layout and extent for pie menus? Should handedness affect the layout of buttons in a dialog box? Through a number of short, tightly-controlled studies, we will attempt to see if human performance follows best-guesses from existing theory for a series of questions such as these. This should yield a number of small but useful metrics for WIMP-style user interface development.

**4.5 External Faculty Mentors**

It is proposed that one external faculty mentor be invited to participate in the program each year. This mentor will be a faculty member at an institution that does not presently have sufficient infrastructure to support and encourage such research. It is expected that the experience of participating in this program will enable this faculty member to establish an active undergraduate program at her institution.

Three faculty members have expressed interest in such participation and possible projects that they would supervise are included here. Their vitae are also included in Section E of this proposal.

**Project: Linking Program Implementations to Original Specifications****Alyce Brady, Kalamazoo College**

This project will focus on developing a system that will establish and maintain hypertext links between formal specifications of object-oriented library components and corresponding assertions in the code that implements them. This system will help developers of object-oriented classes to pin-point code segments that must be updated as a result of changing specifications. We will use Java and/or JavaScript, along with cgi scripts, to

maintain the hypertext links between specifications and programs.

#### **Project: A Java Interface for a Documentation Generation System**

**Keith Vander Linden, Calvin College**

This project will focus on the design and development of an interface to a system which automatically produces hypertext documentation for graphical user interfaces. We will explore different modes of interaction with the underlying documentation system, and will implement the interface in Java. This work is part of a larger, ongoing project on interface design, so students will be able to explore other aspects of the system and potentially tailor the work to suit their own interests.

#### **Project: Using the WWW as the delivery mechanism for interactive, visualization-based instructional modules**

**Myles McNally, Alma College**

This project involves developing an interactive graphics animation system that would allow visualization-based instructional modules to be delivered by the World Wide Web. The client would be created by extending an extensible browser (such as Hot Java) so that all computation would be done at the client level. Problems to be solved include the definition of the graphics system, the appropriate extension to browser software, and the construction of prototype instructional modules.

### **4.6 Post-Project Activities**

All REU participants will be required to submit a final written report on their research activities, an electronic poster describing their work, and an evaluation of the overall program. The P.I. and the mentor will recommend follow-up activities for each participant to carry out during the following academic year. For external students this might involve remote access to Hope College computing facilities as well as communication via electronic mail between student and mentor. For Hope students, this follow-up work may include formal continuation of the project by enrollment in the departmental Senior Project Seminar and/or the Independent Study/Research course. All participants will be encouraged to make a presentation of their work at their home institution and at a scientific meeting. When appropriate, the student's work will be included in a publication submitted to a professional journal.

## **5 THE RESEARCH ENVIRONMENT**

### **5.1 Faculty**

The department's four faculty members are a good mix of junior and senior faculty, with two of each. Three of the faculty hold a Ph.D. in Computer Science and all are active in Computer Science research and have experience supervising undergraduate research. Three members of the faculty have been principal investigators of National Science Foundation projects in the past six years. In addition, they have been the recipients of support for research from other government agencies including the Department of Energy, NASA, DARPA, and the United States Air Force.

In the six years of REU programs at Hope, all faculty in the department have supervised undergraduate research teams. Faculty participating during the next three years will be Herb Dershem, Mike Jipping, and Kevin Denelsbeck. These faculty will supervise the research of the proposed project as their availability permits.

In addition, we will attempt to encourage participation by faculty from institutions that lack the infrastructure for undergraduate research. In order to do this, we will, each year, invite applications from faculty members who wish to participate in this project. Each applicant will submit a proposed research project along with her application. From among these applicants, one will be chosen to join the program and work with two students during the course of this program. The faculty member will be required to be on the Hope College campus working with the students at least two days of every week during the ten weeks of the project. She will also remain in contact with the students electronically on the remaining days. It is expected that a different institution will be represented by an external faculty member each of the three years of this project.

## 5.2 Facilities and Equipment

The departments of Computer Science, Mathematics, and Physics are housed in Vander Werf Hall. This building was constructed in 1964 and a major renovation was completed in 1990, resulting in the building being joined to Van Zoeren Hall. The complex now includes, in addition to the three laboratories that are exclusively for Computer Science, three campus-wide computer laboratories that contain 53 PC-compatible systems, 6 Macintosh computers, 50 X-terminals, and a wide variety of workstations, all connected via a campus network backbone.

The Computer Science Department's hardware facilities are currently 34 Sun workstations. These are shown in the table below:

	Unit	Memory	Disk Capacity	Notes
Servers	SPARCserver 1000 E	128 MBytes	10 GBytes	This is our main server. 2 processors
	SPARCstation 5	32 MBytes	5 GBytes	Usenet News server.
General Purpose Lab	7 SPARCstation 5's	32 MBytes	1 GByte	
	1 Ultra-1	32 MBytes	2 GBytes	
	1 Ultra-2	64 MBytes	2 GBytes	Two processors
OS/Net-working Lab	1 SPARCstation 20	64 MBytes	2 GBytes	Two processors
	1 SPARCstation 20	32 Mbytes	2 GBytes	
	2 SPARCstation 5's	32 MBytes	1 GBytes	
	1 Ultra-1	64 MBytes	2 GBytes	
	2 Pentium 120's	16 MBytes	1 GBytes	
Faculty	2 SPARCstation 5's	32 MBytes	1.0 GBytes	
	1 Ultra-2	64 MBytes	2 GBytes	Two processors
ClabRoom	13 Ultra-1's	64MBytes	2 GBytes	
Miscellaneous	Exabyte 8505			8mm tape drive on Server
	3 Laser Printers			
	Livingston PM2			10 port communication server
	5 Modems			USRobotics, 56Kbaud
	Networking Equipment			Various hubs and cabling

Lab software includes the standard Sun operating system and documentation, windowing system, and reference material. Unbundled components include C and C++ compilers, network management and protocol implementations, word processors, and code debugging environments. Many public domain tools are in use.

The lab is currently administered by one individual. About 7 hours per week are devoted to lab

administration. Both software and hardware administration is handled by this individual. Operator duties, e.g., file system backups and preventative maintenance are mostly automated. The department handles maintenance of its facilities by itself. It negotiates maintenance contracts, keeps on hand supplies for its printers and other peripherals, provides the "raw materials" (e.g., cable, connectors, etc.) and tools for hardware maintenance, and maintains a "spare parts machine" for computer hardware maintenance.

### 5.3 Departmental Statistics

Year	Graduating Majors	Graduates Attending Grad School	Independent Study and Research Projects	Summer Research Students
1983-84	16	2	22	0
1984-85	29	3	34	0
1985-86	18	2	12	0
1986-87	15	3	5	0
1987-88	16	2	17	1
1988-89	8	4	9	2
1989-90	14	3	10	2
1990-91	14	1	14	3
1991-92	12	6	2	7*
1992-93	8	2	5	8*
1993-94	4	1	2	8*
1994-95	7	3	4	8*
1995-96	14	3	6	6*
1996-97	13	2	5	7*

\* These figures include 6 students each summer supported by NSF REU

\*\* These figures include positions already funded plus 6 each summer which would be funded by this proposal.

## 6 STUDENT PARTICIPANTS

### 6.1 Recruitment of Participants

#### 6.1.1 Hope College Students

The summer research program in Computer Science will be announced in all upper-level Computer Science classes, in the departmental seminar, through notices on the departmental bulletin board, and through an electronic mailing to all Computer Science majors. A packet describing the program, research areas, participant benefits and obligations, and applications procedures will be available from the departmental office. Since upper-level classes in Computer Science are typically smaller than 20 students, the professors will be able to individually encourage especially promising students to apply including women and minorities.

#### 6.1.2 Non-Hope College Students

Five of the eight participants each summer will be from institutions other than Hope College. Two of these will be chosen from the institution of the outside faculty member. Recruiting at that institution will follow the same pattern as that described above for Hope College students. The selected outside faculty member will direct the

process of recruiting students at her institution.

Three participants will be selected from institutions other than Hope College and the institution of the outside faculty mentor. A special effort will be made to encourage women and minorities from other institutions to apply.

A program announcement will be sent to the Mathematics and Computer Science chairs and the Officer for Minority Affairs at all colleges and universities within an approximate 500 mile radius of Hope College. These Chairs and Officers will be asked to send the names of women and minorities who are majoring in Computer Science. They will also be asked to post the announcement of the program. The P.I. will contact all students whose names are submitted through this process to encourage them to apply to the program.

Extensive use will be made of the Internet. Announcements will be distributed to a mail list of Computer Science Departments via email. This mail list has been constructed from inquiries received during the past six years of the Hope College Computer Science REU program. In addition, publicity and application forms will be made available via World Wide Web. Information will also be sent to comp.edu, a USENET news groups, and to the listserver for ACM Special Interest Group for Computer Science Education (SIGCSE).

Contacts will be made with Computer Science department chairs at institutions which have historically enrolled a large percentage of minority students, inviting faculty to nominate minority students at their institution for participation in the program. Past experience has shown that this mailing has resulted in a large number of applications to our program, though we have been less successful in turning those applications into participants.

All promotional materials will be distributed by January 31. Applications and transcripts will be due by March 15 and notification of the awards will be made no later than March 22.

## **6.2 Selection Process**

There will be eight student participants in the program, three from Hope College, two from the visiting faculty mentor's institution, and three from other institutions. During the application process, the Hope students will be considered as one pool of applicants, applicants from the visiting mentor's school another, and the non-Hope students still another.

All applicants will be asked to submit a written statement indicating their career goals and the role of research in their future plans. Students from other institutions will also be asked to provide a transcript and a letter of reference from a faculty member. These items will be obtained directly by the P.I. for Hope student applicants.

A number of criteria will be considered in the selection of participants within each pool of applicants. These are the applicant's (1) academic record; (2) demonstrated interest in Computer Science and research; (3) potential for success in research as indicated by independence, creativity, and motivation; and (4) career plans. The faculty participants in this program will comprise the selection committee that will make the final selection of student participants.

The overall aim of this process is to provide flexible guidelines for the selection of participants to insure that the program will have the maximum impact on the participants in their choice of a career in Computer Science and on the discipline of Computer Science itself.

## **6.3 Matching Participants with Research Projects**

After the student participants are selected, the P.I. will coordinate the assignment of students to specific faculty mentors and research projects. Each faculty mentor will be asked to select from the participants those students whose interests and qualifications match the requirements of one of the mentor's research programs and interview that group of students. Those students at institutions other than Hope College will be interviewed by phone. As a result of these interviews, each mentor will provide a priority list of those participants that she would like to supervise. The P.I. will then make the final assignments based on these priority lists as well as consultation with the mentors and the student participants. No assignment will be made that is not enthusiastically supported by both the mentor and the student participant.

## 7 Project Evaluation

The evaluation components will be associated with each of the goals listed in Section 1 of this proposal as specified below:

- *to support and enhance the undergraduate research program of the Hope College Computer Science Department*

This will be evaluated by the amount of research activity as measured by grants received, articles published, and papers presented by the students and faculty at Hope College.

- *to provide a model for Computer Science undergraduate research to other primarily undergraduate institutions*

This will be evaluated through the number of participants of this program who appear in panels at national or regional meetings and the number of articles written by participants encouraging undergraduate Computer Science research. In particular, the Principal Investigator hopes to write an article for the Council on Undergraduate Research Quarterly.

- *to encourage and support undergraduate research at institutions that presently lack the infrastructure to support such research*

The success of research programs at institutions of the external faculty mentors will be measures by grants, articles, and papers, and by the undergraduate research activity at these institutions following the faculty mentor's participation in this project.

- *to motivate undergraduate participants to pursue careers in Computer Science research*

All participants will complete an exit interview survey upon completion of their summer participation and they will be asked to complete another survey three years following their participation.

- *to increase the number of undergraduates from groups underrepresented in Computer Science research to consider such careers*

Data will be collected that will quantify the participation of underrepresented groups.

## E. Biographical Sketches

### Herbert L. Dershem

Department of Computer Science  
Hope College  
Holland, MI 49422-9000

**Academic Rank:** Professor of Computer Science

**Education:** B.S. University of Dayton, 1965  
M.S. (Computer Science) Purdue University, 1967  
Ph.D. (Computer Science) Purdue University, 1969

**Experience:**

Assistant Professor, Hope College, 1969-1974  
Associate Professor, Hope College, 1974-1981  
Professor, Hope College, 1981-  
Visiting Research Scientist, Oak Ridge National Laboratories, 1977-1978  
Visiting Professor, Boston University Overseas Program, 1982-1983  
Distinguished Visiting Professor, United States Air Force Academy, 1993-1994

**Honors and Awards:**

NDEA Fellow, Purdue University, 1965-1968  
Project COMPUTe Awardee, Dartmouth College, 1972  
NASA/ASEE Summer Fellow, Goddard Space Flight Center, 1976  
Oak Ridge Associated Universities Summer Fellow, 1977

**Grants:**

Co-director, "Introduction of the Computer in the Statistics Curriculum," NSF Office of Computing Activities, 1971-73  
Director, "A Modular Approach to the Introductory Course in Computer Science," NSF Local Course Improvement Program, 1978-1980  
Co-Director, "A Microcomputer Laboratory for use in Teaching Statistics," NSF Instructional Scientific Equipment Program, 1979-1980  
Director, "CSNET Membership in Support of Computer Science Research," NSF RUI Program, 1987-1990  
Director, "REU: An Undergraduate Research Participation Program in Computer Science," NSF CISE, 1992-1994  
Director, "Use of Ada, Laboratories, and Visualization in the Teaching of Data Structures and Discrete Mathematics," DARPA Curriculum Development Grant, 1993-1994  
Director, "Curriculum and Textbook Development Using Ada 9X for the Teaching of Object-Oriented Concepts," U.S. Air Force Contract, 1994-1996  
Director, "REU: An Undergraduate Research Participation Program in Computer Science," NSF CISE, 1995-1997

**Publications:** (25 total, those since 1992 included below)

*Programming Languages: Models and Structures, 2nd Edition*, H. Dershem and M. Jipping, PWS Publishing, 1995  
"Finite State Machine Simulation in a Introductory Lab," Ryan McFall\* and Herbert L. Dershem, *Proceedings of the 1994 SIGCSE Technical Symposium, SIGCSE Bulletin*, 26,1,126-130, March, 1994  
"Data Structures with Ada Packages, Laboratories, and Animations," H. Dershem, W. Barth\*, C. Bowsher\*, and D. Brown\*, *Proceedings of the First Australasian Conference on Computer Science Education*, 32-38, July, 1996.

**Collaborators:** Advisors, and Advisees: Robert Lynch, David Cook, Rick Sward

## E. Biographical Sketches

### Michael J. Jipping

Department of Computer Science  
Hope College  
Holland, MI 49422-9000

**Academic Rank:** Associate Professor

**Education:**

B.S., Calvin College, 1981  
M.S., University of Iowa (Computer Science), 1984  
Ph.D., University of Iowa (Computer Science), 1986

**Experience:**

Assistant Professor, University of Iowa, 1986-1987  
Assistant Professor, Hope College, 1987-1995  
Associate Professor, Hope College, 1995-present  
Research Fellow, NASA Langley Research Center, Summer, 1992

**Grants:**

Director, "A New Course in Parallel Programming for Undergraduates," NSF Instrumentation and Laboratory Improvement, 1990  
Recipient, NASA Joint Venture Award, 1992-1995  
Director, "Building a Software Infrastructure for Parallel Software Design," NASA Langley Research Center, 1993-1996  
Recipient, NASA/Jove Augmentation Award, 1995-1996  
Director, "Laboratory for Experimenting with Operating Systems and Networking Concepts," NSF Instrumentation and Laboratory Improvement, 1995-1997.  
Co-Director, "An Integrated Classroom/Laboratory for Introducing Students to Object-Oriented Concepts," NSF Instrumentation and Laboratory Improvement, 1996-1998.

**Publications:** (Undergraduate co-authors indicated with an asterisk)

M.J. Jipping and B. Kim, "Imperative Language Paradigm", in *The Computer Science and Engineering Handbook*, A. Tucker, ed, CRC Press.  
H.L. Dershem and M.J. Jipping, *Programming Languages: Structures and Models*, Second Edition, PWS-Kent Publishing Co., 1995.  
M.J. Jipping, "Using Tcl as a ToolTalk Encapsulation Mechanism", *Proceedings of the 1993 Sun User Group Conference*, December 1993, pp. 161-174.  
D.E. Eckhardt, M.J. Jipping, C.J. Wild, S.J. Zeil, and C.C. Roberts, "Open Environments to Support Systems Engineering Tool Integration: A Study Using the Portable Common Tool Environment (PCTE)", NASA Technical Memorandum 4489, NASA Langley Research Center, September 1993.  
M.J. Jipping, "Developing a Formal Model for Concurrency Control Design", *Proceedings of the Second Great Lakes Computer Science Conference*, April 1991.  
R. Ford, M.J. Jipping, R. Schultz, and B. Wenhardt, "On the Performance of Concurrent Tree Algorithms", *Journal of Parallel and Distributed Computing*, 8, March 1990, pp. 253-266.  
M.J. Jipping, J.R. Toppen\*, and S. Weeber\*, "Concurrent Distributed Pascal: A Hands-on Introduction to Concurrency", *Proceedings of the 1990 SIGCSE Technical Symposium, SIGCSE Bulletin*, Vol. 22, No. 1 (February, 1990), pp. 94-99.

**Collaborators, Advisors, Advisees:** Ray Ford

## E. Biographical Sketches

### Kevin M. Denelsbeck

Department of Computer Science  
Hope College  
Holland, MI 49422-9000

**Academic Rank:** Assistant Professor

**Education:**

B.A., Rutgers University - Camden Campus, 1988  
M.S., University of North Carolina (Computer Science), 1992  
Ph.D., University of North Carolina (Computer Science), 1998 (expected)

**Experience:**

Assistant Professor, Hope College, 1997-present

**Publications:** (Undergraduate co-authors indicated with an asterisk)

- "How many screens does a CT workstation need?", D. V. Beard, B. M. Hemminger, K. M. Denelsbeck, and R. E. Johnston, J. Digital Imaging, 6(1), 1-9, Feb 1994
- "CT Interpretations with a Low Cost Workstation: A Timing Study," D. V. Beard, B. M. Hemminger, E. D. Pisano, K. M. Denelsbeck, D. M. Warshauer, M. A. Mauro, B. Keefe, W. H. McCartney, and C. B. Wilcox, J. Digital Imaging, 7(3), 133-139, Aug 1994
- "Eye-Movement During CT Interpretation: Eyetracker Results & Image-Display-Time Implications," D. V. Beard, E. D. Pisano, K. M. Denelsbeck, and R. E. Johnston, J. Digital Imaging, 7(2), 189, Nov 1994
- "Stacked-Metaphor Workstation versus Film Alternator for Interpretation of Serial Chest CT Examinations," D. V. Beard, P. L. Molina, K. E. Muller, K. M. Denelsbeck, B. M. Hemminger, J. R. Perry, M. P. Braeuning, D. H. Glueck, W. D. Bidgood, M. A. Mauro, R. C. Semelka, A. S. Willms, D. Warshauer, E. D. Pisano, Radiology, 197, 753-758, 1995
- "QGOMS: A Direct-Manipulation Tool for Simple GOMS Models," D. V. Beard, D. K. Smith, and K. M. Denelsbeck, ACM/CHI 1996, II, 25, 1996
- "Quick and Dirty GOMS: A Case Study of Computed Tomography Interpretation," D. V. Beard, D. K. Smith, and K. M. Denelsbeck, Human-Computer Interaction, 11, 157-180, 1996
- "Quick GOMS: A Visual Software Engineering Tool for Simple Rapid Time-Motion Modeling," D. V. Beard, S. Entikin, P. Conroy, N. C. Wingert, C. D. Schou, D. K. Smith, K. M. Denelsbeck, ACM interactions, 4(3), 31-36, May/June 1997
- "Models of Rapid Aimed Movement for Virtual Environments with Lag," K. M. Denelsbeck, Ph. D. thesis, University of North Carolina, 1998 (expected)

**Collaborators, Advisors, Advisees:** James Coggins, David Beard

## E. Biographical Sketches External Faculty Mentor Candidates

### Keith N. Vander Linden

Department of Computer Science  
Calvin College  
Grand Rapids, MI 49546

**Academic Rank:** Assistant Professor

**Education:**

B.S., Central College, 1983  
M.S., University of Iowa (Computer Science), 1985  
Ph.D., University of Colorado (Computer Science), 1993

**Experience:**

Software Engineer, Rockwell International, 1985-1988  
Research Fellow, Information Technology Research Institute, 1993-1996  
Assistant Professor, Calvin College, 1996-present

**Publications:** (Undergraduate co-authors indicated with an asterisk)

Paris, C. and Vander Linden, K. Drafter: An interactive support tool for writing multilingual instructions. *IEEE Computer*, 29(7): 49-56.  
Paris, C., Vander Linden, K., Fischer, M., Hartley, A., Pemberton, L., Power, R., and D. Scott. A support tool for writing multilingual instructions. In *Proceedings of the Fourteenth International Joint Conference on Artificial Intelligence*, Aug 20-25, Montreal, Canada 1398-1404.  
DRAFTER (1993-96), a project funded by the UK Engineering and Physical Sciences Research Council, built a system that allows its users to build a formal specification of the procedure involved in using a particular graphical user interface. It then generates drafts of the instructions for this interface in English and French.  
GIST (1993-96), a multi-national European project funded by the EC Language Research Engineering initiative, built a system that allows its users to specify the information to be solicited by an administrative form. It then generates the text and layout of that form in English, German, and Italian.  
ISOLDE (1996-99), a project funded by the Office of Naval Research, is building a system that integrates the processes of interface design and documentation by taking the interface specification produced by an interface design tool and passing it to a partially automated document generation system. It allows the incremental generation code prototypes accompanied by drafts of the on-line documentation.

**Collaborators, Advisors, Advisees:** None

### Myles F. McNally

Department of Mathematics and Computer Science  
Alma College  
Alma, MI

**Academic Rank:** Associate Professor

**Education:**

B.S., Drexel University (Humanities and Social Sciences), 1974  
Ph.D., Temple University (Philosophy) 1982

## E. Biographical Sketches

### Experience:

Assistant Professor, Washburn University, 1982-1983  
Drexel Fellow, Drexel University, 1983-1985  
Assistant Professor, Drexel University, 1985-1992  
Associate Professor, Alma College, 1992-present

### Publications: (Undergraduate co-authors indicated with an asterisk)

"Using the WWW as the delivery mechanism for interactive, visualization-based instructional modules,"  
To appear in the Proceedings of the 2nd SIGCSE/SIGCUE Conference on Integrating Technology into  
Computer Science Education, (with Joseph Bergin, Ricardo Jiménez-Peris, Tom Naps, Marta Patiño-  
Martínez, Viera K. Proulx, Jorma Tarhio)  
"An Overview of Visualization: Its Use and Design," SIGCSE Bulletin, (V. 28, Special Issue), 1996 and  
SIGCUE Outlook, (V. 24, N. 3), 1996 (with J. Bergin, K. Brodie, M. Goldweber, R. Jimenez-Peris, S.  
Khuri, M. Patino-Martinez, T. Naps, S. Roger, and J. Wilson)  
"Cataloging Self-Complementary Graphs of Order Thirteen," Congressus Numeratium, (V. 108), Dec. 1995  
(with Robert Molina)  
"Review of Alvin Goldman's Philosophy and Cognitive Science," SIGART Bulletin (V. 6, N. 2), 1995

**Collaborators, Advisors, Advisees:** None

### Alyce Brady

Department of Mathematics and Computer Science  
Kalamazoo College  
Kalamazoo, MI 49006

**Academic Rank:** Assistant Professor

### Education:

A.B., Bowdoin College, 1983  
M.S., Rensselaer Polytechnic Institute (Computer Science), 1988  
Ph.D., Rensselaer Polytechnic Institute (Computer Science), 1994

### Experience:

Member of Programming Staff, AT&T Communications, 1983-1986  
Assistant Professor, Kalamazoo College, 1994-present

### Publications: (Undergraduate co-authors indicated with an asterisk)

Brady, Alyce F. Axiomatic Specification for the Synchronization of Object-Oriented Services. Ph.D. thesis,  
Rensselaer Polytechnic Institute, Troy, NY, September 1994.  
Faulstich-Brady, Alyce. "A Taxonomy of Inheritance Semantics." In Proceedings of the 7th International  
Workshop on Software Specification and Design (IWSSD-7), Redondo Beach, CA, December 1993.  
(Sponsored by IEEE Computer Society.)  
Faulstich-Brady, Alyce. "Axiomatic Design and Synchronization: A Model for Maintaining Multiple  
Language Versions of Object-oriented Services," Technical Report 93-25, Department of Computer  
Science, Rensselaer Polytechnic Institute, Troy, NY, October 1993.

**Collaborators, Advisors, Advisees:** David L. Spooner

First Year

# SUMMARY PROPOSAL BUDGET

ORGANIZATION				FOR NSF USE ONLY			
				PROPOSAL NO.		DURATION (MONTHS)	
PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR Herbert L. Dershem				AWARD NO.		Proposed	Granted
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-months		Funds Requested By	Funds Granted by NSF
				CAL	ACAD	SUMR	Proposer (If Different)
1. Herbert L. Dershem					.5	2	\$3,500 (a)
2. Kevin Denelsbeck						1	1,500 (b)
3. Michael J. Jipping						1	1,500 (b)
4. External Faculty						1	1,500 (b)
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)							
7. ( ) TOTAL SENIOR PERSONNEL (1-6)					.5	5	8,000
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (1) POST DOCTORAL ASSOCIATES							
2. ( ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)							
3. ( ) GRADUATE STUDENTS							
4. ( ) UNDERGRADUATE STUDENTS							
5. ( ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							
6. ( ) OTHER							
TOTAL SALARIES AND WAGES (A + B)							8,000
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							1,600 (c)
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							9,600
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							1,500 (d)
2. FOREIGN							
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 25,600 (e)							
2. TRAVEL 2,800 (f)							
3. SUBSISTENCE 2,000 (g)							
4. OTHER							
( ) TOTAL PARTICIPANT COSTS							30,400
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							1,000 (h)
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							
3. CONSULTANT SERVICES							
4. COMPUTER SERVICES							
5. SUBAWARDS							
6. OTHER							
TOTAL OTHER DIRECT COSTS							1,000
H. TOTAL DIRECT COSTS (A THROUGH G)							42,500
I. INDIRECT COSTS (F&A) (SPECIFY RATE AND BASE) 25% of student stipends							
TOTAL INDIRECT COSTS (F&A)							6,400
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							48,900
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECT SEE GPG II.D.7.j.)							
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							48,900 \$
M. COST-SHARING: PROPOSED LEVEL \$				AGREED LEVEL IF DIFFERENT: \$			
PI/PD TYPED NAME AND SIGNATURE* Herbert L. Dershem				DATE 9/12/97		FOR NSF USE ONLY INDIRECT COST RATE VERIFICATION	
ORG. REP. TYPED NAME & SIGNATURE* James M. Gentile				DATE 9/12/97		Date Checked	Date of Rate Sheet
						Initials-ORG	

# SUMMARY PROPOSAL BUDGET

ORGANIZATION				FOR NSF USE ONLY			
				PROPOSAL NO.		DURATION (MONTHS)	
PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR Herbert L. Dershem				AWARD NO.		Proposed	Granted
A. SENIOR PERSONNEL: P/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. Show number in brackets)				NSF-Funded Person-months		Funds Requested By	Funds Granted by NSF
				CAL	ACAD	SUMR	Proposer (If Different)
1. Herbert L. Dershem					.5	2	\$3,500 (a)
2. Kevin Denelsbeck						1	1,500 (b)
3. Michael J. Jipping						1	1,500 (b)
4. External Faculty						1	1,500 (b)
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)							
7. ( ) TOTAL SENIOR PERSONNEL (1-6)					.5	5	8,000
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (1) POST DOCTORAL ASSOCIATES							
2. ( ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)							
3. ( ) GRADUATE STUDENTS							
4. ( ) UNDERGRADUATE STUDENTS							
5. ( ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							
6. ( ) OTHER							
TOTAL SALARIES AND WAGES (A + B)							8,000
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							1,600 (c)
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							9,600
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							1,500 (d)
2. FOREIGN							
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 25,600 (e)							
2. TRAVEL 2,800 (f)							
3. SUBSISTENCE 2,000 (g)							
4. OTHER							
( ) TOTAL PARTICIPANT COSTS							30,400
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							1,000 (h)
2. PUBLICATION COSTS/DOCUMENTATION/DISEMINATION							
3. CONSULTANT SERVICES							
4. COMPUTER SERVICES							
5. SUBAWARDS							
6. OTHER							
TOTAL OTHER DIRECT COSTS							1,000
H. TOTAL DIRECT COSTS (A THROUGH G)							42,500
I. INDIRECT COSTS (F&A) (SPECIFY RATE AND BASE) 25% of student stipends							
TOTAL INDIRECT COSTS (F&A)							6,400
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							48,900
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECT SEE GPG II.D.7.j.)							
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							48,900 \$
M. COST-SHARING: PROPOSED LEVEL \$				AGREED LEVEL IF DIFFERENT: \$			
P/PI TYPED NAME AND SIGNATURE*				DATE		FOR NSF USE ONLY	
Herbert L. Dershem				9/12/97		INDIRECT COST RATE VERIFICATION	
ORG. REP. TYPED NAME & SIGNATURE*				DATE		Date Checked	Date of Rate Sheet
James M. Gentile				9/12/97			Initials-ORG

Third Year

# SUMMARY PROPOSAL BUDGET

ORGANIZATION				FOR NSF USE ONLY			
				PROPOSAL NO.		DURATION (MONTHS)	
PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR Herbert L. Dershem				AWARD NO.		Proposed	Granted
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-months		Funds Requested By Proposer	Funds Granted by NSF (If Different)
				CAL	ACAD	SUMR	
1. Herbert L. Dershem					.5	2	\$3,500 (a)
2. Kevin Denelsbeck						1	1,500 (b)
3. Michael J. Jipping						1	1,500 (b)
4. External Faculty						1	1,500 (b)
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)							
7. ( ) TOTAL SENIOR PERSONNEL (1-6)					.5	5	8,000
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (1) POST DOCTORAL ASSOCIATES							
2. ( ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)							
3. ( ) GRADUATE STUDENTS							
4. ( ) UNDERGRADUATE STUDENTS							
5. ( ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							
6. ( ) OTHER							
TOTAL SALARIES AND WAGES (A + B)				8,000			
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				1,600 (c)			
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				9,600			
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				1,500 (d)			
2. FOREIGN							
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 25,600 (e)							
2. TRAVEL 2,800 (f)							
3. SUBSISTENCE 2,000 (g)							
4. OTHER							
( ) TOTAL PARTICIPANT COSTS				30,400			
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES				1,000 (h)			
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							
3. CONSULTANT SERVICES							
4. COMPUTER SERVICES							
5. SUBAWARDS							
6. OTHER							
TOTAL OTHER DIRECT COSTS				1,000			
H. TOTAL DIRECT COSTS (A THROUGH G)				42,500			
I. INDIRECT COSTS (F&A) (SPECIFY RATE AND BASE) 25% of student stipends							
TOTAL INDIRECT COSTS (F&A)				6,400			
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				48,900			
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECT SEE GPG II.D.7.j.)							
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				48,900 \$			
M. COST-SHARING: PROPOSED LEVEL \$				AGREED LEVEL IF DIFFERENT: \$			
PI/PD TYPED NAME AND SIGNATURE* Herbert L. Dershem				DATE 9/12/97		FOR NSF USE ONLY INDIRECT COST RATE VERIFICATION	
ORG. REP. TYPED NAME & SIGNATURE* James M. Gentile				DATE 9/12/97		Date Checked	Date of Rate Sheet
						Initials-ORG	

Cumulative

# SUMMARY PROPOSAL BUDGET

ORGANIZATION				FOR NSF USE ONLY			
				PROPOSAL NO.		DURATION (MONTHS)	
PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR Herbert L. Dershem				AWARD NO.		Proposed	Granted
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-months		Funds Requested By Proposer	Funds Granted by NSF (If Different)
				CAL	ACAD	SUMR	
1. Herbert L. Dershem					1.5	6	\$10,500 (a)
2. Kevin Denelsbeck						3	4,500 (b)
3. Michael J. Jipping						3	4,500 (b)
4. External Faculty						3	4,500 (b)
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET EXPLANATION PAGE)							
7. ( ) TOTAL SENIOR PERSONNEL (1-6)					1.5	15	24,000
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (1) POST DOCTORAL ASSOCIATES							
2. ( ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)							
3. ( ) GRADUATE STUDENTS							
4. ( ) UNDERGRADUATE STUDENTS							
5. ( ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							
6. ( ) OTHER							
TOTAL SALARIES AND WAGES (A + B)							24,000
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							4,800 (c)
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							28,800
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							4,500 (d)
2. FOREIGN							
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 76,800 (e)							
2. TRAVEL 8,400 (f)							
3. SUBSISTENCE 6,000 (g)							
4. OTHER							
( ) TOTAL PARTICIPANT COSTS							91,200
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							3,000 (h)
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							
3. CONSULTANT SERVICES							
4. COMPUTER SERVICES							
5. SUBAWARDS							
6. OTHER							
TOTAL OTHER DIRECT COSTS							3,000
H. TOTAL DIRECT COSTS (A THROUGH G)							127,500
I. INDIRECT COSTS (F&A) (SPECIFY RATE AND BASE) 25% of student stipends							
TOTAL INDIRECT COSTS (F&A)							19,200
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							146,700
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECT SEE GPG II.D.7.j.)							
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							146,700 \$
M. COST-SHARING: PROPOSED LEVEL \$				AGREED LEVEL IF DIFFERENT: \$			
PI/PD TYPED NAME AND SIGNATURE* Herbert L. Dershem				DATE 9/12/97		FOR NSF USE ONLY INDIRECT COST RATE VERIFICATION	
ORG. REP. TYPED NAME & SIGNATURE*				DATE		Date Checked	Date of Rate Sheet
James M. Gentile				9/12/97			Initials-ORG

## Budget Explanation

- (a) The salary for the Project Director includes \$2,000 for administration of the project and \$1,500 for directing the work of two undergraduates.
  - (b) The salary of the Faculty Associates is \$1,500 for directing the work of two undergraduate participants.
  - (c) Fringe benefits is based on 20% of the faculty salaries.
  - (d) Travel is provided for external faculty mentor for travel from home to Hope College campus.
  - (e) Student stipends are \$320 per week for 10 weeks for 8 students.
  - (f) Travel budget includes \$350 per student. This will be used to reimburse participants for travel between home and campus at the beginning and conclusion of the program, and to pay participant travel expenses to make presentations of their results during the following academic year. Local funds will be used to supplement these travel expenses.
  - (g) The cost of student housing is approximately \$50 per week for a total cost of \$500 per student. Hope College will subsidize one-half of this amount, leaving \$250 per student to be paid by the grant.
  - (h) Other costs are budgeted at \$1,000 per summer. This will be used for postage, telephone, copying, and other general expenses. It will also be used to help defray the cost of off-campus speakers.
- Item I. Indirect Costs: The current charge by the college is 63.3%. As required by this program, the college will forgo the amount in excess of 25% (net of 38.3%) as a contribution to the program.

## Institutional Support

The Computer Science Department and Hope College are committed to the principle that excellence in undergraduate education must include active student involvement in significant research. In support of this commitment, the college will contribute a substantial part of the resources required to carry out this REU project. The college will provide housing to the students at one-half of the normal cost as well as providing all of the services normally available to Hope summer students. These services include use of the physical activities center, the career and counseling center, library facilities, and computing facilities.

The college supports the research efforts of faculty and students through release time for faculty, faculty development grants, travel funds to scientific meetings, acquisition and maintenance of hardware and software, general secretarial and clerical support, and funds for expendable supplies.

The current rate of indirect costs for proposals at Hope is 63.3% of all salaries and wages. Hope College will pay all overhead costs in excess of the 25% of student salaries requested in this proposal.

A summary of Hope College contributions to the REU program is given in the table below:

Contributions of Hope College to REU Project	Annual	Total (3 yrs)
Housing, 8 students @ 10 weeks per student	\$ 2,000	\$6,000
Excluded indirect costs, 63.3% all salaries minus request	\$14,000	\$42,000
<b>TOTAL</b>	<b>\$16,000</b>	<b>\$48,500</b>

## Current and Pending Support

**See GPG Section II.D.8 for guidance on information to include on this form.)**

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Herbert L. Dershem	Other agencies (including NSF) to which this proposal has been/will be submitted.
----------------------------------	-----------------------------------------------------------------------------------

Support:	<input type="checkbox"/> Current	<input checked="" type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title:				
Computer Science Research Experience for Undergraduates				
Source of Support: NSF/CISE/REU				
Total Award Amount: \$146,700		Total Award Period Covered: Feb. 1, 1998 - Jan. 31, 2001		
Location of Project: Hope College				
Person-Months Per Year Committed to the Project.		Cal:	Acad: 1.5	Sumr: 2

Support:	<input type="checkbox"/> Current	<input checked="" type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title:				
Using an Integrated, Web-Based Learning Environment in Computer Science				
Courses for General Education Students and Majors				
Source of Support: NSF/DUE/CCD				
Total Award Amount: \$147,866		Total Award Period Covered: May 1, 1998 - July 31, 2000		
Location of Project: Hope College				
Person-Months Per Year Committed to the Project.		Cal:	Acad: 2.25	Sumr: 2

Support:	<input checked="" type="checkbox"/> Current	<input type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title:				
An Integrated Classroom/Laboratory for Introducing Students to Object-Oriented Concepts				
Source of Support: NSF/DUE/ILI				
Total Award Amount: \$46,356		Total Award Period Covered: June 15, 1996 - May 31, 1998		
Location of Project: Hope College				
Person-Months Per Year Committed to the Project.		Cal:	Acad: 0	Sumr: 0

Support:	<input type="checkbox"/> Current	<input type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title:				
Source of Support:				
Total Award Amount: \$		Total Award Period Covered:		
Location of Project:				
Person-Months Per Year Committed to the Project.		Cal:	Acad:	Sumr:

Support:	<input type="checkbox"/> Current	<input type="checkbox"/> Pending	<input type="checkbox"/> Submission Planned in Near Future	<input type="checkbox"/> *Transfer of Support
Project/Proposal Title:				
Source of Support:				
Total Award Amount: \$		Total Award Period Covered:		
Location of Project:				
Person-Months Per Year Committed to the Project.		Cal:	Acad:	Sumr:

\*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

## Current and Pending Support

**See GPG Section II.D.8 for guidance on information to include on this form.)**

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.			
Investigator: Michael J. Jipping	Other agencies (including NSF) to which this proposal has been/will be submitted.		
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support			
Project/Proposal Title:			
Using an Integrated, Web-Based Learning Environment in Computer Science			
Courses for General Education Students and Majors			
Source of Support: NSF/DUE/CCD			
Total Award Amount: \$147,866		Total Award Period Covered: May 1, 1998 - July 31, 2000	
Location of Project: Hope College			
Person-Months Per Year Committed to the Project.		Cal:	Acad: 2.25    Sumr: 2
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support			
Project/Proposal Title:			
An Integrated Classroom/Laboratory for Introducing Students to Object-			
Oriented Concepts			
Source of Support: NSF/DUE/ILI			
Total Award Amount: \$46,356		Total Award Period Covered: June 15, 1996 - May 31, 1998	
Location of Project: Hope College			
Person-Months Per Year Committed to the Project.		Cal:	Acad: 0    Sumr: 0
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support			
Project/Proposal Title:			
Source of Support:			
Total Award Amount: \$		Total Award Period Covered:	
Location of Project:			
Person-Months Per Year Committed to the Project.		Cal:	Acad:    Sumr:
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support			
Project/Proposal Title:			
Source of Support:			
Total Award Amount: \$		Total Award Period Covered:	
Location of Project:			
Person-Months Per Year Committed to the Project.		Cal:	Acad:    Sumr:
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support			
Project/Proposal Title:			
Source of Support:			
Total Award Amount: \$		Total Award Period Covered:	
Location of Project:			
Person-Months Per Year Committed to the Project.		Cal:	Acad:    Sumr:

\*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.



# **I. Supplementary Documentation**

**Hope College**

**Department of Computer Science**



## **Undergraduate Research in Computer Science Summer 1997**

The Computer Science Department at Hope College with support from the Research Experiences for Undergraduates Program of the National Science Foundation, is providing an opportunity for a number of undergraduate computer science students to participate in a ten-week research program.

**Dates:** May 27, 1997 to August 1, 1997

**Stipend:** \$3,000

**Housing:** On-campus housing provided at no cost

**Travel:** Limited travel funds are available for participants

**Eligibility:** Any U.S. citizen who has not received a baccalaureate degree and will be enrolled in an undergraduate degree program in Fall, 1997 is eligible. Women and members of minority groups are particularly encouraged to apply.

**Projects:** Research opportunities are available in a variety of fields of Computer Science.

**Application Deadline:** February 28, 1997

**Applications and Further Information:** Available from your Computer Science Department or from

**Herbert L. Dershem  
Department of Computer Science  
Hope College  
Holland, MI 49423**

**(616) 395-7508**

**FAX: (616) 395-7123**

**reu@cs.hope.edu**

**Internet:** There is more information available via anonymous FTP from the site **smaug.cs.hope.edu** under the **/pub/reu** directory. Also, information is available on the World Wide Web at

**<http://www.cs.hope.edu/~dershem/info.html>**

Resent-Message-Id: <199903121631.LAA07103@cs.hope.edu>  
Resent-Date: Fri, 12 Mar 1999 11:26:58 -0500  
Resent-To: dershem@cs.hope.edu  
X-Sender: Arndt@mail.hope.edu  
Date: Fri, 12 Mar 1999 11:27:27 -0500  
To: jacobson@hope.edu, dershem@hope.edu  
From: Tracey Arndt <Arndt@hope.edu>  
Subject: AWARD 9732339, Dershem, Herbert  
Cc: gentile@hope.edu, kraay@hope.edu  
Mime-Version: 1.0

>Date: Fri, 12 Mar 99 10:46:42 EDT  
>To: <arndt@hope.edu>  
>From: "award" <AWARD@main.nsf.gov>  
>Subject: AWARD 9732339, Dershem, Herbert

Award Date	March 12, 1999
Grant No.	EIA-9732339
Amendment No.	001

```
>Dr. John H. Jacobson, Jr.  
>President  
>Hope College  
>P.O. Box 9000  
>Holland, MI 49422-9000
```

>Dear Dr. Jacobson:

>The National Science Foundation hereby awards \$48,900 to Hope College  
>for additional support of the project being funded by the  
>above-referenced award.

>This project, under the direction of Herbert L. Dershem, Department of  
>Computer Science, is entitled:

```
>"REU: Computer Science Research Experience for Undergraduates."
```

>This award with this amendment totals \$97,800 and expires  
>January 31, 2000.

>This grant is awarded pursuant to the authority of the National Science  
>Foundation Act of 1950 (42 U.S.C. 1861 et seq.) and is subject to GC-1  
>Grant General Conditions (10/98).

>Except as modified by this amendment, the grant conditions remain  
>unchanged.

>The attached budget indicates the amounts, by categories, on which NSF  
>has based its support.

>The cognizant NSF program official for this grant is Harry G. Hedges  
>(703) 306-1980. The cognizant NSF grants official is Stephanie Gorman  
>(703) 306-1213.

Sincerely,

Stephanie Gorman  
Grants Officer

Resent-Message-Id: <199903121631.LAA07103@cs.hope.edu>  
Resent-Date: Fri, 12 Mar 1999 11:26:58 -0500  
Resent-To: dershem@cs.hope.edu  
X-Sender: Arndt@mail.hope.edu  
Date: Fri, 12 Mar 1999 11:27:27 -0500  
To: jacobson@hope.edu, dershem@hope.edu  
From: Tracey Arndt <Arndt@hope.edu>  
Subject: AWARD 9732339, Dershem, Herbert  
Cc: gentile@hope.edu, kraay@hope.edu  
Mime-Version: 1.0

>Date: Fri, 12 Mar 99 10:46:42 EDT  
>To: <arndt@hope.edu>  
>From: "award" <AWARD@main.nsf.gov>  
>Subject: AWARD 9732339, Dershem, Herbert

Award Date	March 12, 1999
Grant No.	EIA-9732339
Amendment No.	001

```
>Dr. John H. Jacobson, Jr.  
>President  
>Hope College  
>P.O. Box 9000  
>Holland, MI 49422-9000
```

>Dear Dr. Jacobson:

>The National Science Foundation hereby awards \$48,900 to Hope College  
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>The cognizant NSF program official for this grant is Harry G. Hedges  
>(703) 306-1980. The cognizant NSF grants official is Stephanie Gorman  
>(703) 306-1213.

Sincerely,

Stephanie Gorman  
Grants Officer

```
>  
>Email address  
>arndt@hope.edu
```

## SUMMARY PROPOSAL BUDGET

	PERSON MOS			Funds granted
	cal	acad	sumr	By NSF
>A. ( 4.00) Total Senior personnel	0.00	0.50	5.00	\$8,000
>B. Other Personnel				
> 1. ( 0.00) Post doctoral associates	0.00	0.00	0.00	\$0
> 2. ( 0.00) Other professionals	0.00	0.00	0.00	\$0
> 3. ( 0.00) Graduate students				\$0
> 4. ( 0.00) Secretarial-clerical				\$0
> 5. ( 0.00) Undergraduate students				\$0
> 6. ( 0.00) Other				\$0
> Total salaries and wages (A+B)				\$8,000
>C. Fringe benefits (if charged as direct cost)				\$1,600
> Total salaries wages and fringes (A+B+C)				\$9,600
>D. Total permanent equipment				\$0
>E. Travel 1. Domestic				\$1,500
> 2. Foreign				\$0
>F. Total participant support costs				\$30,400
>G. Other direct costs				
> 1. Materials and supplies				\$1,000
> 2. Publication costs/page charges				\$0
> 3. Consultant services				\$0
> 4. Computer (ADPE) services				\$0
> 5. Subcontracts				\$0
> 6. Other				\$0
> Total other direct costs				\$1,000
>H. Total direct costs (A through G)				\$42,500
>I. Total indirect costs				\$6,400
>J. Total direct and indirect costs (H+I)				\$48,900
>K. Residual funds / Small business fee				
> 1. Residual funds (if for further support of current projects GPM 252 and 253)				\$0
> 2. Small business fee				\$0
>L. Amount of this request (J) or (J - K1 + K2)				\$48,900
>M. Cost sharing				

Tracey Arndt  
Administrative Assistant  
Dean of Natural Sciences  
Hope College  
Peale Science Center Rm 175  
Holland, MI 49423  
616-395-7190  
616-395-7923 (fax)



**HOPE COLLEGE**

OFFICE OF THE PRESIDENT

March 15, 1999

Ms. Stephanie Gorman, Grants Officer  
National Science Foundation  
4201 Wilson Boulevard  
Arlington, VA 22230

Dear Ms. Gorman:

SUBJECT: Grant # EIA-9732339  
Amendment # 001

I am pleased to acknowledge your letter of March 12, 1999, regarding the grant award of \$48,900 for additional support of the project being directed by Herbert L. Dershem, Department of Computer Science. The project is entitled:

“REU: Computer Science Research Experience for Undergraduates.”

This award with this amendment totals \$97,800 and expires January 31, 2000.

We pledge our best efforts to use those resources wisely and in accordance with the terms and conditions set forth.

With all good wishes,

John H. Jacobson, President

JHJ/mjw

pc: Dr. Jacob E. Nyenhuis, Provost  
Dr. James Gentile, Dean for the Natural Sciences  
✓ Professor Herb Dershem, Department of Computer Science  
Mr. Barry Werkman, Controller



**HOPE COLLEGE**

OFFICE OF THE PROVOST

April 1, 1999

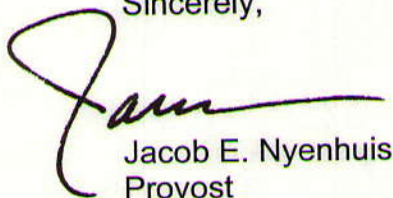
Professor Herb Dershem  
Department of Computer Science  
Hope College

Dear Herb:

I was very pleased to receive a copy of President Jacobson's letter of March 15 to NSF Grants Officer Stephanie Gorman, in which he acknowledged a grant award of \$48,900 in continuing support for your REU grant.

Since renewal grants are not automatic, I congratulate you on the good progress that you have made on your project. Best wishes as you continue to work on your important research project, "REU: Computer Science Research Experience for Undergraduates."

Sincerely,



Jacob E. Nyenhuis  
Provost

JEN:bm/apr99  
pc: Dean James M. Gentile



## ANNUAL REPORT FOR AWARD # 9732339

Herbert L Dershem ; *Hope College*

REU: Computer Science Research Experience for Undergraduates

### **Participant individuals:**

Senior personnel(s): Gordon A Stegink; Michael J Jipping; Alyce F Brady

Undergraduate student(s): Pataricia R Marcoux; David B Christian; Ilya Lipkin; Rebecca E Weinhold; Daisy E Parker; Robert Murillo; Daron Vroon; Jonathan Pater

Participants' Detail

### **Partner organizations:**

### **Activities and findings:**

#### **Research Activities:**

Five projects were conducted during the summer of 1998. They were:

1. Algorithm and Code Animations on the Web
2. Concurrency Anomaly Prevention Using POSIX Threads
3. Exploring Dynamic Web Page Implementations
4. Visualization of Function Calls and Execution
5. Linking Program Implementations to Original Specifications
6. Java Interactive Environment

#### **Research Training:**

All undergraduate participants received training in research techniques and presentation skills.

### **Journal Publications:**

Stegink, G.A., Pater, J. and Vroon, D. , "Computer Science and General Education: Java, Graphics, and the Web", *SIGCSE Bulletin*, vol. 31, (1999). Accepted

### **Book(s) or other one-time publication(s):**

#### **Internet Dissemination:**

<http://www.cs.hope.edu/~dershem/reu/papers98.html> <http://www.cs.hope.edu/~dershem/reu/posters98.ht>

### **Other specific products:**

### **Special Requirements for Annual Project Report:**

*Unobligated funds: less than 20 percent of current funds*

**Categories for which nothing is reported:**

**Participants:** Partner organizations

**Participants:** Other Collaborators

**Education and Outreach**

**Products:** Book or other one-time publication

**Products:** Other specific product

**Contributions Within Discipline**

**Contributions to Other Disciplines**

**Contributions to Education and Human Resources**

**Contributions to Resources for Science and Technology**

**Contributions Beyond Science and Engineering**

**Special Reporting Requirements**

**Animal, Human Subjects, Biohazards**

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## Other Project Participants

**Stegink A Gordon** : Senior personnel  
**Has worked for more than 160 hours** : No  
**Contribution to project** :

Faculty Associate

**Jipping J Michael** : Senior personnel  
**Has worked for more than 160 hours** : No  
**Contribution to project** :

Faculty Associate

**Brady F Alyce** : Senior personnel  
**Has worked for more than 160 hours** : No  
**Contribution to project** :

External Faculty Associate

**Marcoux R Pataricia** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Student Participant

**Christian B David** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Undergraduate Participant

**Lipkin Ilya** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Undergraduate Participant

**Weinhold E Rebecca** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Undergraduate participant

**Parker E Daisy** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Undergraduate participant

**Murillo Robert** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Undergraduate participant

**Vroon Daron** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Undergraduate participant

**Pater Jonathan** : Undergraduate student  
**Has worked for more than 160 hours** : Yes  
**Contribution to project** :

Undergraduate participant

Return



We welcome comments on this system



## FINAL REPORT FOR AWARD # 9732339

Herbert L Dershem ; *Hope College*  
REU: Computer Science Research Experience for Undergraduates

### Participant Individuals:

Senior personnel(s) : Gordon A Stegink; Michael J Jipping  
Undergraduate student(s) : Patricia R Marcoux; David B Christian; Ilya Lipkin; Rebecca E Weinhold;  
Daisy E Parker; Robert Murillo; Daron Vroon; Jonathan Pater  
Senior personnel(s) : Myles McNally  
Undergraduate student(s) : Jessie Link; Jessica Hovater; Josiah Dykstra; Christopher Rowland; Marcia  
Zangrilli; Maria Casipe; Keith Suppes  
Senior personnel(s) : Gary Lewandowski  
Undergraduate student(s) : Michael Branstein; Sarah Dieter; Samantha Sandro; Abigail Walker; Joshua  
Krikke; Sarah Allen; Steven Marlowe; Ngozi Uti  
Senior personnel(s) : Alyce Brady; Andrew Van Pernis

### Participants' Detail

### Partner Organizations:

### Activities and findings:

#### Research and Education Activities:

Six projects were conducted during the summer of 1999. They were:

1. Dynamic Anomaly Detection
2. ALAN: The Algorithm Animator
3. .Java Development Environment
4. Synchronize Implementation of Classes
5. The Function Visualizer
6. WALDO: Web Accessible Learning Design Options

Five projects were conducted during the summer of 1999. They were:

- 1.Exploring Thin Client Technology on Handheld Computers
- 2.Supporting Classroom Interaction Using Handheld Computers
- 3.Algorithm Visualization
- 4.Program Execution Animation and Visualization
- 5.Learning Algorithms Applied to Game Playing

Three projects were conducted during the summer of 2000. They were:

1. Supporting Classroom Interaction Using Handheld Computers
2. Smart(?) LEGO Robots
3. Comparing Methods for Timetable Construction and Student Course Scheduling

Three projects received partial support during the summer of 2001:

1. Electronic Readers and Software: The Textbooks of the Future
2. J V A L L: Java Visual Automated Linked List
3. Hardware Design and Testing Over a LAN

#### **Training and Development:**

All undergraduate participants received training in research techniques and presentation skills.

#### **Outreach Activities:**

In our recruiting and selection process we have made strong efforts to involve underrepresented groups in their participation. In addition, each year we have invited one faculty member and two students from an undergraduate institution that does not presently have an active undergraduate research program.

#### **Journal Publications:**

Stegink, G.A., Pater, J. and Vroon, D. , "Computer Science and General Education: Java, Graphics, and the Web", *SIGCSE Bulletin*, vol. 31, (1999), p. 1. Published

Dershem, H.L., Parker, D.E., Weinhold, R., "A Java Function Visualizer", *Journal of Computing in Small Colleges*, vol. 15, (1999), p. 222. Published

Dykstra, j., Dershem, H., and K. Suppes, "An Abstract Window Toolkit Visualizer for Computer Science Instruction", *Proceedings of the 33rd Midwest Instruction and Computing Symposium*, vol. CD-ROM, (2000), p. CD-ROM. Published

Jipping, M., Krikke, J., Dieter, S., and S. Sandro, "Using Handheld Computers in the Classroom: Laboratories and Collaboration on Handheld Machines", *SIGCSE Bulletin*, vol. 33, (1), p. 169. Published

#### **Book(s) of other one-time publications(s):**

#### **Other Specific Products:**

#### **Internet Dissemination:**

<http://www.cs.hope.edu/~dershem/reu>

This site contains the papers, presentations, and posters of all projects. It also contains the publicity materials that were distributed each year.

#### **Contributions:**

#### **Contributions within Discipline:**

This project has resulted in seventeen successful undergraduate research projects. It has involved faculty from four institutions and students from fourteen institutions. This has proved to be an effective outreach for undergraduate research. Two students supported

under this grant have been awarded best student research at various conferences.

In addition, the results of the projects have contributed to the field of computer science. These results have been particularly noteworthy in two ongoing projects on program visualization and handheld computing in education.

### **Contributions to Education and Human Resources:**

Twelve out of 23 student participants were women and three were members of underrepresented minority groups.

### **Contributions to Resources for Science and Technology:**

All of the projects have resulted in papers and electronic posters that are available on the World Wide Web. Many of these provide teaching resources in computer science.

### **Categories for which nothing is reported:**

**Participants:** Partner organizations

**Participants:** Other Collaborators

**Findings**

**Products:** Book or other one-time publication

**Products:** Other Specific Product

**Contributions to Other Disciplines**

**Contributions Beyond Science and Engineering**

Submit  
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User: dershem  
Host: gandalf  
Class: gandalf  
Job: standard input

Annual Report for Period: 01/2000 - 01/2000

Principal Investigator: Dershem, Herbert L.

Organization: Hope College

Title:

REU Sites: An Undergraduate Research Participation Program in Computer Science

Submitted on: 12/26/2001

Award ID: 0097464

Project Participants

## Senior Personnel

Name: Dershem, Herbert

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Jipping, Michael

Worked for more than 160 Hours: No

Contribution to Project:

Faculty mentor

Name: McFall, Ryan

Worked for more than 160 Hours: No

Contribution to Project:

Faculty mentor

Name: VanderLinden, Keith

Worked for more than 160 Hours: No

Contribution to Project:

Visiting Faculty Mentor

## Post-doc

## Graduate Student

## Undergraduate Student

Name: Augsburg, Derek

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Boes, Matthew

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Ku, Joseph

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Halvorsen, Carrie

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Kelley, Timothy

Worked for more than 160 Hours: Yes

**Contribution to Project:****Research Experience for Undergraduates****Organizational Partners****Other Collaborators or Contacts****Activities and Findings****Research and Education Activities:**

The following seven projects were conducted during the summer of 2001:

1. Infrastructure Design for a Mobile Ad Hoc Network for Parallel Processing
2. Electronic Readers and Software: The Textbooks of the Future
3. Obvis: The Object Visualizer
4. One-to-Many Cryptography
5. Serving User Documentation with Dynamic Web Pages
6. Enhancing A GUI Event Recorder To Support The Automated Creation Of User Documentation
7. Hardware Design and Testing Over a LAN
8. J V A L L: Java Visual Automated Linked List

**Findings:****Training and Development:**

This project developed research skills in the students who participated.

**Outreach Activities:**

We recruited and selected participants to include students from underrepresented groups and from institutions that do not have active research programs.

**Journal Publications****Books or Other One-time Publications****Web/Internet Site****Other Specific Products****Contributions****Contributions within Discipline:****Contributions to Other Disciplines:****Contributions to Human Resource Development:****Contributions to Resources for Research and Education:**

**Contributions Beyond Science and Engineering:**

**Special Requirements**

**Special reporting requirements:** None

**Change in Objectives or Scope:** None

**Unobligated funds:** less than 20 percent of current funds

**Animal, Human Subjects, Biohazards:** None

**Categories for which nothing is reported:**

Organizational Partners

Activities and Findings: Any Findings

Any Journal

Any Book

Any Web/Internet Site

Any Product

Contributions: To Any within Discipline

Contributions: To Any Other Disciplines

Contributions: To Any Human Resource Development

Contributions: To Any Resources for Research and Education

Contributions: To Any Beyond Science and Engineering

User: dershem  
Host: gandalf  
Class: gandalf  
Job: /tmp/Acro.HagyV

From Arndt@HOPE.CIT.HOPE.EDU Fri Feb 20 09:50 EST 1998  
From: Tracey Arndt <Arndt@HOPE.CIT.HOPE.EDU>  
To: Jacobson@HOPE.CIT.HOPE.EDU  
Cc: Dershem@HOPE.CIT.HOPE.EDU, Gentile@HOPE.CIT.HOPE.EDU,  
Kraay@HOPE.CIT.HOPE.EDU  
Subject: AWARD 9732339, Dershem, Herbert  
Date: Fri, 20 Feb 1998 09:51:32 -0500

>Return-path: <AWARD@MAIN.NSF.GOV>  
>Date: Thu, 19 Feb 1998 11:16:15 -0400 (EDT)  
>From: award <AWARD@main.nsf.gov>  
>Subject: AWARD 9732339, Dershem, Herbert  
>To: arndt@HOPE.CIT.HOPE.EDU

>  
> Award Date February 19, 1998  
> Grant No. EIA-9732339  
> Proposal No. EIA-9732339

>  
>Dr. John H. Jacobson, Jr.  
>President  
>Hope College  
>P.O. Box 9000  
>Holland, MI 49422-9000

>  
>Dear Dr. Jacobson:

>  
>The National Science Foundation hereby awards a grant of \$48,900 to Hope  
>College for support of the project described in the proposal referenced  
>above.

>  
>This project, under the direction of Herbert L. Dershem, Department of  
>Computer Science, is entitled:

>  
>"REU: Computer Science Research Experience for Undergraduates."

>  
>This award is effective February 15, 1998 and expires January 31, 1999.

>  
>This is a continuing grant which has been approved on scientific /  
>technical merit for approximately 3 years. Contingent on the  
>availability of funds and the scientific progress of the project, NSF  
>expects to continue support at approximately the following levels:

>  
> FY1999 \$48,900 FY2000 \$48,900

>  
>This grant is awarded pursuant to the authority of the National Science  
>Foundation Act of 1950 (42 U.S.C. 1861 et seq.) and is subject to GC-1  
>Grant General Conditions (12/97) and the following terms and conditions:

>  
>Funds provided by this award include support for "Research Experiences  
>for Undergraduates" in accordance with NSF Announcement 96-102.

>  
>The attached budget indicates the amounts, by categories, on which NSF  
>has based its support.

>  
>The cognizant NSF program official for this grant is John C. Cherniavsky  
>(703) 306-1980. The cognizant NSF grants official is Mavis J. Sinkular  
>(703) 306-1213.

>  
> Sincerely,

**AWARD 9732339, Dershem, Herbert**

Sharon P. Graham  
Grants Officer

>Email address  
>arndt@hope.edu

## SUMMARY PROPOSAL BUDGET

	PERSON MOS			Funds granted	
	cal	acad	sumr	By NSF	
>A. ( 4.00) Total Senior personnel	0.00	0.50	5.00	<u>\$8,000</u>	2000 6000
>B. Other Personnel					
> 1. ( 0.00) Post doctoral associates	0.00	0.00	0.00	\$0	
> 2. ( 0.00) Other professionals	0.00	0.00	0.00	\$0	
> 3. ( 0.00) Graduate students				\$0	
> 4. ( 0.00) Secretarial-clerical				\$0	
> 5. ( 0.00) Undergraduate students				\$0	
> 6. ( 0.00) Other				\$0	3,200
> Total salaries and wages (A+B)				\$8,000	
>C. Fringe benefits (if charged as direct cost)				<u>\$1,600</u>	
> Total salaries wages and fringes (A+B+C)				\$9,600	
>D. Total permanent equipment				\$0	
>E. Travel 1. Domestic				\$1,500	
> 2. Foreign				\$0	
>F. Total participant support costs				<u>\$30,400</u>	
>G. Other direct costs					
> 1. Materials and supplies				\$1,000	
> 2. Publication costs/page charges				\$0	
> 3. Consultant services				\$0	
> 4. Computer (ADPE) services				\$0	
> 5. Subcontracts				\$0	
> 6. Other				\$0	
> Total other direct costs				\$1,000	
>H. Total direct costs (A through G)				\$42,500	
>I. Total indirect costs				\$6,400	
>J. Total direct and indirect costs (H+I)				\$48,900	
>K. Residual funds / Small business fee					
> 1. Residual funds (if for further support of current projects GPM 252 and 253)				\$0	
> 2. Small business fee				\$0	
>L. Amount of this request (J) or (J - K1 + K2)				\$48,900	
>M. Cost sharing					

>  
Tracey Arndt  
Administrative Assistant  
Dean of Natural Sciences  
Hope College  
Peale Science Center Rm 175  
Holland, MI 49423  
616-395-7190  
616-395-7923 (fax)

**Annual Report for Period:** 02/1999 - 01/2000**Submitted on:** 11/06/1999**Principal Investigator:** Dershem, Herbert L.**Award ID:** 9732339**Organization:** Hope College

REU: Computer Science Research Experience for Undergraduates

**Project Participants****Senior Personnel****Name:** Dershem, Herbert**Worked for more than 160 Hours:** No**Contribution to Project:****Name:** Stegink, Gordon**Worked for more than 160 Hours:** No**Contribution to Project:**

Faculty Associate

**Name:** Jipping, Michael**Worked for more than 160 Hours:** No**Contribution to Project:**

Faculty Associate

**Name:** McNally, Myles**Worked for more than 160 Hours:** No**Contribution to Project:**

External Faculty Associate

**Post-doc****Graduate Student****Undergraduate Student****Name:** Suppes, Keith**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Undergraduate Participant

**Name:** Casipe, Maria**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Undergraduate Participant

**Name:** Zangrilli, Marcia**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Undergraduate Participant

**Name:** Rowland, Christopher**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Undergraduate Participant

**Name:** Dykstra, Josiah**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Undergraduate Participant

**Name:** Vroom, Tim

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate Participant

**Name:** Hovater, Jessica

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate Participant

**Name:** Rasche, Karl

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate Participant

**Name:** Link, Jessie

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate participant

**Name:** Pater, Jonathan

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate participant

**Name:** Vroon, Daron

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate participant

**Name:** Murillo, Robert

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate participant

**Name:** Parker, Daisy

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate participant

**Name:** Weinhold, Rebecca

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate participant

**Name:** Lipkin, Ilya

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate Participant

**Name:** Christian, David

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Undergraduate Participant

**Name:** Marcoux, Patricia

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Student Participant

### Organizational Partners

### Other Collaborators or Contacts

### Activities and Findings

#### **Project Activities and Findings:**

Five projects were conducted during the summer of 1999. They were:

- 1.Exploring Thin Client Technology on Handheld Computers
- 2.Supporting Classroom Interaction Using Handheld Computers
- 3.Algorithm Visualization
- 4.Program Execution Animation and Visualization
- 5.Learning Algorithms Applied to Game Playing

#### **Project Training and Development:**

##### **Research Training:**

All undergraduate participants received training in research techniques and presentation skills.

##### **Outreach Activities:**

### Journal Publications

Stegink, G.A., Pater, J. and Vroon, D. , "Computer Science and General Education: Java, Graphics, and the Web", *SIGCSE Bulletin*, p. , vol. 31, (1999). ) Accepted  
Dershem, H.L., Parker, D.E., Weinhold, R., "A Java Function Visualizer", *Journal of Computing in Small Colleges*, p. 222, vol. 15, (1999).  
) Published

### Books or Other One-time Publications

### Web/Internet Sites

#### **URL(s):**

<http://www.cs.hope.edu/~dershem/reu/papers99.html>

<http://www.cs.hope.edu/~dershem/reu/posters99.html>

#### **Description:**

### Other Specific Products

### Contributions

#### **Contributions within Discipline:**

#### **Contributions to Other Disciplines:**

**Contributions to Human Resource Development:**

**Contributions to Science and Technology Infrastructure:**

**Beyond Science and Engineering:**

**Special Requirements**

**Special reporting requirements:** None

**Change in Objectives or Scope:** None

**Unobligated Funds:**

Unobligated funds: less than 20 percent of current funds

**Animal, Human Subjects, Biohazards:** None

**Categories for which nothing is reported:**

Organizational Partners

Activities and Findings: Any Project Training and Development

Activities and Findings: Any Outreach Activities

Any Book

Any Product

Contributions: Any within Discipline

Contributions: To Any Other Disciplines

Contributions: To Any Contributions to Human Resource Development

Contributions: To Any Science or Technology Infrastructure

Contributions: Beyond Science or Engineering