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

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PI/PD Name: Douglas W Jones

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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0433605

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PI/PD Name: Aviel D Rubin

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):   ☐

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0433504

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PI/PD Name: Dan S Wallach

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):   ☒

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0433655

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PI/PD Name: Michael   Byrne

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):   ☒

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0433655

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PI/PD Name: David   Wagner

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):   ☒

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0433484

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PI/PD Name: Deirdre   Mulligan

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):   ☒

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PI/PD Name: Drew   Dean

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

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0433606

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PI/PD Name: Rebecca T Mercuri

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

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PI/PD Name: Peter   Neumann

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:
American Indian or Alaska Native. A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.
Asian. A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
Black or African American. A person having origins in any of the black racial groups of Africa.
Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

WHY THIS INFORMATION IS BEING REQUESTED:

The Federal Government has a continuing commitment to monitor the operation of its review and award processes to identify and address any inequities based on gender, race, ethnicity, or disability of its proposed PIs/PDs. To gather information needed for this important task, the proposer should submit a single copy of this form for each identified PI/PD with each proposal. Submission of the requested information is voluntary and will not affect the organization's eligibility for an award. However, information not submitted will seriously undermine the statistical validity, and therefore the usefulness, of information recieved from others. Any individual not wishing to submit some or all the information should check the box provided for this purpose. (The exceptions are the PI/PD name and the information about prior Federal support, the last question above.)

Collection of this information is authorized by the NSF Act of 1950, as amended, 42 U.S.C. 1861, et seq. Demographic data allows NSF to gauge whether our programs and other opportunities in science and technology are fairly reaching and benefiting everyone regardless of demographic category; to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational oppurtunities; and to assess involvement of international investigators in work supported by NSF. The information may be disclosed to government contractors, experts, volunteers and researchers to complete assigned work; and to other government agencies in order to coordinate and assess programs. The information may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records", 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records", 63 Federal Register 268 (January 5, 1998).

0433606

Submit only ONE copy of this form **for each PI/PD and co-PI/PD** identified on the proposal. The form(s) should be attached to the original proposal as specified in GPG Section II.B. Submission of this information is voluntary and is not a precondition of award. This information will not be disclosed to external peer reviewers. *DO NOT INCLUDE THIS FORM WITH ANY OF THE OTHER COPIES OF YOUR PROPOSAL AS THIS MAY COMPROMISE THE CONFIDENTIALITY OF THE INFORMATION.*

PI/PD Name: David L Dill

Gender: ☒ Male   ☐ Female

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

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

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

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

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

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

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PI/PD Name: Dan   Boneh

Gender: ☒ Male   ☐ Female

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

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

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

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

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

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

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0433701

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:

Bill Arbaugh, Ben Bederson, Univ. of Maryland; Matt Blaze, Univ. of Pennsylvania; David Clark, Shafi Goldwasser, MIT; George Cybenko, Dartmouth; Anita Jones, Univ. of Virginia; Hans Klein, Georgia Tech School of Public Policy; Brian Levine, Univ. of Massachusetts; Bob Morris, retired; Fred Schneider, Cornell; Eugene Spafford, Purdue

REVIEWERS NOT TO INCLUDE:

Ted Selker, MIT Media Lab; Michael Shamos, CMU; Jim Dickson, American Association of People with Disabilities (AAPD); Brit Williams, Kennesaw State University

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

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 04-2	FOR NSF USE ONLY
NSF 04-524 **03/31/04**	**NSF PROPOSAL NUMBER**

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

CNS - CYBER TRUST

0433605

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				062761671	

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)	SHOW PREVIOUS AWARD NO. IF THIS IS ☐ A RENEWAL ☐ AN ACCOMPLISHMENT-BASED RENEWAL	IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)
426004813		

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE	ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE
University of Iowa	**University of Iowa**
AWARDEE ORGANIZATION CODE (IF KNOWN)	**Iowa City, IA. 52242**
0018929000	

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.C For Definitions)	☐ SMALL BUSINESS ☐ FOR-PROFIT ORGANIZATION	☐ MINORITY BUSINESS ☐ WOMAN-OWNED BUSINESS	☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Center for Correct, Usable, Reliable, Auditable and Transparent Elections \(ACCURATE\)**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **1,547,177**	**60** months	**09/01/04**	

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

☐ BEGINNING INVESTIGATOR (GPG I.A)

☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)

☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)

☐ HISTORIC PLACES (GPG II.C.2.j)

☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)

☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____

☐ HUMAN SUBJECTS (GPG II.D.6)

Exemption Subsection _____ or IRB App. Date _____

☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)

_____

☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.E.1)

PI/PD DEPARTMENT **Computer Science**	PI/PD POSTAL ADDRESS
PI/PD FAX NUMBER **319-335-3624**	**Iowa City, IA 52242** **United States**

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Douglas W Jones**	**PhD**	**1980**	**319-335-0740**	**douglas-w-jones@uiowa.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Electronic Signature

0433605

CERTIFICATION PAGE

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 debarment and suspension, drug-free workplace, and lobbying activities (see below), as set forth in Grant Proposal Guide (GPG), NSF 04-2. 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.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Appendix C of the Grant Proposal Guide.

Debarment and Suspension Certification   (If answer "yes", please provide explanation.)

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 ☒

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Appendix D of the Grant Proposal Guide.

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 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 **John S Massa**		**Electronic Signature**	**Mar 31 2004 4:40PM**
TELEPHONE NUMBER **319-335-2123**	ELECTRONIC MAIL ADDRESS **john-massa@uiowa.edu**		FAX NUMBER **319-335-2130**

*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.

0433605

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 04-2	FOR NSF USE ONLY
NSF 04-524　　　　　**03/31/04**	**NSF PROPOSAL NUMBER**

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

0433504

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

CNS - CYBER TRUST

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
				001910777	

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)	SHOW PREVIOUS AWARD NO. IF THIS IS ☐ A RENEWAL ☐ AN ACCOMPLISHMENT-BASED RENEWAL	IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY?　YES ☐　NO ☒　IF YES, LIST ACRONYM(S)
520595110		

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE	ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE
Johns Hopkins University	**Johns Hopkins University**
AWARDEE ORGANIZATION CODE (IF KNOWN)	**3400 North Charles Street**
0020776000	**Baltimore, MD. 212182695**

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.C For Definitions)	☐ SMALL BUSINESS ☐ FOR-PROFIT ORGANIZATION	☐ MINORITY BUSINESS ☐ WOMAN-OWNED BUSINESS	☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT　**Collaborative Research: A Center for Correct, Usable, Reliable, Auditable and Transparent Elections \(ACCURATE\)**

REQUESTED AMOUNT $　836,228	PROPOSED DURATION (1-60 MONTHS) **60**　months	REQUESTED STARTING DATE **09/01/04**	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE

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

☐ BEGINNING INVESTIGATOR (GPG I.A)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____

☐ HUMAN SUBJECTS (GPG II.D.6)
　Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED
　(GPG II.C.2.j)
　_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.E.1)

PI/PD DEPARTMENT **Computer Science and Engineering**	PI/PD POSTAL ADDRESS
PI/PD FAX NUMBER **413-208-9184**	**3400 North Charles St.** **Baltimore, MD 21218** **United States**

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Aviel D Rubin**	**PhD**	**1994**	**410-516-8177**	**rubin@cs.jhu.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Page 1 of 2

Electronic Signature

CERTIFICATION PAGE

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Drug Free Work Place Certification

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Debarment and Suspension Certification   (If answer "yes", please provide explanation.)

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 ☒

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(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 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 **Jennifer L Barron**	**Electronic Signature**	**Apr 1 2004 1:52PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
410-516-5281	**jlb@jhu.edu**	**410-516-7775**

*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.

0433504

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 04-2	FOR NSF USE ONLY
NSF 04-524 **03/31/04**	**NSF PROPOSAL NUMBER**

0433655

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

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DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
				050299031	

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)	SHOW PREVIOUS AWARD NO. IF THIS IS ☐ A RENEWAL ☐ AN ACCOMPLISHMENT-BASED RENEWAL	IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)
741109620		

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE	ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE
William Marsh Rice University	**William Marsh Rice University**
AWARDEE ORGANIZATION CODE (IF KNOWN)	**6100 Main Street, MS-16**
0036046000	**Houston, TX. 772511892**

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.C For Definitions)	☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS	☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT   **Collaborative Research: A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections \(ACCURATE\)**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **1,547,177**	**60** months	**09/01/04**	

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

☐ BEGINNING INVESTIGATOR (GPG I.A)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____

☐ HUMAN SUBJECTS (GPG II.D.6)
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED
(GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.E.1)

PI/PD DEPARTMENT	PI/PD POSTAL ADDRESS
Computer Science	**PO Box 1892**
PI/PD FAX NUMBER	**MS-132**
713-285-5930	**Houston, TX 770051892**
	United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME				
Dan S Wallach	**PhD**	**1999**	**713-737-6155**	**dwallach@rice.edu**
CO-PI/PD				
Michael Byrne	**Ph.D**	**1996**	**713-527-4820**	**byrne@rice.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Electronic Signature

0433655

CERTIFICATION PAGE

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 debarment and suspension, drug-free workplace, and lobbying activities (see below), as set forth in Grant Proposal Guide (GPG), NSF 04-2. 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.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Appendix C of the Grant Proposal Guide.

Debarment and Suspension Certification   (If answer "yes", please provide explanation.)

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 ☒

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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 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 **Heidi Thornton**	**Electronic Signature**		**Mar 31 2004 5:21PM**
TELEPHONE NUMBER **713-348-4820**	ELECTRONIC MAIL ADDRESS **heidi@rice.edu**		FAX NUMBER **713-348-5425**

*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.

0433655

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 04-2	FOR NSF USE ONLY
NSF 04-524 **03/31/04**	**NSF PROPOSAL NUMBER**

0433484

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

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
				153881537	

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)	SHOW PREVIOUS AWARD NO. IF THIS IS ☐ A RENEWAL ☐ AN ACCOMPLISHMENT-BASED RENEWAL	IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)
946002123		

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE	ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE
University of California-Berkeley	**University of California-Berkeley** **Berkeley, CA. 94720**

AWARDEE ORGANIZATION CODE (IF KNOWN)
0013128000

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.C For Definitions)	☐ SMALL BUSINESS ☐ FOR-PROFIT ORGANIZATION	☐ MINORITY BUSINESS ☐ WOMAN-OWNED BUSINESS	☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT	**Collaborative Research: A Center for Correct, Usable, Reliable, Auditable and Transparent Elections \(ACCURATE\)**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **1,483,190**	**60** months	**09/01/04**	

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

☐ BEGINNING INVESTIGATOR (GPG I.A)

☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)

☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)

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☐ HUMAN SUBJECTS (GPG II.D.6)

Exemption Subsection _____ or IRB App. Date _____

☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED

(GPG II.C.2.j)

_____

☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.E.1)

PI/PD DEPARTMENT **EECS**	PI/PD POSTAL ADDRESS **Soda Hall** **U.C. Berkeley** **Berkeley, CA 94720** **United States**
PI/PD FAX NUMBER **510-642-5775**	

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **David Wagner**	**PhD**	**2000**	**510-642-2758**	**daw@cs.berkeley.edu**
CO-PI/PD **Deirdre Mulligan**	**JD**	**1994**	**510-642-0499**	**dmulligan@law.berkeley.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Electronic Signature

0433484

CERTIFICATION PAGE

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(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 of Lobbying Activities," in accordance with its instructions.

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AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Patricia Gates**	**Electronic Signature**	**Mar 31 2004 8:03PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
510-642-8109	**pgates@uclink.berkeley.edu**	**510-642-8236**

*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.

0433484

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 04-2	FOR NSF USE ONLY
NSF 04-524 **03/31/04**	**NSF PROPOSAL NUMBER**

NSF PROPOSAL NUMBER

0433606

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

CNS - CYBER TRUST

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
				009232752	

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)	SHOW PREVIOUS AWARD NO. IF THIS IS ☐ A RENEWAL ☐ AN ACCOMPLISHMENT-BASED RENEWAL	IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)
941160950		

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE	ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE
SRI International	**333 Ravenswood Avenue** **Menlo Park, CA 94025-3493**
AWARDEE ORGANIZATION CODE (IF KNOWN) **4007712000**	

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.C For Definitions)	☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS	☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT   **Collaborative Research: A Center for Correct, Usable, Reliable, Auditable and Transparent Elections \(ACCURATE\)**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **2,224,465**	**60** months	**09/01/04**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW
☐ BEGINNING INVESTIGATOR (GPG I.A)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____

☐ HUMAN SUBJECTS (GPG II.D.6)
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED
(GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.E.1)

PI/PD DEPARTMENT **Computer Science Laboratory**	PI/PD POSTAL ADDRESS **333 Ravenswood Avenue**
PI/PD FAX NUMBER **650-859-2844**	**Menlo Park, CA 940253493** **United States**

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Drew Dean**	**PhD**	**1999**	**650-859-2873**	**ddean@csl.sri.com**
CO-PI/PD **Rebecca T Mercuri**	**PhD**	**2001**	**215-327-7105**	**mercuri@acm.org**
CO-PI/PD **Peter Neumann**	**PhD**	**1961**	**650-859-2375**	**neumann@csl.sri.com**
CO-PI/PD				
CO-PI/PD				

Electronic Signature

0433606

CERTIFICATION PAGE

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 debarment and suspension, drug-free workplace, and lobbying activities (see below), as set forth in Grant Proposal Guide (GPG), NSF 04-2. 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).

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Drug Free Work Place Certification

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Debarment and Suspension Certification   (If answer "yes", please provide explanation.)

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 ☒

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AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Richard L Herz**	**Electronic Signature**	**Mar 31 2004 4:40PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
650-859-2004	**richard.herz@sri.com**	**650-859-6171**

0433606

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 04-2	FOR NSF USE ONLY
	NSF PROPOSAL NUMBER

NSF 04-524 03/31/04

0433701

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

CNS - CYBER TRUST

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
				009214214	

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)	SHOW PREVIOUS AWARD NO. IF THIS IS ☐ A RENEWAL ☐ AN ACCOMPLISHMENT-BASED RENEWAL	IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)
941156365		

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE	ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE
Stanford University	**Stanford University**
AWARDEE ORGANIZATION CODE (IF KNOWN)	**651 Serra Street**
0013052000	**Stanford, CA. 943054125**

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.C For Definitions)	☐ SMALL BUSINESS ☐ FOR-PROFIT ORGANIZATION	☐ MINORITY BUSINESS ☐ WOMAN-OWNED BUSINESS	☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Center for Correct, Usable, Reliable, Auditable and Transparent Elections \(ACCURATE\)**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **1,635,061**	**60** months	**09/01/04**	

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

☐ BEGINNING INVESTIGATOR (GPG I.A)
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  (GPG II.C.2.j)
  _____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.E.1)

PI/PD DEPARTMENT **Computer Science**	PI/PD POSTAL ADDRESS **Gates Bldg 3A**
PI/PD FAX NUMBER **650-725-6949**	**Stanford, CA 94305** **United States**

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **David L Dill**	**PhD**	**1987**	**650-725-3642**	**dill@cs.stanford.edu**
CO-PI/PD **Dan Boneh**	**PhD**	**1996**	**650-725-3897**	**dabo@cs.stanford.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Electronic Signature

0433701

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

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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 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 **Sharon Bergman**	**Electronic Signature**	**Mar 31 2004 7:03PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
650-725-1432	**sbergman@stanford.edu**	**650-723-0075**

*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.

0433701

B   Proposal Summary

The voting system integrity problem is a paradigmatic hard Cyber Security problem, spanning the entire Cyber Trust program including trustworthy system architectures, security, integrity, privacy, anonymity, high assurance, and man-machine interfaces. Voting systems are an excellent example of the class of systems where any weak link may result in undetected accidents or enable malicious tampering.

Without exaggeration, voting systems are one of the pillars of our democracy. Voting systems allow the electorate to determine the course taken by our nation. As a result, voting systems face a wide variety of requirements and constraints. Voting systems must be secure against tampering, yet they must be easy to use for all voters. They must satisfy a variety of state and national standards, yet they must be affordable to purchase and maintain. They must help voters to correctly indicate their voting intent, even when the voter intends not to cast a vote! They must preserve a voter's privacy and anonymity, to reduce risks of voter coercion and bribery, yet they must be sufficiently auditable and transparent to allow for mistakes and errors to be identified and reconciled. They must be robust against corruption and malice among system developers and the officials who run the election, yet the systems must be safe enough to leave unattended in a school cafeteria overnight.

Engineering voting systems to satisfy these often contradictory constraints is a difficult problem, requiring research into the full gamut of the problem, from the software and hardware design through the careful consideration of legal and administrative procedures. Human factors issues must be considered to make the voting systems accessible to all eligible voters, regardless of disability. Likewise, the system must be comprehensible to poll workers and transparent to election observers. Ultimately, the election system is responsible not for naming the winner of a race, but for convincing the loser that he or she, indeed, lost the election. We will investigate software architectures, tamper-resistant hardware, and cryptographic protocols. We will look at the role paper should play in electronic voting systems. We will examine system usability and study how public policy and administrative procedure can better safeguard the system. Only by considering all possible aspects of these systems can we have any assurance, at the end of the day, that our elections will be fair and that the will of the electorate will be correctly reported.

Intellectual Merit To tackle the voting problem, the proposed research must answer many deep and difficult questions that are of great interest to a number of other types of systems. The most basic question is: How can we responsibly employ computer systems for tasks that require high levels of trustworthiness, when we know that those systems will not be totally reliable, bug-free, or totally secure, particularly when every human participant from the system designers to the end users is a potential adversary and when human errors are commonplace?

Solving this problem requires thinking about the end-to-end behavior of a whole system, including software, hardware, procedures, law, and people. Perhaps more importantly, the research problem requires people from different areas of computer science, law, and human factors to combine their efforts in new and innovative ways.

Broader Impacts This proposal is motivated by a need to achieve greater integrity in our elections, a problem of burning public interest that has consumed an increasing amount of time for many of the PIs on this proposal. We have heard the repeated pleas from various communities, including technologists, voters with disabilities, election officials, politicians at all levels of government, and members of the general public to find some better solutions than current voting systems. We hope to produce some of those solutions, both in the form of modifications to existing voting technologies and the procedures used in running them, as well as future approaches to constructing trustworthy election systems.

Many of the PIs on this proposal are already engaged in the public debate, speaking at political events, testifying at state and national legislative hearings, and working with standards bodies. This NSF center will directly increase our impact, giving us the resources to create new technologies and to validate existing ones. Furthermore, the prestige of an NSF center will help us to interact with the voting system industry. Currently, many of us must politely decline invitations to study products from specific vendors due to our lack of resources. This NSF center will enable us not only to audit vendors' products, but also to create technologies that can be directly adopted by vendors. This center will ultimately increase the assurance we may have in all commercial voting systems used in our country, and will have further technical impact on the assurance of a variety of other Cyber Trust applications.

TABLE OF CONTENTS

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

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	1	
Table of Contents	1	
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)**	15	
References Cited	4	
Biographical Sketches (Not to exceed 2 pages each)	2	
Budget (Plus up to 3 pages of budget justification)	8	
Current and Pending Support	1	
Facilities, Equipment and Other Resources	2	
Special Information/Supplementary Documentation	0	
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. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

0433605

TABLE OF CONTENTS

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

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	_____	_____
Table of Contents	___1___	_____
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)**	___0___	_____
References Cited	_____	_____
Biographical Sketches (Not to exceed 2 pages each)	___2___	_____
Budget (Plus up to 3 pages of budget justification)	___7___	_____
Current and Pending Support	___1___	_____
Facilities, Equipment and Other Resources	___2___	_____
Special Information/Supplementary Documentation	___0___	_____
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)**	_____	_____

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0433504

TABLE OF CONTENTS

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

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	_____	_____
Table of Contents	1	_____
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)**	0	_____
References Cited	_____	_____
Biographical Sketches (Not to exceed 2 pages each)	4	_____
Budget (Plus up to 3 pages of budget justification)	8	_____
Current and Pending Support	2	_____
Facilities, Equipment and Other Resources	2	_____
Special Information/Supplementary Documentation	0	_____
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:

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0433655

TABLE OF CONTENTS

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

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	_____	_____
Table of Contents	1	_____
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)**	0	_____
References Cited	_____	_____
Biographical Sketches (Not to exceed 2 pages each)	4	_____
Budget (Plus up to 3 pages of budget justification)	7	_____
Current and Pending Support	3	_____
Facilities, Equipment and Other Resources	3	_____
Special Information/Supplementary Documentation	0	_____
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:

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0433484

TABLE OF CONTENTS

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

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	_____	_____
Table of Contents	1	_____
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)**	0	_____
References Cited	_____	_____
Biographical Sketches (Not to exceed 2 pages each)	6	_____
Budget (Plus up to 3 pages of budget justification)	21	_____
Current and Pending Support	3	_____
Facilities, Equipment and Other Resources	1	_____
Special Information/Supplementary Documentation	0	_____
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. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

0433606

TABLE OF CONTENTS

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

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	_____	_____
Table of Contents	1	_____
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)**	0	_____
References Cited	_____	_____
Biographical Sketches (Not to exceed 2 pages each)	6	_____
Budget (Plus up to 3 pages of budget justification)	8	_____
Current and Pending Support	2	_____
Facilities, Equipment and Other Resources	1	_____
Special Information/Supplementary Documentation	0	_____
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:

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0433701

C Project Description

A Call to Arms Elections are the defining institution in a democracy, and the integrity of the system of elections is essential to the integrity of any democratic nation. The rapid introduction of new election technology in the United States threatens the integrity of our democracy. Today, this technology is being developed, tested, and certified by agencies that are poorly prepared to judge questions about information security. In part, this is because elections pose extremely difficult information security challenges, problems that may be more difficult than the military security problems that have traditionally driven information security research.

Indeed, voting poses problems that go beyond the scope of traditional information security. Every participant in an election is a potential adversary, just as is the case in classical military security; however, in an election, the emphasis is on the accuracy and integrity of the data. The only thing that should require secrecy, besides encryption and authentication keys, is the binding between voter and vote. Furthermore, the number of participants is a sizable fraction of the entire population of the nation. Our focus, therefore, must be on data integrity in the face of an extraordinary range of threats.

Recent History The accuracy and integrity of the technology used for elections in the United States was brought into question once again by the events of Election 2000 [67, 34] when widespread attention was focused on the failings of punched-card voting systems. (These problems have been demonstrated repeatedly since at least 1984 [52].) The reforms instituted after that election, most notably the Help America Vote Act of 2002 (HAVA) [2], accelerated the already-begun replacement of aging lever machines and some flawed forms of punched-card voting systems; the replacement equipment includes both optical and mark-sense ballot scanners (not unlike the scanners used for machine scoring of standardized educational tests) as well as direct-recording electronic (DRE) voting systems, frequently based on touch-screen user interfaces.

Whereas each of the 50 states is free to select its own voting systems under broad technical outlines set by civil rights law and by HAVA, most states have opted to require conformance to a set of voluntary standards promulgated by the Federal Election Commission and the National Association of State Election Directors in 1990 [25] and revised in 2002 [26] (the FEC/NASED standards). These standards remain voluntary only in the sense that the Federal government does not require that vendors seek certification or that states demand conformance to these standards. Technically, HAVA has removed the authority for voting system standards from the FEC, transferring them to the Federal Election Assistance Commission; however, the standards activities of this commission have not yet been funded.

The adequacy of the FEC/NASED standards had already been called into question by several of us (Jones, Mercuri[1]) in 2001 [34]. These standards are ad-hoc, cover only parts of our voting systems, and have no clear foundation in information security. The volunteer effort that led to their development was dominated by voting system vendors, and perhaps as a result, they tend to enshrine current practice. In 2003, our warnings about these standards were confirmed when one voting system vendor, Diebold Election Systems, accidentally disclosed the source code for the software used in its AccuVote TS voting system to the public [28]. This story exploded into the press with the public release by several of us (Rubin, Wallach) of a report documenting serious security flaws in that software (the Hopkins report) [39]. Whereas the vendor has strenuously denied the significance of these flaws [23], subsequent reports commissioned by the state of Maryland from Science Applications International Corporation (SAIC) [63] and RABA Technologies [58], and by the state of Ohio from InfoSentry [35] and Compuware [20], substantially confirm all of the major security flaws identified in the Hopkins report.

All voting systems certified under the FEC/NASED standards are subject to testing by Federally certified independent testing authorities, and these tests include a source-code audit, the detailed results of which are confidential. The original source-code audit for the system that would later become the Diebold AccuVote TS system was available to one of us (Jones); the independent testing authority's report [68], written in 1996, indicated that this voting system software was the best the examiners had ever examined and that they were particularly impressed by its security. In light of the security flaws that were evident in that report [34] (Jones testimony)—some of which were still present many years later—and in light of the even more severe flaws revealed since then, such an evaluation calls into question both the examination process

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[1]Rebecca Mercuri, "The FEC Proposed Voting Systems Standard Update", submitted to the Federal Election Commission on September 10, 2001 in accordance with Federal Register FEC Notice 2001-9, Vol. 66, No. 132. http://www.notablesoftware.com/Papers/FECRM.html

and the security of all other voting systems in the marketplace.

It is worth asking, why would a Federally certified testing laboratory declare a voting system to be secure while five other reviews of that same system found major flaws? The answer lies, in part, in the question being answered. The Federally certified laboratory asked if the system met the FEC/NASED standards, while the other reviewers simply asked if the system was secure and applied their own reasonable definitions of what it means to be secure. Therefore, this result calls into question the FEC/NASED standards themselves as much as it calls into question the competence of the Federally certified examiners.

Whereas the reports done for Maryland cover only the security of the Diebold AccuVote TS, the reports for Ohio [35, 20] cover systems made by Diebold, Election Systems and Software, Hart InterCivic, and Sequoia. Between them, these four vendors dominate the marketplace for voting technology in the United States, and the Ohio reports make it clear that, indeed, the FEC/NASED standards process has not ensured that voting systems meet the level of security standards that are commonplace to critical computer equipment deployment, such as that used by the Department of Defense, the health care and avionics industries, and banking.

These reports also reveal something very disturbing about the state of the security assessment business today. While the SAIC report appears to have been thorough (in as much as this can be determined in light of its redaction by the State of Maryland), some of these reports contain little evidence of technical sophistication, and some conclusions appear to be based on misunderstandings of several key issues, such as the distinction between random and pseudorandom, and the distinction between cryptographically secure document signatures and cryptography for the purpose of obscuring the contents of documents.

All four state-sponsored reports identify serious security problems in the state administrative rules and procedures governing the use of voting systems in Ohio and Maryland. An additional audit of voting equipment used in 17 California counties determined that unauthorized voting software was in use in *every one* of these counties in November 2003 [65]. Taken together, these irregularities bring into question the assertion by Diebold that current "checks and balances in elections equipment and procedures" are sufficient to defend the security of our voting technology [23]. Apparently no operational configuration control or good management practices (not even the most minimum suggested by NIST) are currently used or required by the FEC/NASED process to ensure that the voting systems being deployed are identical in construction to those that were certified. This a serious and dangerous omission.

It is clear that the voting system standards that we have today do not address the entire voting system as a system. Human factors questions were explicitly omitted from earlier FEC/NASED standards, although this seems to be changing. Furthermore, the current IEEE Voting System Standard effort focuses only on equipment actually used in the polling place, explicitly excluding the larger context in which these systems are used [22]; it also entirely omits the equipment and software used to tally the votes and report the vote totals, and at present pertains only to the balloting systems. In addition, the large-scale involvement of current voting system vendors and the evolutionary development from the 1990 FEC/NASED standard through the 2002 revision to the current IEEE standards effort have codified existing practices and retarded consideration of alternative paradigms. The early standards efforts and subsequent writing on voting system accountability and integrity by Roy Saltman [59, 60, 61, 62] (formerly at NBS/NIST) are highly relevant here, reflecting the thinking of the recognized pioneer in the voting standards.

Numerous irregularities in the election process suggested by a variety of sources such as [52], Web sites of Rebecca Mercuri http://www.notablesoftware.com/evote.html, David Dill http://www.verifiedvoting.org, and others. These sources document many cases in which something was clearly wrong or in many cases where it was impossible to determine the accuracy and integrity of the process.

Overview of the Proposal We propose to form *A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections* (ACCURATE). In considering the voting problems as an end-to-end problem, we intend to adopt a defense-in-depth philosophy of security and not rely on any one line of defense, be it administrative or technical [3]. In any other computer application critical to national security, we would demand that the Common Criteria be applied [36]; one of us has long advocated the application of these same criteria to election systems [41, 34].

Broadly speaking, we can divide the proposed work into questions arising from existing voting technology and an exploration of the potential for new voting technology. Given the extreme weakness of existing technology, the primary thing we need to consider is, how can we harden this technology? Among the ideas proposed for this is the voter-verified paper audit trail, but there are many variants on this idea that have

not been properly compared.

Auditing methods, both those that allow absolute reconstruction of the election results from the original evidence and those that center on statistical evaluation, must be explored along with the application of these methods to the canvassing process. Canvassing, the computation of vote totals over the distributed election system, needs to be carefully examined, and given the frequency of clerical errors in real elections, all of the operations and procedures involved in the conduct of an election need to be studied with a goal of finding ways to add self-checking while keeping the system as simple as possible.

Looking at next-generation voting systems, we must explore several options for paperless DRE voting systems, including those that use trusted hardware and multiple independently developed components. In looking at proposals for such systems, we must take an aggressive approach to their evaluation, viewing the system as a potential adversary and seeking out avenues of attack, hoping to find them before the systems go into production or before an actual adversary comes along.

We intend to aggressively pursue design-for-audit principles, seeking ways to simplify the demonstration that an election is correct despite the presence of many components for which complete, mathematical proof is impossible. The use of voter-verified audit trails is but one model that allows this. We are interested in exploring others, using our knowledge of what can be audited to focus the designer's attention on the key system components where audit is difficult, and then bringing those components out into the open. In addition, we will explore the application of both hardware, such as trusted computing platforms, and software, such as proof-carrying code and assertion checkers to this problem.

Because elections are inherently distributed, we must explore the use of networking in elections, not limiting ourselves to major networks such as the Internet, but also considering what has been called sneakernet, the network implemented using hand-carried data, and we will investigate the extreme case represented by remote or absentee voting.

All of our work will be informed by studies of usability and accessibility, since election systems must be usable and accessible, not only to voters, but to the myriad of election workers who administer various parts of the system during the election cycle. In addition, because election systems are strictly governed by law, and because these laws frequently contribute to both the security and vulnerability of the election system, we must focus attention on the broad range of laws governing elections in this country.

Requirements for Secure Voting Systems The basic requirement of any voting system involves accuracy and integrity. The results of the election should reflect the will of the electorate, even if individuals or groups conspire to subvert the results of the election. While it is not sufficient to trust parties with opposing interests to monitor each other, it may well be useful as a means of reducing the likelihood of collusion.

In addition to the question of accuracy and trustworthiness, other essential requirements further complicate the design of election systems.

Correct capture is the property of recording each vote exactly as intended. This property can be compromised by voter error (which may be exacerbated by poor usability), hardware or software design flaws (i.e., "bugs") that may be introduced accidentally or maliciously, or hardware failure. *Correct counting* is the property that each vote is counted as captured. It can be compromised by errors or malicious interference in the transmission of votes to a central facility, or by data corruption in the storage of those votes, or in accidental or intentional errors in vote reporting.

Secrecy is extremely important to voters. Ballot secrecy requirements usually go beyond privacy requirements in other domains by requiring that voters not be able to prove how they voted, even if the voters desire to do so, to prevent vote selling or coercion.

Voting systems must be *auditable.* It must be possible to reconstruct the results independently from original records of the votes, which requires that these records be kept secure from accidental or intentional modification until the audit occurs. At the very least, even if it is not possible to recover from all failures, we must be able to detect failures. No voting system should permit the possibility of undetected fraud.

Elections must be *transparent,* which requires that observers understand election technology and procedures well enough to be able to testify to the quality of the election. Elections must be trusted by the populace, and must be justifiably trustworthy. The legitimacy of election results must be so far beyond reproach that even the losers, and especially the losers, are convinced to accept the winners of the election.

Voting systems must be highly *available and accessible.* Nothing should prevent voters from casting their votes, including computer crashes, running out of paper ballots, or failure to provide ballots that are

3

usable by non-English speakers or people with various kinds of disabilities. Many other properties can be compromised if election technology is not *administrable*. It must be possible for election officials to run an election without infeasible amounts of skill and training, and especially with poorly paid poll workers.

Of course, elections need to be conducted at reasonable *cost* while adequately achieving these other properties. To this end, and to accelerate the deployment of solutions to the many problems of elections, it is desirable to encourage *interoperability* between components of election systems through conformance to *widely agreed-upon standards*. For example, standard interfaces for voter-verifiable printers and standard data formats for ballots would probably lead to superior election systems through increased competition.

Requirements and criteria for election systems have been considered in [41, 50, 51], for example.

Hardening of Legacy Voting Systems It is important to consider what techniques can be used to strengthen voting systems that are currently in use. We propose research that will dramatically improve transparency and trustworthiness, meaningful auditability, the trustworthiness of canvassing, and simplified voting system operations.

Transparency and Trust in Electronic Election Systems The current debate involving the availability (or lack thereof) of voter-verified ballots from which to perform a recount with fully automated voting systems [42] stems from two fundamental concepts made evident by Florida's 2000 U.S. Presidential election: (1) Voters must be able to confirm that they have cast their ballots as they intended to vote. (2) There must be an undisputable way of determining the vote totals following the election. The major voting system manufacturers currently maintain that proprietary machines can be trusted to collect and tabulate ballots electronically, and that these results can accurately determine election outcomes. But a growing body of scientists has endorsed the need for independently verifiable elections, and legislators (e.g., [32]) have introduced Federal and state bills that would mandate the availability of paper audit trails.

Yet many fear the return to paper-based elections, not only due to their chad-filled past, but also because of issues of whether or not people can be trusted as well as (or better than) computers to collect and count ballots. Elections are sociological phenomena for which technological solutions are being applied, whether this be paper and pencil, punchcard, or touchscreen. These technologies necessarily result in a disparity between the expectations for the voting system and what performance is actually capable of being delivered. For example, election officials are quick to assert that "every vote counts" even though it has long been known that 3% to 5% of votes may not be cast or recorded in many elections, no matter what form of balloting technology was actually used [14]. Cryptographers, such as David Chaum [17] claim that it is possible, using mathematical techniques, to provide total assurance of election results using methods that are independently verifiable. Still, all cryptographic technology involves trusted agents as well as a degree of obscurity, so there may be some lingering doubt as to the integrity of the outcome. A computational solution that could be acceptable to the scientific community may not be sufficiently error-free or transparent enough to instill confidence in the voting public. Rebecca Mercuri's [42] method involving the use of a paper audit trail, could be expanded to include cryptography and barcodes to ensure that the ballots remain in the box, and to allow for independent development of nonproprietary and open-source solutions for end-of-day tallying directly from the ballots that the voters had verified.

The question at hand is to determine a methodology for counterbalancing transparency and trust in voting systems. This component of the ACCURATE proposal will use the election scenario as a test bed for developing theories in this regard. Inherent conflicts between anonymity and auditability will be examined. The result would most likely take the form of a hierarchical structure in which levels of transparency and trust can be ascertained. This model would then be explored using real-world settings, and concrete remedies would be provided to equipment vendors and members of the election community to assist them in mitigating exposure to risks. Results, having potential expansion to other trusted application areas beyond voting, would be published broadly, in order to obtain feedback and so that others can make use of this research.

The Center will evaluate the many proposals for voter-verified balloting, including those that use voter-verified paper, as well as those that use fully electronic technologies. The first step in this process is to develop a taxonomy of voter-verified balloting technologies. The next step is to consider threat and audit models for each approach, as the threats and audit methodologies are different depending on the specific model of voter-verification.

There are many interesting questions here. Should ballots have unique identifiers and/or digital signatures? On the one hand, such features may make "ballot stuffing" more difficult, and could greatly improve random auditing (we could choose a small number of ballot IDs at random and compare the paper and any

4

electronic records). On the other hand, ballot IDs could also facilitate vote selling and coercion. If the ID were a number that the voter could memorize or write down, those counting the votes could arrange for the voter to be paid for voting for a particular candidate. Even if the ID were bar-coded or otherwise made difficult to interpret, we might worry about cameras taken into the voting booth. What if there are multiple representations of the ballot data?How do we audit the consistency of these representations, and how do we make sure that all manners of reading the representations are trustworthy?

Statistics and Audit Many groups have suggested statistical testing of voting systems as a way to detect vote fraud, malicious code, and other attacks on the integrity of our elections. For instance, California state law mandates a manual recount of a random sample of 1% of the votes. This poses several interesting research questions. How effective is statistical testing at detecting and deterring vote fraud? Can it be used to reliably detect malicious code in DREs and other electronic voting systems? How much testing is enough? Many observers have hypothesized that a combination of voter-verifiable paper audit trails and manual recounts of a random sample of paper ballots could be used to detect DREs that have been subverted by malicious code. (See [44].) We will test this hypothesis.

We will undertake a mathematical analysis of the power of statistical testing. The relevant metric is our confidence in detecting vote fraud, and in particular the probability that the outcome of the election is altered without being noticed, as a function of the number of votes tampered with, how close the election is, the fraction of ballots sampled for recounting, and the way in which ballots are selected. We will assume a worst-case attack that attempts to swap votes according to whatever strategy is optimal for the attacker, and we will use realistic figures from past elections to bound the probability of a successful undetected attack.

One nontrivial aspect of this problem is that, in the real world, there are many complexities in how ballots are selected for counting. It is not feasible to choose a uniformly random sample from the set of all ballots; instead, to reduce cost, election officials typically choose a subset of precincts and count all ballots in those precincts, and so on. Also, the analysis needs to take into account the procedures used for the recount: what level of deviation is considered acceptable, and how are precincts chosen? Furthermore, it is important to take into account typical voting patterns; close elections make it harder to detect fraud, and so one must model this as well. Once these complexities are taken into account, it becomes possible to ask whether random sampling can indeed detect fraud, and to seek optimal sampling strategies that best accomplish this goal with minimal resources.

Also, we will study other forms of statistical audit in voting systems. Saltman has proposed a definition of auditability, viewed as an accounting system [62]; the goal is that the output of the system should be justifiable, given its inputs and operating procedures. We will investigate how random sampling and other methods can be used for *probabilistic audit*. We will study the security guarantees that can be provided by parallel testing and other auditing procedures.

Canvassing and Reporting All but the simplest of elections are distributed over many polling places, and this greatly complicates the process of canvassing the election. Computationally, canvassing is frequently no more complex than a simple summation, but it is distributed over a hierarchy with polling places at the base, and local and regional canvassing centers between the polling places and the topmost canvassing center where the final results are computed.

Each link in this hierarchy is potentially subject to attack, and the participants at each canvassing center may themselves be intent on corrupting the result. Experienced election workers can almost always tell many stories of canvassing gone awry because of clerical errors. The problem, therefore, is to design transmission protocols and to partition the summation to deter these attacks and rapidly detect and correct these errors.

Unfortunately, much of what has been done in this area is based on major misunderstandings of the problem. For example, one major security assessment report [20] appears to have assumed that simple encryption of everything is sufficient, without reference to the fact that much of what they asked to be encrypted is public record, and that encryption with a symmetric key cipher does not necessarily provide any degree of authentication.

The design of reliable, secure, and trustworthy canvassing procedures must involve an understanding of the audit criteria used to provide assurance that the results are correct and an understanding of the appropriate use of cryptographic and authentication technology. The Center will study these issues, and provide guidelines for canvassing and reporting that can increase the likelihood they are performed correctly.

Regardless of whether the data transmission occurs over some kind of network, or uses hand-carried media, the transmission must be secure against replay attacks, and apply appropriate cryptographic techniques to

deter an active adversary from modifying the data. We must find techniques to authenticate ballots that do not compromise voter privacy. We will develop canvassing techniques that are self-checking. When these checks detect errors, our techniques must determine whether extraneous records exist or whether records were lost or corrupted. We need to determine where the error occurred and how to correct it.

Operations and Procedures All voting systems must be operated under rules that prevent errors and reduce the risks of fraudulent behavior. Such procedures are inherently specific to the design of the voting system, but even then procedures for the same exact equipment vary widely from one state to another, as legacy procedures and regulations are updated and applied to new technology. We propose to develop a model code of procedures for each sufficiently robust voting system we study, that if followed, would allow that voting system to be used to conduct correct, usable, reliable, auditable, transparent elections.

These policies and procedures must satisfy a wide range of needs. To preserve the accuracy and integrity of an election, the chain of custody over any electronic or paper records must be carefully maintained, using a combination of physically tamper-evident seals and strong cryptography. Of course, to use cryptography correctly, it will be necessary for a county or state to distribute appropriate key materials to the voting terminals, whether using public key cryptography or symmetric key systems. We propose to study alternative models for secure key distribution and storage, for example, the use of internal smartcards to isolate the key from the rest of the voting system. We also intend to analyze the ability of "trusted hardware" designs to securely manage these signing keys.

We must specify and analyze the protocols by which registered voters authenticate themselves (while preserving anonymity) to a voting terminal exactly once to cast their ballot. Diebold's smartcard protocol, as used in the AccuVote-TS, for example, was found to be trivially flawed, possibly allowing an attacker to fraudulently authenticate and vote as many times as desired [39]. We must also specify any protocols spoken among the voting terminals and any networked "controller" in the polling place as well as any protocols used at the end of the day to transmit votes to a centralized tabulating / canvassing location.

A number of other operational issues must be studied as well. We need to study whether all paper ballots must be scanned, or whether statistical sampling methods are sufficient to detect missing or corrupt ballots. We need to design policies and procedures for installing software upgrades to minimize the risks of Trojan horses. And, most important, every policy or operational procedure we design must be comprehensible to nontechnical election officials and poll workers. We cannot expect to have skilled systems administrators or cryptographers on hand at every poll site.

Incident Reporting Several of our team members have maintained extensive files of incident reports, gleaned from the press, from first-hand reports, and from many other sources [52]. Other collections of incidents have been published [31]. The InfoSentry report for the State of Ohio [35] pointed out that, in that state, there was no central repository for reports of election irregularities or equipment failures, and were there to be such a repository, there was nobody charged with analysis of such reports. We believe this to be the case in most states, and as well, there is no repository for the country at large. Incident collection and reporting is further hampered by the restrictive non-disclosure agreements that have been signed between voting equipment vendors and purchasing authorities making it a third-degree felony to disclose the cause of an equipment-related election problem, even if such has resulted in court hearings. [43]

One component of the project will involve creation of an incident reporting and analysis facility similar to Carnegie Mellon's CERT Coordination Center[2] as a central repository for collection and distribution of voting equipment anomalies. Incident types could include: inability to open or close polling places on time; other break-downs and denial-of-service occurrences; detection of deployment or distribution of uncertified software or components; excessive MTBF rates; anomalous vote tally reports. each of these types has occurred in US elections during the past 6 months. Using this data, categories of failures and vulnerabilities could be developed, correlation with particular product models and vendors could be identified, and true reasons for failures could be assessed. This repository would be of tremendous use by those having direct or indirect involvement with the election process. The incident reporting data could be used to support and motivate many of the other aspects of the ACCURATE research project.

Design and Analysis of Next-generation Voting Systems   Fully-Electronic Voting Systems An important threat against any electronic voting system is *software tampering*, whereby an attacker might try

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[2]http://www.cert.org

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to install some "Trojan horse" logic to cause the voting system to bias its results in some fashion. Even software testing, performed concurrently on the day of the election, cannot necessarily detect the presence of such tampering. To date, the only solution known to mitigate these risks is to have the voting machine print a voter-verifiable paper ballot. However, there may be other possible solutions. We will investigate novel architectures for paperless systems.

An intriguing possibility is to break a voting machine into separate parts, built by unrelated vendors, which must cooperate to produce the final tally. [10] For example, one part might interact with the voter to produce a ballot, and a second might ask the voter to verify his or her choices, while a third records the ballot for canvassing. We must assure that these are independent and do not collude; this will require research. We will study how such a system can be designed and implemented to be usable despite the large number of components with which the voter interacts.

Another intriguing possibility to consider is the application of recent *trusted hardware* concepts that allow a computer to *attest* to the software that it is running. We discuss these concepts below. Our research will consider whether cooperating machines or trusted hardware components may be able to increase the resistance of voting systems to tampering.

Adversarial Evaluation of Voting Systems In the security community, it is widely accepted that a system may only be considered secure after it has been subject to intense and continuing attempts to break it. This adversarial process has been applied successfully in the design of a variety of systems. An important example is the process used by NIST to create AES, the advanced encryption standard, meant to replace the aging DES. Each participant in the challenge had their own cryptosystem and spent significant effort finding flaws in the competition. While this process does not guarantee security, the resulting AES cryptosystem is widely considered far more robust than comparable systems built without such scrutiny.

In the voting space, we similarly wish to apply an adversarial process toward engineering stronger voting systems. In addition to studying our own designs, we will examine existing work, including complete systems such as the Australian open-source eVACS system [4], and design concepts including Frogs [10, 14] and various cryptographic techniques [16, 17]. In general, our goal will be to produce a portfolio of battle-hardened voting technologies that may be applicable to any vendor's systems. By developing a working understanding of how these systems can fail, we can build stronger systems for production use.

Design for Audit Electronic voting machines consist of hardware and software. One of the most serious threats to the integrity of these machines is the possibility that an insider, with access to the development environment, might insert malicious code into the software that would alter the outcome of the election, in such a way that would be undetectable. Automated reasoning about software is extremely difficult. The halting problem is an impossibility result that implies little hope for developing automated tools to discover malicious code in software. The best technique developed to date for dealing with this problem is perhaps *proof carrying code* (PCC) [47], where programs carry *proofs* with them that they do not violate some safety property. However, PCC is still the subject of active research, and has not yet been applied to software on the scale of a voting system. Continued advances in PCC, as well as new structures for voting systems, may make these techniques applicable in the future. As code analysis for malicious code appears to be too difficult a problem, we propose a research problem that is more tractable, and yet offers promise in avoiding maliciously installed software by insiders who develop electronic voting machines.

The idea is to design software in such a way that it is easier to audit. While the general problem of auditing software is intractable, it is possible that with a constrained development environment, it would be much more difficult to hide malicious code and avoid detection. The malicious code would have to conform to the design constraints, and this limits the flexibility of the attackers' design space. For instance, we might restrict voting software to be deterministic and exclude all access to random-number generators and other sources of nondeterminism, on the observation that randomized software is harder to test than deterministic software. Or, we might use programming environments that use logging and checkpointing to enforce that all computation is replayable, to ensure that all results can be consistently reproduced after the election; this might deter would-be attackers from inserting malicious code. These are just two examples from a very large design space of possible constraints. As part of this research, we propose to study and experiment with different ways one might constrain the development environment to maximize the potential for audit, minimize the ability of programmers to hide malicious code, and minimize the impact on legitimate development. The other major direction is to eliminate the need for trusted software, (e.g., through a voter-verified audit trail) as discussed above.

Cryptographic Protocols for Voting A number of cryptographic techniques provide promising research directions. One technique, called mix nets [15], provides voter privacy while offering the possibility of public validation of the election. This property, known as *universal verifiability*, is appealing; however, a number of issues remain before it can be put to use:

Ease of use and simplicity: Is there a simple cryptographic mechanism that provides universal verifiability? Currently, the principles underlying mix nets are beyond most voters and election officials. The question is whether one can achieve universal verifiability by using a simpler mechanism that is easy to use, administer, and understand. Chaum [17] describes an idea in this direction by using visual cryptography. We intend to pursue additional directions with the goal of simplicity in mind.

Security: Security of universally verifiable voting systems is poorly understood. For example, there is currently no definition or model for what is a secure voting mix net. As a result there is no way to prove the security of existing constructions. We hope to resolve this issue by providing a model that captures the different attack methods on universally verifiable systems. This will enable us to provide a proof of security for new constructions that we propose.

Performance: Cryptographic systems that provide universal verifiability often break down in large elections because of the computational cost of verifying the election. Currently the most efficient systems are described in [49, 9, 37]. We hope to continue our work in this area to provide more efficient systems.

Just as important as new breakthrough in cryptography will be the integration of this technology into the overall voting system. While cryptography can offer solutions to problems not amenable to any other solution, the overall integrity of a voting system based on novel cryptographic techniques will be limited by the other issues discussed in this section.

Software Engineering Tools Many tools are available that can provide assistance with constructing an assurance argument. We can classify these tools in three categories: (1) Tools that primarily assist in modeling and reasoning about systems. Examples of such tools include SRI's PVS [54] and SAL [21], Bell Labs' SPIN [33], Stanford's Murphi [24], and CVCL [66] and other theorem provers and model checkers, some of which are specialized to areas such as cryptographic protocol analysis. These tools can be used to great advantage at early stages of software design to ensure that the design meets the security properties derived from requirements. (2) Tools that assist in the implementation (or analysis of implemented software). Examples of such tools include MOPS [19], CCured [48], CQUAL [29], BOON, CMC [45], and ARCHER. [69] By performing mechanical analysis of code, we can find problems that people have overlooked, despite rigorous code reviews. (3) Another necessary component to an assurance argument is a secure configuration management system. It does little good to analyze code (at either the source code or object code level) if we cannot assure that the code being analyzed is actually the code being used. We also seek to have strong auditability of changes made to the system at all levels, from requirements to executable code.

Any solution to voting system integrity will rely on tools from all three of the above categories. Theorem provers and model checkers let us reason about high levels of design. We need to preserve security properties as we move from architecture and design into implementation. We absolutely must prevent the recent situation in which California counties using Diebold's DRE systems found themselves, running uncertified code, contrary to state law. [65] One aspect of configuration management that we intend to pursue is the use of configuration management software on top of operating systems that support mandatory integrity policies (e.g., SELinux). By effectively combining operating system integrity guarantees, along with the configuration management system's audit trail, we can gain additional assurance in our repository. We will investigate combining cryptographic integrity protection, as in OpenCM [64] with distributed configuration management, as found in many commercial products.

Trusted Hardware Platforms Recently, IBM and HP, among other companies, have released computers with hardware conforming to the Trusted Computing Platform Alliance (TCPA) specification. There is a long history of research and development of tamper-resistant coprocessors, recently exemplified by the IBM 4758. Recent research advances [40] suggest that we may be able to use the security guarantees of TCPA hardware to bootstrap an assurance argument similar to that of a tamper-resistant coprocessor, and thereby render electronic voting systems more secure against malicious code and unauthorized tampering. We will examine both the role and impact of tamper-resistant coprocessors in architectures for secure electronic voting, and whether commercial TCPA hardware can serve as a secure substitute. A major research area around the use of the secure coprocessor will involve trusted paths: how can we assure that input (e.g., from a touchscreen) is not tampered with on the way into the tamper-resistant hardware? Furthermore, if we

assume the presence of tamper-resistant hardware in every precinct, is it possible to leverage this hardware in support of canvassing activities?

The TCPA hardware can also be put to use for configuration management. While many are uneasy about the possibilities of widely deployed TCPA hardware [5], a low-level mechanism that will run only properly digitally signed code could be of great benefit to voting system integrity. A side effect of this mechanism is that "accidentally" running the wrong code will not be the result of a simple mistake.

Use of Networking in Voting The last several years have seen a strong push toward electronic voting. It is only natural to consider the possibility of network-based or Internet voting; in the most extreme model, this allows citizens to vote from their personal computers at home. Internet voting is now a reality in Geneva, Switzerland, and in the United States, Internet voting has been used in several primaries. The first was the Arizona Democratic presidential primary, in March of 2000, in which approximately 85,000 votes were cast and counted. The Reform Party national primary was also conducted over the Internet that summer, as were various nonbinding Internet voting experiments in some counties of Washington, California, Arizona, and elsewhere. The use of the Internet for the Michigan Democratic Caucus in 2004 is also noteworthy, if only for the fact that it appeared to be an Internet-based election but without any of the protections of a secret ballot; in fact, all remote-site or absentee voting sacrifices many of the protections of ballot secrecy, for example, freedom from coercion, no matter what the technology.

There have been several important studies of Internet voting: The first was by the California Secretary of State's Task Force on Internet Voting, whose report [12] was issued in January, 2000; this was the first to clearly articulate most of the technical security issues regarding Internet voting. Another study was conducted by the Internet Policy Institute with funding from the National Science Foundation. Its report [46] was based on a conference held in October 2000, and was published in March 2001. The report stated, "Remote Internet voting systems pose significant risk to the integrity of the voting process, and should not be fielded for use in public elections until substantial technical and social science issues are addressed." Other reports have come to the same conclusions (see, e.g., [14]).

This year, the Department of Defense considered fielding an Internet voting system called SERVE for overseas civilians and military personnel. The project was abandoned when a report[3], co-authored by two of us (Rubin, Wagner) and two others, showed that the security concerns were too serious for SERVE to be used, even experimentally.

While much of the focus on the use of networks in voting has centered on the Internet and voting from the home, much of the criticism leveled against Internet voting also applies to the use of other network technologies, from wireless networks to the telephone network, and much of it applies to more conservative use of networks for vote transmission, for example, from the polling place at the close of the polls. One of us (Jones) pointed this out in 2000 in his critique of the California Internet Voting Task Force Report[4].

We believe that there are platform issues and availability issues that need to be resolved before all but the most conservative uses of networks in voting can become a reality. Today's personal computers not secure enough to be used as a platform for voting over public networks, but we will study the possibility that the trusted hardware platforms (discussed previously) can be used to ameliorate this. A second problem involves availability; most networks are highly susceptible to denial-of-service attacks that could disrupt a network-based election. The center will conduct research into defenses against denial-of-service attacks, so that if and when the platform issues are resolved, there might be hope for this form of voting.

Remote and Absentee Voting To preserve ballot secrecy and anonymity, it is clearly preferable to require voters to vote in polling places that offer the necessary privacy. However, voter turnout can be increased if voters have a way to vote early, whether by mail or by visiting a designated polling place. Also, most jurisdictions make provisions for absentee voting by mail, to allow voters who are unable to appear at the polling place in person to vote. Mail-in ballots offer great convenience to voters, notably including soldiers serving abroad, who cannot return home to vote in their home precinct. However, mail-in ballots can also easily be sold by or coerced from voters. We would prefer a system that has the flexibility of mail-in ballots with the privacy guarantees of a secure polling place. Ideally, voters should to be able to cast their ballots at *any* polling place in the state, but this will require replacing how voters are currently authenticated.

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[3]The report is available online at `http://servesecurityreport.org/`.
[4]available online at `http://www.cs.uiowa.edu/~jones/voting/california.html`.

In many states, voters can "authenticate" themselves merely by stating their names and signing in a book. While it might seem natural to require voters to produce ID cards, single-use ticket stubs, or some other proof of their eligibility to vote, such measures might disenfranchise voters who cannot find their single-use tickets or might enable vote selling. Also, requiring the production of ID cards is seen to be intimidating by numerous minority groups. Traditional forms of biometric authentication may be unacceptable for the election setting, because many voters fear governmental collection of such data, and they may choose not to vote if they are required to use such systems.

Hybrid system will be considered, where voters voting in their home precincts can validate their registration in the same fashion as they always have. However, voters wanting to vote remotely can request, in advance, suitable credentials that can prove their identity at any polling location. We have already investigated the use of visual cryptography in such an endeavor [55], and we believe other cryptographic measures, perhaps borrowed from the digital cash literature [18], would allow each voter to cast one ballot anonymously, but would reveal the identity of any voter who attempted to vote more than once. In addition to normal cryptographic soundness proofs, we would need to investigate the usability and accessibility of our scheme as well as the additional cost and risks of sending such credentials to every voter, most likely through postal mail.

Usability and Accessibility Usability by a broad public is particularly important in voting systems. No matter how secure and reliable a voting system is, if that system places demands on the voter such that he or she is unable to vote successfully, or is made uncomfortable with doing so, voters will be disenfranchised. Voting is a particularly challenging human factors problem because voting systems must be usable by citizens regardless of age, disability, education, socioeconomic status, history of computer use, literacy level, native language, and the like. A successful system must go beyond simple usability in terms of the voters' ability to accurately cast their votes, but also must produce confidence that their intent was accurately recorded and tallied. The Federal Election Commission has explicitly acknowledged the importance of these issues and recommends that those procuring voting systems conduct usability tests before making a decision on what system to deploy [27].

Despite the breadth and depth of the problem, voting is not a domain that has received much attention from the human factors/human-computer interaction community; the bulk of the activity in this area has been a reaction to the 2000 U.S. presidential election. Thus, few techniques or approaches have been developed specifically for voting. However, there is no reason to believe that the problem is beyond the scope of current human factors methodology.

Our approach to this will be three-pronged, based on usability analysis, laboratory usability testing, and field usability testing. *Usability analysis* will involve the application of traditional human factors analytic techniques to voting interfaces. This includes informal methods such as heuristic evaluation [53] and more formal approaches such as Cognitive Walkthrough [57] or GOMS analysis [38]. In addition, computational/mathematical techniques such as Information Foraging analysis [56] or computational cognitive modeling [11] may be applied as well.

Laboratory usability testing is empirical testing of voters (or potential voters). We intend to draw from two primary populations: Rice University undergraduates, representing in some sense the "best-case" scenario (e.g., highly educated, low rate of disability, high general visual acuity), and local Houston residents, recruited through newspaper advertisements. While this will not generate a completely representative sample, it should be substantially more diverse than the undergraduate sample. These participants will be brought into a laboratory environment and observed interacting with voting systems using objective techniques (i.e., performance measurement of time and accuracy), videotaped "think aloud" protocols, and subjective measurements (e.g., scaled responses on attributes such as perceived difficulty and trust).

Field usability testing consists of similar measurements taken outside the laboratory. To collect the widest and most heterogeneous sample possible, participants will also have to be recruited and the voting systems assessed in participants' own neighborhoods. This should significantly increase the generality of the sample, particularly since the Houston area contains a strong diversity in terms of socioeconomic status, ethnicity, education, and so on. Testing in remote locations will by necessity rely less on video and objective measures, but they need not be entirely eliminated.

Efforts will be made in both the laboratory and field studies (especially the field studies) to recruit participants who are likely to have particular difficulty with voting, including visually disabled, non-English-speaking, and low-socioeconomic status participants.

This approach is intentionally similar to the approach employed by researchers at the University of Maryland in their analysis of the Diebold AccuVote-TS system [7, 8], which is one of the most comprehensive usability studies of electronic voting systems to date. The primary difference is the addition of quantitative, analytic methods, which have proven to be valuable in other contexts (e.g., [30]) and are a particular specialty of the co-PI responsible for this portion of the project.

Another difference between this work and the Maryland study is an added element. In addition to the assessments above, we will conduct a retrospective analysis of data from the Florida 2000 election. We already possess a substantial archive of the required data. This election provides an unparalleled source of data about the response of real voters to real election systems. The quality of this data is particularly good in the realm of human factors issues in optical mark-sense ballot design, an area that is of growing importance because of the widespread use of this voting technology, both in polling places and for absentee ballots. Although much of the data for the Florida 2000 election was collected with goals quite different from ours (we have no interest in arguing about who ought to have won), we have found considerable value in the data from the official Florida canvass, the media-sponsored ballot examinations [1], and the U.S. Commission on Civil Rights [67]. While this data has been extensively reviewed by political scientists and news pundits, we come at this data from a different perspective, seeing it as a window into fundamental issues of human-computer interaction.

Legal and Policy Issues In the course of designing an election system that is usable, reliable, and transparent, several legal and policy issues need to be addressed. The research will be complicated by the interaction of state and Federal law. Although Federal law necessarily overrides contrary state law, much of the election machinery in the United States is left to states to run essentially unsupervised by Federal law. Thus, the research will require looking at election laws in all fifty states. From a legal and policy perspective, we want to examine the entire system, from voter registration to post-election litigation. While the technical work described in the proposal will focus on the actual voting and canvassing systems, it is important to consider the entire legal and policy framework relating to voting and canvassing.

The first stage to research is the registration process. First, we should do research on state requirements regarding voter-provided information. To what extent do these requirements vary? To what extent do they assure accurate voter rolls? To what extent do they respect voter's privacy interests [13]?

What protections are provided for state voter registration databases? At the same time, at the back end of registration—the *purge process*—there have been several problems that should be examined. States have subcontracted to private firms the task of identifying individuals who should be removed from registration rolls, for reasons ranging from their having moved or died to their having been convicted of disqualifying criminal offenses. Many of the most error-filled purges have relied on computer programs to match and remove voters. Many of these purges have used private sector databases, which are exempt from various state and Federal laws requiring accuracy and citizen access. The Federal laws most applicable are the Voting Rights Act of 1965, as amended, 42 U.S.C. §1973 et seq., and the National Voter Registration Act of 1993, 42 U.S.C. §1973gg. The procedural and substantive rules governing the citizen access and correction rights and government computer matching programs found in the Privacy Act 5 U.S.C. §552a, and the Computer Matching and Privacy Protection Act of 1988 (5 U.S.C. §552a(o) et seq.) are relevant to this inquiry. In addition, all fifty states have both laws and regulations regarding access to voter registration records and the security of voter information. What additional laws and procedures should surround database purges?

The second stage is voting itself. Here, one key area of research will focus on the interaction between new voting technologies and Federal and state law regarding voter privacy, voter assistance, and equal access to the ability to vote. In addition, we will examine the "soft" checks and balances in the polling place that buttress efforts to authenticate voters and provide some level of transparency in the voting process. The particularly relevant pieces of Federal law include sections 2 and 5 of the Voting Rights Act, which forbid the use of election systems that have a disparate impact on racial and ethnic minorities; section 203 of the Voting Rights Act, which deals with voters' right to assistance; the Voting Accessibility for the Elderly and Handicapped Act, 42 U.S.C. §1973ee et. seq.; the Uniform and Overseas Citizens Absentee Voting Act, 42 U.S.C. §1973ff et. seq., which is of particular relevance to absentee voting, including voting by military personnel; and the Americans With Disabilities Act, 42 U.S.C., 42 U.S.C. §12133 et seq., which has to do with physical accessibility of polling opportunities. In addition, in some regions of the United States, the bilingual ballot provisions of the Voting Rights Act may further complicate the design of appropriate election technology given that ballots must be printed in a significant number of languages. Areas of research

include the process of on-site verification of voter eligibility as well as vote casting. Research will consider the interaction of law and practice with current electronic voting systems and with future systems that may, for example, automate determinations of eligibility or authentication of voters as well as the casting of votes. What would the authentication/anonymization mechanism for a futuristic polling site ATM-style machine look like from a privacy, accuracy, and fraud perspective?

The third stage of the process is vote tabulation and canvassing. This is governed almost entirely by state law. In thinking about new voting technologies, research into the audit trail and public manual tally requirements of different states will be particularly important. How are votes tabulated? Who has access to ballots, and under what circumstances? In a fully electronic environment what methods can be used to meet the transparency and spot checking goals of the manual tally provisions of state laws? How do we achieve a similar (or perhaps greater) level of transparency with machines? Are there places where open code is a necessity? Is there a way to balance open and proprietary code? If proprietary code is used, are there alternative methods of providing transparency?

The fourth stage is electoral contests and judicial challenges. These, too, are governed almost entirely by state law. Most states provide for a two-step process in which (1) candidates or political parties (or in a few states, individual voters) can file administrative challenges to announced election results and seek a recount and (2) candidates can file lawsuits seeking to have certified election results overturned. We need to research the current legal bases for contests and challenges to see whether they are adequate to address the issues posed by new technologies. We also need to determine the kind of evidence both that the new technologies will provide and that administrative bodies or courts are able to use.

Education and Outreach Plan The proposed Center will make significant efforts for outreach and education. Voting is important to all citizens. The leadership of our Center has a long record in involvement in public elections, working as election observers and precinct election judges, and serving on county and state election boards, committees, and task forces. By establishing a research center focused on the security of voting technologies, undergraduates, graduate students, and faculty will work on projects that will naturally involve them in the civic process. Students will be encouraged to get involved, become election judges and poll watchers, and to participate in our democracy. As an example of this, several students at Johns Hopkins became election judges after taking a security course that covered all of the recent studies of electronic voting [14, 12, 46, 63, 39].

We will make a special effort to reach out to state and local election officials, both by involving them in the center's oversight structure, by inviting them to our annual workshop, and by addressing much of our annual report and web site to them. These activities fall under our technology transfer and management plans.

The proposed Center will also provide an outlet for educational programs, projects, and engagement of students in the election process. Doug Jones has taught a seminar on computers in elections that reached out to political science and business students as well as computer science students, and will be teaching a new course on computer security next year where voting systems will serve as a major example. Dan Wallach taught a course at Rice University where students studied the difficulty of embedding and discovering malicious code in a voting system [6]; source code and other materials from Wallach's course are online and freely available. Avi Rubin taught a course with a similar project at Johns Hopkins University, where students built voting machines and then studied mechanisms for embedding and detecting back doors. Future course projects will continue this adversarial process and will emphasize a *design for audit* theme; students will explore different ways to constrain a programming environment to make it more difficult to embed malicious code in software.

Students of our institutions will eventually assume leadership positions in government and industry in a society in which the role played by information security and assurance is increasingly pervasive and critical. We believe that the research described in this proposal, which provides many opportunities to involve students in data gathering, toolset design and implementation, empirical analysis, and exposure to pressing issues of technology and society will provide an outstanding educational vehicle.

Technology Transfer Plan The major vendors have participated with many of us on the IEEE voting standards development team, and have a vested interest in having improved accuracy, integrity, reliability, usability, auditability, and so on in their products. We expect that they will engage in ongoing discussion with our Center, and potentially offer products for testing and evaluation. Because of a variety of limitations (e.g., closed-source proprietary software, competitive vendors), our proposal explicitly does not include any

of the existing commercial vendors as direct participants.

We will make a special effort to involve the Open Voting Consortium (OVC)[5], a nonprofit group devoted to exploring the application of the open-source development process to the domain of voting and elections. We hope to be able to provide technical guidance to OVC volunteer developers, we plan to use the products developed by the OVC as test cases, and we may be able to use the efforts of OVC volunteer developers to implement and test results of our work. Furthermore, we see no problems with cooperating with any other voting system vendor willing to frame that cooperation in terms of an open-source development model.

At least two expected contributors of hardware (particularly trusted computing platforms) and software have expressed their intent to interact technically with Center participants as well.

With respect to voting communities, the Center will provide considerable resources for election officials and voter-related interest groups, including facilities for evaluating proprietary and open-source systems and our studies of election law and procedures. In order to facilitate our communication with this community, we will invite and help fund participation of election officials in our annual workshop, and we will address a major part of our annual report to the election community.

The FEC/NASED voting system standards define themselves as "working" standards, as does the IEEE standard now under development. At the same time that these standards are being used to certify particular voting systems, they are open to ongoing revision in response to changes in the technological landscape as well as changes in law and voting practices.

The ACCURATE Center should be able to provide valuable resources to developers of voting system standards. Much of our proposed work is directly relevant, from the appropriate use of cryptography, criteria for evaluating the auditability of voting systems, and alternative models of voter verifiability, to studies of human factors and the legal context. Our work on adversarial testing should also contribute to the standards process, as should our studies of the relationships between system elements and our work on canvassing and recount procedures.

The IEEE has recently created a subgroup of its voting systems standards effort to study data transfer, hoping to define a protocol that can be used for cross-platform communication of ballot layouts. The OASIS consortium[6] is also interested in developing such protocols. We are particularly well qualified to evaluate and assist in the inclusion of of security, reliability and auditability features into such protocols and the development of protocols for the secure distribution of software updates to voting systems, but our general interest in end-to-end issues leads to the possibility of far broader impact.

Management Plan The Center will be led by Doug Jones and located at the University of Iowa. Professor Jones has brought his experience in secure operating systems and real-time embedded systems to bear on election technology for the past decade, working with local, state and national election administrators, elected officials, and lawmakers. Probably no other computer scientist in the country has served as effectively as a bridge between academic computer science, election officials, and voting system vendors. Professor Jones has served as a machine inspector for the State of Iowa, and created the premiere body of research on optically-scanned voting systems. See his biography for more details.

A full-time administrative assistant will be hired for the Center and housed at Iowa, with responsibilities split between grant accounting, personnel management, and support for Center researchers on the one hand and facilitating the Center's interaction with election officials and the public on the other hand. One quarter-time undergraduate research assistant at Iowa will assist the administrator with the latter, serving as webmaster for the Center's Web site.

All of the investigators involved in this proposal have strong records in the intersection of election technology and computer security, some dating back over a decade, and within this group, are many established collaborations. For much of the past year, we have been in intensive communication.

The Center's strategic directions will be set by a Steering Committee, consisting of Drs. Dill, Dean, Jones, Rubin, Wagner and Wallach, one member from each participating institution. The Center will also establish an unpaid external Advisory Board that encompasses extensive knowledge of election procedures (e.g., county registrars and secretaries of state), relevant legal expertise, voter interest groups such as the handicapped, and computer expertise. The proposal explicitly avoids selection of the members of this board, in order not to contaminate the reviewer pool; however, one group that must be represented on the Advisory

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[5]See `http://www.openvotingconsortium.org/`.
[6]See `http://www.oasis-open.org/`.

Board is the Open Voting Consortium (OVC)[7].

The principal investigators will meet twice yearly, with one meeting rotating between the participating institutions in the fall and a spring meeting at Iowa, in conjunction with a meeting of the Advisory Board, invited guests and selected graduate students. The major part of this meeting will take the form of a workshop, disseminating results to election officials in attendance as well as grounding the researchers who attend in the reality faced by election officials.

Between the twice-yearly meetings, the Steering Committee will communicate largely by email and monthly conference calls. The primary responsibility of this group will be to monitor the work being done at each institution, seeking out ways in which work being done at one institution can support and enhance work being done at another.

The Center will place a strong emphasis on collaboration on the proposed research agenda. Toward this goal, doctoral committees for participating graduate students are likely to include external advisors or members from other Center organizations, and we will make opportunities for graduate students to visit other Center institutions for summer internships or other extended visits. The Center participants already have a strong record of collaborating in smaller groups, on e-voting security and on other research issues; the goal of the Center will be to expand and strengthen this collaboration.

The administrative time line includes the various meetings noted above. In addition, expected deliverables include numerous papers, reports, evaluation results, experimental results, and an annual report that will appear on the Center Web site.

Evaluation Plan The ACCURATE Center will require substantially more complicated evaluation metrics than other Cyber Trust projects, and most other NSF-funded centers. The ACCURATE Center seeks, through a multidisciplinary approach including technological, legal, and policy aspects, to catalyze change in the way America votes. This change will ensure the continued future of fair elections in the nation. There are no technical challenge problems that can be solved within the confines of the proposed Center to determine success, as this change will reverberate through both technical and public policy communities.

Clearly, some traditional metrics for evaluating progress are applicable. One expected output of the Center will be new technical approaches to the computer security problems found in election systems. We fully expect that some of these technologies will be applicable to other problem domains where the chosen technology is a distributed system. Along this line, traditional measures such as publication and citation counts can show the scientific progress of the Center and its researchers.

One area not covered by traditional NSF-funded centers, but highly important to ACCURATE, is work in the public policy arena. One obvious approach is to measure the Center's impact on legal changes supporting the switch to electronic voting, but this may be too narrow: good policy analysis can be held hostage to political forces. More meaningful metrics in the legal and policy arenas include: ACCURATE Center participants testifying before legislative (e.g., Congress, state legislatures, county boards of supervisors, and municipal councils) and administrative bodies; The Center participation (either as individuals or as an institution) in standards bodies (e.g., IEEE); Articles and editorials discussing the work of the ACCURATE Center; Publication of scholarly articles in appropriate journals and conferences. Taken together, these venues should indicate the success of the Center in influencing the necessary public debate.

The true technical success of the Center will be measured by having its technologies available in FEC-qualified election systems, either from today's leading vendors, or new entrants to the market, or an open source platform with appropriate support resources. Unfortunately, this will most likely be impossible to measure before the end of the initial 5 years: ACCURATE technologies will most likely be maturing in the Center, and not ready for transition until the fourth or fifth year of the Center. One can then expect a further 2- to 3-year delay of commercialization when product cycles are taken into account.

Results from Prior NSF Support Drs. Dean, Mercuri, and Neumann and Professors Byrne, Jones, Karlan, and Mulligan have not had NSF support in the last 5 years.

Prior NSF support for Avi Rubin (a) Award number: G420-E46-2130-2000 Amount: $616,923 Period of support: 10/1/03 - 9/30/06 (b) Title: Towards more Secure Inter-Domain Routing (c) So far, we have evaluated historical BGP data to examine how security solutions would have performed under peak loads.

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[7]See http://www.openvotingconsortium.org/.

We have implemented several of the BGP security solutions in a simulator, and we have an implementation of the IRV system. This work is still in the early stages, as we have had the award for only 6 months. (d) We are planning on submitting our first publication this summer.

Prior NSF support for David Wagner   (a) NSF CCR-0093337, $268,000, 3/1/01 – 2/28/06. (b) Title: CAREER: Security in the Large: Gaining Assurance in Real-World Systems. (c) This grant supports research on model checking, lightweight formal methods, and domain-specific heuristics to detect security bugs in legacy systems. We have developed BOON, a program analysis tool that finds buffer overrun vulnerabilities in C code, and MOPS, a model checking tool that is used to find dozens of security bugs in C applications. We have shown how to use CQual, a type-inference tool, to find format string vulnerabilities in C programs. (d) This grant has resulted in more than a dozen publications on software security, cryptography, and related topics.

Prior NSF support for Dan Wallach   (a) NSF-CCR-9985332, $200,000, 4/1/00 – 3/30/04. (b) Title: CAREER: Security and Resource Management in Type-Safe Language Environments. (c) This project aims to add protection semantics, normally associated with operating systems, to language runtime systems to support the concurrent execution of multiple untrusted programs within the same runtime. We have developed a technique for rewriting programs to guarantee that they will terminate without destabilizing other programs using the same language runtime. We have developed memory accounting within a garbage-collected runtime. This grant has also partly supported other security-related work, including performance measurement of SSL systems, studies of copy protection systems, and the study of security issues in wireless networks. (d) This grant has directly supported ten publications and partly supported another five on topics in computer systems and security.

Prior NSF support for Dan Boneh   Dan Boneh was previously awarded NSF grant CCR-9984259 (CAREER), lasting from February 2000 to January 2004. During this project we discovered the first usable Identity Based Encryption scheme. We also worked on message integrity in a multicast environment. Using this CAREER award we proposed a new encryption mode for the RSA and Rabin cryptosystems that provides a high level of security and is much simpler than previous constructions. Finally, we developed a digital signature scheme where the signatures are extremely short – they are half the size of current popular digital signatures (e.g., DSA). Short signatures are important in environments where humans manually type in the signature.

Prof. Boneh was also awarded NSF grant CCR-9732754, lasting from October 1998 to June 2001. The award enabled us to study several topics. We began by studying the feasibility of using the PalmPilot for digital payments. To do so we built a digital wallet for the PalmPilot. One problem in using the PalmPilot for security is the use of RSA. We devised new techniques for managing RSA keys on the PalmPilot that improve performance by up to a factor of 5. Our implementation shows the effectiveness of this approach. Other publications that resulted from this project include (1) results on the strength of the RSA cryptosystem, (2) copyright protection, and (3) new anonymous authentication schemes.

The two NSF projects mentioned above resulted in more than twenty publications.

Prior NSF support for David Dill   (a) NSF ITR CCR-0121403, $2,100,000, 10/1/01 – 9/30/05. (b) Title: ITR/SY: Computational Logic Tools for Research and Education (c) This grant has supported research in computational logic, including automated decision procedures, formal verification tools for infinite state systems, programs, and cryptographic protocols, and educational software. (d) Research conducted under this grant by PI Dill's team (one of three PIs) has resulted in seven papers and two PhD theses to date. (e) CVCL is an efficient implementation of decision procedures for quantifier-free first-order logic that is being distributed in open source form over the Web.

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BIOGRAPHICAL SKETCH
Douglas W. Jones

(i) Professional Preparation

Carnegie-Mellon University   Physics   BS 1973
University of Illinois at Urbana Champaign   Computer Science   MS 1976, PhD 1980

(ii) Appointments

University of Iowa   Associate Professor of Computer Science   1988
University of Iowa   Assistant Professor of Computer Science   1980

(iii) Publications

1) Douglas W. Jones, ''Evaluating Voting Technology'', Chapter 1 of *Secure Electronic Voting*, Dimitris Gritzalis, ed, Kluwer Academic Publishers, 2002, pages 3-16.

2) Douglas W. Jones, ''System for Handicapped Access to Mark-Sense Ballots,'' Patent Application filed Aug 23, 2002.

3) Douglas W. Jones, ''Voting System Standards -- Work that Remains to be Done,'' Invited testimony before the Federal Election Commission, Washington DC, Apr 17, 2002. http://www.cs.uiowa.edu/~jones/voting/fec3.html

4) Douglas W. Jones, ''Problems with Voting Systems and the Applicable Standards,'' *Improving Voting Technology*, Hearing before the Committee on Science, House of Representatives, 107th Congress, Washington DC, May 22, 2001. USGPO Serial No. 107-20, pages 18-19 (oral statement) and pages 85-99 (written statement). http://www.cs.uiowa.edu/~jones/voting/congress.html

Other publications

5) Douglas W. Jones, ''Evaluating Voting Technology,'' Testimony before the United States Commission on Civil Rights, Tallahassee, Florida, January 11, 2001. http://www.cs.uiowa.edu/~jones/voting/uscrc.html (This forms the basis of the first part of Chapter 8 of the USCCR report *Voting Irregularities in Florida During the 2000 Presidential Election*. June 2001. http://www.usccr.gov/pubs/vote2000/report/main.htm)

6) Douglas W. Jones, Sections 5.2.10, 10.8 - 10.10 of the *Handbook of Small Electric Motors*, Yeadon and Yeadon, eds, McGraw-Hill, 2001, pages 5.83-5.99 and 10.71-10.97.

7) Herbert Hoeger and Douglas W. Jones, ''Integrating Concurrent and Conservative Distributed Discrete-Event Simulators,'' *Simulation, 67,* 5 (Nov. 1996) pages 303-314.

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9) R. E. Gantenbein and Douglas W. Jones, ''The Design and Implementation of a Dynamic Binding Feature for a High-Level Language,'' *The Journal of Systems and Software, 8,* 4 (Sept. 1988) pages 259-273.

10) Douglas W. Jones, ''Application of Splay Trees to Data Compression,'' *Communications of the Association for Computing Machinery, 31,* 8 (Aug. 1988) pages 132-137.

(iv) Synergistic Activities

My interest in operating systems led me to an investigation of priority scheduling that led me to early participation in the development of splay trees, the development of parallel algorithms for operations on splay trees (8 above), a new splay-tree-based data compression (10 above), and a

new model of parallel discrete-event simulation (9 above). The data compression algorithm has gone on to widespread use, in part because of the fact that it also serves as a useful symmetric key encryption algorithm. My work on discrete-even simulation brought me home to where I started, real-time scheduling.

My interest in real-time scheduling led me to seek simple examples, and this led me to develop an the extensive tutorial on stepping motors from which my contribution to the Handbook of Small Motors was developed (6 above); this also led me to 4 years of consulting with industry on embedded systems and motor control. US Patent 6,027,257, on which my name does not occur, was a significant product of this work.

My interest in embedded systems and my background in operating systems led me to volunteer to serve on the Iowa Board of Examiners for Voting Machines and Electronic Voting Systems, to which I was appointed in 1994. I was elected to three terms as chair of this board from 1999 to 2002, and it is this work that has led me to take the critical look at voting system standards and technology that led to my part in the current proposal (1-5 above).

The problems with Election 2000 called attention to some early criticisms of our election system that I had written, and as a result, I have been asked to testify before several government bodies (3-5 above), I have consulted with the Illinois Civil Liberties Union, legislators at the state and national level, and lawyers from around the country on issues of election law, and I have been quoted in over 20 newspaper stories (including the New York Times and Washington Post) and have been interviewed for many broadcast programs (twice on NPR Science Friday).

My administrative experience includes service on the boards of several community nonprofits, on the advisory board for VerifiedVoting.org, and as Vice President of the Open Voting Consortium. I have also served as President of the University of Iowa Liberal Arts Faculty Assembly, and as the Associate Chair of the University of Iowa Department of Computer Science.

(v) Collaborators & Other Affiliations

(a) Collaborators -- My book chapters (1 above and 6 above) were solicited by the editors without informing me of the identity of my coauthors. The editors were Dimitris Gritzalis of the Athens University of Economics and Business (Greece) and Bill Yeadon of Yeadon Energy Systems in Iron River MI. The bulk of my consulting was for Basic Telepresence Incorporated, under Bill Richards, currently of Industrial Video and Control of Watertown MA. I am currently collaborating with Reston Condit of Microchip Inc on an applications note, *Stepping Motor Fundamentals*.

I am currently listed as a consultant on an NSF proposal submitted by Patrick E. Mantey and Arthur M. Keller of UC Santa Cruz, and Arnold B. Urken of Stevens Tech. Matt Bishop of UC Davis, Sergiu Dascalu of U of Nevada at Reno, Alan Dechert of the Open Voting Consortium, Peter Maggs of the U of Illinois at Urbana and David Mertz, independent consultant, are also listed as consultants on that proposal.

I currently sit on the board of the Open Voting Consortium, along with Amit Sahai of MIT, Arthur M. Keller of UC Santa Cruz, Alan Dechert, and Peter Maggs of the U of Illinois at Urbana.

(b) Graduate Advisor -- Thomas Chen, Global Information Systems Technology, Champaign IL.

(c) Thesis Advisor to -- Rex Gantenbein, University of Wyoming, and Herbert Hoeger, Universidad de Los Andes, Venezuela. These were my only two PhD students. I have supervised 10 MS thesis students, and one of them, Frank W. Miller of sentitO Networks, Rockville MD, went on to his PhD.

AVIEL DAVID RUBIN

Professional preparation
- ∞ University of Michigan, Computer Science, B.S., 1989.
- ∞ University of Michigan, Computer Science and Engineering, M.S.E., 1991.
- ∞ University of Michigan, Computer Science and Engineering, Ph.D. 1994.

Appointments
- ∞ Associate professor, Computer Science, Johns Hopkins University, 2003 - present.
- ∞ Technical Director, JHU Information Security Institute 2003 – present.
- ∞ Principal Researcher, AT&T Labs, 1997-2002.
- ∞ Research Scientist, Bellcore, 1994- 1996.

Publications

Related
- ∞ Tadayoshi Kohno, Adam Stubblefield, Aviel D. Rubin, and Dan S. Wallach, *Analysis of an Electronic Voting System,* Proc. IEEE Symposium on Security and Privacy (May, 2004).
- ∞ Nathanael Paul, David Evans, Aviel D. Rubin and Dan Wallach, *Authentication for Remote Voting*, ACM Workshop on Human-Computer Interaction and Security Systems (April, 2003))
- ∞ Aviel D. Rubin, *Security Considerations for Remote Electronic Voting*, Communications of the ACM *December, 2002*.

Other
- ∞ William R. Cheswick, Steven M. Bellovin and Aviel D. Rubin, Firewalls and Internet Security: Repelling the Wily Hacker (2e), Addison Wesley Publishing Company, Inc., (February, 2003).
- ∞ Aviel D. Rubin, *White-hat Security Arsenal*, Addison Wesley Publishing Company, Inc., (June, 2001).
- ∞ Aviel D. Rubin, Daniel Geer, Marcus J. Ranum, *Web Security Sourcebook,* John Wiley & Sons, Inc., (June, 1997).
- ∞ Michael K. Reiter and Aviel D. Rubin, *Crowds: Anonymity for Web Transactions* , ACM Transactions on Information and System Security, (June, 1998).
- ∞ Marc Waldman, Aviel D. Rubin, and Lorrie F. Cranor, *The Architecture of Robust Publishing Systems,* ACM Transactions on Internet Technology (TOIT), (November, 2001).

Synergistic Activities

- ∞ **Election Judge:** Baltimore County, March 2004 – present.
- ∞ **Board of Directors:** USENIX Association, 2000 – 2004.
- ∞ **Member**: DARPA Information Science And Technology Study Group (2003-2006).
- ∞ **Panel moderator:** Conference on Democracy and the Internet in an Enlarging Europe *Overview of On-Line Voting: Systems and Issues,* New York, NY (March, 2001).
- ∞ **Panelist**: Financial Cryptography 2001, *The Business of Electronic Voting*, Grand Cayman (Feb. 2001).
- ∞ **Panelist**: National Science Foundation *E-voting workshop*, Washington, DC, (October, 2000).

Collaborators & Other Affiliations

(a) William Aiello, AT&T Labs, Steve Bellovin, AT&T Labs, Dan Boneh, Stanford University, Simon Byers, AT&T Labs, Bill Cheswick, Lumeta Corporation, Lorrie Cranor, AT&T Labs, Dan Geer, @stake, Trent Jaeger, IBM Watson, David Kormann, AT&T Labs, John Ioannidis, AT&T Labs, Dahlia Malkhi, Hebrew University, Patrick McDaniel, AT&T Labs, Fabian Monrose, Johns Hopkins University, Siviramakrishnan Rajagopalan, Telcordia Technologies, Marcus Ranum, NFR, Michael Reiter, CMU, Martin Strauss, AT&T Labs, Adam Stubblefield, Johns Hopkins University, Doug Tygar, University of California at Berkeley, Marc Waldman, NYU, David Wagner, University of California at Berkeley.

(b) Thesis advisor: Peter Honeyman, University of Michigan

Dan Seth Wallach

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Houston, TX 77005-1892
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Professional Preparation	The University of California at Berkeley, Electrical Engineering / Computer Science, B.S., 1993
	Princeton University, Computer Science, M.A., 1995
	Princeton University, Computer Science, Ph.D., 1999
Appointments	Rice University, Houston, TX. Assistant Professor, CS Department, since 1998
	Princeton University, Princeton, NJ. Graduate Student, CS Department, 1993–1998

Relevant Publications

Most papers are available on the web: `http://www.cs.rice.edu/~dwallach/pub/`

Tadayoshi Kohno, Adam Stubblefield, Aviel D. Rubin, Dan S. Wallach, *Analysis of an Electronic Voting System*, 2004 IEEE Symposium on Security and Privacy (Oakland, California), May 2004.

Jonathan Bannet, David W. Price, Algis Rudys, Justin Singer, Dan S. Wallach, *Hack-a-Vote: Demonstrating Security Issues with Electronic Voting Systems*, IEEE Security & Privacy Magazine, volume 2, number 1, January/February 2004, pp. 32-37.

Miguel Castro, Peter Druschel, Ayalvadi Ganesh, Antony Rowstron and Dan S. Wallach, *Security for Peer-to-Peer Routing Overlays*. Fifth Symposium on Operating Systems Design and Implementation (OSDI '02) (Boston, Massachusetts), December 2002.

Scott A. Craver, Min Wu, Bede Liu, Adam Stubblefield, Ben Swartzlander, Dan S. Wallach, Drew Dean, and Edward W. Felten, *Reading Between the Lines: Lessons from the SDMI Challenge*, 10th Usenix Security Symposium (Washington, D.C.), August 2001.

Dan S. Wallach, Dirk Balfanz, Drew Dean, and Edward W. Felten. *Extensible Security Architectures for Java*. 16th Symposium on Operating Systems Principles (SOSP '97) (Saint-Malo, France), Oct. 1997, pp. 116-128. **Outstanding Paper Award**.

Other Selected Publications

Scott Crosby and Dan S. Wallach, *Denial of Service via Algorithmic Complexity Attacks*, 12th Usenix Security Symposium (Washington, D.C.), August 2003.

Alan Mislove, Charles Reis, Ansley Post, Paul Willmann, Peter Druschel, Dan S. Wallach, Xavier Bonnaire, Pierre Sens, Jean-Michel Busca, Luciana Arantes-Bezerra, *POST: A Secure, Resilient, Cooperative Messaging System*, 9th Workshop on Hot Topics in Operating Systems (HotOS IX) (Lihue, Hawaii), May 2003.

Tsuen-Wan "Johnny" Ngan, Dan S. Wallach, and Peter Druschel, *Enforcing Fair Sharing of Peer-to-Peer Resources*, 2nd International Workshop on Peer-to-Peer Systems (IPTPS '03) (Berkeley, California), February 2003.

Algis Rudys and Dan S. Wallach, *Termination in Language-based Systems*, ACM Transactions on Information and System Security, volume 5, number 2, May 2002.

Dan S. Wallach, Edward W. Felten, and Andrew W. Appel, *The Security Architecture Formerly Known as Stack Inspection: A Security Mechanism for Language-based Systems*, ACM Transactions on Software Engineering and Methodology, volume 9, number 4, October 2000.

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Synergistic Activities

Ongoing collaboration with Microsoft Research on peer-to-peer systems security.

Public speaking on issues related to computer security, including general-interest talks on copy protection research and electronic voting systems. Following the initial publication of the Rice/Hopkins report, which detailed security flaws found in Diebold's electronic voting system, Wallach has been invited to speak on the topic of electronic voting worldwide, including a recent invited talk before a European Union conference on e-Democracy. Wallach also collaborated with David Dill, Peter G. Neumann, and Rebecca Mercuri on a frequently-asked-questions document for security issues associated with electronic voting systems[1].

Developed a new computer security course targeted at senior undergraduates and graduate students, including the Hack-a-Vote learning exercise, where students first engineer "Trojan horse" modifications to a voting system and are then asked to discover these in other students' work (see the "Hack-a-Vote" citation, above).

Program committees: ACM Conference on Computer and Communications Security (CCS) 2004; ACM Role-Based Access Control Workshop 1999 and 2000; HotOS Workshop 2003; IEEE Security and Privacy 1999 and 2004; IEEE Workshop on Mobile Computing Systems and Applications (WMCSA) 2002, 2004; International Peer-to-Peer Symposium (IPTPS) 2004; Network and Distributed Systems Security Symposium (NDSS) 2002-2004; NSF Trusted Computing Panel 2002; South Central Information Security Symposium 2003 and 2004; Usenix Annual Conference 2001; Usenix Security Symposium 1999-2003; Usenix Symposium on Internet Technologies and Systems (USITS) 2003; Workshop on Economics in Peer-to-Peer Systems 2004; WWW Conference 1999, 2000, 2003, 2004

Program committee chair: Usenix Security Symposium 2001

Invited talks coordinator: Usenix Security Symposium 2002

Editorial/advisory board memberships: International Journal of Information Security; International Journal for Infonomics; Abusable Technologies Awareness Center; VerifiedVoting.org; VoteWatch

Graduate Advisors

Andrew W. Appel and Edward W. Felten: Princeton University

Recent Collaborators

(*current affiliations are noted*) Behnaam Aazhang[1], Andrew W. Appel[2], Luciana Arantes-Bezerra[7], Dirk Balfanz[2], Richard G. Baraniuk[1], Xavier Bonnaire[7], Jean-Michel Busca[7], Miguel Castro[6], Joseph Cavallaro[1], Scott Craver[2], Alan Cox[1], Drew Dean[3], David Dill[13], Eyal de Lara[10], Peter Druschel[1], Dave Evans[8], Edward W. Felten[2], Jason Flinn[11], Ayalvadi Ganesh[6], Y. Charlie Hu[12], Lydia Kavraki[1], Edward W. Knightly[1], Bede Liu[2], Rebecca Mercuri[14], Peter G. Neumann[3], Jim Roskind[13], Antony Rowstron[6], Aviel D. Rubin[4], M. Satyanarayanan[5], Pierre Sens[7], Raman Tenneti[13], Min Wu[9], Willy Zwaenepoel[1] ([1]*Rice University,* [2]*Princeton University,* [3]*SRI International,* [4]*Johns Hopkins University,* [5]*Carnegie Mellon University,* [6]*Microsoft Research,* [7]*Laboratoire d'Informatique de Paris 6,* [8]*University of Virginia,* [9]*University of Maryland,* [10]*University of Toronto,* [11]*University of Michigan,* [12]*Purdue University,* [13]*Stanford University,* [14]*Harvard University*)

Recent Advisees

(*current affiliations are noted*) Jonathan Bannet[1], Kostas Bekris[1], John Clements[2], Yogesh Chopra[7], Cristian Coarfa[1], Scott Crosby[1], Eyal de Lara[5], Anwis Das[1], Yuri Dotsenko[1], Andrew Fuqua, Tadayoshi Kohno[11], Rajnish Kumar[9], Andrew M. Ladd[1], Guillaume Marceau[4], Alam Mislove[1], Animesh Nandi[1], Tsuen-Wan "Johnny" Ngan[1], Nathanaael Paul[8], Ansley Post[1], David W. Price[10], Charles Reis[1], Algis Rudys[1], Atul Singh[1], Justin Singer[12], Adam Stubblefield[3], Ben Swartzlander, Ping Tao[13], Nilesh Vaghela[7], Paul Willman[1], Weimin Yu[6] ([1]*Rice University,* [2]*Northeastern University,* [3]*Johns Hopkins University,* [4]*Brown University,* [5]*University of Toronto,* [6]*Ipsum Networks,* [7]*University of Houston,* [8]*University of Virginia,* [9]*Georgia Institute of Technology,* [10]*University of Texas, Austin,* [11]*University of California, San Diego,* [12]*SMBology, Inc.,* [13]*Texas Instruments*)

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[1] http://www.verifiedvoting.org/drefaq.asp

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Professional and Academic Information

Professional Preparation:
* Postdoctoral Research Associate in Cognitive Psychology, Carnegie Mellon University, 1996-1999.
* Ph.D. in Experimental Psychology, Georgia Institute of Technology, 1996.
* M.S. in Computer Science, Georgia Institute of Technology, 1995.
* M.S. in Experimental Psychology, Georgia Institute of Technology, 1993.
* B.S. in Engineering (Magna Cum Laude), University of Michigan, 1991.
* B.A. in Psychology (High Distinction), University of Michigan, 1991.

Appointments:

Summer 1999 -present
Assistant Professor, Rice University Department of Psychology, Human Factors/Human-Computer Interaction program.

Fall 1996 -Summer 1999
Postdoctoral Research Associate, Carnegie Mellon University. Primary project involved integration of production system models of cognition with theories of perception and action.

Publications

Five related publications
* Katz, M. A., & Byrne, M. D. (2003, in press). Effects of scent and breadth on use of site-specific search on e-commerce Web sites. ACM Transactions on Computer-Human Interaction,10, 198-220.

* Byrne, M. D., Catrambone, R., & Stasko, J. T. (1999). Evaluating animations as student aids in learning computer algorithms. Computers and Education, 33, 253-278.

* Byrne, M. D., & Bovair, S. (1997). A working memory model of a common procedural error. Cognitive Science, 21, 31-61.

* Byrne, M. D. (2003). Cognitive architecture. In J. Jacko & A. Sears (Eds.), The human-computer interaction handbook: Fundamentals, evolving technologies and emerging applications (pp. 97-117). Mahwah, NJ Lawrence Erlbaum.

* Byrne, M. D., Wood, S. D., Sukaviriya, N., Foley, J. D., & Kieras, D. E. (1994). Automating interface evaluation. Human Factors in Computing Systems: Proceedings of CHI'94, 232-237. Reading, MA: Addison-Wesley.

Five other publications

* Byrne, M. D., & Kirlik, A. (in press). Using computational cognitive modeling to diagnose possible sources of aviation error. To appear in International Journal of Aviation Psychology.

* Anderson, J. R., Bothell, D., Byrne, M. D., Douglass, S., Lebiere, C., & Quin, Y. (in press). An integrated theory of the mind. To appear in Psychological Review.

* Byrne, M. D., & Anderson, J. R. (2001). Serial modules in parallel: The psychological refractory period and perfect time-sharing. Psychological Review, 108, 847-869.

* Byrne, M. D., (2001). ACT-R/PM and menu selection: Applying a cognitive architecture to HCI. International Journal of Human-Computer Studies, 55, 41-84.

> Byrne, M. D., & Gray, W. D. (2003). Returning human factors to an engineering discipline: Expanding the science base through a new generation of quantitative methods—preface to the special section. Human Factors, 45, 1-4.

Synergistic Activities

* Serves on the editorial board for the journal Human Factors. Serves as a reviewer for numerous journals and conferences ranging from basic experimental psychology to systems-oriented human-computer interaction. This includes the annual conferences of the Cognitive Science Society and ACM SIGCHI as well as the journals Cognitive Science, Journal of Experimental Psychology: Applied, Psychology and Aging, Human-Computer Interaction, ACM Transactions on Computer-Human Interaction, and International Journal of Human-Computer Studies.

DAVID WAGNER

Professional Preparation

Ph.D., Computer Science, U.C. Berkeley, 2000.
M.S., Computer Science, U.C. Berkeley, 1999.
A.B., Mathematics, Princeton University, 1995.

Appointments

Assistant Professor, EECS Department, U.C. Berkeley, 2000-present.

Awards

2003: Alfred P. Sloan Research Fellow
2003: Named Information Security Magazine's Best Academic Researcher
2002: ACM Dissertation Award (Honorary Mention)
2002: Computer Science Division Information Technology Faculty Award
2002: CRA Digital Government Fellow
2002: Named one of Popular Science's Brilliant 10
2001: NSF CAREER Award
2000: Okawa Foundation Research Grant

Closely related publications

A Security Analysis of the Secure Electronic Registration and Voting Experiment (SERVE). David Jefferson, Aviel D. Rubin, Barbara Simons, and David Wagner. Public report for Department of Defense's FVAP (Federal Voting Assistance Program).

MOPS: An Infrastructure for Examining Security Properties of Software. Hao Chen and David Wagner. ACM Computer & Communications Security (CCS 2002), November 18, 2002.

Intercepting Mobile Communications: The Insecurity of 802.11. Nikita Borisov, Ian Goldberg, and David Wagner. 7th ACM Conference on Mobile Computing and Networking (MOBICOM 2001), July 16, 2001.

A First Step Towards Automated Detection of Buffer Overrun Vulnerabilities. David Wagner, Jeffrey S. Foster, Eric A. Brewer, and Alexander Aiken. 7th ISOC Symposium on Network & Distributed System Security (NDSS 2000), Feb. 2000.

Privacy-enhancing technologies for the Internet. Ian Goldberg, David Wagner, and Eric A. Brewer. IEEE COMPCON '97, February 1997.

Other significant publications

Model Checking One Million Lines of C Code. Hao Chen, Drew Dean, and David Wagner. 11th Annual Symposium on Network & Distributed System Security (NDSS 2004), February 2004.

Intrusion Detection via Static Analysis. David Wagner and Drew Dean, 2001 IEEE Symposium on Security and Privacy, May 13, 2001.

Practical Techniques for Searches on Encrypted Data. Dawn Song, David Wagner, and Adrian Perrig. 2000 IEEE Symposium on Security and Privacy, May 14, 2000.

Cryptanalysis of the Cellular Message Encryption Algorithm. David Wagner, Bruce Schneier, and John Kelsey. Advances in Cryptology—CRYPTO '97, August 21, 1997.

A secure environment for untrusted helper applications: confining the wily hacker. Ian Goldberg, David Wagner, Randi Thomas, and Eric A. Brewer. 1996 USENIX Security Symposium.

Synergistic activities

Program co-chair of IEEE Security & Privacy 2003 and 2004, past or current steering committee member for 4 conferences, past or current program committee member for 14 conferences.

Invited speaker at 12 conferences, invited panelist at 6 conferences.

Served on Security Peer Review Group for Secure Electronic Registration and Voting Experiment.

Informal advisor on e-voting security to ACLU of Northern California.

External Ph.D. thesis committee member for 2 students at institutions other than U.C. Berkeley.

Frequent contributor to standards processes at NIST, IEEE, IETF, and other other standards bodies, including the IPSec, TLS, AES, 802.11, and CFRG working groups.

Collaboration

Collaborators (last 48 months). Alexander Aiken (U.C. Berkeley), Mihir Bellare (U.C. San Diego), Steven M. Bellovin (AT&T Research), Alex Biryukov (Technion Inst., Israel), Nikita Borisov (U.C. Berkeley), Eric A. Brewer (U.C. Berkeley), Nancy Cam-Widget (Cisco), Hao Chen (U.C. Berkeley), Monica Chew (U.C. Berkeley), Don Coppersmith (IBM Research), Michele D. Crabb (Cisco), Scott Crosby (CMU), E. Dawson (Queensland Univ., Australia), Drew Dean (Xerox PARC), Pompiliu Donescu (VDG Inc.), Niels Ferguson, Jeffrey S. Foster (U. Maryland), Ian Goldberg (Zero Knowledge Systems), Virgil D. Gligor (U. Maryland), Steven D. Gribble (U. Washington), Chris Hall (Princeton Univ.), Russ Housley (VigilSec), Yuval Ishai (Technion Inst., Israel), Rob Johnson (U.C. Berkeley), Mark Johnson (U.C. Berkeley), Chris Karlof (U.C. Berkeley), John Kelsey (Entrust), Lars R. Knudsen (U. Bergen, Norway), Helger Lipmaa (Helsinki Univ. of Technology, Finland), Moses Liskov (MIT), Stefan Lucks (U. Mannheim, Germany), Mudge (@stake), W. Millan (Queensland Univ., Australia), David Molnar (U.C. Berkeley), David Oppenheimer (U.C. Berkeley), Adrian Perrig (CMU), Kannan Ramchandran (U.C. Berkeley), Ben Reichardt (U.C. Berkeley), Vincent Rijmen (K.U. Leuven, Belgium), Ronald L. Rivest (MIT), M.J.B. Robshaw (RSA Labs), Phillip Rogaway (U.C. Davis), Naveen Sastry (U.C. Berkeley), Amit Sahai (Princeton Univ.), Bruce Schneier (Counterpane), Adi Shamir (Technion Inst., Israel), Umesh Shankar (U.C. Berkeley), L. Simpson (Queensland Univ., Australia), Dawn Song (CMU), Paolo Soto (Secure Software), Zhendong Su (U.C. Davis), Kunal Talwar (U.C. Berkeley), Randi Thomas (U.C. Berkeley), Stephen Thomas (Wave7), Jesse Walker (Intel), Doug Whiting (Hifn).

Co-Editors (last 24 months). None.

Graduate advisor. Prof. Eric Brewer, U.C. Berkeley.

Thesis advisor and Post-graduate scholar sponsor. Current graduate students (8): Hao Chen, Robert Johnson, Chris Karlof, David Molnar, Naveen Sastry, Ben Schwarz, Umesh Shankar, and Jason Waddle. Postdoctoral scholars sponsored (1): Bodo Möller.

DEIRDRE KATHLEEN MULLIGAN

Samuelson Law, Technology & Public Policy Clinic
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University of California at Berkeley
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Professional Preparation

- **Georgetown University Law Center,** Juris Doctor 1994
- **Smith College,** Northampton, Massachusetts, Bachelor of Arts 1988
- **New York State Bar 1996**
- **California State Bar 2001**

Appointments

- **Samuelson Law, Technology & Public Policy Clinic, School of Law (Boalt Hall), University of California at Berkeley,** Director and Acting Clinical Professor of Law, 2001 - present
- **Center for Democracy and Technology,** Staff Counsel, 1994 - 2000
- **American Civil Liberties Union**, **Privacy and Technology Project**, Law Clerk, 1992 - 1994

Relevant Publications

ìRevisiting the Electronic Communications Privacy Act,î Deirdre K. Mulligan, GEORGE WASHINGTON LAW REVIEW, (forthcoming summer 2004).

REPORT OF THE BIPARTISAN CALIFORNIA COMMISSION ON INTERNET POLITICAL PRACTICES (Vice-Chair), December, 2003.

ìHow DRM-based Content Delivery Systems Disrupt Expectations of ëPersonal Useíî
D. Mulligan, J. Hahn and A. Burstein, PROCEEDINGS OF THE 2003 ACM WORKSHOP ON DIGITAL RIGHTS MANAGEMENT, Washington, DC (2003), p. 77-89. ISBN: 1-58113-786-9

ìImplementing Copyright Limitations in Rights Expression Languages,î D. Mulligan and A. Burstein, in Digital Rights Management (July 2003).

WHO GOES THERE? AUTHENTICATION THROUGH THE LENS OF PRIVACY, Stephen T. Kent and Lynette I. Millett, editors, Committee on Authentication Technologies and Their Privacy Implications, National Research Council, National Academies Press (2003).

IDsó NOT THAT EASY: QUESTIONS ABOUT NATIONWIDE IDENTITY SYSTEMS, Stephen T. Kent and Lynette I. Millett, editors, Committee on Authentication Technologies and Their Privacy Implications, National Research Council, National Academies Press (2002).

ìDigital Grass Roots: Issue Advocacy in the Age of the Internet,î in THE CIVIC WEB: ONLINE POLITICS AND DEMOCRATIC VALUES (July 2002) (with J. Berman).

ìPrivacy in the Digital Age: Work in Progress,î Jerry Berman, Deirdre K. Mulligan
NOVA LAW REVIEW, Volume 23, Number 2, Winter 1999.
http://www.cdt.org/publications/lawreview/1999nova.shtml

ìSquare Pegs and Round Holes: Applying the Campaign Finance Law to the Internetó Risks to Free Expression and Democratic Values,î Matt Grossman, Deirdre K. Mulligan, James X. Dempsey, October 1999.
http://www.cdt.org/speech/political/financereport.shtml

Other Selected Publications

Amicus Curiae Brief of the *World Wide Web Consortium, Access Now, Inc. and Robert Gumson v. Southwest Airlines Co.*, United States District Court for the Southern District of Florida (No. 02-21734-CIV) (March, 2003).

ì The Dangers of Code-based Public Policy Enforcement,î co-authored with John S. Erickson, in PROCEEDINGS OF THE IEEE (Institute of Electrical and Electronics Engineers, Inc.), Special Issue on Digital Rights Management Technology (forthcoming 2004).

ì Neglecting the National Memory: How Copyright Term Extension Compromises the Development of Digital Archives,î Deirdre K. Mulligan and Jason M. Schultz, the JOURNAL OF APPELLATE PRACTICE AND PROCESS, Vol. 4, No. 2, p. 451-473, Fall 2002.

ì Threat Analysis of the Geopriv Protocol,î co-authored with M. Danley, J. Morris, and J. Peterson, Internet Engineering Task Force (IETF) Internet-Drafts, The Internet Society, February 20, 2003.

ì Geopriv Requirements,î co-authored with Jorge Cuellar, John B. Morris, Jr., Jon Peterson, and James Polk, Internet Engineering Task Force (IETF) Internet-Drafts, The Internet Society (2001).

Synergistic Activities

Vice-Chair, the California Bipartisan Commission on Internet Political Practices 2001 - 2003

Member, National Academy of Sciences Committee on Authentication Technology and Its Privacy Implications 2001 - 2003

Board Member, Trustworthy Computing Academic Advisory Board, Microsoft Corporation 2003 - present

Board Member, California Voter Foundation 2002 - present

Member, California Office of Privacy Protection Advisory Council, California Department of Consumer Affairs 2002 - present

Computers Freedom and Privacy Conference, Board Member 2003 - present, Conference Chair 2004

Federal Advisory Committee on Online Access and Security 1999 - 2000

World Wide Web Consortiumís Platform for Privacy Preferences Working Group (Co-chair, Vocabulary and Policy working groups)

National Task Force on Privacy, Technology and Criminal Justice Information 2000 - 2001

Recent Collaborators

Laurel Fletcher, Mark Lemley, Pamela Samuelson, Jennifer M. Urban, Matt Grossman, UC Berkeley; John Erickson, Hewlett Packard; Jerry Berman, James X. Dempsey, Ari Schwartz, John B. Morris, Jr. Center for Democracy and Technology; Jason Schultz, Electronic Frontier Foundation; Jorge Cuellar, Siemens AG Corporate Technology (IETF Internet-Draft); Jon Peterson, Neustar (IETF Draft); Kim Alexander, California Voter Foundation; Osbaldo Cantu, (FBI, CIA) (former student); Aaron Burstein, Boalt Hall, UC Berkeley (current student); John Han, Mahad Ibrahim, UC Berkeley (SIMS) (current student).

DREW DEAN

Computer Science Laboratory
SRI International
333 Ravenswood Ave.
Menlo Park, CA 94025
Email: ddean@csl.sri.com

Professional Preparation

Carnegie Mellon University, Mathematics/Computer Science, B.Sc., 1992
Princeton University, Computer Science, M.A., 1996
Princeton University, Computer Science, Ph.D., 1999

Appointments

Computer Scientist, Computer Science Laboratory, SRI International, 2001–present
Member of the Research Staff, Xerox PARC, 1998–2001
Graduate Research Associate, Princeton University, Princeton, New Jersey, 1994–1998
Associate Engineer, ROLM, Santa Clara, California, 1993–1994

Relevant Publications

Ajay Chander, Drew Dean, and John C. Mitchell, "Reconstructing Trust Management," *Journal of Computer Security*, 12(1), January 2004, pp. 131 – 164. An extended abstract of this work appeared under the title "Deconstructing Trust Management" in ACM SIGPLAN and IFIP WG 1.7 *Workshop on Issues in the Theory of Security (WITS'02)*, Portland OR, January 2002.

Drew Dean, Matt Franklin, and Adam Stubble£eld, "An Algebraic Approach to IP Traceback," *ACM Transactions on Information and System Security*, 5(2), 119–137, May 2002. An earlier version appeared in *Proceedings of the 2001 Network and Distributed Systems Security Symposium*, San Diego, CA, February 2001. **Best Paper Award**

Dan S. Wallach, Dirk Balfanz, Drew Dean, and Edward W. Felten, "Extensible Security Architectures for Java," In *16th Symposium on Operating Systems Principles*. Saint-Malo, France, Oct. 1997, pp. 116-128. **Outstanding Paper Award**.

Drew Dean, "The Security of Static Typing with Dynamic Linking," In *Proceedings of the Fourth ACM Conference on Computer and Communications Security*, Zurich, Switzerland, April 1997. **Best Student Paper Award**

Drew Dean, Edward Felten, and Dan Wallach, "Java Security: From HotJava to Netscape and Beyond," *Proceedings of the 1996 IEEE Symposium on Security and Privacy*, Oakland, CA, May 1996.

Other Selected Publications

Hao Chen, David Wagner, and Drew Dean, "Setuid Demysti£ed," *Proceedings of the 11th USENIX Security Symposium*, San Francisco, CA, August 2002.

Jessica Staddon, Sara Miner, Matt Franklin, Dirk Balfanz, Michael Malkin, and Drew Dean, "Self-Healing Key Distribution with Revocation," *Proceedings of the 2002 IEEE Symposium on Security and Privacy*, Oakland, CA, May 2002.

Ajay Chander, Drew Dean, and John Mitchell, "A State-Transition Model of Trust Management and Access Control," *Proceedings of the Fourteenth IEEE Computer Security Foundations Workshop*, Cape Breton, Nova Scotia, June 2001.

David Wagner and Drew Dean, "Intrusion Detection via Static Analysis," *Proceedings of the 2001 IEEE Symposium on Security and Privacy*, Oakland, CA, May 2001.

Dirk Balfanz, Drew Dean, and Michael Spreitzer, "A Security Infrastructure for Distributed Java Applications," *Proceedings of the 2000 IEEE Symposium on Security and Privacy*, Oakland, CA, May 2000.

Synergistic Activities

Program committees: IEEE Security and Privacy 1999, 2003; Usenix Security Symposium 2002–2004; IEEE Computer Security Foundations Workshop, 2000, 2002; NSF Trusted Computing Panel 2002

Editorial board member: International Journal of Information Security

Graduate Advisor

Andrew W. Appel: Princeton University

Collaborators

Dirk Balfanz[1], Thomas Berson[7], Ajay Chander[4], Hao Chen[8], Scott Craver[2], Edward W. Felten[2], Matthew Franklin[6], Bede Liu[2], Sara Miner[9], Michael Malkin[4], John Mitchell[4], Diana Smetters[1], Michael Spreitzer[11], Jessica Staddon[1], Adam Stubble£eld[5], Ben Swartzlander, David Wagner[8], Dan Wallach[3], Min Wu[10], ([1]Palo Alto Research Center, [2]Princeton University, [3]Rice University, [4]Stanford University, [5]Johns Hopkins University, [6]UC Davis, [7]Anagram Laboratories, [8]UC Berkeley, [9]UC San Diego, [10]University of Maryland, [11]IBM Research)

Advisees

None.

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Professional Preparation:
    Pennsylvania State University, B.S. in Computer Science, 1977.
    Drexel University, M.S. in Computer Science, 1989.
    University of Pennsylvania, School of Engineering and Applied Science, M.S., Eng., 1990.
    University of Pennsylvania, School of Engineering and Applied Science, Ph.D. 2001.

Current Appointments:
    Research Fellow, Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University (nonstipendiary).
    President, Notable Software, Inc., Princeton, NJ, since 1981.
    (http://www.notablesoftware.com)
    Other recent previous employment included Assistant Professorships at Bryn Mawr College and Drexel University.

Relevant Publications:
    Rebecca T. Mercuri, "On Auditing Audit Trails," Security Watch, *Communications of the ACM*, Vol. 46, No. 1, January 2003.
    Rebecca T. Mercuri and Peter G. Neumann, "*Verification for Electronic Balloting Systems*," Chapter 3, Secure Electronic Voting, Dimitris Gritzalis, ed., Advances in Information Security, Volume 7, Kluwer Academic Publishers, 2002.
    Rebecca Mercuri, "Florida 2002: Sluggish Systems, Vanishing Votes," Inside Risks, *Communications of the ACM*, Vol. 45, No. 11, November 2002.
    Rebecca Mercuri, "A Better Ballot Box?", *IEEE Spectrum*, Vol. 39, No. 10, October 2002.
    Rebecca T. Mercuri, "Electronic Vote Tabulation: Checks and Balances," Ph.D. dissertation, University of Pennsylvania, School of Engineering and Applied Science, April 2001.

Other Selected Publications:
    Rebecca T. Mercuri, "Standards Insecurity," Security Watch, *Communications of the ACM*, Vol. 46, No. 12, December 2003.
    Rebecca T. Mercuri, "Computer Security: Quality Rather than Quantity", Vol. 45, No. 10, *Communications of the ACM*, October 2002.
    Rebecca Mercuri, "Humanizing Voting Interfaces", *Usability Professionals Association*, Conference Proceedings, July 11, 2002.
    Peter Neumann, Rebecca Mercuri, Lauren Weinstein, "Internet and Electronic Voting", *ACM Software Engineering Notes* , Vol. 26, No. 2, March 2001.
    Dorée Duncan Seligmann, Rebecca T. Mercuri, and John T. Edmark, "Providing Assurances in a Multimedia Interactive Environment", *ACM SIGCHI '95*, May, 1995.

Synergistic Activities:

Conducted research related to electronic voting issues since 1989, specializing in digital real-time systems, computer security, and computer public policy.

Provided testimony to the 11th Circuit Court of appeals following the November 2000 presidential election (which occurred a few weeks after her thesis defense), and subsequently referenced in briefs presented the the U.S. Supreme Court in "Bush v. Gore."

Presented written and/or oral testimony for the U.S. House Science Committee, Federal Election Commission, and the U.K. Cabinet. Quoted in the U.S. Congressional Record and in reports by the U.S. Library of Congress, the U.K. Office of the e-Envoy, and other governmental agencies.

Has past and ongoing direct roles in municipal, state, federal, and international legislative initiatives (including the U.S. and many states and counties, as well as the United Kingdom, Ireland, Brazil and Singapore).

Credited as the originator of the "Mercuri Method" to provide independent auditability for fully electronic voting systems, through the use of voter verified paper audit trails.

Authors the quarterly "Security Watch" column in the Communications of the ACM, and has written over three dozen papers (for conferences and technical publications) on computer-related subjects ranging from electronic voting to digital multimedia.

Serves on several advisory boards and committees: IEEE working group on Voting System Standards; IEEE Princeton Section Executive Committee; Princeton professional chapter of the ACM; Princeton professional chapter of the IEEE Computer Society; Delaware Valley Acoustical Society of America; Philadelphia Audio Engineering Society. Senior member of the IEEE.

Conference presentations have included:

- *Specification, Testability, Accreditation and Qualification in Voting Systems*, Voting Standards Symposium, National Institute for Standards and Technologies, December 2003. (Panelist)
- *Comparative Analysis of the Voting Systems in Use During Elections and Recommendations Under Consideration for Improvement*, Council on Governmental Ethics Laws, September 2002. (Panelist)
- *A Debate on Computerized Voting: A New Solution for a New Generation of Voters*, Democracy Online Project, George Washington University, January 2001. (Panelist)
- *Computers and Elections: Risks, Reliability, and Reform*, Computer Professionals for Social Responsibility, October 1996. (Panelist)
- *Security and Auditability of Electronic Vote Tabulation Systems*, National Computer Security Conference, September 1993. (Session chair and panelist)
- *Electronic Voting – Threats to Democracy*, 3rd Conference on Computers, Freedom and Privacy, March 1993. (Session chair and panelist)

Thesis Advisor: Norman I. Badler, University of Pennsylvania.

Recent Collaborators: Peter Neumann (SRI), L. Jean Camp (Harvard University), Lauren Weinstein (PFIR), David Dill (Stanford University), Dan Wallach (Rice University).

Peter G. Neumann
Computer Science Laboratory, SRI International
333 Ravenswood Ave., Menlo Park, CA 94025-3493
Neumann@CSL.sri.com; http://www.csl.sri.com/neumann

Professional Preparation:
• Harvard University, Mathematics AB 1954
• Harvard University, Applied Math AB 1955
• Harvard University, Applied Math (prior to existence of CS!) PhD 1961
• Technical University Darmstadt, Dr rerum naturarum 1960

Appointments:
• SRI International, Computer Science Lab, 1971–present (Principal Scientist since 1990)
• Bell Telephone Labs, Computer Science Lab, Murray Hill NJ, 1960–1970
• Technical University, Darmstadt, Germany, Fulbright grantee 1958–1960 and lecturer 1960
• Visiting Mackay Lecturer, Stanford University, spring 1964, and University of California at Berkeley, 1970–1971; Adjunct Professor, University of Maryland, fall 1999
• Harvard University, Teaching fellow and research assistant, 1954-1958

Relevant Publications:
• P.G. Neumann, Risks in Computerized Elections, *Comm. ACM, 33,* 11, 1990, p.170 (http://www.csl.sri.neumann/insiderisks.html#5)
• P.G. Neumann, *Computer-Related Risks,* Addison-Wesley, 1995 (includes requirements for and risks related to voting systems)
• P.G. Neumann, On Hierarchical Design of Computer Systems for Critical Applications, *IEEE Transactions on Software Engineering, SE-12, 9,* September 1986, pp. 905–920
• P.G. Neumann and R.J. Feiertag, PSOS Revisited, *Proceedings of the 19th Annual Computer Security Applications Conference (ACSAC 2003)*, Classic Papers section, IEEE Computer Society, Las Vegas, Nevada, December 2003, pp. 208–216 (http://www.csl.sri.com/neumann/psos03.pdf, reassessment of the Provably Secure Operating System formal design, 1973-1980.
• P.G. Neumann and P.A. Porras, Experience with EMERALD to Date, *Proceedings of the First USENIX Workshop on Intrusion Detection and Network Monitoring,* Santa Clara, California, April 11-12, 1999, pp. 73–80 (Best Paper Award, http://www.csl.sri.com/neumann/det99.pdf)

Other Selected Publications:
• R. Mercuri and P.G. Neumann, Verification for Electronic Balloting Systems, *Secure Electronic Voting,* D. Gritzalis (editor), Kluwer Academic Publishers, Boston, 2002
• P.G. Neumann, R. Mercuri, and L. Weinstein, Internet and Electronic Voting, *ACM Software Engineering Notes,* 26, 2, March 2001, p. 8
• P.G. Neumann, Security Criteria for Electronic Voting, *Proceedings of the Sixteenth National Computer Security Conference,* Baltimore, Maryland, September 1993, pages 478–482
• Illustrative Risks to the Public in the Use of Computers, originally published annually in *ACM Software Engineering Notes* in the 1980s, now updated regularly online as an index to risks cases (http://www.csl.sri.com/neumann/illustrative.html; click on "Election Problems" for numerous relevant irregularities; also .pdf, .ps for printing)

• P.G. Neumann, Achieving Principled Assuredly Trustworthy Composable Systems and Networks, *Proceedings of the DARPA Information Survivability Conference and Exhibition, DISCEX3, volume 2*, DARPA and IEEE Computer Society, April 2003, pp. 182–187 (http://www.csl.sri.com/neumann/discex3.pdf), early summary of DARPA final report, Principled Assuredly Trustworthy Composable Architectures, 2004 (http://www.csl.sri.com/neumann/chats4.pdf, .ps, .html);

Synergistic Activities:
• ACM: Founder of SIGSOFT's Software Engineering Notes in 1976, editor for 18 years, since then Associate Editor; Chairman of the ACM Committee on Computers and Public Policy (since 1985); Communications of the ACM, Contributing Editor; creator and moderator of the ACM Risks Forum (since 1985; comp.risks, risks.org)
• IEEE: Editorial board of Security and Privacy
• International Journal of Information Security, Advisory board
• National Academies of Science: Multilevel Secure Database Management (1982), Computers at Risk (1990) and Cryptography's Role In Securing the Information Society (1996)
• Advisory roles: U.S. General Accounting Office Executive Council on Information Management and Technology; California Office of Privacy Protection advisory council; previously: NSF CISE advisory board; eight testimonies for U.S. House and Senate; advisory boards for four companies
• Fellow: AAAS, ACM, IEEE
• Awards: ACM Outstanding Contribution Award for 1992, the Electronic Frontier Foundation Pioneer Award in 1996, ACM SIGSOFT Distinguished Service Award in 1997, CPSR Norbert Wiener Award for in October 1997, for "deep commitment to the socially responsible use of computing technology", and National Computer Systems Security Award for 2002; first SRI Exceptional Performance Award for Leadership in Community Service in 1992; SRI Fellow in 2001
• Relevant SRI project work: New York City Board of Elections in early 1990s, establishing requirements, evaluating, and carrying out source-code review for their would-be electronic voting system; many SRI projects on security, reliability, fault tolerance, survivability, formal methods, cryptography, vulnerability and risk analyses, etc.
• Multics: co-designer of the file system with Bob Daley, leader of the overall Bell Labs effort, coordinating with MIT (F.J. Corbató) and Honeywell (C. Clingen), 1965-1969

Graduate Advisor: Anthony G. Oettinger, Harvard University

PhD committee member: for Rebecca Mercuri (external advisor), Drew Dean, Lenny Foner, ChenXi Wang, Jeff Ullman (long ago)

Recent Collaborators: Rebecca Mercuri, Drew Dean, Rich Feiertag (NAI Labs, now McAfee Labs), Phil Porras (SRI), Lauren Weinstein (PFIR), Dave Farber (CMU); Hal Abelson, Ross Anderson, Steven M. Bellovin, Josh Benaloh, Matt Blaze, Whitfield Diffie, John Gilmore, Ronald L. Rivest, Jeffrey I. Schiller, Bruce Schneier ("11 cryptographers" paper, 1997 and revised/republished 1998); Susan Landau, Steve Kent, Clint Brooks, Scott Charney, Dorothy Denning, Whitfield Diffie, Anthony Lauck, Douglas Miller, David Sobel (ACM crypto study, 1994); National Academies' study group colleagues (three studies, 1983, 1990, 1996 – too long ago to mention)

David L. Dill
Gates Building 3A, Rm 344
Stanford, CA 94305-9030
(650) 725-3642
dill@cs.stanford.edu
http://verify.stanford.edu

A. Professional Preparation

- 1979 S.B. Computer Science and Engineering, Massachusetts Institute of Technology.

- 1982 M.S. Computer Science, Carnegie-Mellon University.

- 1987 Ph.D. Computer Science, Carnegie-Mellon University.

B. Appointments

- *Professor*, Department of Computer Science, Stanford University, September 2000 to present.

- *Associate Professor*, Department of Computer Science, Stanford University, September 1994 to August 2000.

- *Chief Scientist*, 0-In Design Automation, July 1996 – September 1997.

- Intel Visiting Professor, Summer 1995.

- *Assistant Professor*, Department of Computer Science, Stanford University, September 1987 to August 1994.

C. Publications

Five publications relevant to the proposal

1. Madanlal Musuvathi, David Park, Andy Chou, Dawson R. Engler, and David L. Dill. CMC: A Pragmatic Approach to Model Checking Real Code. In *Proceedings of the Fifth Symposium on Operating Systems Design and Implementation*, December 2002.

2. Sergey Berezin, Vijay Ganesh, and David L. Dill. Online Proof-Producing Decision Procedure for Mixed-Integer Linear Arithmetic. In *Proceedings of TACAS 2003*, Warsaw, Poland, April, 2003.

3. Satyaki Das and David L. Dill. Counter-example based predicate discovery in predicate abstraction. In *Formal Methods in Computer-Aided Design*. Springer-Verlag, November 2002.

4. David Lie, Andy Chou, Dawson Engler, and David L. Dill, "A simple method for extracting models from protocol code," *International Symposium on Computer Architecture*, Association for Computing Machinery, 2001.

5. Clark W. Barrett, David L. Dill, and Aaron Stump. Checking Satisfiability of First-Order Formulas by Incremental Translation to SAT. In Ed Brinksma and Kim Guldstrand Larsen, editors, *14th International Conference on Computer Aided Verification (CAV)*, volume 2404 of *Lecture Notes in Computer Science*, pages 236–249. Springer-Verlag, 2002. Copenhagen, Denmark.

Five other significant publications

1. J.R. Burch, E. M. Clarke, K.L. McMillan, D.L. Dill, and L.J. Hwang. "Symbolic model checking: 10^{20} states and beyond," *Information and Computation*, 98(2):142–170, June 1992.

2. R. Alur and D.L. Dill, "A theory of timed automata," *Theoretical Computer Science*, 126:183–235, 1994.

3. Rajeev Alur, Constantin Courcoubetis, and David Dill, "Model-Checking for Real-Time Systems" *Information and Computation*, 104(1):2–34, May 1993.

4. C. Norris Ip and David L. Dill, "Better verification through symmetry," *Formal Methods in System Design*, 9(1–2):41–75, 1996.

5. David L. Dill, *Trace Theory for Automatic Hierarchical Verification of Speed-independent Circuits*, MIT Press, 1989.

D. Synergistic Activities

I'm a member of the DRE Citizen's Oversight Board for Santa Clara County, a member of the IEEE P1583 Voting Standard's Committee, and the founder of VerifiedVoting.org, a non-profit organization whose mission is to champion transparent, reliable, and publicly verifiable elections in the United States.

E. Collaborators and Other Affiliations

Collaborators

Sergey Berezin, Stephen Boyd, Dawson Engler, Tom Henzinger, Zohar Manna, John C. Mitchell, Sam Owre, John Rushby, Natarajan Shankar, Henny Sipma, Jens Skakkebaek, Ulrich Stern, Claire Tomlin

Graduate advisor

Prof. Edmund M. Clarke, Carnegie-Mellon University.

Previous Ph.D. Students

Husam Abu Haimed (current), Rajeev Alur (U. Penn), Supratik Chakraborty (IIT), Shankar Govindaraju (Trans-Meta), Alan J. Hu (U. of British Columbia), C. Norris Ip (Jasper), Robert B. Jones (Intel), Steven M. Nowick (Columbia U.), Seungjoon Park (Intel), Elizabeth S. Wolf (Intel), Howard Wong-Toi (Cadence), C. Han Yang (unknown), Kenneth Y. Yun (U.C. San Diego), Xiao-Wu Su (unknown), Clark Barrett (NYU), Aaron Stump (Washington University, St. Louis), Kanna Shimizu (IBM), David Park (current), Madanlal Musuvathy (current), Satyaki Das (current), Vijay Ganesh (current), Chris Wilson (unknown), Eric Smith (current), Debashis Sahoo (current)

DAN BONEH

Department of Computer Science, Stanford University

475 Gates CS Building, Stanford, CA 94305-9045, U.S.A.

`dabo@cs.stanford.edu`, **(650) 725-3897,** `crypto.stanford.edu/~dabo`

Professional preparation

Technion, Israel, Computer Science, B.Sc., 1992

Princeton University, Computer Science, Ph.D., 1996

Appointments

Associate Professor, Computer Science, 6/1997–present, Stanford University, Stanford, CA.

Research Scientist, 7/1996–6/1997, Bellcore Research Lab

Five publications most closely related to the project

D. Boneh and P. Golle, "Almost entirely correct mixing with applications to voting," in proceedings of the 9'th ACM conference on Computer and Communications Security (CCS), 2002.

T. Garfinkel, B. Pfaff, J. Chow, M. Rosenblum, and D. Boneh, "Terra: A Virtual Machine-Based Platform for Trusted Computing," In Proceedings of 19th ACM Symposium on Operating Systems Principles (SOSP), pp 193–206, 2003.

D. Boneh and D. Brumley, "Remote timing attacks are practical," in proceedings of the 12'th Usenix Security Symposium, pp. 1–12, 2003. Best paper award.

D. Boneh, C. Gentry, H. Shacham, and B. Lynn, "Aggregate and Verifiably Encrypted Signatures from Bilinear Maps," in *proceedings of Eurocrypt 2003*, pp. 416–432.

D. Boneh, E.-J. Goh, H. Shacham, and N. Modadugu, "SiRiUS: Securing Remote Untrusted Storage," in proc. of the Internet Society's 2003 *Symposium on Network and Distributed System Security (NDSS)*.

Five other publications

D. Boneh and J. Shaw, "Collision Secure Fingerprinting for Digital Data," *IEEE Transactions on Information Theory* **44(5)** (1998), pp. 1897–1905.

D. Boneh and G. Durfee, "Cryptanalysis of RSA with Private Key d Less Than $N^{0.292}$," *IEEE Transactions on Information Theory* **46(4)** (2000), pp. 1339–1349.

D. Boneh and M. Franklin, "Efficient Generation of Shared RSA Keys," *Journal of the ACM* (JACM), **48 (4)**, pp. 702–722, July 2001

D. Boneh and M. Franklin, "Identity-Based Encryption from the Weil Pairing," SIAM J. of Computing, Vol. 32, No. 3, pp. 586–615, 2003.

D. Boneh, C. Dunworth, R. Lipton, and J. Sgall, "On the Computational Power of DNA," in *Discrete Applied Mathematics, Special Issue on Computational Molecular Biology* **71** (1996), pp. 79–94.

Synergistic activities

Program-Committee Chair:

NDSS 2004, Febuary 2004, San Diego, CA;   *Crypto* 2003, August 2003, Santa Barbara, CA;
Usenix 2002, August 2002, San Francisco, CA;   *Workshop on the Management of Digital IP*, April 17-18, 2000, New Jersey.

Program-Commitee Member:

Eurocrypt 2002; *ISOC Network and Distributed Systems Security* 2002; *Crypto* 2000, Santa Barbara,

CA; *Crypto* 1998, Santa Barbara, CA; *Eurocrypt* 2000, May 2-6, 2000, Belgium; *IEEE Security and Privacy* May 2000, Oakland, California; *6th ACM Conference on Computer and Communications Security*, 1999; *7th USENIX security symposium*, San Antonio, Texas, 1998.
NSF CAREER Panel, Nov. 2001.

Collaborators and other affiliations

Co-authors and co-PIs in the last 48 months: Eli Biham (Technion, Israel) Ed Felten (Princeton), Matt Franklin (UC Davis), Shai Halevi (IBM Watson), Nick Howgrave-Graham (IBM Watson), Markus Jakobsson (RSA Labs), A. Joux (ENS, Paris), Ari Juels (RSA Labs), M. Naor (Weizmann Institute), P. Nguyen (ENS, Paris), Eric Rescola (TFM Consulting), Avi Rubin (Johns Hopkins), Alice Silverberg (Ohio State University), Gene Tsudik (UC Irvine), Ramarathnam Venkatesan (Microsoft Research).

PhD Advisor: R. Lipton (Georgia Tech)

PhD Students (8 total): G. Durfee, J. Horwitz, P. Golle, M. Malkin, N. Modadugo, I. Mironov, H. Shacham, B. Lynn.

Awards

2002 IBM Partnership Award.
2002 First place Bases e-challange competition.
2002 DARPA award for excellence in academic research.
2000 NSF CAREER Award.
2000 Packard Fellow Award.
1999 Alfred P. Sloan Research Fellow Award.
1999 Terman Fellow Award.
1999 IBM Partnership Award.
1998 Okawa foundation research award.
1997 Filo-Yang faculty scholar award.
1992 Technion presidential honors.
1991 Technion presidential honors.

Research interests

Applied Cryptography and Network Security.

Pamela S. Karlan

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559 Nathan Abbott Way
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http://www.law.stanford.edu/faculty/karlan

A. Professional Preparation
1980 B.A. History, Yale
1984 M.A. History, Yale
1984 J.D., Yale

B. Appointments
Kenneth and Harle Montgomery Professor of Public Interest Law, Stanford University, 1999- present
Visiting Professor of Law, University of Virginia, Fall 2002
Professor of Law, Stanford University, 1998-99
Roy L. and Rosamond Woodruff Morgan Research Professor, University of Virginia, 1994-98
Visiting Professor of Law, Stanford Law School, Fall 1996
Visiting Professor of Law, Harvard Law School, 1994-95
Professor of Law, University of Virginia, 1993-98
Visiting Associate Professor of Law, NYU Law School, Spring 1993
Visiting Associate Professor of Law, Yale Law School, Fall 1992
Associate Professor of Law, University of Virginia, 1988-93
Assistant Counsel, NAACP Legal Defense and Educational Fund, Inc., 1986-88
Law Clerk, Justice Harry A. Blackmun, Supreme Court of the United States, 1985-86
Law Clerk, Judge Abraham D. Sofaer, U.S. District Court for the Southern District of N.Y., 1984-85.

C. Publications
Five publications relevant to the proposal
1. Pamela S. Karlan, Ballots and Bullets: The Exceptional History of the Right to Vote, 71 U. Cin. L. Rev. 1345 (2003)
2. Samuel Issacharoff, Pamela S. Karlan, and Richard H. Pildes, The Law of Democracy: Legal Structure of the Political Process, revised 2d ed. 2002
3. Kenneth A. Gross, Pamela S. Karlan, Stephen M. Nickelsbur, Daniel R. Ortiz, and Trevor Potter, The Federal Regulation of Elections< Background Report of the Task Force on Legal and Constitutional Issues, National Commission on Federal Election Reform, June 2001, available at
http://election2000.stanford.edu/task.force.report.8.2001.pdf
4. Pamela S. Karlan and Eben Moglen, The Soul of a New Political Machine: The Online, the Color Line, and Electronic Democracy, 34 Loy. L.A.L. Rev. 1089 (2001).
5. Pamela S. Karlan, The Rights To Vote: Some Pessimism About Formalism, 71 Tex. L. Rev. 1705 (1993)

Five other significant publications
1.x Pamela S. Karlan, Disarming the Private Attorney General, 2003 U. Ill. L. Rev. 183
2. Pamela S. Karlan, Equal Protection, Due Process, and the Stereoscopic Fourteenth Amendment, 33 McGeorge L. Rev. 473 (2002). Alur and D.L. Dill, "A theory of timed automata," *Theoretical Computer Science*, 126:183–235, 1994.
3. Pamela S. Karlan, The Irony of Immunity: The Eleventh Amendment, Irreparable Injury, and Section 1983, 53 Stan. L. Rev. 1311 (2001)
4. Samuel Issacharoff and Pamela S. Karlan, The Hydraulics of Campaign Finance Reform, 77 Tex. L. Rev. 1704 (1999)
5. Pamela S. Karlan, Race, Rights, and Remedies in Criminal Adjudication, 96 Mich. L. Rev. 2001 (1998)

D. Synergistic Activities

I serve as an appointed member of the California Fair Political Practices Commission, the government agency charged with, among other things, enforcing the state's campaign finance laws

I serve as a cooperating attorney for the NAACP Legal Defense and Educational Fund, Inc., the nation's leading public interest law firm, regarding its voting rights-related litigation.

I work with the Harvard Civil Rights Project on its voting-related work.

E. Collaborators and Other Affiliations

Collaborators

Cary Coglianese, Samuel Issacharoff, John C. Jeffries, Jr., Peter W. Low, Richard H. Pildes, George A. Rutherglen, L. Michael Seidman, Geoffrey R. Stone, Cass R. Stunstein, Mark V. Tushnet

Students Now Teaching in Election Law-Related Fields (Law schools generally do not have more formal supervision relationships)

Kareem Crayton, Vanderbilt; Ellen Katz, University of Michigan; Daryl Levinson, N.Y.U; Nathaniel Persily, University of Pennsylvania; Philip Weiser, University of Colorado, Adam Winkler, U.C.L.A.

		FOR NSF USE ONLY	
ORGANIZATION **University of Iowa**		PROPOSAL NO.	DURATION (months)
			Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Douglas W Jones**		AWARD NO.	

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. **Douglas W Jones - Associate Professor**	0.00	0.00	2.00	$ 17,387	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	2.00	17,387	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				38,194	
4. (**2**) UNDERGRADUATE STUDENTS				8,505	
5. (**1**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				29,708	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				93,794	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				21,068	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				114,862	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				8,100	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				1,240	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				520	
5. SUBAWARDS				0	
6. OTHER				12,364	
TOTAL OTHER DIRECT COSTS				14,124	
H. TOTAL DIRECT COSTS (A THROUGH G)				137,086	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **47.5% (Rate: 47.5000, Base: 124722)**					
TOTAL INDIRECT COSTS (F&A)				59,243	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				196,329	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 196,329	$
M. COST SHARING PROPOSED LEVEL $ **40,159** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Douglas W Jones**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **John massa**	Date Checked / Date Of Rate Sheet / Initials - ORG

1 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433605

PROPOSAL BUDGET

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)
ORGANIZATION		Proposed	Granted
University of Iowa			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR	AWARD NO.	
Douglas W Jones		

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. **Douglas W Jones - Associate Professor**	0.00	0.00	2.00	$ 18,246	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	2.00	18,246	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	0.00	9.00	2.00	52,500	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				40,103	
4. (**3**) UNDERGRADUATE STUDENTS				19,713	
5. (**1**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				31,193	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				161,755	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				30,089	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				191,844	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				11,340	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				1,302	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				855	
5. SUBAWARDS				0	
6. OTHER				12,988	
TOTAL OTHER DIRECT COSTS				15,145	
H. TOTAL DIRECT COSTS (A THROUGH G)				218,329	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
47.5% (Rate: 47.5000, Base: 205342)					
TOTAL INDIRECT COSTS (F&A)				97,537	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				315,866	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 315,866	$
M. COST SHARING PROPOSED LEVEL $ **66,715** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
Douglas W Jones	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
John massa			

2 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433605

SUMMARY
PROPOSAL BUDGET

YEAR 3

	FOR NSF USE ONLY	
ORGANIZATION **University of Iowa**	PROPOSAL NO.	DURATION (months)
		Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Douglas W Jones**	AWARD NO.	

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. **Douglas W Jones - Associate Professor**	**0.00**	**0.00**	**2.00**	$ **19,159**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**0.00**	**0.00**	**2.00**	**19,159**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	**0.00**	**9.00**	**2.00**	**55,125**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**2**) GRADUATE STUDENTS				**42,109**	
4. (**3**) UNDERGRADUATE STUDENTS				**20,699**	
5. (**1**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**32,753**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**169,845**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**31,594**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**201,439**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**11,904**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ _____ **0**					
2. TRAVEL _____ **0**					
3. SUBSISTENCE _____ **0**					
4. OTHER _____ **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**1,367**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**1,120**	
5. SUBAWARDS				**0**	
6. OTHER				**13,637**	
TOTAL OTHER DIRECT COSTS				**16,124**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**229,467**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **47.5% (Rate: 47.5000, Base: 215829)**					
TOTAL INDIRECT COSTS (F&A)				**102,519**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**331,986**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **331,986**	$
M. COST SHARING PROPOSED LEVEL $ **64,255** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Douglas W Jones**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **John massa**	Date Checked | Date Of Rate Sheet | Initials - ORG

3 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433605

SUMMARY
PROPOSAL BUDGET

YEAR **4**

	FOR NSF USE ONLY	
ORGANIZATION **University of Iowa**	PROPOSAL NO.	DURATION (months)
		Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Douglas W Jones**	AWARD NO.	

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. **Douglas W Jones - Associate Professor**	0.00	0.00	2.00	$ 20,117	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	2.00	20,117	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	0.00	9.00	2.00	57,881	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				44,214	
4. (**3**) UNDERGRADUATE STUDENTS				21,734	
5. (**1**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				34,390	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				178,336	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				33,173	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				211,509	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				12,504	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				1,435	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				1,168	
5. SUBAWARDS				0	
6. OTHER				14,319	
TOTAL OTHER DIRECT COSTS				16,922	
H. TOTAL DIRECT COSTS (A THROUGH G)				240,935	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **47.5% (Rate: 47.5000, Base: 226617)**					
TOTAL INDIRECT COSTS (F&A)				107,643	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				348,578	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 348,578	$
M. COST SHARING PROPOSED LEVEL $ **67,468** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY
Douglas W Jones	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME*	Date Checked | Date Of Rate Sheet | Initials - ORG
John massa	

4 *****ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433605

SUMMARY
PROPOSAL BUDGET

YEAR 5

	FOR NSF USE ONLY	
ORGANIZATION **University of Iowa**	PROPOSAL NO.	DURATION (months)
		Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Douglas W Jones**	AWARD NO.	

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. **Douglas W Jones - Associate Professor**	0.00	0.00	2.00	$ 21,123	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	2.00	21,123	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	0.00	9.00	2.00	60,775	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				46,425	
4. (**2**) UNDERGRADUATE STUDENTS				15,214	
5. (**1**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				36,110	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				179,647	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				34,604	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				214,251	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				13,116	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ _____ 0					
2. TRAVEL _____ 0					
3. SUBSISTENCE _____ 0					
4. OTHER _____ 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				1,507	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				1,216	
5. SUBAWARDS				0	
6. OTHER				15,036	
TOTAL OTHER DIRECT COSTS				17,759	
H. TOTAL DIRECT COSTS (A THROUGH G)				245,126	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **47.5% (Rate: 47.5000, Base: 230089)**					
TOTAL INDIRECT COSTS (F&A)				109,292	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				354,418	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 354,418	$
M. COST SHARING PROPOSED LEVEL $ **70,838** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Douglas W Jones**	FOR NSF USE ONLY		
	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME* **John massa**	Date Checked	Date Of Rate Sheet	Initials - ORG

5 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433605

SUMMARY
PROPOSAL BUDGET

Cumulative

				FOR NSF USE ONLY	
ORGANIZATION **University of Iowa**				PROPOSAL NO.	DURATION (months)
					Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Douglas W Jones**				AWARD NO.	

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. **Douglas W Jones - Associate Professor**	0.00	0.00	10.00	$ 96,032	$
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	10.00	96,032	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**4**) POST DOCTORAL ASSOCIATES	0.00	36.00	8.00	226,281	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**10**) GRADUATE STUDENTS				211,045	
4. (**13**) UNDERGRADUATE STUDENTS				85,865	
5. (**5**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				164,154	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				783,377	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				150,528	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				933,905	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				56,964	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				6,851	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				4,879	
5. SUBAWARDS				0	
6. OTHER				68,344	
TOTAL OTHER DIRECT COSTS				80,074	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,070,943	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				476,234	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,547,177	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,547,177	$
M. COST SHARING PROPOSED LEVEL $ **309,435** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Douglas W Jones**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **John massa**	Date Checked / Date Of Rate Sheet / Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433605

Budget Justification
University of Iowa ACCURATE Proposal

As the administrative center of the ACCURATE collaboration, and with its central location, the ACCURATE lab at Iowa will serve not only as a research center, but also a center for the dissemination of results to national, state and local election officials and a point of contact for press inquiries. While the Internet will serve an important role in this, physical materials will also be important, particularly in dealing with inquiries from state and county election offices. Roughly half of the workload for the clerical staff will be devoted to handling this mission, along with one undergraduate assistant, serving as webmaster.

We plan to create this center incrementally, hiring a postdoc, an administrative assistant, half-time graduate research assistants, and quarter-time undergraduates as outlined in the following timeline, which also indicates sources of funds:

Staffing Proposal:

	Year 1	Year 2	Year 3	Year 4	Year 5	(trips/year)
PI(summer)	NSF	NSF	NSF	NSF	NSF	6
Postdoc		NSF	NSF	NSF	NSF	2
RA1	NSF	NSF	NSF	NSF	NSF	1
RA2	NSF	NSF	NSF	NSF	NSF	1
RA3		UI	UI	UI	UI	1
UGA1	NSF	NSF	NSF	NSF	NSF	
UGA2	UI	NSF	NSF	NSF		
UGA3	[sum]	NSF	NSF	NSF	NSF	
Admin	NSF	NSF	NSF	NSF	NSF	1

Budget Summary:

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
PI	17,387	18,246	19,159	20,117	21,123	96,032
Postdoc		52,500	55,125	57,881	60,775	226,281
RAs	38,194	40,130	42,109	44,214	46,425	211,045
UGAs	8,505	19,713	20,699	21,734	15,214	85,865
Admin	29,708	31,193	32,753	34,390	36,110	164,154
Tot. Salary	**93,794**	**161,755**	**169,845**	**178,336**	**179,647**	**783,377**
Fringe	21,068	30,089	31,594	33,173	34,604	150,528
Tot. Sal+Fringe	**114,862**	**191,844**	**201,439**	**211,509**	**214,251**	**993,905**
Travel	8,100	11,340	11,904	12,504	13,116	56,964
Publication	1,240	1,302	1,367	1,435	1,507	6,851
Comp. Svcs.	520	855	1,120	1,168	1,216	4,879
RA Tuition	12,364	12,988	13,637	14,319	15,036	68,344
Tot. Other Dir.	**14,124**	**15,145**	**16,124**	**16,922**	**17,759**	**80,074**
Tot. Dir. Cost	**137,086**	**218,329**	**229,467**	**240,935**	**245,126**	**1,070,943**
Tot. Indir Cost	59,243	97,537	102,519	107,643	109,292	476,234
Total	**196,329**	**315,866**	**331,986**	**348,578**	**354,418**	**1,547,177**
Cost Sharing	40,159	66,715	64,255	67,468	70,838	309,435

As the administrative center for the ACCURATE project, we plan to host all of the PIs, the advisory board and other interested parties at an annual workshop with from 30 to 50

0433605

attendees, with participant costs covered by cost sharing. and we plan on printing and distributing the project's annual report, aiming at a general readership among election administrators as well as at the election research community.

A second meeting of the PIs will be held at a rotating location each year. The travel budget covers this for the PI and administrator, with the remaining 8 trips, 9 in years 2 and up, divided between the PI, postdoc, and grad students, allowing 4-6 domestic events a year with 1 or 2 attendees at each event. Travel is based on an assumed 2004 cost of $600 per round trip flight to Iowa City plus 2 nights at $150, including meals. This and all cost figures (if not noted otherwise) include a 5% inflation figure for succeeding years.

Computer hardware and furnishings for the lab is covered by cost sharing. The divisional computing lab charges $100 per workstation per year for service, plus $120 per gigabyte per year of server space (no adjustment for inflation on this), and we assume that the project will need 2 gigabytes of server space by year 3.

The cost sharing proposal covers part of one undergraduate assistant and a grad student who joins the project in year 2, as well as all computer equipment for the center.

Details for Select Line Items:

These budget figures assume a 5% inflation rate from year to year. We first work out the cost per staff member if paid for directly by the U of Iowa and if paid for out of the NSF budget. The latter is higher because of Indirect costs that must be charged, at a rate of 47.5%. Also note that the fringe benefit rates shift in year 2 for many of these.

Details for individual personnel items that don't show above

	Year 1	Year 2	Year 3	Year 4	Year 5	
RA Sal.	19,097	20,052	21,054	22,107	23,212	1/2 time 11 mo.
RA Fringe rate	17.7%	19.8%	19.8%	19.8%	19.8%	
RA Tuition	6,182	6,494	6,819	7,160	7,518	
UGA Sal.	6,240	6,552	6,880	7224	7585	1/4 time 11 mo.
UGA fringe	3.3%	3.3%	3.3%	3.3%	3.3%	
Postdoc Sal.	50,000	52,500	55,125	57,881	60,775	
Postdoc fringe	17.7%	9.4%	9.4%	9.4%	9.4%	
Admin Sal.	29,708	31,193	32,753	34,390	36,110	full time 11 mo.
Admin fringe	32%	36.5%	36.5%	36.5%	36.5%	
PI Sal. 2-month	17,378	18,247	19,159	20,117	21,123	full time 2 mo.
PI fringe	26%	28.7%	28.7%	28.7%	28.7%	

Travel is budgeted assuming the PI and Administrator go to one steering committee meeting a year (the other will be local), that the Postdoc travels to 2 or 3 meetings a year, and that each RA goes to 1 meeting a year, with the PI attending 4 to 5 meetings a year.

Cost for travel: based on a $600 round trip and 2 nights at $150 each

	Year 1	Year 2	Year 3	Year 4	Year 5
cost/trip	900	945	992	1,042	1,093
Trips/Year	9	12	12	12	12
Travel cost	8,100	11,340	11,904	12,504	13,116

ORGANIZATION	FOR NSF USE ONLY		
Johns Hopkins University	PROPOSAL NO.	DURATION (months)	
		Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR	AWARD NO.		
Aviel D Rubin			

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. **Aviel D Rubin - none**	0.00	0.00	0.00	$ 0	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	0	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**3**) GRADUATE STUDENTS				52,499	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				52,499	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				1,338	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				53,837	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				8,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				4,000	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				14,792	
TOTAL OTHER DIRECT COSTS				18,792	
H. TOTAL DIRECT COSTS (A THROUGH G)				80,629	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
Indirect Costs (Rate: 63.5000, Base: 65838)					
TOTAL INDIRECT COSTS (F&A)				41,807	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				122,436	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 122,436	$
M. COST SHARING PROPOSED LEVEL $ 24,487	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME	FOR NSF USE ONLY		
Aviel D Rubin	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Jennifer barron			

1 **ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433504

SUMMARY
PROPOSAL BUDGET

YEAR 2

		FOR NSF USE ONLY	
ORGANIZATION		PROPOSAL NO.	DURATION (months)
Johns Hopkins University			Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR		AWARD NO.	
Aviel D Rubin			

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. **Aviel D Rubin - none**	**0.00**	**0.00**	**0.00**	$ **0**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**0.00**	**0.00**	**0.00**	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**3**) GRADUATE STUDENTS				**55,124**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**55,124**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**1,406**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**56,530**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**8,400**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**4,200**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**15,531**	
TOTAL OTHER DIRECT COSTS				**19,731**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**84,661**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
Indirect Costs (Rate: 63.5000, Base: 69130)					
TOTAL INDIRECT COSTS (F&A)				**43,898**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**128,559**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **128,559**	$
M. COST SHARING PROPOSED LEVEL $ **25,712**		AGREED LEVEL IF DIFFERENT $			

PI/PD NAME	FOR NSF USE ONLY		
Aviel D Rubin	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Jennifer barron			

2 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433504

SUMMARY
PROPOSAL BUDGET

YEAR 3

ORGANIZATION				FOR NSF USE ONLY		
Johns Hopkins University				PROPOSAL NO.	DURATION (months)	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR					Proposed	Granted
Aviel D Rubin				AWARD NO.		

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. **Aviel D Rubin - none**	**2.00**	**0.00**	**0.00**	$ **29,478**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.00**	**0.00**	**0.00**	**29,478**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**2**) GRADUATE STUDENTS				**51,449**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**80,927**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**10,220**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**91,147**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**8,820**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**4,410**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**16,308**	
TOTAL OTHER DIRECT COSTS				**20,718**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**120,685**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
Indirect Costs (Rate: 63.5000, Base: 104377)					
TOTAL INDIRECT COSTS (F&A)				**66,279**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**186,964**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **186,964**	$
M. COST SHARING PROPOSED LEVEL $ **37,393** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
Aviel D Rubin	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Jennifer barron			

3 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET***

0433504

		FOR NSF USE ONLY	
ORGANIZATION		PROPOSAL NO.	DURATION (months)
Johns Hopkins University			Proposed Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR		AWARD NO.	
Aviel D Rubin			

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. **Aviel D Rubin - none**	**2.00**	**0.00**	**0.00**	$ **30,068**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.00**	**0.00**	**0.00**	**30,068**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**2**) GRADUATE STUDENTS				**54,022**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**84,090**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**10,955**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**95,045**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**9,261**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **17,123**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**17,123**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**4,631**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**4,631**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**126,060**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
Indirect Costs (Rate: 63.5000, Base: 108936)					
TOTAL INDIRECT COSTS (F&A)				**69,174**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**195,234**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **195,234**	$
M. COST SHARING PROPOSED LEVEL $ **39,047** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
Aviel D Rubin	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Jennifer barron			

4   ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433504

SUMMARY PROPOSAL BUDGET   YEAR 5

			FOR NSF USE ONLY	
ORGANIZATION **Johns Hopkins University**			PROPOSAL NO.	DURATION (months)
				Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Aviel D Rubin**			AWARD NO.	

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. **Aviel D Rubin - none**	**2.00**	**0.00**	**0.00**	$ **30,669**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.00**	**0.00**	**0.00**	**30,669**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**2**) GRADUATE STUDENTS				**56,723**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**87,392**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**11,206**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**98,598**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**9,724**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ _____ **0**					
2. TRAVEL _____ **0**					
3. SUBSISTENCE _____ **0**					
4. OTHER _____ **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**4,862**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**17,980**	
TOTAL OTHER DIRECT COSTS				**22,842**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**131,164**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Indirect Costs (Rate: 63.5000, Base: 113183)**					
TOTAL INDIRECT COSTS (F&A)				**71,871**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**203,035**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **203,035**	$
M. COST SHARING PROPOSED LEVEL $ **40,607**	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME **Aviel D Rubin**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Jennifer barron**	Date Checked / Date Of Rate Sheet / Initials - ORG

5   *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433504

SUMMARY
PROPOSAL BUDGET
Cumulative

					FOR NSF USE ONLY		
ORGANIZATION					PROPOSAL NO.	DURATION (months)	
Johns Hopkins University						Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR					AWARD NO.		
Aviel D Rubin							

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. **Aviel D Rubin - none**	**6.00**	**0.00**	**0.00**	$ **90,215**	$
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**6.00**	**0.00**	**0.00**	**90,215**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**12**) GRADUATE STUDENTS				**269,817**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**360,032**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**35,125**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**395,157**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**44,205**	
2. FOREIGN				**0**	

F. PARTICIPANT SUPPORT COSTS

1. STIPENDS $ —————————— **0**
2. TRAVEL   —————————— **0**
3. SUBSISTENCE   —————————— **0**
4. OTHER   —————————— **17,123**

TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS	**17,123**	
G. OTHER DIRECT COSTS		
1. MATERIALS AND SUPPLIES	**22,103**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION	**0**	
3. CONSULTANT SERVICES	**0**	
4. COMPUTER SERVICES	**0**	
5. SUBAWARDS	**0**	
6. OTHER	**64,611**	
TOTAL OTHER DIRECT COSTS	**86,714**	
H. TOTAL DIRECT COSTS (A THROUGH G)	**543,199**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)		
TOTAL INDIRECT COSTS (F&A)	**293,029**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)	**836,228**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)	**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)	$ **836,228**	$
M. COST SHARING PROPOSED LEVEL $ **167,246** AGREED LEVEL IF DIFFERENT $		

PI/PD NAME	FOR NSF USE ONLY		
Aviel D Rubin	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Jennifer barron			

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433504

Budget Justification

Principal Investigator

Avi Rubin will draw salary for 2 calendar months each year for years three, four and five.

Graduate Students

The funds will support two Ph.D. students for a calendar each year during the full proposal period. An additional graduate student will be supported for the summer months only in years one and two.

Fringe

The fringe rate of 33% is calculated on the principal investigators salary. The additional fringe is 7.65% of the graduate student summer month salaries.

Travel

The funds requested will support travel to collaborate with the lead institution and the other investigators involved in the proposal. The funds will also be used to participate in conferences such as:
 IEEE Symposium on Security & Privacy
ACM Computer and Communications Security conference
USENIX Security conference
Networks and Distributed Systems Security Conference

Supplies

The amount requested will allow the purchase of computers, printers and general office supplies for the graduate students.   These funds will also be utilized to purchase the necessary software.

Other

The amount requested is for 20% of the two full-time graduate students tuition and health insurance.

Indirect Costs

The indirect cost rate of 63.5% is charged to all items except the graduate student tuition and health insurance.

Matching Funds

The matching funds will be provided by The Johns Hopkins University Whiting School of Engineering in the form of the graduate student tuition.

0433504

SUMMARY
PROPOSAL BUDGET

YEAR 1

ORGANIZATION **William Marsh Rice University**					FOR NSF USE ONLY	
				PROPOSAL NO.	DURATION (months)	
					Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Dan S Wallach**				AWARD NO.		

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. **Dan S Wallach - Assistant Professor**	0.00	0.00	1.50	$ 13,231	$
2. **Michael Byrne - Assistant Professor**	0.00	0.00	1.50	11,792	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	25,023	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**4**) GRADUATE STUDENTS				106,667	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				131,690	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				45,156	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				176,846	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				9,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				7,800	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				4,164	
5. SUBAWARDS				0	
6. OTHER				590	
TOTAL OTHER DIRECT COSTS				12,554	
H. TOTAL DIRECT COSTS (A THROUGH G)				198,400	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **51% MTDC (Rate: 51.0000, Base: 160000)**					
TOTAL INDIRECT COSTS (F&A)				81,600	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				280,000	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 280,000	$
M. COST SHARING PROPOSED LEVEL $ **56,000** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Dan S Wallach**	FOR NSF USE ONLY		
	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME* **Heidi thornton**	Date Checked	Date Of Rate Sheet	Initials - ORG

1 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433655

SUMMARY
PROPOSAL BUDGET   YEAR   2

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)
		Proposed / Granted
ORGANIZATION **William Marsh Rice University**	AWARD NO.	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Dan S Wallach**		

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. **Dan S Wallach - Assistant Professor**	0.00	0.00	1.50	$ 13,892	$
2. **Michael Byrne - Assistant Professor**	0.00	0.00	1.50	12,381	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	26,273	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**4**) GRADUATE STUDENTS				112,000	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				138,273	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				47,414	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				185,687	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				11,640	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				6,000	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				4,373	
5. SUBAWARDS				0	
6. OTHER				620	
TOTAL OTHER DIRECT COSTS				10,993	
H. TOTAL DIRECT COSTS (A THROUGH G)				208,320	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **51% MTDC (Rate: 51.0000, Base: 168000)**					
TOTAL INDIRECT COSTS (F&A)				85,680	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				294,000	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 294,000	$
M. COST SHARING PROPOSED LEVEL $ **58,800** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Dan S Wallach**	FOR NSF USE ONLY INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME* **Heidi thornton**	Date Checked	Date Of Rate Sheet	Initials - ORG

2 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433655

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)
ORGANIZATION **William Marsh Rice University**		Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Dan S Wallach**	AWARD NO.	

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. **Dan S Wallach - Assistant Professor**	0.00	0.00	1.50	$ 14,587	$
2. **Michael Byrne - Assistant Professor**	0.00	0.00	1.50	13,000	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	27,587	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**4**) GRADUATE STUDENTS				117,600	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				145,187	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				49,784	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				194,971	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				12,250	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				6,270	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				4,595	
5. SUBAWARDS				0	
6. OTHER				650	
TOTAL OTHER DIRECT COSTS				11,515	
H. TOTAL DIRECT COSTS (A THROUGH G)				218,736	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **51% MTDC (Rate: 51.0000, Base: 176400)**					
TOTAL INDIRECT COSTS (F&A)				89,964	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				308,700	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 308,700	$
M. COST SHARING PROPOSED LEVEL $ **61,740** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY
Dan S Wallach	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME*	Date Checked | Date Of Rate Sheet | Initials - ORG
Heidi thornton	

3 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433655

SUMMARY
PROPOSAL BUDGET
YEAR 4

	FOR NSF USE ONLY		
ORGANIZATION **William Marsh Rice University**	PROPOSAL NO.	DURATION (months)	
		Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Dan S Wallach**	AWARD NO.		

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. **Dan S Wallach - Assistant Professor**	0.00	0.00	1.50	$ 15,316	$
2. **Michael Byrne - Assistant Professor**	0.00	0.00	1.50	13,650	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	28,966	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**4**) GRADUATE STUDENTS				123,480	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				152,446	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				52,273	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				204,719	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				13,370	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				6,077	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				4,825	
5. SUBAWARDS				0	
6. OTHER				682	
TOTAL OTHER DIRECT COSTS				11,584	
H. TOTAL DIRECT COSTS (A THROUGH G)				229,673	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **51% MTDC (Rate: 51.0000, Base: 185220)**					
TOTAL INDIRECT COSTS (F&A)				94,462	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				324,135	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 324,135	$
M. COST SHARING PROPOSED LEVEL $ **64,827** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Dan S Wallach**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Heidi thornton**	Date Checked / Date Of Rate Sheet / Initials - ORG

4 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433655

PROPOSAL BUDGET

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)
ORGANIZATION		Proposed	Granted
William Marsh Rice University		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR	AWARD NO.	
Dan S Wallach		

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. **Dan S Wallach - Assistant Professor**	0.00	0.00	1.50	$ 16,082	$
2. **Michael Byrne - Assistant Professor**	0.00	0.00	1.50	14,333	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	30,415	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**4**) GRADUATE STUDENTS				129,654	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				160,069	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				54,888	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				214,957	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				14,050	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				6,368	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				5,065	
5. SUBAWARDS				0	
6. OTHER				717	
TOTAL OTHER DIRECT COSTS				12,150	
H. TOTAL DIRECT COSTS (A THROUGH G)				241,157	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
51% MTDC (Rate: 51.0000, Base: 194481)					
TOTAL INDIRECT COSTS (F&A)				99,185	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				340,342	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 340,342	$
M. COST SHARING PROPOSED LEVEL $ **68,068** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY
Dan S Wallach	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Heidi thornton			

5 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433655

SUMMARY
PROPOSAL BUDGET   Cumulative

	FOR NSF USE ONLY	
ORGANIZATION **William Marsh Rice University**	PROPOSAL NO.	DURATION (months)
		Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Dan S Wallach**	AWARD NO.	

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. **Dan S Wallach - Assistant Professor**	0.00	0.00	7.50	$ 73,108	$
2. **Michael Byrne - Assistant Professor**	0.00	0.00	7.50	65,156	
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	15.00	138,264	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**20**) GRADUATE STUDENTS				589,401	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				727,665	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				249,515	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				977,180	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				60,310	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				32,515	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				23,022	
5. SUBAWARDS				0	
6. OTHER				3,259	
TOTAL OTHER DIRECT COSTS				58,796	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,096,286	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				450,891	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,547,177	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,547,177	$
M. COST SHARING PROPOSED LEVEL $ **309,435**	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME **Dan S Wallach**	FOR NSF USE ONLY		
	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME* **Heidi thornton**	Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433655

BUDGET SUMMARY

Rice University
Dan Wallach
Michael Byrne

1. Summer salary is requested for each of the Investigators in each year of the project and is calculated on the current rates with an anticipated 5% annual increase in each year of the project.

2. Graduate Student support is based on the actual rate for AY2004-AY2005 with an anticipated annual increase of 5% in each year of the project.

3. Domestic travel funds are requested for the Principal Investigator and graduate student(s) to attend conferences relating to the research of this proposal.   Travel funds will be required for the PI's to travel to the participating institutions to collaborate on the research of the proposed project.

4. Student tuition remission fees are charged at the current approved and anticipated rates in each year of the project.

5. Other Direct Costs:
    a. Materials and supplies include the project costs of laboratory supplies (software programs and licenses, cd's and/or floppy disks for research material, etc.), desktop computers and/or laptop computers with a cost of less than a cost of $2,500 per unit.

    b. Computer services represent a prorated share of the cost of operating and maintaining shared departmental research facilities. The rate charge is established by approved department and university procedures which require annual recalculation to ensure that the rate recovers only the actual operating costs. This fee provides each individual the use of a variety of high performance computers, networking operations, copying, printing, and computer facilities support. The costs of the maintenance contracts are reviewed with vendors annually during negotiation of agreements.

6. Indirect costs are charged at the approved rate of 63.50% of modified total direct costs (MTDC). MTDC excludes equipment, pooled graduate student tuition remission and participant support costs. Indirect costs are calculated on the first $25,000 of the total of each sub-award (see attached schedule).

WILLIAM MARSH RICE UNIVERSITY
Budget Attachment

	FY04	FY05	FY06	FY07	FY08
	7/1/2003- 6/30/2004	7/1/2004- 6/30/2005	7/1/2005- 6/30/2006	7/1/2006- 6/30/2007	7/1/2007- 6/30/2008

FACILITIES & ADMINISTRATIVE COSTS

	Approved	Approved	Approved	Provisional	Provisional
On-Campus	51%	51%	51%	51%	51%
Off-Campus	26%	26%	26%	26%	26%
Inst & Training	51%	51%	51%	51%	51%

Facilities and administrative costs were approved by DHHS on 8/7/02. The University will accept awards using currently approved rates until new negotiated rates are approved. Pooled graduate tuition remission is not subject to facilities and administrative costs.

FRINGE BENEFITS

Rice University fringe benefit rates for FY2005 have been calculated based on FY03 actual costs with adjustments made for anticipated cost changes and prior year over and under recoveries. Fringe benefits are calculated by Rice and approved by our cognizant DHHS agency. Rates for FY2005 and beyond are marked "Projected". The University will accept awards using "Actual" rates until new negotiated rates are approved. Fringe benefits include: group hospital and life insurance; employer's share of FICA; workers' compensation insurance; faculty and staff tuition waivers; retirement contributions; sabbatical salaries-faculty; unemployment taxes and short-term disability costs. The rates have been set as follows:

Fringe Benefit Rates	Actual FY04	Projected FY05	Projected FY06	Projected FY07	Projected
Faculty	26%	27%	27%	27%	27%
Postdoctoral Students	27%	27.5%	27.5%	27.5%	27.5%
Staff	27%	27.5%	27.5%	27.5%	27.5%
Graduate Fellows (Not RA/TA's)	2%	2%	2%	2%	2%
Undergraduate Students	2%	2%	2%	2%	2%

POOLED GRADUATE TUITION REMISSION RATES*

Graduate Research Asst. (RA)	36%	36%	36%	36%	36%
Graduate Research Asst. (TA)	36%	36%	36%	36%	36%

*The pooled graduate tuition remission rate includes graduate tuition waivers and is an average rate applied to all graduate research and teaching assistants' salaries. Graduate tuition remission rates are calculated by Rice and reviewed and approved by our cognizant DHHS agency.

BUSINESS OFFICIAL: Jordan Konisky, Ph.D.
Vice Provost for Research and Graduate Studies - MS 16
Rice University
P.O. Box 1892
Houston, TX 77251-1892

(02/04)
Telephone: (713) 348-4820 or (713) 348-6200; Fax: (713) 348-5425

SUMMARY
PROPOSAL BUDGET   YEAR 1

				FOR NSF USE ONLY	
ORGANIZATION **University of California-Berkeley**				PROPOSAL NO.	DURATION (months)
					Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **David Wagner**				AWARD NO.	

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. **David Wagner - Professor**	0.00	0.00	1.00	$ 8,749	$
2. **Deirdre Mulligan - Professor**	0.00	0.00	2.00	25,817	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	34,566	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	12.00	0.00	0.00	20,400	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**3**) GRADUATE STUDENTS				81,530	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				136,496	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				29,645	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				166,141	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) **PCs** $ 6,928					
TOTAL EQUIPMENT				6,928	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				12,664	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				1,488	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				96	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				6,140	
5. SUBAWARDS				0	
6. OTHER				720	
TOTAL OTHER DIRECT COSTS				8,444	
H. TOTAL DIRECT COSTS (A THROUGH G)				194,177	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Modified Total Direct Costs (Rate: 52.0000, Base: 165044)**					
TOTAL INDIRECT COSTS (F&A)				85,823	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				280,000	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 280,000	$
M. COST SHARING PROPOSED LEVEL $ **56,000** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **David Wagner**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Patricia Gates**	Date Checked | Date Of Rate Sheet | Initials - ORG

1 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433484

SUMMARY PROPOSAL BUDGET   YEAR 2

		FOR NSF USE ONLY	
ORGANIZATION		PROPOSAL NO.	DURATION (months)
University of California-Berkeley			Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR		AWARD NO.	
David Wagner			

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. **David Wagner - Professor**	0.00	0.00	1.00	$ 8,924	$
2. **Deirdre Mulligan - Professor**	0.00	0.00	2.00	26,334	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	35,258	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	12.00	0.00	0.00	20,808	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**3**) GRADUATE STUDENTS				83,154	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				139,220	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				32,013	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				171,233	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) **PCs** $ 7,066					
TOTAL EQUIPMENT				7,066	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				12,912	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				1,536	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				96	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				6,616	
5. SUBAWARDS				0	
6. OTHER				720	
TOTAL OTHER DIRECT COSTS				8,968	
H. TOTAL DIRECT COSTS (A THROUGH G)				200,179	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Modified Total Direct Costs (Rate: 52.0000, Base: 168687)**					
TOTAL INDIRECT COSTS (F&A)				87,717	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				287,896	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 287,896	$
M. COST SHARING PROPOSED LEVEL $ 57,579 AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY
David Wagner	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME*	Date Checked / Date Of Rate Sheet / Initials - ORG
Patricia Gates	

2 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433484

SUMMARY
PROPOSAL BUDGET

YEAR 3

				FOR NSF USE ONLY	
ORGANIZATION				PROPOSAL NO.	DURATION (months)
University of California-Berkeley					Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				AWARD NO.	
David Wagner					

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. **David Wagner - Professor**	0.00	0.00	1.00	$ 9,102	$
2. **Deirdre Mulligan - Professor**	0.00	0.00	2.00	26,860	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	35,962	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	12.00	0.00	0.00	21,222	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**3**) GRADUATE STUDENTS				84,822	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				142,006	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				34,607	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				176,613	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
PCs $ 7,208					
TOTAL EQUIPMENT				7,208	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				13,168	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				1,584	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				96	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				7,142	
5. SUBAWARDS				0	
6. OTHER				720	
TOTAL OTHER DIRECT COSTS				9,542	
H. TOTAL DIRECT COSTS (A THROUGH G)				206,531	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
Modified Total Direct Costs (Rate: 52.0000, Base: 172452)					
TOTAL INDIRECT COSTS (F&A)				89,675	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				296,206	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 296,206	$
M. COST SHARING PROPOSED LEVEL $ 59,241	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME	FOR NSF USE ONLY		
David Wagner	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Patricia Gates			

3 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433484

SUMMARY
PROPOSAL BUDGET

YEAR 4

	FOR NSF USE ONLY		
ORGANIZATION **University of California-Berkeley**	PROPOSAL NO.	DURATION (months)	
		Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **David Wagner**	AWARD NO.		

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. **David Wagner - Professor**	0.00	0.00	1.00	$ 9,284	$
2. **Deirdre Mulligan - Professor**	0.00	0.00	2.00	27,398	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	36,682	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	12.00	0.00	0.00	21,648	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**3**) GRADUATE STUDENTS				86,525	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				144,855	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				37,450	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				182,305	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) **PCs** $ 7,352					
TOTAL EQUIPMENT				7,352	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				13,432	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				1,632	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				96	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				7,714	
5. SUBAWARDS				0	
6. OTHER				720	
TOTAL OTHER DIRECT COSTS				10,162	
H. TOTAL DIRECT COSTS (A THROUGH G)				213,251	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Modified Total Direct Costs (Rate: 52.0000, Base: 176344)**					
TOTAL INDIRECT COSTS (F&A)				91,699	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				304,950	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 304,950	$
M. COST SHARING PROPOSED LEVEL $ 60,990 AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **David Wagner**	FOR NSF USE ONLY		
	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME* **Patricia Gates**	Date Checked	Date Of Rate Sheet	Initials - ORG

4 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433484

SUMMARY
PROPOSAL BUDGET
YEAR 5

ORGANIZATION				FOR NSF USE ONLY		
University of California-Berkeley				PROPOSAL NO.	DURATION (months)	
					Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				AWARD NO.		
David Wagner						

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. **David Wagner - Professor**	0.00	0.00	1.00	$ 9,470	$
2. **Deirdre Mulligan - Professor**	0.00	0.00	2.00	27,946	
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	3.00	37,416	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL ASSOCIATES	12.00	0.00	0.00	22,080	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**3**) GRADUATE STUDENTS				88,255	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				147,751	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				40,567	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				188,318	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
PCs $ 7,500					
TOTAL EQUIPMENT				7,500	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				13,696	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				1,680	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				96	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				8,348	
5. SUBAWARDS				0	
6. OTHER				720	
TOTAL OTHER DIRECT COSTS				10,844	
H. TOTAL DIRECT COSTS (A THROUGH G)				220,358	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
Modified Total Direct Costs (Rate: 52.0000, Base: 180346)					
TOTAL INDIRECT COSTS (F&A)				93,780	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				314,138	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 314,138	$
M. COST SHARING PROPOSED LEVEL $ 62,828		AGREED LEVEL IF DIFFERENT $			

PI/PD NAME	FOR NSF USE ONLY		
David Wagner	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Patricia Gates			

5 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433484

				FOR NSF USE ONLY	
ORGANIZATION				PROPOSAL NO.	DURATION (months)
University of California-Berkeley					Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				AWARD NO.	
David Wagner					

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. **David Wagner - Professor**	0.00	0.00	5.00	$ 45,529	$
2. **Deirdre Mulligan - Professor**	0.00	0.00	10.00	134,355	
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**2**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	15.00	179,884	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**5**) POST DOCTORAL ASSOCIATES	60.00	0.00	0.00	106,158	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**15**) GRADUATE STUDENTS				424,286	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				710,328	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				174,282	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				884,610	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) $ 36,054					
TOTAL EQUIPMENT				36,054	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				65,872	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				7,920	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				480	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				35,960	
5. SUBAWARDS				0	
6. OTHER				3,600	
TOTAL OTHER DIRECT COSTS				47,960	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,034,496	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				448,694	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,483,190	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,483,190	$
M. COST SHARING PROPOSED LEVEL $ **296,638** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
David Wagner	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Patricia Gates			

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433484

NSF-ACCURATE
David Wagner, PI
University of California, Berkeley
09/01/04 – 08/31/09

<u>Budget Justification</u>

The Faculty Investigators, David Wagner and Deirdre Mulligan, will receive summer, 1 summer month per year for David Wagner and 2 summer months per year for Deirdre Mulligan. Other Personnel is specific a Post Doctoral Researcher, paid 12 months at 49.9% time per year. Salary and associated costs of education are provided for 2 Graduate Student Researchers for 9 academic year months at 49.9% time and 3 summer months at 100% time per year, and 1 Graduate Student for 9 academic year months at 49.9% time and 3 summer months at 50% time per year. All salaries are current with cost-of-living increases projected as follows: 2.0% for faculty and other academic staff per project year and 2.0% for students, effective every July 1, per project year.

Benefits rates are 12.7% for Faculty Summer salary, 7.3% for other academic staff salary, 1.3% for Graduate Student Researcher academic year salary, and 3% for Graduate Student Researcher summer salary. GSR Health Insurance is projected at $410 per student per semester and Partial Fee Remission is projected at $3,291 per resident student per semester for the first year, with 10% increases projected for the following years.

Requested equipment for this project includes 2 PCs per year, for a total of 10. The requested model is identified for its technical specifications, but actual equipment purchased may vary according to advances in technological development. The current quotation was obtained from Dell, and pricing includes taxes and reflects the maximum educational discount possible, with projected 2% cost increases per year.

Travel costs are obtained via estimated costs for round-trip, coach, non-restricted trips to the East Coast, and average per diem costs, budgeted as eight trips per project year, to be shared among the Faculty Investigators, Post Doctoral Researcher, and graduate students, for a total of 40 trips over the five project years. The purpose is to attend technical meetings with collaborators.

Supplies and Expenses for this project include research supplies, publication charges, computer support charges (including a Computer Infrastructure Fee, system software and hardware administration, back-up charges, printer charges, and hardware maintenance), mailing, phones, and photocopying expenses.

For verification of rates, please see the University of California, Sponsored Projects Office web site: http://www.spo.berkeley.edu/Policy/benefits/benefits.html.

0433484

SUMMARY   YEAR   1
PROPOSAL BUDGET

			FOR NSF USE ONLY	

ORGANIZATION
SRI International

	PROPOSAL NO.	DURATION (months)
		Proposed	Granted

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Drew Dean

AWARD NO.

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. **Drew Dean - PI**	**2.50**	**0.00**	**0.00**	$ **24,546**	$
2. **Rebecca T Mercuri - none**	**0.00**	**0.00**	**0.00**	**0**	
3. **Peter Neumann - CoPI**	**0.00**	**0.00**	**0.00**	**27,597**	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.50**	**0.00**	**0.00**	**52,143**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**2**) GRADUATE STUDENTS				**58,978**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**111,121**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**29,241**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**140,362**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**15,066**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ ————————— **0**					
2. TRAVEL ————————— **0**					
3. SUBSISTENCE ————————— **0**					
4. OTHER ————————— **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**24,411**	
5. SUBAWARDS				**110,000**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**134,411**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**289,839**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **G&A (Rate: 27.2000, Base: 248796) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				**136,631**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**426,470**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **426,470**	$
M. COST SHARING PROPOSED LEVEL $ **85,294** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Drew Dean**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION

ORG. REP. NAME* **Richard herz**	Date Checked	Date Of Rate Sheet	Initials - ORG

1 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433606

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

** I- Indirect Costs
Research Overhead (Rate: 43.0000, Base 140362)
Support Cost Burden (Rate: 6.4000, Base 134411)

0433606

SUMMARY PROPOSAL BUDGET

YEAR 2

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

ORGANIZATION
SRI International

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Drew Dean

AWARD NO.

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. **Drew Dean - PI**	2.50	0.00	0.00	$ 25,391	$
2. **Rebecca T Mercuri - none**	0.00	0.00	0.00	0	
3. **Peter Neumann - CoPI**	0.00	0.00	0.00	28,546	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	2.50	0.00	0.00	53,937	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				61,008	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				114,945	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				30,248	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				145,193	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				15,066	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				24,411	
5. SUBAWARDS				110,000	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				134,411	
H. TOTAL DIRECT COSTS (A THROUGH G)				294,670	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **G&A (Rate: 27.2000, Base: 255704) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				140,586	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				435,256	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 435,256	$
M. COST SHARING PROPOSED LEVEL $ **87,051** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
Drew Dean	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Richard herz			

2 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433606

SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

** I- Indirect Costs
Research Overhead (Rate: 43.0000, Base 145192)
Support Cost Burden (Rate: 6.4000, Base 134411)

0433606

SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION	FOR NSF USE ONLY		
SRI International	PROPOSAL NO.	DURATION (months)	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR		Proposed	Granted
Drew Dean	AWARD NO.		

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. **Drew Dean - PI**	2.50	0.00	0.00	$ 26,282	$
2. **Rebecca T Mercuri - none**	0.00	0.00	0.00	0	
3. **Peter Neumann - CoPI**	0.00	0.00	0.00	29,548	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	2.50	0.00	0.00	55,830	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				63,149	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				118,979	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				31,309	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				150,288	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				15,066	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				24,411	
5. SUBAWARDS				110,000	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				134,411	
H. TOTAL DIRECT COSTS (A THROUGH G)				299,765	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
G&A (Rate: 27.2000, Base: 262990) (Cont. on Comments Page)					
TOTAL INDIRECT COSTS (F&A)				144,759	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				444,524	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 444,524	$
M. COST SHARING PROPOSED LEVEL $ **88,905**	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME	FOR NSF USE ONLY		
Drew Dean	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Richard herz			

3 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433606

SUMMARY PROPOSAL BUDGET COMMENTS - Year 3

** I- Indirect Costs
Research Overhead (Rate: 43.0000, Base 150288)
Support Cost Burden (Rate: 6.4000, Base 134411)

0433606

SUMMARY
PROPOSAL BUDGET

				FOR NSF USE ONLY	
ORGANIZATION **SRI International**				PROPOSAL NO.	DURATION (months)
				AWARD NO.	Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Drew Dean**					

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. **Drew Dean - PI**	2.50	0.00	0.00	$ 27,206	$
2. **Rebecca T Mercuri - none**	0.00	0.00	0.00	0	
3. **Peter Neumann - CoPI**	0.00	0.00	0.00	30,587	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	2.50	0.00	0.00	57,793	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				65,369	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				123,162	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				32,410	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				155,572	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				15,066	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				24,411	
5. SUBAWARDS				110,000	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				134,411	
H. TOTAL DIRECT COSTS (A THROUGH G)				305,049	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **G&A (Rate: 27.2000, Base: 270546) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				149,087	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				454,136	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 454,136	$
M. COST SHARING PROPOSED LEVEL $ **90,827**	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME **Drew Dean**	FOR NSF USE ONLY INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME* **Richard herz**	Date Checked	Date Of Rate Sheet	Initials - ORG

4 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433606

SUMMARY PROPOSAL BUDGET COMMENTS - Year 4

** I- Indirect Costs
Research Overhead (Rate: 43.0000, Base 155571)
Support Cost Burden (Rate: 6.4000, Base 134412)

SUMMARY PROPOSAL BUDGET

YEAR 5

	FOR NSF USE ONLY	
ORGANIZATION **SRI International**	PROPOSAL NO.	DURATION (months)
		Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Drew Dean**	AWARD NO.	

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. **Drew Dean - PI**	2.50	0.00	0.00	$ 28,162	$
2. **Rebecca T Mercuri - none**	0.00	0.00	0.00	0	
3. **Peter Neumann - CoPI**	0.00	0.00	0.00	31,662	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	2.50	0.00	0.00	59,824	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (**2**) GRADUATE STUDENTS				67,666	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				127,490	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				33,549	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				161,039	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				15,066	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				0	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				24,411	
5. SUBAWARDS				110,000	
6. OTHER				0	
TOTAL OTHER DIRECT COSTS				134,411	
H. TOTAL DIRECT COSTS (A THROUGH G)				310,516	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **G&A (Rate: 27.2000, Base: 278363) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				153,563	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				464,079	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 464,079	$
M. COST SHARING PROPOSED LEVEL $ **92,816**	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME **Drew Dean**	FOR NSF USE ONLY		
	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME* **Richard herz**	Date Checked	Date Of Rate Sheet	Initials - ORG

5 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433606

SUMMARY PROPOSAL BUDGET COMMENTS - Year 5

** I- Indirect Costs
Research Overhead (Rate: 43.0000, Base 161038)
Support Cost Burden (Rate: 6.4000, Base 134410)

SUMMARY
PROPOSAL BUDGET

Cumulative

ORGANIZATION				**FOR NSF USE ONLY**		
SRI International				PROPOSAL NO.	DURATION (months)	
					Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				AWARD NO.		
Drew Dean						

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. **Drew Dean - PI**	**12.50**	**0.00**	**0.00**	$ **131,587**	$
2. **Rebecca T Mercuri - none**	**0.00**	**0.00**	**0.00**	**0**	
3. **Peter Neumann - CoPI**	**0.00**	**0.00**	**0.00**	**147,940**	
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	**12.50**	**0.00**	**0.00**	**279,527**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**10**) GRADUATE STUDENTS				**316,170**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**595,697**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**156,757**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**752,454**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**75,330**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ _____ 0					
2. TRAVEL _____ 0					
3. SUBSISTENCE _____ 0					
4. OTHER _____ 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**122,055**	
5. SUBAWARDS				**550,000**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**672,055**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**1,499,839**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**724,626**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**2,224,465**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **2,224,465**	$
M. COST SHARING PROPOSED LEVEL $ **444,893**		AGREED LEVEL IF DIFFERENT $			

PI/PD NAME	**FOR NSF USE ONLY**		
Drew Dean	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Richard herz			

C *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433606

A: DIRECT LABOR

Direct labor charges are based on actual salaries (current as of the date of this proposal) for the staff members who are expected to perform the tasks, plus a factor added to the current base salaries for merit increases during the proposed contract period. The direct labor rates may be verified by an authorized representative of the U.S. Government by calling DCAA at (650) 859-4532.The hourly rates are based on a 40-hour work week.

A 3.5% annual merit factor has been applied to the current base salaries for increases expected during the period of performance. All annual merit increases will go into effect at the beginning of SRI's fourth accounting period (mid-March).

C: FRINGE BENEFITS

SRI benefit rate for students is 9.0% and 45.9% of total salaries and wages for regular staff.

E: TRAVEL AND SUBSISTENCE

SRI's travel agent, American Express Travel Services, has provided air fare quotations for this proposal based on the United Airlines Apollo system rates as of 29 January 2004.

The air fares used in this proposal are "SRI logical" air fares provided by American Express. These fares are an average of all fares to a destination which match American Express' overall experience with SRI travelers. For most destinations the flights are nonstop, at convenient departure and arrival times, and have no cancellation or change penalties. We have used the logical air fares since we anticipate being able to plan meeting and travel requirements in enough time to take advantage of reasonable discounted air fares.

The subsistence rates in this proposal are based on the ceilings established by FAR 31.205-46. Surface travel is based on an average of $48.00 per day which may include airport transportation, car rental, parking fees, and tolls. The mileage rate for personal auto expenses is currently established at $0.375 per mile.

SRI's travel policy requires the traveler to complete an expense claim for travel costs incurred on company business. Travel costs billed will be within the guidelines established by FAR 31.205-46.

A breakdown of travel and subsistence costs is provided below

Task / Purpose / From / To	No. Staff	Fare ($)	Total Per Diem Days	Per Diem ($)	Tot Surf. Days	Surf. ($) /Day	Local Miles ($)	Other Costs ($)	Total ($)
YEAR 1 East coast meeting San Francisco, CA Washington, DC	2	2,598	6	201	3	48	35	0	6,581
West coast meeting San Francisco, CA San Diego, CA	2	622	4	161	2	48	35	0	2,019

Attend conference San Francisco, CA Miami, FL	1	2,408	4	154	4	48	17	0	3,233
YEAR 2 East coast meeting San Francisco, CA Washington, DC	2	2,598	6	201	3	48	35	0	6,581
West coast meeting San Francisco, CA San Diego, CA	2	622	4	161	2	48	35	0	2,019
Attend conference San Francisco, CA Miami, FL	1	2,408	4	154	4	48	17	0	3,233
YEAR 3 East coast meeting San Francisco, CA Washington, DC	2	2,598	6	201	3	48	35	0	6,581
West coast meeting San Francisco, CA San Diego, CA	2	622	4	161	2	48	35	0	2,019
Attend conference San Francisco, CA Miami, FL	1	2,408	4	154	4	48	17	0	3,233
YEAR 4 East coast meeting San Francisco, CA Washington, DC	2	2,598	6	201	3	48	35	0	6,581
West coast meeting San Francisco, CA San Diego, CA	2	622	4	161	2	48	35	0	2,019
Attend conference San Francisco, CA Miami, FL	1	2,408	4	154	4	48	17	0	3,233
YEAR 5 East coast meeting San Francisco, CA Washington, DC	2	2,598	6	201	3	48	35	0	6,581
West coast meeting San Francisco, CA San Diego, CA	2	622	4	161	2	48	35	0	2,019
Attend conference San Francisco, CA Miami, FL	1	2,408	4	154	4	48	17	0	3,233

Total SRI Travel $75,328

G.4: SRI COMPUTER USAGE

The CSL/SDL Computer Facility provides the infrastructure necessary for the support and integration of project and SRI-owned workstations.

The cost of the CSL/SDL computer facility infrastructure is divided equally across all workstations. The hourly charges for the facility are currently estimated at $7.90. The calculations for these computer costs are shown in the table below.

COMPUTER CHARGES

	Computer Name	Comp Hrs.	Rate	Total
Year 1	CSL--SRI-owned machines	3,090	@7.90 per hr	$24,411
Year 2	CSL--SRI-owned machines	3,090	@7.90 per hr	$24,411
Year 3	CSL--SRI-owned machines	3,090	@7.90 per hr	$24,411
Year 4	CSL--SRI-owned machines	3,090	@7.90 per hr	$24,411
Year 5	CSL--SRI-owned machines	3,090	@7.90 per hr	$24,411

TOTAL COMPUTER $122,055.

G.5: SUBCONTRACTS

This proposal is based on subcontractor(s) performing a portion of the tasks. When required by applicable regulations, copies of the subcontractor(s) proposal and Standard Form 1411 are included with SRI's proposal. The subcontractors follow:

	Subcontractor	Each Year	Cost Share
Year 1	Notable Software, Inc	$110,000	$22,000
Year 2	Notable Software, Inc	$110,000	$22,000
Year 3	Notable Software, Inc	$110,000	$22,000
Year 4	Notable Software, Inc	$110,000	$22,000
Year 5	Notable Software, Inc	$110,000	$22,000
Total		$550,000	$110,000

M: COST SHARING
SRI plans to cost share 20% each year with in-kind funds.

Year 1	$426,470	$85,294
Year 2	$435,256	$87,051
Year 3	$444,524	$88,905
Year 4	$454,136	$90,827
Year 5	$464,079	$92,816
TOTAL	$2,224,465	$444,893

SUMMARY
PROPOSAL BUDGET

YEAR 1

	FOR NSF USE ONLY	
ORGANIZATION	PROPOSAL NO.	DURATION (months)
Notable Software, Inc.		Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR	AWARD NO.	
Rebecca T Mercuri		

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. **Rebecca T Mercuri - PI**	**2.40**	**0.00**	**0.00**	$ **95,000**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.40**	**0.00**	**0.00**	**95,000**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**95,000**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**95,000**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**10,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,500**	
TOTAL OTHER DIRECT COSTS				**5,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**110,000**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
NA (Rate: 0.0000, Base: 0)					
TOTAL INDIRECT COSTS (F&A)				**0**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**110,000**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **110,000**	$
M. COST SHARING PROPOSED LEVEL $ **22,000** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
Rebecca T Mercuri	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Richard herz			

1 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433606

PROPOSAL BUDGET

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)
ORGANIZATION **Notable Software, Inc.**		Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Rebecca T Mercuri**	AWARD NO.	

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. **Rebecca T Mercuri - PI**	**2.40**	**0.00**	**0.00**	$ **95,000**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.40**	**0.00**	**0.00**	**95,000**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**95,000**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**95,000**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**10,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,500**	
TOTAL OTHER DIRECT COSTS				**5,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**110,000**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NA (Rate: 0.0000, Base: 0)**					
TOTAL INDIRECT COSTS (F&A)				**0**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**110,000**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **110,000**	$
M. COST SHARING PROPOSED LEVEL $ **22,000** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Rebecca T Mercuri**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Richard herz**	Date Checked / Date Of Rate Sheet / Initials - ORG

2 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433606

SUMMARY
PROPOSAL BUDGET

YEAR 3

	FOR NSF USE ONLY	
ORGANIZATION **Notable Software, Inc.**	PROPOSAL NO.	DURATION (months)
		Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Rebecca T Mercuri**	AWARD NO.	

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. **Rebecca T Mercuri - PI**	**2.40**	**0.00**	**0.00**	$ **95,000**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.40**	**0.00**	**0.00**	**95,000**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**95,000**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**95,000**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**10,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,500**	
TOTAL OTHER DIRECT COSTS				**5,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**110,000**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NA (Rate: 0.0000, Base: 0)**					
TOTAL INDIRECT COSTS (F&A)				**0**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**110,000**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **110,000**	$
M. COST SHARING PROPOSED LEVEL $ **22,000** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **Rebecca T Mercuri**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Richard herz**	Date Checked / Date Of Rate Sheet / Initials - ORG

3 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433606

SUMMARY PROPOSAL BUDGET — YEAR 4

ORGANIZATION **Notable Software, Inc.**				FOR NSF USE ONLY	
				PROPOSAL NO.	DURATION (months)
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Rebecca T Mercuri**				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. **Rebecca T Mercuri - PI**	2.40	0.00	0.00	$ 95,000	$
2.					
3.					
4.					
5.					
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)	2.40	0.00	0.00	95,000	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (0) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	0	
3. (0) GRADUATE STUDENTS				0	
4. (0) UNDERGRADUATE STUDENTS				0	
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (0) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				95,000	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				0	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				95,000	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				0	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				10,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (0) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				3,500	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				1,500	
TOTAL OTHER DIRECT COSTS				5,000	
H. TOTAL DIRECT COSTS (A THROUGH G)				110,000	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NA (Rate: 0.0000, Base: 0)**					
TOTAL INDIRECT COSTS (F&A)				0	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				110,000	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 110,000	$
M. COST SHARING PROPOSED LEVEL $ 22,000	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME **Rebecca T Mercuri**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Richard herz**	Date Checked / Date Of Rate Sheet / Initials - ORG

4 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433606

SUMMARY
PROPOSAL BUDGET

YEAR 5

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)
ORGANIZATION **Notable Software, Inc.**		Proposed / Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **Rebecca T Mercuri**	AWARD NO.	

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 CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Rebecca T Mercuri - PI**	**2.40**	**0.00**	**0.00**	$ **95,000**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**2.40**	**0.00**	**0.00**	**95,000**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**95,000**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**95,000**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**10,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,500**	
TOTAL OTHER DIRECT COSTS				**5,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**110,000**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NA (Rate: 0.0000, Base: 0)**					
TOTAL INDIRECT COSTS (F&A)				**0**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**110,000**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **110,000**	$
M. COST SHARING PROPOSED LEVEL $ **22,000**	AGREED LEVEL IF DIFFERENT $				

PI/PD NAME **Rebecca T Mercuri**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Richard herz**	Date Checked / Date Of Rate Sheet / Initials - ORG

5 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433606

SUMMARY
PROPOSAL BUDGET

Cumulative

	FOR NSF USE ONLY	
ORGANIZATION	PROPOSAL NO.	DURATION (months)
Notable Software, Inc.		Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR	AWARD NO.	
Rebecca T Mercuri		

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. **Rebecca T Mercuri - PI**	**12.00**	**0.00**	**0.00**	$ **475,000**	$
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	**0.00**	**0.00**	**0.00**	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	**12.00**	**0.00**	**0.00**	**475,000**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	**0.00**	**0.00**	**0.00**	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	**0.00**	**0.00**	**0.00**	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**475,000**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**475,000**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**50,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ _____ **0**					
2. TRAVEL _____ **0**					
3. SUBSISTENCE _____ **0**					
4. OTHER _____ **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**17,500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**7,500**	
TOTAL OTHER DIRECT COSTS				**25,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**550,000**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**0**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**550,000**	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **550,000**	$
M. COST SHARING PROPOSED LEVEL $ **110,000** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY
Rebecca T Mercuri	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME*	Date Checked | Date Of Rate Sheet | Initials - ORG
Richard herz	

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433606

Budget Justification Page

Salary - PI will spend 2.4 calandar months during each year.

Travel - PI will make approximately 5 trips to California each year.

Other Supplies - PI will require high speed Internet service and photocopying and materials.

ORGANIZATION				FOR NSF USE ONLY		
Stanford University				PROPOSAL NO.	DURATION (months)	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR					Proposed	Granted
David L Dill				AWARD NO.		

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. **David L Dill - Professor**	0.00	0.00	1.00	$ 10,594	$
2. **Dan Boneh - Associate Professor**	0.00	0.45	0.00	5,279	
3. **Pamela S Karlan**	0.00	0.00	0.00	0	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.45	1.00	15,873	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	5.40	0.00	0.00	36,153	
3. (**3**) GRADUATE STUDENTS				77,398	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				129,424	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				18,077	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				147,501	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Compute Server $ 5,000					
TOTAL EQUIPMENT				5,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				11,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				4,230	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				38,090	
TOTAL OTHER DIRECT COSTS				42,320	
H. TOTAL DIRECT COSTS (A THROUGH G)				205,821	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
MTDC (Rate: 60.0000, Base: 162731)					
TOTAL INDIRECT COSTS (F&A)				97,639	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				303,460	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 303,460	$
M. COST SHARING PROPOSED LEVEL $ **60,692** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
David L Dill	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Sharon bergman			

1 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433701

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)
ORGANIZATION **Stanford University**		Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **David L Dill**	AWARD NO.	

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. **David L Dill - Professor**	0.00	0.00	1.00	$ 10,912	$
2. **Dan Boneh - Associate Professor**	0.00	0.45	0.00	5,437	
3. **Pamela S Karlan**	0.00	0.00	0.00	0	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.45	1.00	16,349	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	5.40	0.00	0.00	37,238	
3. (**3**) GRADUATE STUDENTS				79,721	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				133,308	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				18,619	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				151,927	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) **Compute Server** $ 5,000					
TOTAL EQUIPMENT				5,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				11,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				5,946	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				39,540	
TOTAL OTHER DIRECT COSTS				45,486	
H. TOTAL DIRECT COSTS (A THROUGH G)				213,413	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 60.0000, Base: 168873)**					
TOTAL INDIRECT COSTS (F&A)				101,324	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				314,737	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 314,737	$
M. COST SHARING PROPOSED LEVEL $ **62,947** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **David L Dill**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Sharon bergman**	Date Checked | Date Of Rate Sheet | Initials - ORG

2 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433701

				FOR NSF USE ONLY	
ORGANIZATION				PROPOSAL NO.	DURATION (months)
Stanford University					Proposed | Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				AWARD NO.	
David L Dill					

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. **David L Dill - Professor**	0.00	0.00	1.00	$ 11,239	$
2. **Dan Boneh - Associate Professor**	0.00	0.45	0.00	5,600	
3. **Pamela S Karlan**	0.00	0.00	0.00	0	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.45	1.00	16,839	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	5.60	0.00	0.00	40,059	
3. (**3**) GRADUATE STUDENTS				82,111	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				139,009	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				19,671	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				158,680	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Compute Server $ 5,000					
TOTAL EQUIPMENT				5,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				11,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ _____ 0					
2. TRAVEL _____ 0					
3. SUBSISTENCE _____ 0					
4. OTHER _____ 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				5,604	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				41,048	
TOTAL OTHER DIRECT COSTS				46,652	
H. TOTAL DIRECT COSTS (A THROUGH G)				221,332	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
MTDC (Rate: 60.0000, Base: 175284)					
TOTAL INDIRECT COSTS (F&A)				105,170	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				326,502	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 326,502	$
M. COST SHARING PROPOSED LEVEL $ **65,300** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY		
David L Dill	INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Sharon bergman			

3 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433701

SUMMARY
PROPOSAL BUDGET

YEAR 4

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)

ORGANIZATION					
Stanford University				Proposed	Granted

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR	AWARD NO.
David L Dill	

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. **David L Dill - Professor**	0.00	0.00	1.00	$ 11,576	$
2. **Dan Boneh - Associate Professor**	0.00	0.45	0.00	5,768	
3. **Pamela S Karlan**	0.00	0.00	0.00	0	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.45	1.00	17,344	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	5.70	0.00	0.00	42,139	
3. (**3**) GRADUATE STUDENTS				84,575	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				144,058	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				20,516	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				164,574	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Compute Server $ 5,000					
TOTAL EQUIPMENT				5,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				11,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				6,405	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				42,614	
TOTAL OTHER DIRECT COSTS				49,019	
H. TOTAL DIRECT COSTS (A THROUGH G)				229,593	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
MTDC (Rate: 60.0000, Base: 181979)					
TOTAL INDIRECT COSTS (F&A)				109,187	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				338,780	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 338,780	$
M. COST SHARING PROPOSED LEVEL $ 67,756 AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY
David L Dill	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME*	Date Checked / Date Of Rate Sheet / Initials - ORG
Sharon bergman	

4 *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433701

SUMMARY PROPOSAL BUDGET

YEAR 5

	FOR NSF USE ONLY	
	PROPOSAL NO.	DURATION (months)

ORGANIZATION
Stanford University

			AWARD NO.		Proposed	Granted

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
David L Dill

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. **David L Dill - Professor**	0.00	0.00	1.00	$ 11,924	$
2. **Dan Boneh - Associate Professor**	0.00	0.45	0.00	5,941	
3. **Pamela S Karlan**	0.00	0.00	0.00	0	
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.45	1.00	17,865	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	6.00	0.00	0.00	45,212	
3. (**3**) GRADUATE STUDENTS				87,112	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				150,189	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				21,656	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				171,845	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Compute Server $ 5,000					
TOTAL EQUIPMENT				5,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				11,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				6,124	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				44,232	
TOTAL OTHER DIRECT COSTS				50,356	
H. TOTAL DIRECT COSTS (A THROUGH G)				238,201	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
MTDC (Rate: 60.0000, Base: 188969)					
TOTAL INDIRECT COSTS (F&A)				113,381	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				351,582	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 351,582	$
M. COST SHARING PROPOSED LEVEL $ **70,316** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME	FOR NSF USE ONLY
David L Dill	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME*	Date Checked	Date Of Rate Sheet	Initials - ORG
Sharon bergman			

5 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

0433701

SUMMARY PROPOSAL BUDGET

Cumulative

				FOR NSF USE ONLY		
ORGANIZATION **Stanford University**				PROPOSAL NO.	DURATION (months)	
					Proposed	Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR **David L Dill**				AWARD NO.		

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. **David L Dill - Professor**	0.00	0.00	5.00	$ 56,245	$
2. **Dan Boneh - Associate Professor**	0.00	2.25	0.00	28,025	
3. **Pamela S Karlan**	0.00	0.00	0.00	0	
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	0	
7. (**3**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	2.25	5.00	84,270	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL ASSOCIATES	0.00	0.00	0.00	0	
2. (**5**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	28.10	0.00	0.00	200,801	
3. (**15**) GRADUATE STUDENTS				410,917	
4. (**0**) UNDERGRADUATE STUDENTS				0	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				0	
6. (**0**) OTHER				0	
TOTAL SALARIES AND WAGES (A + B)				695,988	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				98,539	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				794,527	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) $ 25,000					
TOTAL EQUIPMENT				25,000	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				55,000	
2. FOREIGN				0	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ 0					
2. TRAVEL 0					
3. SUBSISTENCE 0					
4. OTHER 0					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				0	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				28,309	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				0	
3. CONSULTANT SERVICES				0	
4. COMPUTER SERVICES				0	
5. SUBAWARDS				0	
6. OTHER				205,524	
TOTAL OTHER DIRECT COSTS				233,833	
H. TOTAL DIRECT COSTS (A THROUGH G)				1,108,360	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				526,701	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				1,635,061	
K. RESIDUAL FUNDS (IF FOR FURTHER SUPPORT OF CURRENT PROJECTS SEE GPG II.C.6.j.)				0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ 1,635,061	$
M. COST SHARING PROPOSED LEVEL $ **327,011** AGREED LEVEL IF DIFFERENT $					

PI/PD NAME **David L Dill**	FOR NSF USE ONLY
	INDIRECT COST RATE VERIFICATION
ORG. REP. NAME* **Sharon bergman**	Date Checked / Date Of Rate Sheet / Initials - ORG

C *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

0433701

STANFORD UNIVERSITY BUDGET JUSTIFICATION
(Applicable to each of 5 years)
PI: PROFESSOR David Dill

This budget was constructed for the 5 year period 9/01/04 through 8/31/09.

The indirect cost and benefit rates used are those most recently negotiated with the Office of Naval Research and are the rates appropriate for the time frame proposed.

For each subsequent year, an increase of 3% was assumed for salaries and a 4% inflation rate was assumed for tuition. All effort and expenses charged to this project will be for services specific to the project and not for the general support of the academic activity of the faculty or department.

A. SENIOR PERSONNEL:
David Dill, Professor and Principal Investigator. Prof Dill will oversee all aspects of this study and supervise the graduate students working on this project.
Co-PI is Dan Boneh.
Other investigator is Pamela Karlan.

B. OTHER PERSONNEL:

B-2 Other Professional: S. Berezin, a Research Associate, will perform research on Verification of High Assurance Software.

B-3: Graduate Students: Two Computer Science graduate students and two Law School students will work as research assistants on this project.

C. FRINGE BENEFITS:
         Faculty and Staff: 29.0%
         Graduate Students: 3.5%
         Postdoctoral Fellows: 18.7%
         Contingent Employees   9.1%

The budgeted salary amount is comprised of the direct effort for the project plus 8.65% vacation accrual/disability sick leave (DSL) for exempt employees and 7.45% for non-exempt employees. These amounts do not exceed total salary. The vacation accrual/DSL rates will be charged at the time of the salary expenditure. No net salary will be charged when the employee is on vacation,disability or workerís compensation.

D. PERMANENT EQUIPMENT: We have budgeted for the the cost of one compute server each year at a cost of $5,000 each.

E. TRAVEL: Funding is requested for domestic travel to disseminate results of research and to discuss future experiments. We have budgeted $11,000 per year for research personnel to attend academic conferences and workshops, and to work with project participants at other institutions.

G. OTHER DIRECT COSTS:
Based on previous experience the PI and Co-PIís believe the following costs are appropriate and sufficient for this project.

G-1 MATERIALS AND SUPPLIES: Funding requested will cover the annual costs of research including laptop computers, photocopying of research materials, report costs, long distance phone charges, computer supplies and other technical supplies to be used by the graduate students in carrying out the proposed research.

G-6 GRADUATE STUDENT TUITION:
The 1993 OMB Circular A-21 revisions require Stanford University to charge tuition directly for Graduate Student Research Assistants working on sponsored projects.

I. INDIRECT COST RATES Assessed on "Modified Total Direct Costs":
Stanford Universityís current negotiated indirect cost rate for a research project of this nature is 60% for FY 2004. This rate will be charged to the modified total direct cost base, which excludes the salaries of undergraduate students, subcontracts in excess of $25,000, tuition, and equipment costing more than $5,000 with a useful life in excess of one year.

M. Cost Sharing: The required 20% cost sharing will be provided by cash contributions from internal Stanford funds, specifically, the Office of Dean of Research ($94,846), School of Engineering Dean ($94,846), Computer Science Department ($94,846), and the Law School ($42,474).

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: **Douglas Jones**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Research: A Center for Correct, Usable, Reliable, Auditable and Transparent Elections (ACCURATE)**

Source of Support: **NSF**
Total Award Amount: $ **1,547,177** Total Award Period Covered: **09/01/04 - 08/31/09**
Location of Project: **University of Iowa**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **0.00** Sumr: **2.00**

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaboration: UCVS: Open-Source PC-Based Voting System**

Source of Support: **NSF**
Total Award Amount: $ **790,797** Total Award Period Covered: **09/01/04 - 08/31/08**
Location of Project: **Stevens Tech**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **1.47** Sumr: **0.33**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: Summ:

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

Page G-1   USE ADDITIONAL SHEETS AS NECESSARY

0433605

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: **Aviel Rubin**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Towards more Secure Inter-Domain Routing**

Source of Support: **NSF STI program**
Total Award Amount: $ **616,923** Total Award Period Covered: **09/01/03 - 08/31/06**
Location of Project: **STI**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad:**0.00** Sumr: **2.00**

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections (ACCURATE)**

Source of Support: **NSF Cybertrust**
Total Award Amount: $ **836,228** Total Award Period Covered: **01/01/00 - 01/01/00**
Location of Project: **Iowa**
Person-Months Per Year Committed to the Project. Cal:**1.20** Acad:**0.00** Sumr: **0.00**

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Center for Cyber-Security and Privacy in its Social Context**

Source of Support: **NSF**
Total Award Amount: $ **500,031** Total Award Period Covered: **01/01/00 - 01/01/00**
Location of Project: **Princeton**
Person-Months Per Year Committed to the Project. Cal:**0.60** Acad:**0.00** Sumr: **0.00**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: Summ:

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

0433504

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: **Dan Wallach**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current   ☒ Pending   ☐ Submission Planned in Near Future   ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Research: A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections (ACCURATE)**

Source of Support: **NSF**
Total Award Amount: $ **1,547,177** Total Award Period Covered: **09/01/04 - 08/31/09**
Location of Project: **Rice University**
Person-Months Per Year Committed to the Project.   Cal:**0.00**   Acad: **0.00**   Sumr: **1.50**

Support: ☐ Current   ☒ Pending   ☐ Submission Planned in Near Future   ☐ *Transfer of Support

Project/Proposal Title: **Towards a Secure and Robust Overlay Networking Infrastructure for Dependable Internet Distributed Systems**

Source of Support: **NSF**
Total Award Amount: $ **2,250,000** Total Award Period Covered: **09/01/04 - 08/31/07**
Location of Project: **Rice University**
Person-Months Per Year Committed to the Project.   Cal:**0.00**   Acad: **0.00**   Sumr: **2.00**

Support: ☒ Current   ☐ Pending   ☐ Submission Planned in Near Future   ☐ *Transfer of Support

Project/Proposal Title: **Security and Resource management in Type-Safe Language Environments (CAREER)**

Source of Support: **NSF**
Total Award Amount: $ **200,000** Total Award Period Covered: **04/01/00 - 03/31/04**
Location of Project: **Rice University**
Person-Months Per Year Committed to the Project.   Cal:**0.00**   Acad: **0.02**   Sumr: **0.00**

Support: ☒ Current   ☐ Pending   ☐ Submission Planned in Near Future   ☐ *Transfer of Support

Project/Proposal Title: **IBM Faculty Partnership Award**

Source of Support: **IBM**
Total Award Amount: $ **40,000** Total Award Period Covered: **08/01/00 - 07/31/04**
Location of Project: **Rice University**
Person-Months Per Year Committed to the Project.   Cal:**0.00**   Acad: **0.02**   Sumr: **0.00**

Support: ☒ Current   ☐ Pending   ☐ Submission Planned in Near Future   ☐ *Transfer of Support

Project/Proposal Title: **Resource Management for Safe Deployment of Edge Services**

Source of Support: **THECB**
Total Award Amount: $ **125,000** Total Award Period Covered: **01/01/02 - 08/31/04**
Location of Project: **Rice University**
Person-Months Per Year Committed to the Project.   Cal:**0.00**   Acad: **0.02**   Summ: **0.00**

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

0433655

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 Byrne**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Research: A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections (ACCURATE)**

Source of Support: **NSF**
Total Award Amount: $ **1,547,177** Total Award Period Covered: **09/01/04 - 08/31/09**
Location of Project: **Rice University**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad:**0.00** Sumr: **1.50**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Systematic Procedural Error**

Source of Support: **Office of Naval Research**
Total Award Amount: $ **192,598** Total Award Period Covered: **10/22/02 - 09/30/05**
Location of Project: **Rice University**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad:**0.00** Sumr: **1.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Integrated Modeling of Cognition and the Information Environment**

Source of Support: **NASA**
Total Award Amount: $ **273,578** Total Award Period Covered: **03/01/02 - 12/31/04**
Location of Project: **Rice Univrsity**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad:**0.00** Sumr: **2.00**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: Summ:

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

0433655

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: David Wagner	Other agencies (including NSF) to which this proposal has been/will be

Support:	☒ Current	☐ Pending	☐ Submission Planned in Near Future	☐ *Transfer of Support

Project/Proposal Title:

CAREER: Security in the Large: Gaining assurance in real-world systems

Source of Support: NSF

Total Award Amount: $267,703   Total Award Period Covered: 3/1/01-12/31/06

Location of Project: University of California, Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr: .6

Support:	☒ Current	☐ Pending	☐ Submission Planned in Near Future	☐ *Transfer of Support

Project/Proposal Title:

Network Embedded Technology (NEST)

(David Culler, PI; David Wagner, Co-PI)

Source of Support: DARPA

Total Award Amount: $5,725,130   Total Award Period Covered: 5/29/01-08/15/05

Location of Project: University of California, Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: 0   Sumr: 1

Support:	☒ Current	☐ Pending	☐ Submission Planned in Near Future	☐ *Transfer of Support

Project/Proposal Title: ITR/SY(CISE): Cryptography: Examining the Assumptions

(David Wagner, PI)

Source of Support: NSF

Total Award Amount: $499,983   Total Award Period Covered:1/9/01-8/31/04

Location of Project: University of California, Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: 0   Sumr: .0

Support:	☒ Current	☐ Pending	☐ Submission Planned in Near Future	☐ *Transfer of Support

Project/Proposal Title: ITR/SI (ANI): Center of Information Technology Research in the Interest of Society

James Demmel, PI (supports research of 20 faculty, and includes one subcontract to U.C. Davis)

Source of Support: NSF

Total Award Amount: $15,000,000   Total Award Period Covered: 9/1/01-8/31/06

Location of Project: University of California, Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: 0   Sumr: 0

Support:	☒ Current	☐ Pending	☐ Submission Planned in Near Future	☐ *Transfer of Support

Project/Proposal Title: ITR/Language-Based Software Security

(Alexander Aiken, PI, Thomas Henzinger, David Schmidt, George Necula, David Wagner, Ras Bodik; Co-PI);
includes subcontract to Kansas State University

Source of Support: National Science Foundation

Total Award Amount: $3,975,073   Total Award Period Covered: 9/1/03-8/31/08

Location of Project: U.C. Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: 0   Sumr: 1

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

0433484

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: David Wagner	Other agencies (including NSF) to which this proposal has been/will be

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: ITR: Secure Signal Embedding -- Code Design and Cryptanalysis (U Illinois lead), Wagner coPI with Ramchandran:

Source of Support: NSF
Total Award Amount: $1,200,000   Total Award Period Covered: 9/1/03-8/31/07
Location of Project: University of California, Berkeley
Person-Months Per Year Committed to the   Cal: Acad: 0   Sumr: 1

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: cyber DEfense Technology Experimental Research Network (DETER)
Shankar Sastry, PI

Source of Support: NSF-EIN
Total Award Amount: $5.4M   Total Award Period Covered: 9/1/03 - 8/31/06
Location of Project: University of California, Berkeley
Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr: .5

Support: ☐ Current ☐ Pending ☒ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: A Center for Correct, Usable, Reliable, Auditable and Transparent Elections
                (ACCURATE)
   David Wagner, PI; Dierdre Mulligan, co-PI
Source of Support: NSF
Total Award Amount: $ 1,483,190   Total Award Period Covered: 9/1/04 – 8/31/09
Location of Project: U.C Berkeley
Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr: .6

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:
                Collaborative Research: Type Qualifiers for Software Security

Source of Support: NSF
Total Award Amount: 909,523   Total Award Period Covered: 9/1/04 – 8/31/7
Location of Project: U.C. Berkeley
Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr: 2

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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:

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

2

0433484

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: Deirdre K. Mulligan	Other agencies (including NSF) to which this proposal has been/will be

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Samuelson Law, Technology & Public Policy Clinic

Source of Support: Robert J. Glushko and Pamela Samuelson Foundation, $2,000,000 endowment

Total Award Amount: $2,000,000 endowment   Total Award Period Covered:

Location of Project: Samuelson Law, Tech. & Public Policy Clinic, School of Law (Boalt Hall), UC Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Samuelson Law, Technology & Public Policy Clinic, general projects

Source of Support: Supnick cy pres fund

Total Award Amount: $113,000   Total Award Period Covered: 1/01/2003 – 6/30/2004

Location of Project: Samuelson Law, Tech. & Public Policy Clinic, School of Law (Boalt Hall), UC Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Samuelson Law, Technology & Public Policy Clinic, privacy work

Source of Support: Rose Foundation for Communities and the Environment

Total Award Amount: $50,000   Total Award Period Covered: 2/07/2003 – 12/31/2004

Location of Project: Samuelson Law, Tech. & Public Policy Clinic, School of Law (Boalt Hall), UC Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Center for Cybersecurity in the Public Interest

Source of Support: National Science Foundation

Total Award Amount: $1,000,000   Total Award Period Covered: 9/01/2004 – 8/31/2009

Location of Project: Samuelson Law, Tech. & Public Policy Clinic, School of Law (Boalt Hall), UC Berkeley

Person-Months Per Year Committed to the Project.   Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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:

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

NSF Form 1239 (10/99)   USE ADDITIONAL SHEETS AS NECESSARY

55

0433484

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.

	Other agencies (including NSF) to which this proposal has been/will be submitted.
Investigator: **Drew Dean**	

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Secure Agent Architecture and Types**

Source of Support: **ONR**
Total Award Amount: $ **899,996** Total Award Period Covered: **04/01/01 - 06/01/04**
Location of Project: **SRI International**
Person-Months Per Year Committed to the Project. Cal:**0.50** Acad: **0.00** Sumr: **0.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Architecutral Frameworks for Composable Survivability and Securtiy**

Source of Support: **SPAWAR Systems Center**
Total Award Amount: $ **1,076,438** Total Award Period Covered: **06/29/01 - 06/28/04**
Location of Project: **SRI International**
Person-Months Per Year Committed to the Project. Cal:**0.20** Acad: **0.00** Sumr: **0.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **A Self-Recovering Introspective Virtual Machine**

Source of Support: **DARPA**
Total Award Amount: $ **1,114,420** Total Award Period Covered: **04/01/04 - 09/30/05**
Location of Project: **SRI International**
Person-Months Per Year Committed to the Project. Cal:**5.00** Acad: **0.00** Sumr: **0.00**

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Center for Computer Security Research**

Source of Support: **UCD/NSF**
Total Award Amount: $ **3,499,612** Total Award Period Covered: **06/15/05 - 06/14/10**
Location of Project: **SRI International**
Person-Months Per Year Committed to the Project. Cal:**2.20** Acad: **0.00** Sumr: **0.00**

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Research: A Center for Correct, Usable, Reliable, Audible and Transparent Elections**

Source of Support: **NSF**
Total Award Amount: $ **2,224,465** Total Award Period Covered: **09/01/04 - 08/31/09**
Location of Project: **SRI International**
Person-Months Per Year Committed to the Project. Cal:**2.50** Acad: **0.00** Summ: **0.00**

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

0433606

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: **Rebecca Mercuri**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Research: A Center for Correct, Usable, Reliable, Audible and Transparent Elections**

Source of Support: **SRI/NSF**
Total Award Amount: $ **550,000** Total Award Period Covered: **09/01/04 - 08/31/09**
Location of Project: **Notable Software Lawrenceville, New Jersey**
Person-Months Per Year Committed to the Project. Cal: **2.40** Acad: **0.00** Sumr: **0.00**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: Summ:

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

0433606

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: **Peter Neumann**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Research: A Center for Correct, Usable, Reliable, Audible and Transparent Elections**

Source of Support: **NSF**
Total Award Amount: $ **2,224,465** Total Award Period Covered: **09/01/04 - 08/31/09**
Location of Project: **SRI International**
Person-Months Per Year Committed to the Project. Cal:**2.50** Acad: **0.00** Sumr: **0.00**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: Summ:

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

0433606

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: **David Dill**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **ITR/SY: Computational Logic Tools for Research and Education**

Source of Support: **NSF**
Total Award Amount: $ **2,100,000** Total Award Period Covered: **10/01/01 - 09/30/06**
Location of Project: **Stanford**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **0.45** Sumr: **1.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Pathway Logic**

Source of Support: **NIH**
Total Award Amount: $ **151,174** Total Award Period Covered: **11/01/03 - 10/31/06**
Location of Project: **SRI, International**
Person-Months Per Year Committed to the Project. Cal:**0.45** Acad: **0.00** Sumr: **0.00**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: Summ:

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

0433701

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: **Dan Boneh**	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Collaborative Research: ITR Sensitive Information in a Wired World**

Source of Support: **National Science Foundation CCR-033164**
Total Award Amount: $ **6,755,668** Total Award Period Covered: **10/01/03 - 09/30/08**
Location of Project: **Stanford University**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **2.25** Sumr: **1.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Deployment-Oriented Security and Content Protection**

Source of Support: **National Science Foundation - CCR-0205733**
Total Award Amount: $ **1,870,000** Total Award Period Covered: **07/15/02 - 06/30/05**
Location of Project: **Stanford Unversity**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **0.45** Sumr: **1.00**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **ITR: The System Architecture of a Computing Utility**

Source of Support: **National Science Foundation - ANI-0121481**
Total Award Amount: $ **2,911,212** Total Award Period Covered: **10/01/01 - 09/30/06**
Location of Project: **Stanford University**
Person-Months Per Year Committed to the Project. Cal:**0.00** Acad: **0.00** Sumr: **0.00**

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *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: Summ:

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

0433701

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory:

Clinical:

Animal:

Computer: **The University of Iowa Division of Mathematical Sciences Computing Laboratory provides file storage and backup using an HP J5000 server with 2 PA 8500 processors, 2GB RAM and a RAID disk system containing 350 GB of disk. This server provides basic storage and backup infrastructures to**

Office: **The office of the University of Iowa Department of Computer Science provides access to shared heavy office equipment such as a photocopier, a color printer and fax machine.**

Other:

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

0433605

FACILITIES, EQUIPMENT & OTHER RESOURCES

COMPUTER FACILITIES (continued):

labs and offices in the building. A high speed 10-BaseT switched network provides excellent connectivity throughout the building. The laboratory is staffed by three full-time employees providing Unix and PC support to the Departments of Computer Science, Mathematics and Statistics. The support staff installs and maintains software, manages printing resources, maintains equipment, maintains written documentation and provides user assistance.

0433605

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory: **The Computer Science department at Johns Hopkins University provides access to a large number and wide variety of computers for both faculty and student use. The research facilities at the department hosts several undergraduate and graduate computing labs. Personal**

Clinical:

Animal:

Computer:

Office:

Other:

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

0433504

FACILITIES, EQUIPMENT & OTHER RESOURCES

LABORATORY FACILITIES (continued):

computing employs various Sun workstations, PCs, HP workstations, and several other machines most of which are running Linux, Windows NT, FreeBSD, MacOSX or Solaris. More importantly, the Information Security Institute (where the investigators' offices are located) provides sufficient lab space to host the experiments we expect to conduct. The Institute occupies 12,000 sq. ft. on the 4th floor of the Wyman Park building located on the Johns Hopkins University Homewood campus. In addition to faculty and staff offices, the space hosts three research laboratories which currently provide office space for 15 graduate students. There is a conference room with video and teleconferencing capabilities. The Institute is fully connected to the Hopkins networking infrastructure, which is connected to the Internet via a 45Mb/s backbone.

<u>Rice University Facilities</u>:

Computer Science Department – Dan Wallach:

Rice Terascale Cluster (RTC)
280 900MHz 1.5MB Itanium2 processors rack mounted cluster:
1 HP zx6000 dual node with 8GB of DDR RAM and 3 73GB Ultra 160 SCSI HD
5 HP zx6000 dual nodes with 8GB of DDR RAM and 73GB Ultra 160 SCSI HD
20 HP zx6000 dual nodes with 4GB of DDR RAM and 73GB Ultra 160 SCSI HD
106 HP zx6000 dual nodes with 4GB of DDR RAM and 36GB Ultra 160 SCSI HD
4 HP rx5670 quad nodes with 16GB of DDR RAM and 2 73GB Ultra 160 SCSI HD
Interconnect:
96 nodes interconnected with Myrinet2000 (compute)
All nodes connected with 1000 Ethernet (compute)
All nodes connected with 10/100 Ethernet (management)
Foundry FastIron 1500 switch for Ethernet
Scalable Cluster File Server
2 HP zx6000 dual nodes with 8GB of DDR RAM and 2 73GB Ultra 160 SCSI HD
2 0.5TB Ultra 160 SCSI disk arrays attached to data servers with dual fiber channels
Shared Front End
1 HP rx5670 dual node with 8GB of DDR RAM and 2 73GB Ultra SCSI HD
2TB Ultra 160 SCSI RAID 5 disk array attached to data server with dual fiber channels
Front End Tape Storage
HP SureStore 4/60 Ultrium Tape Backup with 4 LDVS Ultrium Tape Drives
Attached to front end data server with dual fiber channels

8 Pentium Pro 166MHz each w/ 64MB memory, 1.2GB disk, 100Mb/s switched
Ethernet: 6 Pentium II 300MHz (Dell) each w/ 128MB memory, 4GB disk, 100Mb/s
switched Ethernet

DEC Alpha Cluster
3x4way 400Mhz Alpha 4100 Processors w/ 4 GB memory, 25 GB disk, High Speed
Memory Channel interconnection.

COMPAQ Alpha Cluster
32 Processor (8x4) Rackmount UNIX AlphaServer ES40 (EV6) Cluster:
 8 nodes interconnected via HSMC2 and 2 100Mhz ethernets
 Each node - ES40 model 2 w/ 4 500Mhz EV6 processors,
 2 nodes with 8 GB memory each, 6 nodes with 2 GB memory each,
 40 18.2GB + 8 4.3 GB Disks (total) 10 slot DLT tape library w/ 2 DLT drives.

4 Alphaserver DS 20 each w/ 2 500Mhz EV6 processors, 2GB memory,
 15" monitor, 4 9.1 GB Disks, and 100Mhz Ethernet

Psychology Department – Michael Byrne:

The Computer-Human Interaction Laboratory (approximately 1,000square feet total), under the direction of Dr. Michael Byrne (Co-PI), contains multiple networked eMac personal computers which are suitable for running experiments measuring standard variables such as task completion time and error rates. Each one is partitioned off in its own cubicle and headphones are available if more audio isolation is necessary; it is not unusual for the lab to run numerous participants at a time. This facility also includes digital video equipment for compressing, editing, and coding videotaped think-aloud protocols of the type commonly performed in standard usability laboratories.

A second room houses several Macintosh G4 workstations and a networked high-capacity laser printer for data analysis, video coding, document preparation, and other graphics, statistical, and database management needs of the research conducted in the lab. The laboratory also has its own Web and file server, which enables remote administration of Web-based questionnaires.

Finally, a third room houses the lab's eye-tracking facilities. An ISCAN ETL-500 head-mounted eye-tracker allows the monitoring and recording of eye movements made by experimental participants. Various software tools are available to lab members to support the coding and analysis of such data.

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory: **At Berkeley, research on this project will be carried out at the Computer Science building, Soda Hall, UC Berkeley. Berkeley faculty on this project will use their current office space, and office space for graduate and undergraduate students will be provided. The research administration**

Clinical:

Animal:

Computer: **The Berkeley researchers on this project will use state of the art workstations (primarily PCs and Sparcs) for day-to-day development activities. The workstations are connected to the major 100 Mbit networking infrastructure housed in various machine rooms in the Computer**

Office: **Berkeley faculty on this project will use their current office space, and office space for graduate and undergraduate students will be provided. The research administration staff will use existing current office space. Offices are located in Soda Hall, the major building that houses UC**

Other:

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

0433484

FACILITIES, EQUIPMENT & OTHER RESOURCES

Continuation Page:

LABORATORY FACILITIES (continued):

staff will use existing current office space. All offices for the
Berkeley effort are located in Soda Hall, the major building that houses
UC Berkeley's Computer Science Division.

The CITRIS project has promised to make available space in the new Center
for Information Technology Research in the Interests of Society (CITRIS)
building, which is being built starting in Fall 2004 on the Berkeley
campus using over $90 Million of California State funds and over $50
Million of gifts from individuals and corporations. This space will
provide offices and laboratories for ACCURATE team members and for
visitors from our partner institutions on the ACCURATE project.
Additionally, the CITRIS building will house several auditoriums, which
will be used for instructional and outreach purposes.

COMPUTER FACILITIES (continued):

Science building, Soda Hall. Researchers rely on department-wide services
including system administration services, backup services, and software
support services.

The researchers will also have access to advanced computing facilities.
Additional shared facilities at Berkeley include the Millennium cluster of
clusters of computers featuring the newest generation of Itanium
processors from Intel/HP; there is an extensive home page at
http://www.millenium.berkeley.edu. The testbed contains nearly a thousand
computers, granted by Intel as part of its Technology 2000 program and
with frequent updates including the Itanium machines recently donated by
Intel/HP, and networked using high-bandwidth gigabit ethernet links. The
networking is provided through an NSF CISE Research Infrastructure Grant
complementing a large donation from Nortel Networks. Staff support,
network management and facilities is provided by the University and NSF.

Instructional resources include lab space and significant numbers of
workstations for use by students. Intel Pentium Pro servers and PCs run
the Microsoft Windows 2000OS. Sparcs run Solaris and/or Linux. Both are
available for general classes, multimedia authoring usage, and computer
graphics classes.

OFFICE FACILITIES (continued):

Berkeley's Computer Science Division, and in the CITRIS building.

0433484

All SRI-CSL/SDL staff are provided with individual Workstations that they use for computing, communications, report preparation and other tasks. Projects with a significant system development component are usually expected to provide workstations and other hardware to be dedicated to the project. CSL/SDL supports its own research facility consisting of over 100 workstations, and over 30 file servers (providing over two terabytes of storage) and CPU servers including several multiprocessor machines. Most of the computing facility is running Linux, with dedicated machines running FreeBSD, SunOS, Solaris, AIX and Digital UNIX. The computer Service Center provides the infrastructure necessary to the support and integration of project and SRI owned workstations. A printing service is maintained providing high-quality monochrome and color printing. All of the servers, workstations and printers are connected to a high-capacity Cisco switch providing 200MB links to offices, and by multiple redundant links to the Internet.

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory: **Stanford's Computer Science department has state of the art computer facilities and a full time dedicated administration staff. The department has fast Ethernet as well as a wireless network.**

Clinical:

Animal:

Computer:

Office:

Other:

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

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