

**INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and
co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS**

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PI/PD Name: Edward D Lipson

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

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

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

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

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

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

Ethnicity Definition:

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

Race Definitions:

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PI/PD Name: Sheryl Burgstahler

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

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

Disability Status:
(Select one or more)
 Hearing Impairment
 Visual Impairment
 Mobility/Orthopedic Impairment
 Other _____
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PI/PD Name: Geoffrey C Fox

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

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

Disability Status:
(Select one or more)
 Hearing Impairment
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PI/PD Name: Corinna E Lathan

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

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

Disability Status:
(Select one or more)
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PI/PD Name: Gregg C Vanderheiden

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

Race:
(Select one or more)
 American Indian or Alaska Native
 Asian
 Black or African American
 Native Hawaiian or Other Pacific Islander
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COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 99-2					FOR NSF USE ONLY	
NSF 99-29			02/01/99		NSF PROPOSAL NUMBER	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					9976583	
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
				002257350		
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <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 ACRONYMS(S)		
150532081						
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
Syracuse University			Syracuse University			
AWARDEE ORGANIZATION CODE (IF KNOWN)			113 Bowne Hall			
0028829000			Syracuse, NY. 132441200			
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT 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 A Cross-Disability-Accessible Knowledge Network for Education and Collaboration in Science and Technology						
REQUESTED AMOUNT \$ 2,556,752	PROPOSED DURATION (1-60 MONTHS) 36 months		REQUESTED STARTING DATE 10/01/99		SHOW RELATED PREPROPOSAL NO., IF APPLICABLE	
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG 1.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)			
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG II.D.10)			Exemption Subsection _____ or IRB App. Date _____			
<input type="checkbox"/> NATIONAL ENVIRONMENTAL POLICY ACT (GPG II.D.10)			<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES _____			
<input type="checkbox"/> HISTORIC PLACES (GPG II.D.10)			<input type="checkbox"/> FACILITATION FOR SCIENTISTS/ENGINEERS WITH DISABILITIES (GPG V.G.)			
<input type="checkbox"/> SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.12)			<input type="checkbox"/> RESEARCH OPPORTUNITY AWARD (GPG V.H)			
<input type="checkbox"/> GROUP PROPOSAL (GPG II.D.12)						
PI/PD DEPARTMENT Department of Physics			PI/PD POSTAL ADDRESS			
PI/PD FAX NUMBER 315-443-9103			Syracuse University			
			Syracuse, NY 132441130			
			United States			
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address		
PI/PD NAME Edward D Lipson	Ph.D.	1971	315-443-9107	edlipson@syr.edu		
CO-PI/PD Sheryl Burgstahler	Ph.D.	1992	205-543-0622	sherylb@cac.washington.edu		
CO-PI/PD Geoffrey C Fox	Ph.D.	1967	315-443-2163	gcf@cs.fsu.edu		
CO-PI/PD Corinna E Lathan	PhD	1994	202-319-5095	lathan@cua.edu		
CO-PI/PD Gregg C Vanderheiden	PhD	1984	608-262-6966	gv@trace.wisc.edu		

CERTIFICATION PAGE

Certification for Principal Investigators and Co-Principal Investigators:

I certify to the best of my knowledge that:

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

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

Name (Typed)	Signature	Social Security No.*	Date
PI/PD Edward D Lipson		*ON FASTLANE SUBMISSIONS* SSNs are confidential and are not displayed	
Co-PI/PD Sheryl Burgstahler			
Co-PI/PD Geoffrey C Fox			
Co-PI/PD Corinna E Lathan			
Co-PI/PD Gregg C Vanderheiden			

Certification for Authorized Organizational Representative or Individual Applicant:

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

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

Debt and Debarment Certifications

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

Is the organization delinquent on any Federal debt? Yes No

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

Certification Regarding Lobbying

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

Certification for Contracts, Grants, Loans and Cooperative Agreements

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

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

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

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

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

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME/TITLE (TYPED) Mary Ann Holmquist, Research Admin. II		02/02/99
TELEPHONE NUMBER 315-443-9358	ELECTRONIC MAIL ADDRESS maholmqu@syr.edu	FAX NUMBER 315-443-9361

*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 INFORMATION SYSTEM AND ASSIST IN PROCESSING THE PROPOSAL. SSN SOLICITED UNDER NSF ACT OF 1950, AS AMENDED.

A Cross-Disability-Accessible Knowledge Network for Education and Collaboration in Science and Technology

Project Summary

This multidisciplinary collaboration will develop and research a knowledge network that is accessible to individuals with a wide range of disabilities. We combine expertise in collaboration, object Web, human computer interfaces, education and cross disability access. We will use the concept of a Cross-Disability-Accessible Document Object Model (DOM) as the underlying theoretical framework. However our approach will involve building an operational Cross-Disability-Accessible Knowledge Network (CDAKN) based on iterative improvement of existing technologies for collaboration and interfaces. This Knowledge Network (KN) will initially be used by the project team as a collaboratory both to build the KN itself and to design and prepare cross-disability versions of existing successful Web-based educational material. The same testbed will be used to deliver distance education with both computer-science and natural-sciences curricula and will so extend the testing of the KN and develop further important capabilities. The research issues addressed in this project include the architecture of CDAKN and implications for a CDADOM; the integration of knowledge agents with collaboration and human-interface technology; and the design of customizable interfaces. The major outcome of the proposed research will be knowledge on how easy or difficult it is to create CDAKNs, how to identify barriers, and how to overcome them. This will be quantified through the CDADOM design principles that we will develop. The main practical outcome of this project will be the creation of the CDAKN itself, which would serve as a model for further research and for widespread application of CDAKNs.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.C.

Section	Total No. of Pages in Section	Page No.* (Optional)*
Cover Sheet (NSF Form 1207 - Submit Page 2 with original proposal only)		
A Project Summary (not to exceed 1 page)	1	_____
B Table of Contents (NSF Form 1359)	1	_____
C Project Description (including Results from Prior NSF Support) (not to exceed 15 pages) (Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	5	_____
D References Cited	_____	_____
E Biographical Sketches (Not to exceed 2 pages each)	12	_____
F Budget (NSF Form 1030, including up to 3 pages of budget justification)	3	_____
G Current and Pending Support (NSF Form 1239)	0	_____
H Facilities, Equipment and Other Resources (NSF Form 1363)	0	_____
I Special Information/Supplementary Documentation	0	_____
J Appendix (List below.) (Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	_____	_____
Appendix Items:		

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

Project Description

The basic goal of the proposed work is to build a Cross-Disability-Accessible Knowledge Network (CDAKN) and then evaluate and advance its effectiveness a) in distance education in science and technology curricula and b) for scientific collaboration. This goal and the project are based on the following principles:

1. People need to be integrated into society and its activities irrespective of physical disabilities.
2. Web technologies and pervasive communication infrastructure provide a universal backbone for which one can build more effective cross-disability access (CDA) with specialized perception and expression capabilities optimized for individuals.
3. The ‘anyplace’ characteristic of the Internet is particularly attractive for individuals with disabilities, who may find their geographical location limited. Thus Internet collaboration is especially important for building knowledge networks involving individuals with disabilities.
4. Syracuse University has developed state-of-the-art collaboration (TangoInteractive) and universal-interface (NeatTools/TNG[serial interface box]/sensor/transducer) technologies.
5. The Trace Research and Development Center (trace.wisc.edu) in Wisconsin has pioneered the principles of universal design for computer interfaces and brings a broad national knowledge network to augment the prototype communities built at Syracuse. The CDAKN will be based largely on technology developed at Syracuse for “interactive collaborative environments,” combined with accessibility strategies developed by the Trace Center.
6. Science, mathematics, engineering and technology (SMET) education is a national priority, for which universal participation is highly desirable.
7. Distance education, including both teachers and students with disabilities, exemplifies the general goal of implementing societal functions in a way that allows universal participation.
8. Distance education provides an attractive early testbed for new technology, because it has a natural structure that puts less stress on base hardware and software technologies. We have shown this in our successful distance education experiments between Syracuse and Jackson State (historically black college in Jackson, Mississippi) using TangoInteractive.
9. Scientific research collaborations increasingly depend on electronic communication. TangoInteractive is fundamentally a collaboratory system that is optimal for long-distance collaboration among researchers. A CDAKN based on Tango and NeatTools can advance science by inclusion of team members regardless of geographical location or (dis)ability.

Research Program

We intend to contribute to research in collaboration technologies, the design and architecture of CDAKNs, and new approaches to cross-disability interfaces for multimedia material. Our approach is to use a testbed that will implement a CDAKN, and then evaluate and iteratively improve it. We will use the testbed both as collaboratory among the project team members, and to deliver cross-disability education. This program will be implemented stepwise as follows. First, we will gather initial requirements for CDAKN from both user, content and technology aspects. We will use the concept of a CDA Document Object Model (DOM) to categorize the information flowing in the CDAKN. A major result of our project will be new design principles for such a DOM which will provide important extensions to the current World Wide Web Consortium (W3C) DOM which does not have cross disability built into it. Although we will use the CDAKN to guide the project, it would be too ambitious to fully implement such an extended DOM. Our research and testbed experience will, however, help in the future revision

of current document object models in order to become truly CDA. We will integrate universal interface design (Wisconsin) implemented as a knowledge agent linking the interface technology and collaboration software (Syracuse) to produce prototype CDAKN for particular disabilities. Again, the knowledge agent will initially be simple and will be refined as the project progresses.

We will first set up a general collaboratory starting with project members, and their natural contacts through NCSA Alliance/NPACI/EOT, Trace Center, Center for Applied Special Technology (CAST, in Boston area), Catholic University (Corinna Lathan et al., and National Rehab Hospital; their new “Telerehab” Rehab. Engineering Research Center grant explicitly included NeatTools in proposal; Trace director Gregg Vanderheiden serves as advisor for this new RERC), and DO-IT (Disabilities, Opportunities, Internetworking, and Technology) at University of Washington (Sheryl Burgstahler, director). This team will plan and implement the broader use of the CDAKN, which will involve specific educational activities in both computer science and the natural sciences. This will use material already developed, but not universally accessible at present. Our first area is Internetics, which is a curriculum developed by co-PI Geoffrey Fox that combines computational science and modern information/communication technologies. Our major focus is *Science for 21st Century*, a large- enrollment course at Syracuse developed by PI and others with modular approach to teaching science in an integrated way to non-science majors. Two current NSF grants, associated with this course, support development of interactive Web-based educational modules; see <http://www.simsience.org> and www.phy.syr.edu/courses/CCD_NEW/. We will start with the *Science for 21st Century* modules, as these are broadly useable at both high school, undergraduate and general science literacy levels. Note that Gregg Vanderheiden and Geoffrey Fox are team leaders in the joint Alliance/NPACI EOT (Education, Outreach and Training) activity in areas of universal access, learning technologies and graduate education.

Participants on this project—including students and scientists with various disabilities—will use the CDAKN both to attend these courses and, within the core group, to actually research and develop the CDA technologies and educational material in a process of bootstrap and progressive optimization. We will hold conventional and CDAKN workshops to involve others in this area, disseminate lessons, and provide training in universal interface and collaboration methods. We will also produce research publications and presentations, and continually post results and issues on our Web sites for communication, feedback, and dissemination.

The research issues include: a) architecture of CDAKN and implications for a CDADOM, b) integration of knowledge agents with collaboration and human-interface technology, and c) determination of customizable interface approaches and effectiveness using visual programming environments and modular interface hardware.

Methodology

The representative core technologies on this project include TangoInteractive and NeatTools/TNG/devices (see below). Both systems are, in general, highly modular and adaptable, and can work very well together. An early technical objective will be to integrate Tango and NeatTools and then do preliminary multimodal testing of the emerging CDAKN.

We will leverage the new NEC Foundation grant (Syracuse) to include students with disabilities in Syracuse, Washington DC, Minneapolis, Seattle (DO-IT), Madison (Trace), and Boston (CAST; www.cast.org; consultant here). Further, we will adapt interactive Java-based science education modules (see URLs above; some already in Tango) from two NSF-funded grants at Syracuse to become CDA. These are associated with *Science for the 21st Century* course offered by the Syracuse Physics Department. Meanwhile, the Trace Center will address the

issues that arise in creating CDA multimedia interactive environments. Catholic University will co-develop interface technology with Syracuse team, and will develop assessment ‘instruments’ for formative evaluation. CAST (Boston) and DO-IT (U Washington) will begin testing by diverse users. Besides its core role in the CDAKN, Tango will be used for project communication, design, and bootstrapping/optimization of CDAKN. We will also set up representative CDA distance-learning courses (or, at least, exemplary class sessions, such as seminars) in SMET fields.

The research emphasis throughout the project will be based on hypotheses concerning CDA, KN (functionality, effectiveness, usability) and formative evaluation with consequent refinement. For example, can users who are abled, blind, deaf, or quadriplegic access the CDAKN and keep up with one another in interactive sessions? We will identify problems and take corrective design actions in an iterative fashion. The project will include quantitative performance assessment in Tango and in NeatTools interface programs (event tracking, database recording, data analysis). In this way we can strive toward developing a CDA-multimedia-interactive KN.

Outcomes

The fundamental outcome of the proposed research will be *knowledge* on how easy or difficult it is to create CDAKNs, how to identify barriers, and how to overcome them. The main practical outcome will be the creation of the CDAKN itself – the first of its kind. This will serve as a model for further research and for widespread application of CDAKNs.

Another substantial outcome will be our KDI research on this CDAKN to evaluate its effectiveness and continually improve it during and beyond the proposed work. This will serve as foundation for continued research (KDI/CDA/KN). We intend to sustain the project and its results for the long term, and will seek continued funding from NSF and other sources, while bringing in additional partners for broader implementation and testing.

We will make extensive use of the Web for dissemination of project information and free software (Tango and NeatTools). Information on how to obtain low cost modular interface hardware will also be provided. This would include our computer interface boxes and sensor kits and other commercial components listed in the Trace Resource Book, as appropriate. Project results will also be disseminated by traditional-style presentations, publications, and workshops.

A final major outcome of this CDAKN research and development project will be that users with disabilities will have far greater opportunities for SMET education (active learning in constructivist paradigm; lab participation; lifelong learning) and SMET careers.

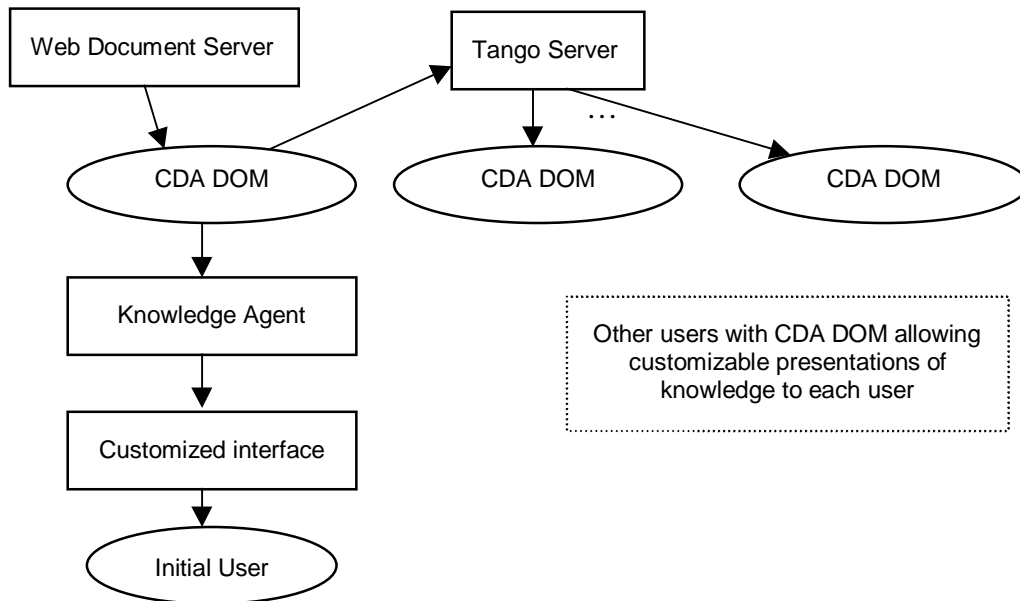
Knowledge of the CDAKN

The CDAKN will be used in two distinct roles: a) initially by team of content and technology developers (Syracuse/CUA/NRH), designers (Trace) and outreach sites (CAST, DO-IT) to develop initial CDA educational modules, starting with *Science for the 21st Century* course material (note that we have 2 NSF funded grants for this work; see above); and b) at outreach sites, to deliver material of increasing sophistication in both education and literacy modes.

Technology of the CDAKN

Overall Architecture. We will describe information as stored in the client computer in terms of a (generalized) document object model CDADOM, based initially on the current W3C proposals (www.w3.org/DOM/). The architecture is shown below. The capability of TangoInteractive to support client-dependent views of information will be used to produce optimized displays for

each user, depending in general on both physical capabilities and prior knowledge. This customization is supported in two ways. First, a traditional knowledge agent employs a user profile to broker the custom conversion of information (stored in CDADOM) to client-dependent



knowledge. This essentially involves processing text and images in the original document. Second, we process the event handlers for user interaction and convert abstract content appropriately (e.g. text and images to audio for the blind). Event handlers are typically specified by “onclick” or “onkeydown,” but this is clearly not in CDA form. Initially, we will map, in the Tango (which traps all DOM events for sharing with its JavaScript interface) interface to NeatTools, such classic input devices to those appropriate on this client. As a result of this study, we will propose a more abstract CDADOM where content and events are specified abstractly and on conventional machines mapped to text, images, onclick, etc.

TangoInteractive Background. TangoInteractive (or Tango; <http://www.npac.syr.edu/tango>) is an advanced, powerful, and extensible Web collaboratory, and is perhaps the most flexible of systems of its type. It is not aimed at exploring research issues in collaborative system design, but rather at exploring applications such as those proposed here. In this regard, great effort has been put into making the base infrastructure quite robust, so that it can be used outside a tolerant research environment.

Tango is written in Java, but supports collaborative applications in any language. Further Tango is fully integrated with Web browsers, and this provides the basis of convenient, familiar interfaces. To run Tango, one starts the system from a browser and connects to a Tango server. Both the client and server code for Tango are freely available on CD-ROM or from our Web site, which also contains the well documented API's for C++, Java, Java Beans, and JavaScript. Once in the system, the user can select from over 25 collaboratory applications to work on projects with partners, play a game of Bridge or Chess, take a class at a virtual university, create and use a public or private chat room, conduct a videoconference, view a movie, or surf with friends using the powerful shared browser. It is possible to do all this at the same time, in any combination, and multiple copies of applications such as chat rooms can be launched. Further, Tango can provide shared sessions for either client- or server-side applications. The latter include

both shared (Web-linked) databases (as in Oracle-based WebWisdom curriculum management system) and shared CGI scripts (as in our integration of NCSA's Biology Workbench with Tango). We believe that no other collaborative system, public domain or commercial, gives you so many applications under such consistent and simple session and floor control.

Besides running Java applets under Tango, one can run JavaScript-based client-side Web applications. Moreover, in Tango the user can take an arbitrary HTML page and automatically turn it into a shared entity. To build a 3D VRML world, populate it with avatars, and let them interact, Tango provides support via two integration modes: VRML JavaScript nodes and External Authoring Interface. Applications written in C or C++ (e.g. PowerPoint) can also be readily adapted to run collaboratively under the Tango API. In this proposal, we will use the C++ interface of Tango to link the NeatTools specialized interfaces. Note that the shared collaboration model of Tango allows each client to have different views of the same shared application, and this is essential for universal access. Shared display systems such as Microsoft's NetMeeting are less flexible.

NeatTools Background. We have been developing NeatTools, a visual-programming and runtime environment, for interfacing humans and computers (www.pulsar.org; http://www.pulsar.org/ed/manuscripts/mmvr7/MMVR99_paper_5.htm). It enables users to input information to a computer through various kinds of sensors and devices and, among other things, displays the information in the form of text, graphics, audio, video, or other methods. One constructs a dataflow network (visual program) in this environment by dragging and dropping objects (modules) from an on-screen toolbox to the desktop workspace and then connecting these with input or output controls and control of parametric lines. Editing and execution of programs occur simultaneously, so that no compilation is necessary.

NeatTools is written in C++ on top of a Java-like cross-platform application programming interface (API) so that it can run on multiple platforms including Windows 95/98/NT, Unix, Irix, and Linux. Macintosh will be supported once its multithreaded operating system is released. NeatTools is simple, object-oriented, network-ready, robust, secure, architecture neutral, portable, high-performance, multi-threaded, extensible, and dynamic. It can interface with serial, parallel, and joystick devices (and see below). Other significant features include Internet connectivity; display of time signals; mathematical and logic functions; character generation; multimedia; Musical Instrument Device Interface (MIDI) controls; and a visual relational database with multimedia functions. A developer's kit, for writing new external modules, is also available online for those proficient in object-oriented programming in C++.

Devices Background. We have also developed the palm-sized TNG-3 hardware interface box, which detects signals from sensors and switches. Both TNG-3 and the latest version, TNG-3B, have 8 analog and 8 digital input channels and stream data to the serial port of a personal computer at 19200 baud. We also have a working bench prototype of TNG-4, which has more capacity and versatility, with 8 analog and 22 digital lines that are dynamically bidirectional. In other words, each digital line can serve as an input or an output, and this can be dynamically reconfigured at any time within NeatTools by manual or automatic control. We have used *NeatTools* to interface various types of hardware devices to TNG-3, including displacement potentiometers, photocells, magnetic sensors (Hall Effect transducers), pressure transducers, and bend sensors. The customizable and extensible features of these modular hardware and software systems are important for the project goal of extending such technology to accommodate users with a broad range of disabilities.

Edward Lipson, Professor of Physics, Syracuse University

EDUCATION

Ph.D. Physics, California Institute of Technology, Pasadena, CA (1971)

B.Sc.(Hons.) Physics and Mathematics, University of Manitoba, Winnipeg, Canada (1966)

ACADEMIC EMPLOYMENT

1999- Adjunct Professor of Radiology, SUNY Health Science Center, Syracuse
1996-97 Interim Chair, Department of Physics, Syracuse University
1995-96 Acting Chair, Department of Physics, Syracuse University
1994- Faculty Associate, Northeast Parallel Architectures Center, Syracuse University
1990 Compton Visiting Professor, Department of Biology, Technion
(Haifa, Israel; January-May)
1989-1995 Associate Chair, Department of Physics, Syracuse University
1985- **Professor of Physics, Syracuse University**
1983-89 Director, Graduate Biophysics Program, Syracuse University
1980-85 Associate Professor of Physics, Syracuse University
1976-80 Assistant Professor of Physics, Syracuse University
1974-76 Senior Research Fellow, Caltech
1971-74 Research Fellow, Caltech

HONORS

1979-83 Alfred P. Sloan Foundation Fellow
1972-74 NIH Postdoctoral Research Fellow
1966-69 NSF Predoctoral Fellow
1966-67 Woodrow Wilson Fellow (Honorary)

PUBLICATIONS

Five publications most closely related to the proposed project

- Lipson, E., Warner, D., Chang, Y.-J. 1999. Universal Interfacing System for Interactive Technologies in Telemedicine, Disabilities, Rehabilitation, and Education. In: *Medicine Meets Virtual Reality — The Convergence of Physical and Informational Technologies: Options for a New Era in Healthcare*, Westwood, J., Hoffman, H., Robb, R. and Stredney, D., editors, IOS Press, Amsterdam, pp. 205-211.
- Warner, S., Catterall, S., and Lipson E.D. 1997. Java simulations for physics education. *Concurrency: Practice and Experience*, 9:477-484.
- Catterall, S., Goldberg, M., Middleton, A., and Vidali, G. 1997. Implementation of information technologies in the teaching of “Science for the 21st Century” *Int. J. Mod. Phys. C* 8:49-66.
- Pratap, P., Palit, A., and Lipson, E. D. 1986. System analysis of *Phycomyces* light-growth response with sum-of-sinusoids test stimuli. *Biophys. J.* 50:645-651.
- Lipson, E. D. 1995. Action Spectroscopy. In: *Handbook of Organic Photochemistry and Photobiology* (Horspool, W. and Song, P.-S., editors), CRC Press, Boca Raton, pp. 1257-1266.
- Chen, X., Xiong, Y., and Lipson, E. D. 1993. Action spectrum for subliminal light control of adaptation in *Phycomyces* phototropism. *Photochem. Photobiol.* 58:425-431.

Geoffrey Charles Fox

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Education

B.A. in Mathematics from Cambridge Univ., Cambridge, England (1961-1964)

Ph.D. in Theoretical Physics from Cambridge University (1964-1967)

M.A. from Cambridge University (1968)

Professional Experience

1990- Professor of Computer Science, Syracuse University

1990- Professor of Physics, Syracuse University

1990- Director of Northeast Parallel Architectures Center

1979-1990 Professor of Physics, California Inst. of Tech.

1986-1988 Associate Provost for Computing, California Inst. of Tech.

1983-1985 Dean for Educational Computing, California Inst. of Tech.

1981-1983 Executive Officer of Physics, California Inst. of Tech.

1974-1979 Associate Professor of Physics, California Inst. of Tech.

1971-1974 Assistant Professor of Physics, California Inst. of Tech.

1970-1971 Millikan Research Fellow in Theoretical Physics, Caltech

1970 Visiting Scientist (April-May), Brookhaven National Laboratory

1969-1970 Research Fellow at Peterhouse College, Cavendish Lab., Cambridge

1968-1969 Research Scientist, Lawrence Berkeley Lab., Berkeley, Calif.

1967-1968 Member of School of Natural Science, Inst. for Advanced Study,
Princeton, New Jersey

Awards and Honors

Senior Wrangler, Part III Mathematics, Cambridge (1964)

Alfred P. Sloan Foundation Fellowship (1973-75)

Fellow of the American Physical Society (1990)

Editor of Concurrency: Practice and Experience (John Wiley, Inc.)

Selected Publications - Geoffrey C. Fox

1. Fox, G.C., Johnson, M.A., Lyzenga, G.A., Otto, S.W., Salmon, J.K., Walker, D.W., Solving Problems on Concurrent Processors, Vol. 1, Prentice-Hall, Inc. 1988; Vol. 2, 1990.

2. Fox G.C., and Podgorny M, "Real Time Training and Integration of Simulation and Planning using the TangoInteractive Collaborative System", in Proceedings of International Test and Evaluation Workshop on High performance Computing, July 1998, Aberdeen Maryland.

3. Fox, G.C., Akarsu E., Furmanski W., Haupt T., "WebFlow -- High-level Programming environment and Visual Authoring Toolkit for High Performance Distributed Computing" in Proceedings of SC98, Orlando, November 1998.

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

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

Summary of Interests

See: <http://www.npac.syr.edu/DC>

Java based Computation: <http://www.npac.syr.edu/projects/javaforcse>

For education: <http://www.webwisdom.org>

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

David Jay Warner, M.D.

EDUCATION

Doctor of Medicine: Loma Linda University, Spring 1995.
Bachelor of Arts: Physical Science, San Diego State University 1986.

CURRENT POSITIONS

Professional:

Director/CEO of the Institute for Interventional Informatics, 94-Present.
Director of the "Technology Task Force" for the American Telemedicine Association, 96-98
Director of Medical Intelligence for International Telemedicine Associates Inc., 96-Present.

Academic:

Nason Fellow at the Northeast Parallel Architectures Center-Syracuse Univ., 95-present
Adjunct Professor of Pathology and Clinical Informatics-SUNY HSC-Syracuse, 96-present.
Visiting Scholar for the Human Interface Technology Lab-Univ. of Washington, 96-present
(Physiologically based Interface Design).
Adjunct Professor of Plastic Surgery-UCSD San Diego 97-present
(Medical interfacing for assessing task performance).

PUBLICATIONS

Publications most closely related to the proposed project

- Lipson, E., Warner, D., Chang, Y.-J. (1999) Universal Interfacing System for Interactive Technologies in Telemedicine, Disabilities, Rehabilitation, and Education. In: *Medicine Meets Virtual Reality — The Convergence of Physical and Informational Technologies: Options for a New Era in Healthcare*, Westwood, J., Hoffman, H., Robb, R. and Stredney, D., editors, IOS Press, Amsterdam, pp. 205-211.
- Warner D, Tichenor J.M, Balch D.C. (1996) Telemedicine and Distributed Medical Intelligence. *Telemedicine Journal 2*: 295-301.
- Warner, D., Sale, J., (1995) Interventional Informatics: Healing with Information. In *Proceedings of Medicine Meets Virtual Reality III*. San Diego, CA: Aligned Management Associates.
- Warner, D., Anderson, T., and Johanson, J. (1994). Bio-Cybernetics: A Biologically Responsive Interactive Interface. In *Medicine Meets Virtual Reality II: Interactive Technology & Healthcare: Visionary Applications for Simulation Visualization Robotics*. (pp. 237-241). San Diego, CA, USA: Aligned Management Associates.
- Warner, D., Sale, J., Price, S. and Will, D. (1992). Re-enabling Technologies: Immediate Medical Applications for Virtual Reality Interfaces. In *Proceedings of Medicine Meets Virtual Reality*. San Diego, CA: Aligned Management Associates.
- Warner, D., Sale, J., Price, S. and Will, D. (1992). Remapping the Human-Computer Interface for Optimized Perceptualization of Medical Information. In *Proceedings of Medicine Meets Virtual Reality*. San Diego, CA: Aligned Management Associates.

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RESEARCH INTERESTS

Research and development in the area of universal design and "everyone interfaces," particularly in the area of information systems, to allow their use by people with the broadest possible range of abilities and disabilities.

EDUCATION

- B.S. Electrical Engineering (1972), University of Wisconsin-Madison
- M.S. Biomedical Engineering (1974), University of Wisconsin-Madison
- Ph.D. Technology in Communication Rehabilitation and Child Development (1984), University of Wisconsin-Madison

PROFESSIONAL EXPERIENCE

- 1986-Present: Faculty, Human Factors Program, Department of Industrial Engineering, University of Wisconsin-Madison.
- 1972-Present: Director, Trace R&D Center; a rehabilitation engineering center with a focus on design of communication control and computer access systems. The center currently operates under a 5-year core grant of \$3.5 million from the National Institute of Disability and Rehabilitation Research, plus other funding, with a project agenda of 33 projects & programs (affiliated Clinic not included).
- 1971-Present: Principal investigator on 140+ grants and projects, totaling \$15+ million, in the area of Rehabilitation Engineering, Access to National Information Infrastructure and Next-Generation Information Systems, Computer Access Systems, and Augmentative Communication & Writing, Systems for children and adults with disabilities. Activities included research, development, commercial facilitation, information summary, and training (pre-service and in-service). Funding sources included, among others: National Institute of Disability and Rehabilitation Research (US DOE), National Science Foundation, Rehabilitation Services Administration, National Institutes of Health, IBM, Apple Computer, Pacific Telesys, AT&T, American Association for the Advancement of Science, US Government Accounting Office, US General Services Administration, Office of Special Education (US DOE).

SELECTED PUBLICATIONS (More than 150 books, book chapters, journal papers, conference publications, and other articles)

- Vanderheiden, G. (1997) Position Paper: Nomadicity, disability access and the every-citizen interface. In *More than Screen Deep: Every Citizen Interfaces to the National Information Infrastructure. Science and Telecommunication Board*, pp. 297-306. National Research Council, National Academy of Science. Washington, DC. 1997.

- Vanderheiden, G. (1997) Design for people with functional limitations due to disability, aging, or circumstances. In Gavriel Salvendy, Ed., *Handbook of Human Factors and Ergonomics*, pp. 2010-2052. John Wiley & Sons.
- Vanderheiden, G. (1996) Development of a multisensory visual interface to computers for blind users. In *Human Factors Perspectives on Human-Computer Interactions: Selections from Human Factors and Ergonomics Society Annual Meeting Proceedings, 1983-1994*. Santa Monica, California: Human Factors and Ergonomics Society.
- Vanderheiden, G. (1997) Design for people with functional limitations due to disability, aging, or circumstances. In Gavriel Salvendy, Ed., *Handbook of Human Factors and Ergonomics*. John Wiley & Sons.
- Making information systems accessible. *Universal Design*, Volume 2, No. 4, October 1995.

Sheryl Burgstahler

Education

Ph.D., Policy, Governance and Administration of Higher Education, 1992, University of Washington, Seattle, WA (Dissertation: Computing Services for Disabled Students in Institutions of Higher Education)

Masters' Degree, Mathematics, 1975, University of Washington

Bachelors' Degree, Mathematics, 1970, University of Washington, Summa Cum Laude

Administrative Experiences

Director, DO-IT, 1992-present.

Assistant Director, Information Systems, Computing & Communications, University of Washington, 1991-present.

Director, DO-IT (Disabilities, Opportunities, Internetworking, and Technology, 1992 - present.

Manager, Desktop Computing Services, Computing & Communications, University of Washington, 1988-91.

Manager, Micro Support Group, Academic Computing Services, University of Washington, 1984-88.

Chairman, Department of Mathematics and Computer Science, Saint Martin's College, 1980-84.

Director, Summer Session, 1980-84, Saint Martin's College.

Director, Computer In-service, Saint Martin's College, Lacey, WA, 1982-84.

Associate Director, Microcomputer Resource Center, Saint Martin's College, 1981-84.

Project Director, Computers and the Physically Disabled, Saint Martin's College, 1982-84.

Education Center Administrator, Department of Defense (DOD) PREP School, Osan Air Base, South Korea, 1975-76.

Post-secondary Mathematics, Computer Science, Internet, Teacher Education

Teaching Experiences

University of Washington, 1984-present.

Saint Martin's College, 1978-84.

Seattle Pacific University, Seattle, WA, 1981.

University of Puget Sound, Tacoma, WA, 1978-79.

Fort Steilacoom Community College, Tacoma, WA, 1977-79.

University of Maryland, Los Angeles City College, South Korea, 1976.

University of Washington, Seattle, WA, 1974-75.

Pre-college Teaching Experiences

Bethel Junior High School, Tacoma, WA, 1977-78.

Department of Defense Prep School, Osan Air Base, South Korea, 1975-76.

Showalter Junior High School, Seattle, WA, 1971-74.

Selected Publications Closely Related to Proposal

- Burgstahler, S. E. (1998). Making web pages universally accessible. Computer-Mediated Communications Magazine, 5 (1).
- Burgstahler, S. E. (1997). Peer support: What role can the Internet play? Journal of Information Technology and Disability, 4 (4).
- Burgstahler, S. E. (1995). Faculty facilitate research for students with disabilities. Council on Undergraduate Research Quarterly, 8-11.
- Burgstahler, S. E. (1995). Technology eases the transition to college for students with disabilities. Learning and Leading with Technology, 23 (1), 39-41.
- Burgstahler, S. E. (1994). Increasing the representation of people with disabilities in science, engineering, and mathematics. Journal of Information Technology and Disability, 1(4).

BIOGRAPHICAL SKETCH

A. Vitae

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PhD, Neuroscience, Massachusetts Institute of Technology, 1994
MS, Aeronautics and Astronautics, Massachusetts Institute of Technology, 1995
BS, Biopsychology and Mathematics, Swarthmore College, 1988

- 1995-Present** Assistant Professor of Biomedical Engineering, **The Catholic University Of America**, Washington, D.C.
- 1995-Present** Consultant to the Medical Staff, **National Rehabilitation Hospital**, Washington, D.C.
- 1996-Present** Adjunct Assistant Professor, Department of Radiology, Imaging Science and Information Systems Center **Georgetown University School of Medicine**, Washington, D.C.
- 1993-Present** Founder, **Keys to Empowering Youth**, <http://www.ee.cua.edu/~lathan/keys.htm>
- 1996** Design Project Faculty, **International Space University**, Vienna, Austria.
- 1996** Consultant, National Photographic Interpretation Center (NPIC) Human Computer Interface Guidelines Project.
- 1995** Visiting Scientist, Laboratory of Perception and Action Physiology, **Centre Nationale De Recherche Scientifique/Collège de France**, Paris, France.
- 1994-1995** Research Assistant, Sensory Communications Group, Research Laboratory of Electronics, Department of Electrical Engineering and Computer Science, **Massachusetts Institute Of Technology**, Cambridge, MA.
- 1989-1994** Man-Vehicle Laboratory, MIT Center for Space Research, Department of Aeronautics and Astronautics/Department of Brain and Cognitive Sciences, **Massachusetts Institute Of Technology**, Cambridge, MA.
- 1990-1994** Research Assistant, Massachusetts Eye and Ear Infirmary, Boston, MA.
- 1989-1990** Consultant, Department of Biomedical Sciences, **Universities Space Research Association**, Houston, TX.
- 1987** Staff, Ashton Graybiel Spatial Orientation Laboratory, Department of Psychology, **Brandeis University**, Waltham, MA.
- Editorial Board.** Journal of Human Performance in Extreme Environments.
- Guest Editor.** The Telemedicine Journal, special issue on Human Factors, 1998-99.
- Reviewer.** International Journal of Human Computer Interaction; American Journal of Public Health; IEEE, Systems, Man and Cybernetics; Presence, Teleoperators and Virtual Environments; Computers & Electrical Engineering, An International Journal.
- Grant Reviewer.** National Institute on Disability and Rehabilitation Research (NIDRR) (Panel Chair);

B. Selected Publications

- Lathan, C.E., D. Hamilton, M.S. Bogner, and A. Blanarovich. "Human-centered design of home care technologies" *Neurorehabilitation*, In press.
- Sebrechts, M.M., C.E. Lathan, DM Clawson, MS Miller, C. Trepanier "Transfer of Training in virtual environments: Issues for human performance," *Psychological Issues in the Design and Use of Virtual, Adaptive Environments*, Eds. L.J. Hettinger and M.W. Haas, Mahwah, NJ: Lawrence Erlbaum Associates, In Press.
- Winters, J., C.E. Lathan, S. Sukthankar, T. Pieters, and T. Rahman, "Human performance and rehabilitation technologies" *Biomechanics and Neural Control of Movement*, Eds. J. Winters and P. Crago Springer-Verlag. *In press*.
- Lathan, C.E., K. Cleary, and R. Greco, "Development and evaluation of a spine biopsy simulator," in *Medicine Meets Virtual Reality*, J.D. Westwood, H.M. Hoffman, D. Stredney, and S.J. Weghorst Eds. IOS Press, Amsterdam. (1998)
- Lathan, C.E, "Human computer interface design principles for web-based telemedicine systems," *Telemedicine Journal*. 3:1:90 (1997)

Marek Podgorny

Research Director
NPAC, Syracuse University
111 College Place
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<http://www.npac.syr.edu>, [//trurl.npac.syr.edu](http://trurl.npac.syr.edu)]

Education

Habilitation (higher doctoral degree) , '91, Theoretical Physics, Jagellonian University, Cracow, Poland.

PhD, '78, Experimental Physics, Jagellonian University, Cracow, Poland.

MSc, '73, Experimental Physics, Jagellonian University, Cracow, Poland.

Professional Employment

Research Director, NPAV, Syracuse University, '97 - now

Associate Director for Advanced Systems, NPAC, Syracuse University, '95 - '97

Associate Director for System Engineering, NPAC, Syracuse University, '93 - '95

Sr. Researcher in NPAC, Syracuse University, '92 - '94

Visiting Professor, Ruhr University, Bochum, Germany, '90

Assistant Professor and Director of the Computer Services, Jagellonian University, Cracow, Poland, '86-'89

Senior Scientific Associate, Ruhr University, Bochum, Germany, '86

Humboldt Research Fellow, Dortmund University, Dortmund, Germany, '84 - '85

Scientific Associate, INFN Frascati, Rome, Italy, '80

Assistant Professor, Jagellonian University, Cracow, Poland, '79 - '83.

Scientific Associate, Nijmegen University, Nijmegen, Holland, '78 - '79.

Assistant, Experimental Physics, Jagellonian University, Cracow, Poland, '73 - '78

Projects supervised (last five years)

- TANGO Interactive: a Web-based collaborative framework, , ~\$1.1M, '97 - now
- Collaboration and Interactive Visualization, sponsored by DARPA via Rome Laboratory, \$2M '95 - '97
- Northeast Parallel Architectures Center facility upgrade grant, sponsored by New York State, \$6,5M, '93 - '96
- Video on Demand Project in NPAC, sponsored by Rome Laboratory, Griffiss Air Force Base, \$400K, '94 - '96
- NYNET ATM Network Project in NPAC, in collaboration with NYNEX, Griffiss Air Force Base, Cornell University, Columbia University, and Brooklyn Polytechnic, '93 - '96

Current responsibilities

Technical and research management of a number of NPAC projects. Sole responsibility for project planning, staffing, implementation, and delivery. Providing leadership and supervision for 20+ researchers and graduate students.

Expertise

- Experimental Physics: optical properties of semiconductors, spectroscopy in the energy range from IR to synchrotron radiation, computer on-line experiment control and data acquisition.
- Theoretical Physics: solid state theory, specialty: optical properties of materials and theory of magnetism; advanced mathematical skills.
- Computational Physics: electronic structure calculations, Monte Carlo simulations.
- High Performance Computing and Communication:
 - computer architectures: PCs, workstations, vector machines, massively parallel machines
 - networking technology: hardware infrastructure and software layers, including SONET and ATM; internetworking, ISDN, integrated services, Internet protocols, quality of service
 - storage technology: hierarchical and network storage systems
 - software: web technology; client - server system architectures spanning PC UNIX and supercomputer systems; multi-tier architectures, distributed collaborative systems, database technology including parallel databases, multimedia including video server technologies, digital audio and video codecs and transports, multimedia protocols
 - active programming skills Fortran, C, Visual Basic, SQL ; active system and DBA administration
 - distributed computing and system integration

Relevant Publications

- Fox G.C., and Podgorny M, "Real Time Training and Integration of Simulation and Planning using the TangoInteractive Collaborative System", in Proceedings of International Test and Evaluation Workshop on High performance Computing, July 1998, Aberdeen Maryland.
- Fox, G., Scavo T., Bernholdt D.,Markowski R.,McCracken N.,Podgorny M., Mitra D. and Malluhi Q., "Synchronous Learning at a Distance: Experiences with TangoInteractive", in Proceedings of SC98, Orlando, November 1998.

SUMMARY PROPOSAL BUDGET YEAR 1

ORGANIZATION Syracuse University				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Edward D Lipson				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-mos.		Funds Requested By proposer	Funds granted by NSF (if different)
	CAL	ACAD	SUMR				
1. Edward D Lipson - Professor	0.00	0.00	1.95	\$ 54,340			
2. Sheryl Burgstahler - Director, DO-IT	0.00	0.00	0.00	0			
3. Geoffrey C Fox - Professor, NPAC Director	0.00	0.00	0.00	0			
4. Corinna Lathan - Assistant Professor	3.00	0.00	0.00	0			
5. Marek Podgorny - Assoc. Director, NPAC	6.00	0.00	0.00	148,200			
6. (2) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	3.00	0.00	0.00	17,500			
7. (7) TOTAL SENIOR PERSONNEL (1 - 6)	12.00	0.00	1.95	220,040			
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (2) POST DOCTORAL ASSOCIATES	72.00	0.00	0.00	240,000			
2. (2) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	72.00	0.00	0.00	240,000			
3. (3) GRADUATE STUDENTS				152,471			
4. (2) UNDERGRADUATE STUDENTS				21,000			
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0			
6. (0) OTHER				0			
TOTAL SALARIES AND WAGES (A + B)				873,511			
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				251,064			
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				1,124,575			
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
computers				\$ 60,000			
TOTAL EQUIPMENT				60,000			
E. TRAVEL							
1. DOMESTIC (INCL. CANADA AND U.S. POSSESSIONS)				36,000			
2. FOREIGN				0			
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____				0			
2. TRAVEL _____				0			
3. SUBSISTENCE _____				0			
4. OTHER _____				0			
(0) TOTAL PARTICIPANT COSTS				0			
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES				90,000			
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				30,000			
3. CONSULTANT SERVICES				90,000			
4. COMPUTER SERVICES				0			
5. SUBAWARDS				360,000			
6. OTHER				28,935			
TOTAL OTHER DIRECT COSTS				598,935			
H. TOTAL DIRECT COSTS (A THROUGH G)				1,819,510			
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
First Indirect Cost Item (Rate: 51.0000, Base: 1370575) (Cont. on Comments Page)							
TOTAL INDIRECT COSTS (F&A)				737,243			
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				2,556,753			
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.D.7.j.)				0			
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				\$ 2,556,753			
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI / PD TYPED NAME & SIGNATURE*			DATE	FOR NSF USE ONLY			
Edward D Lipson				INDIRECT COST RATE VERIFICATION			
ORG. REP. TYPED NAME & SIGNATURE*			DATE	Date Checked	Date Of Rate Sheet	Initials - ORG	

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

Other Senior Personnel

Name - Title	Cal	Acad	Sumr	Funds Requested		
Vanderheiden, Gregg - Professor, Trace Director	0.00		0.00	0.00	0.00	0
Warner, David J - NPAC Senior Scientist		3.00	0.00	0.00	17500	

**** C- Fringe Benefits**

17.3%(A1+A2)+34.2%(A3+A7+B1+B2)+12.7%(B3)+7%(B4)

**** G-6 Other**

tuition (\$643/cr hr)

**** I- Indirect Costs**

subawards (applied to \$25k of each) (Rate: 51.0000, Base 75000)

IDC on 25k during year 1 only

SUMMARY PROPOSAL BUDGET Cumulative

ORGANIZATION Syracuse University				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Edward D Lipson				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-mos.		Funds Requested By proposer	Funds granted by NSF (if different)
	CAL	ACAD	SUMR				
1. Edward D Lipson - Professor	0.00	0.00	1.95	\$ 54,340			
2. Sheryl Burgstahler - Director, DO-IT	0.00	0.00	0.00	0			
3. Geoffrey C Fox - Professor, NPAC Director	0.00	0.00	0.00	0			
4. Corinna Lathan - Assistant Professor	3.00	0.00	0.00	0			
5. Marek Podgorny - Assoc. Director, NPAC	6.00	0.00	0.00	148,200			
6. (2) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	3.00	0.00	0.00	17,500			
7. (7) TOTAL SENIOR PERSONNEL (1 - 6)	12.00	0.00	1.95	220,040			
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (2) POST DOCTORAL ASSOCIATES	72.00	0.00	0.00	240,000			
2. (2) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	72.00	0.00	0.00	240,000			
3. (3) GRADUATE STUDENTS				152,471			
4. (2) UNDERGRADUATE STUDENTS				21,000			
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0			
6. (0) OTHER				0			
TOTAL SALARIES AND WAGES (A + B)				873,511			
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				251,064			
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				1,124,575			
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
			\$ 60,000				
TOTAL EQUIPMENT				60,000			
E. TRAVEL 1. DOMESTIC (INCL. CANADA AND U.S. POSSESSIONS)				36,000			
2. FOREIGN				0			
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____			0				
2. TRAVEL _____			0				
3. SUBSISTENCE _____			0				
4. OTHER _____			0				
(0) TOTAL PARTICIPANT COSTS				0			
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES				90,000			
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				30,000			
3. CONSULTANT SERVICES				90,000			
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I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)				737,243			
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K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.D.7.j.)				0			
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				\$ 2,556,753			
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI / PD TYPED NAME & SIGNATURE*			DATE	FOR NSF USE ONLY			
Edward D Lipson				INDIRECT COST RATE VERIFICATION			
ORG. REP. TYPED NAME & SIGNATURE*			DATE	Date Checked	Date Of Rate Sheet	Initials - ORG	