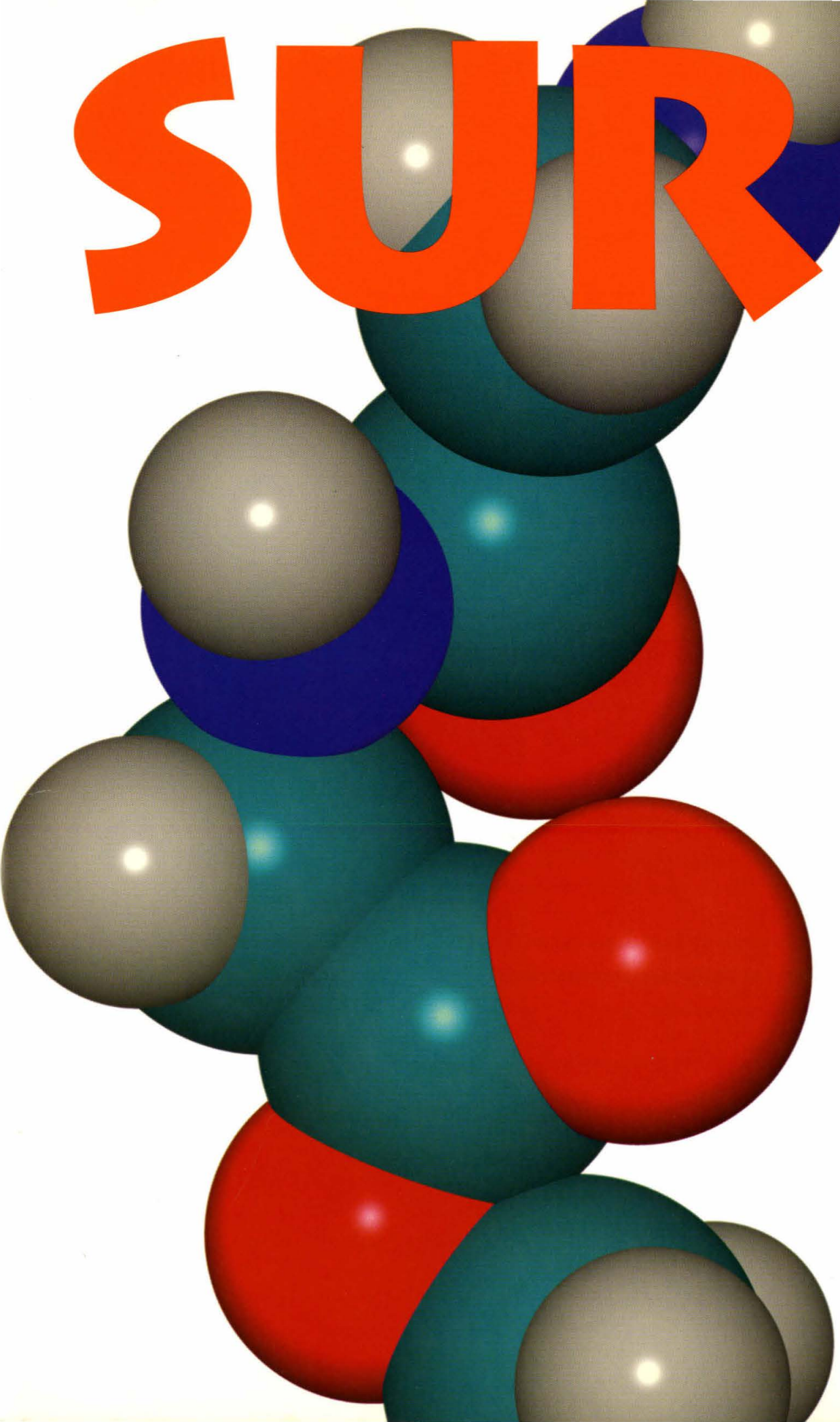
SURF

CALIFORNIA INSTITUTE OF TECHNOLOGY

Summer Undergraduate Research Fellowships
Annual Report

1995

SURF



Congratulations to SURF on its seventeenth anniversary! This summer was a banner year with 246 students working as colleagues with 157 faculty and JPL technical staff. I am greatly impressed with SURF's growth, both in the number of students participating in research and in the excellence of the enrichment activities. SURF is one of the programs that helps Caltech achieve its place of leadership and quality in the academic world.

Through SURF, students have the unique opportunity to ask new questions and seek solutions to unsolved problems, to gain insight into career preferences, and to improve communication skills. The SURF program provides a rich enhancement to the undergraduate program at Caltech, and the Institute applauds its accomplishments.

For each SURF student, there are at least two other individuals making the experience possible. This large cadre of participants includes donors, mentors and their research groups, the SURF Board, the SURF Administrative Committee, alumni, volunteers, and administrative staff. I heartily thank everyone who participates for your commitment to and leadership in this excellent educational program.

Thomas E. Everhart
President
California Institute of Technology

DEDICATION

The 1995 SURF program is dedicated to Samuel P. Krown in recognition of his vision and leadership of SURF and with deep appreciation for his loyal support.

Samuel Krown joined the SURF team in 1980, shortly after the program's founding by Fred Shair. Mr. Krown identified the need to raise funds from external sources to support student stipends, and he and his wife Frances contributed the first gift. He recognized that SURF would benefit from advice and wise counsel, and he formed the SURF Board, serving as its first chairman. He proposed that SURF begin an endowment to ensure the future of the program, and he established the first fund, the Samuel P. and Frances Krown SURF Endowment. He recruited many people who became generous friends of the program, and he brought in energetic people who continue to help. Samuel's generosity and vision are important factors in SURF's prosperity. To date, more than 1750 students have participated in the program; 54 have been supported by the Krown endowment. We are delighted to recognize his outstanding contributions by dedicating the 1995 SURF program to Samuel Krown.

FROM THE SURF BOARD

Carl V. Larson

As I complete the second, and final, year of my chairmanship of the SURF Board, I review the remarkable accomplishments that SURF has achieved over its seventeen year history. SURF has become a jewel in Caltech's crown. It is a rich enhancement to students' exceptional educational opportunities. Students have the unparalleled opportunity to work with world-class faculty, use state-of-the-art tools to explore the secrets of nature, to solve problems, and to seek truth. Through their SURF experiences students gain important insights into career preferences; I believe some of the most valuable undergraduate research experiences occur when students learn what kind of work they do not want to pursue. As a Caltech alumnus, I am very glad that today's students have these superb opportunities.

Carl Larson

The SURF Board is a voluntary support organization consisting of individuals dedicated to the educational values of undergraduate research at Caltech, and who, through their advice, encouragement, and financial support, contribute to the vitality, continuity, and effectiveness of the SURF program. SURF Board activities this year have supported our mission.

I am extremely glad to note that this year for the first time in SURF's history all funding for student stipends was in hand or pledged before student applications were due on March 1! One of the SURF Board's goals has been to help SURF achieve a stronger financial situation, and we are delighted that the program reached this objective this year.

The Administration, through President Thomas Everhart, former Provost Paul Jennings, and Provost Steve Koonin, agreed again this year to underwrite up to 20 stipends for Caltech students recommended by the Administrative Committee to receive awards. The agreement was made to alleviate uncertainty for students created by possible late receipt of stipend moneys. SURF did not have to draw upon any of these funds this year; but it was nice to have this backup support available.

The Small Business Industrial Associates program created and driven by Phyllis Hosey, Assistant Director of Corporate Relations, was successful this year with students and sponsors reporting positive experiences. This program provides opportunities for students to work on an industrial research problem with the counsel of a faculty member and an industrial researcher.

We look forward to 1996 with the goal of meeting the fundraising challenges for SURF and anticipate increasing opportunities for our bright and talented students. SURF depends upon the support of its many friends, and with your commitment, SURF's success is assured!

FROM THE SURF ADMINISTRATIVE COMMITTEE

Terry Cole

The SURF Administrative Committee sets the academic policies of the SURF program, oversees the intellectual standards, and advises the Caltech Administration on long term plans for development of SURF and other programs relating to SURF. The committee consists of faculty from each of the Institute's academic divisions, senior members of the JPL technical staff, student representatives, and members of the Caltech administrative staff, including the SURF director.

The committee reviewed more than 310 proposals and recommended awards to 246 students, the largest class in SURF's history. This year's SURFers were academically strong with a median GPA of 3.5 and an average GPA of 3.4 for those students receiving grades. (Caltech freshmen receive pass/fail grading.) Since high grade point average does not necessarily correlate with research ability, the program requires a minimum grade point average of 2.0. The substantially higher academic achievement of most SURFers is notable.

Terry Cole

Members of the committee served as judges in each of the three rounds of the Doris S. Perpall SURF speaking competition.

We welcome the addition of the SURF Student Advisory Council to provide student input into program planning and evaluation. We applaud the efforts of the SURFSAC in creating the *Caltech Undergraduate Research Journal* and are pleased that members of the Administrative Committee will serve on the editorial board.

The AdComm has worked closely with the SURF Board and particularly with Carl Larson. We thank Carl for his enthusiastic leadership of the Board and for his energy in promoting SURF within the Institute, the Associates, and the alumni. This year's financial situation was excellent with all funding in hand or pledged before student applications were due. We applaud the many friends of SURF who contributed financial and personal resources to achieve that important milestone!

We look ahead with optimism and enthusiasm to the continuing development of undergraduate research at Caltech.

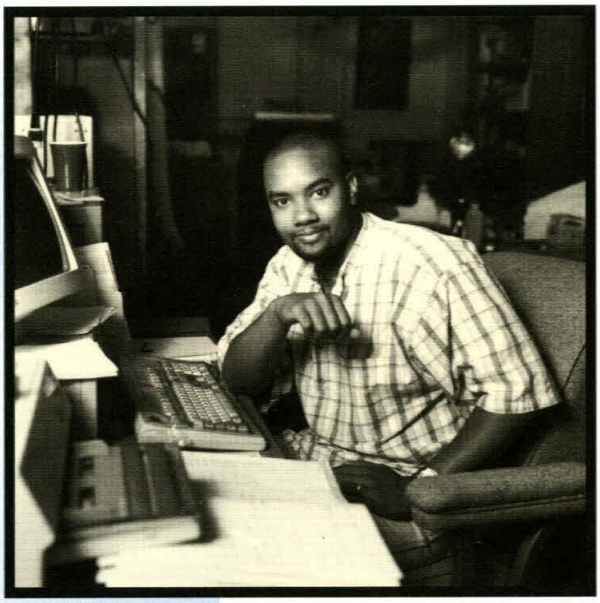
This summer's SURF program was a rich mix of research, lunch time seminars, and dinner time discussions. Highlights and initiatives this year were:

- SURF '95 was the largest class in the program's seventeen year history with 246 students participating.
- For the first time, all stipend funding was in hand or pledged before student applications were due on March 1.
- The SURF Student Advisory Council is creating the first *Caltech Undergraduate Research Journal* to be published in spring 1996.
- Eleven students in the Small Business Industrial Associates SURF program were jointly mentored by Caltech faculty and industrial researchers on projects of interest to the participating companies.
- Students are linking their research home pages to the SURF home page on the World Wide Web to give visibility to their work and a broad overview of the program.
- A SURF student studied the SURF program this year to confirm anecdotal evidence that the program provides excellent benefits to its participants.

Carolyn Merkel

PROFILE OF SURF '95 PARTICIPANTS

Division	*Total Number of Students*	*Number of Caltech Students*	*Number of Non-Caltech Students*	*Number of Research Sponsors*
Biology	40	25	15	29
Chemistry and Chemical Engineering	51	39	12	21
Engineering and Applied Science	45	41	4	31
Geological and Planetary Sciences	9	9	0	6
Humanities and Social Sciences	5	5	0	5
Physics, Mathematics and Astronomy	30	27	3	22
Jet Propulsion Laboratory	42	22	20	24
Small Business Industrial Associates	11	10	1	10
Off-Campus	6	6	0	6
Education SURFs	7	3	4	3
	246	187	59	157



THE SURF PROGRAM HAS BEEN AN EXTREMELY GRATIFYING EXPERIENCE. IT HAS ALLOWED ME TO INCORPORATE ALL OF MY KNOWLEDGE – BIOLOGY, CHEMISTRY, AND PHYSICS. I HAVE TRULY FALLEN IN LOVE WITH CALTECH.

Jamal I. Berry
Lincoln University
MURF

PROFILE OF THE 1995 SURFERS

Sophomores	22%
Juniors	35%
Seniors	43%
Women SURFers	32%
Minority SURFers	7%

SURFers Win Awards!
At Commencement 1995:

52% of students receiving their bachelor's degrees had completed a SURF.

66% of the students graduating with honor were former SURFers.

70% of the students receiving prizes were SURF students.

We are proud of these extraordinary students! Congratulations, SURFers!

Minority Undergraduate Research Fellowships (MURF)
Twelve students participated in the 1995 MURF program which runs concurrently and is closely associated with SURF. The MURF program provides support for talented non-Caltech undergraduates to spend a summer working in a research laboratory and is aimed at improving the representation of African Americans, Hispanics, Native Americans, Puerto Ricans, and Pacific Islanders in biological, chemical, and engineering sciences. MURF students participate in all aspects of the SURF program.

SURF '95 HIGHLIGHTS

SURF Student Advisory Council
The SURF Student Advisory Council (SURFSAC) was created to provide a student voice in planning and implementating the program and to gain on-going feedback on activities. The students take their leadership role seriously, offering thoughtful ideas and suggestions on the philosophical, intellectual, and social aspects of the program. Jennifer Miller was elected SURFSAC chair; Jian Zhang, vice chair; and Lin Jia, secretary.

An initial SURFSAC activity was creation of the *Caltech Journal of Undergraduate Research* (*CURJ*) to be published in the spring of 1996. This journal will contain the best papers reviewed by an editorial board of undergraduate and graduate students, faculty, and alumni. The *CURJ* committee, under the chairmanship of Chou Hung, is developing guidelines for submission to the journal.

SURF SURF

Heidi Eldenburg, a SURF '95 student, studied the SURF program to get quantitative and qualitative information on the program from former SURF students. A survey was created and mailed; a database was set up; and results will be analyzed. This project is the first effort to track SURF alumni and to confirm anecdotal evidence that SURF provides excellent benefits to participants.

Small Business Industrial Associates

Eleven students worked on industrial research projects with company and faculty research sponsors providing SURF students the opportunity to expand research experiences into the industrial environment. Companies participating are listed on page 34.

World Wide Web Pages

David Cuthbert, a senior in electrical engineering, created a WWW index page that will link students' research home pages with the SURF home page. The linked pages will provide a broad overview of the program, will give interesting and important information about SURF students, and will be fun to browse.

SURF PROGRAM AND ACTIVITIES

Professional Development Seminars

William M. Whitney, BS '51, Division Technologist, Observational Systems Division, JPL, organized seven informal discussions on topics relevant to issues students will face as they prepare for and commence their professional careers. Bill created this series to encourage students to make short-term decisions in the context of long-term career and life goals. The sessions and their participants were:

Role of Communication in Careers: Introduction to the Communication Program
Mary Ann Smith, President, Applied Leadership Systems; and Wayne Waller, Director, Media Integration Laboratory, Campus Computing Organization, Caltech

Intellectual Property: Minding the Gold that is Yours!
Julia A. Kornfield, Assistant Professor of Chemical Engineering; and William Weiland, Caltech Patent Counsel and Manager, Office of Patents and New Technology, JPL

Decision Making: Yes, You Can Change Your Mind!
Bill Whitney; Kathleen Bartle-Schulweis, Director of the Women's Center, Caltech; John Davis, graduate student in electrical engineering; Carlotta Glackin, Assistant Research Scientist, Director, Research and Development, Department of Anatomic Pathology, City of Hope; Jacklyn Green, New Millennium Program Outreach Director, JPL

Career Options: What Can You Do With a Technical Background?
Sally Asmundson, Director, Career Development Center with panelists Jay Ebersohl, President, Advatech Pacific; Bonnie Wallace, Staff Writer, Los Angeles County Natural History Museum; and Deborah Pinck, Member of the Technical Staff, JPL

Scientists as Speakers
Andrew E. Lange, Professor of Physics; Kyle Miller, Member of the Technical Staff, JPL; and Mary Ann Smith

Dilemmas of the Workplace: Do the Right Thing! (But What is the Right Thing?)
Bill Whitney with panelists David Goodstein, Vice Provost, Professor of Physics and Applied Physics, and Frank J. Gilloon Distinguished Teaching and Service Professor; Jacklyn Green, New Millennium Program Outreach Director, JPL; Helen Hasenfeld, Ombudsperson, Caltech; and Doug Sanders, Ethics Officer, Business Ethics Office, JPL

FOUR WEEKS OF FIGHTING AGAINST INSTRUMENTATION FAILURES IS ENOUGH TO MAKE ANYONE WONDER IF RESEARCH IS THE RIGHT CHOICE FOR THEM. THE SURF PROGRAM GAVE ME A SUPPORTIVE ENVIRONMENT TO FIND OUT THAT FOR ME THE ANSWER IS YES!

Kimberly L. Komisarek
Class of '36 Endowment Fund

Graduate School
Sally Asmundson with panelists John Davis, graduate student in electrical engineering; Michael Kantner, graduate student in chemistry; and Ivett Leyva, graduate student in aeronautics.

Communication Program
Mary Ann Smith designed the SURF communication program to help students prepare for the required presentation on SURF Seminar Day. For many students, the SURF talk is their first experience in public speaking and is a challenging assignment since the audience consists of both technically trained individuals and lay people.

Peer Coach Workshops
Fifteen Caltech SURFers were trained by Mary Ann Smith to facilitate workshops to help students organize and prepare their oral presentations, learn public speaking skills and techniques, and to develop analogies to explain technical material to a non-technical audience. Through group interaction, students gain confidence and experience in talking about their research. This process has led students to ask more iterative questions of their research sponsors, improving the educational quality of their research experiences.

Scientists as Speakers
Andrew E. Lange spoke to SURF students on measuring the absolute velocity of the universe. Following an outstanding presentation, he discussed how he prepares a talk for various audiences, the importance of communicating technical information to lay audiences, and how he develops analogies to help the audience understand technical information.

Doris S. Perpall SURF Speaking Awards
Lin Jia, Roshan Kumar, and Anandi Raman were the winners of the second annual Doris S. Perpall SURF speaking competition. The prizes were awarded at the conclusion of a three-round competition judged by members of the faculty, JPL staff, alumni, and administrative staff. Robert C. Perpall, BS '52, MS '56, a member of the SURF Board, endowed the prize in memory of his late wife.

The SURF Talk Book

The SURF Talk Book provides the curriculum for the peer-coached workshops including exercises, guidelines, and checklists for presenters to help with organization and preparation for oral or poster presentations. It has been revised, copyrighted, and republished this year; copies are available in the SURF Office.

Conferences

SURF Seminar Day

Each SURF student was required to give an oral presentation of his or her research on SURF Seminar Day on October 21. The annual symposium is modeled on a professional technical meeting with one poster session and 23 parallel oral sessions. Students, faculty, research sponsors, JPL staff, donors, alumni, and parents of SURFers attend the seminars to hear the students' reports. An announcement of the first-round winners of the Perpall SURF Speaking Awards is made at the reception following the seminars.

Southern California Conference on Undergraduate Research

SURF organized and hosted the first and second annual SCCUR conferences in November, 1993 and 1994. Over 500 students, faculty, and administrators attended the multidisciplinary symposium last fall with more than 220 students presenting their research in oral and poster sessions. Keynote speakers were Fredrick H. Shair (Manager, Educational Affairs, JPL, and founder of the SURF program) who spoke on *Grand Challenges for Science in Society* and Joann M. Stock (Associate Professor of Geophysics) who spoke on *The Stress Fields that Cause Earthquakes in Southern California*. The third conference will be held at The Claremont Colleges.

National Conference on Undergraduate Research

Twelve Caltech students attended the ninth annual NCUR at Union College in April, 1995. Students were very enthusiastic about their experiences of presenting their research at this multidisciplinary conference, exchanging ideas and information with students from colleges and universities nationwide, and hearing how research is carried out and reported in a variety of disciplines. Caltech hosted the fifth NCUR in 1991.

Seminars

Each Wednesday, members of the Caltech faculty, JPL technical staff, and industrial researchers presented overviews of their areas of research. Speakers and topics were:

Kenneth A. Farley, Assistant Professor of Geochemistry, *Variations in the Cosmic Dust Flux in the Geologic Record*

Jacklyn Green, New Millennium Program Outreach Director, JPL, *NASA's New Millennium Program*

John F. Hall, Associate Professor of Civil Engineering, *The Problem of Steel Buildings and Earthquakes*

Fiona A. Harrison, Robert A. Millikan Research Fellow in Physics, *Telescopes for Hard X-Ray and Gamma-Ray Astronomy*

Julia C. Lester, Air Quality Specialist, South Coast Air Quality Management District, *Ozone Modeling and the 1994 Air Quality Management Plan*

Mitchio Okumura, Associate Professor of Chemical Physics, *The Chemistry of Stratospheric Ozone Depletion*

Scott E. Page, Assistant Professor of Economics, *Complexity and Social Science*

Erin M. Schuman, Assistant Professor of Biology, *How We Learn and Remember: Encoding and Storing Information at Synapses in the Brain*

Steven A. Witherly, Director, Research Development, Nutrilite Products, Inc., *The Doritos Effect: Why Humans Like Junk Food*

Each Friday members of the JPL technical staff presented summaries of their work to the JPL SURF students. Speakers and their topics were:

Claudia J. Alexander, Earth and Space Sciences Division, *Mathematical Modeling in the Planetary Sciences*

Henry B. Garrett, Office of Engineering and Mission Assurance, *Space Weather*

IT IS HELPFUL TO PUT WHAT IS LEARNED IN CLASSES INTO PRACTICE AND ALLOW FOR A MORE PRACTICAL PERSPECTIVE ON THEORY. MY SURF PROJECT WAS VERY BENEFICIAL IN THIS RESPECT. STUDYING THE RIJKE TUBE GAVE ME A MUCH CLEARER UNDERSTANDING OF ACOUSTICS AND HOW SIMPLE THEORETICAL APPROXIMATIONS CAN BE USED TO PREDICT BEHAVIOR OF A COMPLICATED SYSTEM.

Roman Jarosiewicz
Dr. Chandler C. Ross SURF Fellowship

Alexander G. Gray, Information Systems Development and Operations Division, *Applications of Machine Learning*

Pamela J. Hoffman, Mechanical Systems Engineering and Research Division, *Design and Development of the Cassini Imaging Science Subsystem*

Stephen M. Lichten, Telecommunications Science and Engineering Division, *Precise Satellite Tracking and the Global Positioning System*

Linda M. Miller, Avionic Systems and Technology Division, *Tunneling Sensors for Space Instruments*

Virgil B. Shields, Avionic Systems and Technology Division, *Silicon Carbide Crystal Growth (or Putting Humpty Dumpty Back Together Again)*

Steven J. Walter, Observational Systems Division, *Living Upside-Down: A Year in Antarctica*

Stacy S. Weinstein, Systems Division, *Mission Design*

William M. Whitney, Observational Systems Division, and Terry Cole, Chief Technologist, presented an extemporaneous seminar on *Universal Clocks, GPS, and Other Interesting Phenomena*

Roundtable Discussions

Roundtable discussions provided students the opportunity to meet in small groups with leaders in academia, industry, or government to discuss current topical or career development issues. Discussion leaders this summer were:

Career "Tacking" - Following a Course by Changing Direction. Discussion Leader: Paul A. Robinson, Jr., Associate Professor of Physics, Principia College; Facilitator: Terry Cole, Chief Technologist, JPL and Chair, SURF Administrative Committee

Opportunities for Technically Trained People in Investment Banking. Discussion Leader: Roger Goodspeed, Managing Director, Lehman Brothers Inc.; Facilitator: Bill Whitney

Non-Traditional Career Paths: From Math to Commercial Outreach. Discussion Leader: Merle McKenzie, Manager, Technology Transfer and Commercialization Program Office, JPL; Facilitator: Bill Whitney

Medical School. Discussion Leader: Jason Lee, SURF '92 and '93, BS '94, second year medical student, University of California, San Diego; Facilitator: Sally Asmundson

What is Involved in Becoming an Entrepreneur for Hi-Tech Opportunities? Discussion Leader: Larry Gilbert, Director of Technology Transfer, Caltech; Facilitator: Gaylord E. Nichols, Director of the Industrial Relations Center, Caltech

Analyzing Ancient Documents Such as the Dead Sea Scrolls Using JPL Infrared Imaging Technology. Discussion Leader: Greg Bearman, Member of the Technical Staff, JPL; Facilitator: Bill Whitney

Field Trips

Mount Wilson

Forty SURF students toured several telescopes and facilities at Mt. Wilson. Professor of Planetary Science Andrew Ingersoll lectured on the Shoemaker-Levy 9 comet crash on Jupiter, and students had the opportunity to observe with a group of amateur astronomers who had set up their telescopes. We thank Gil Clark for arranging the tour.

Jet Propulsion Laboratory

Bill Whitney coordinated a tour of the Jet Propulsion Laboratory for SURF students who had the opportunity to see *Welcome to Outer Space*, a presentation of JPL's history and accomplishments. They visited the space museum housing models and memorabilia of past missions. Students saw the spacecraft assembly and flight operations facilities and the Microdevices Laboratory where technology is developed to enable smaller, less expensive spacecraft.

Goldstone Deep Space Communications Complex

Fifteen SURF students traveled to the Goldstone Deep Space Communications Complex to see the antennae used in tracking satellites and spacecraft. They heard a talk about the Deep Space Network and viewed the impressive 70-meter antenna used to communicate with spacecraft at the edge of the solar system.

SURF FUNDING

For the first time in program history, SURF had funding in hand or pledged for student stipends by the time applications were due on March 1! Each SURF student receives a stipend of $3600 for the ten-week period, a total salary budget of $885,600. Over half of these funds are raised from external, non-federal sources as shown on the following page. The Institute pays administrative costs for the program, research sponsors pay research expenses; therefore, all moneys raised from other sources are used for student stipends or special research-related opportunities.

Endowment Funds

The SURF endowment was created to ensure the continuation of the program. Individuals may establish an endowment, named as the donor designates, for $100,000; the proceeds from the fund will support one student annually in perpetuity. A SURF endowment is an excellent investment in the future of our students. Currently, 23 endowment-supported students participate in SURF each summer.

Endowment Challenge

Friends of SURF have issued a challenge for SURF to raise two endowments to be matched by a third. The Caltech Associates have accepted the challenge and will direct this year's solicitation toward this goal. Donors to The Associates SURF challenge have the satisfaction of becoming partners with Caltech in the education and development of outstanding students. SURFers appreciate and value the generosity and vision of those who have invested in their futures.

Erika C. Vote SURF Endowment

The family and friends of Erika C. Vote established an endowment in her memory this year. This fund will support a woman student working in the Microdevices Laboratory at JPL. It is a fitting memorial to a young woman who was enthusiastic about learning and captivated by her own undergraduate research experiences.

SURFING GAVE ME A CHANCE TO EXPERIENCE WHAT REAL RESEARCH WAS LIKE. I LEARNED THAT PROFESSORS DON'T PUBLISH PAPERS EVERY WEEK, EXPERIMENTS DO FAIL, AND THAT GETTING RESULTS WAS THRILLING!

Pauline Ng
Howard Hughes Medical Institute

Current Operating Funds

Donors who contribute the amount of a SURF stipend ($3600) or more, by annual contributions or through endowment, are listed with the students in the annual report. Financial sponsors receive a written introduction to the students they have supported and frequently have the opportunity to meet them and to follow their progress throughout the summer. All funds raised from private sources are used to support Caltech students working with faculty.

Funding Profile

Faculty grants and Institute sources	40%
JPL and NASA	20%
Foundations	14%
Endowment	13%
Individuals	8%
Corporations	6%

THE SURF TEAM

This summer's SURF team numbers over 500; it takes *at least* two individuals for every SURF student to provide an excellent research experience. SURF's long-term success can be attributed to the strong commitment of the research sponsors and outstanding students. We depend upon and value the generous financial contributions of our many friends, the vigorous support of the SURF Board, the dedication of the SURF Administrative Committee, and the efforts of our volunteers and consultants. Special thanks to Carol Casey and Susan Clark for their great ideas, hard work, skill, patience, and cheerfulness in attending to the day-to-day, year-round details of SURF.

In particular, we recognize Bill Whitney for his dedication to the SURF program. He has volunteered countless hours and devoted much effort to planning, organizing, and implementing SURF programs, setting up and facilitating roundtables, arranging the JPL seminars, and counseling SURF students. Thank you, Bill!

And special acknowledgment to Fred Shair, without whom there would be no SURF.

STUDENT	TOPIC	RESEARCH SPONSOR
Lada A. Adamic *Junior, Ph* *NASA SURF Fellow*	Solar Wind Concentrator Design for the Suess-Urey Discovery Mission	Donald S. Burnett *Professor of Geochemistry*
Amir G. Alagheband *Senior, ME*	Inflatable Reflecting Integrated Structure (IRIS)	Joel C. Sercel *Program Element Manager, JPL*
Kristie L. Armentrout *Sophomore, EE* *Erika C. Vote SURF Endowment*	Building an Atmospheric CVD	Imran Mehdi *Member of the Technical Staff, JPL*
Kirstin E. Aschbacher Brown University *Sophomore, Music/Neuroscience* *Howard Hughes Medical Institute*	Pitch Perception in Barn Owls (*Tyto alba*)	S.E. Roian Egnor *Graduate Student in Biology*
Natalie S. Austin Occidental College *Junior, Bioch*	The Effect of Protein-Heme Bonding on the Stability of the *Cytochrome c* Protein	Harry B. Gray *Arnold O. Beckman Professor of Chemistry* Angelo DiBilio *Research Fellow in Chemistry*
Abel J. Baerga-Ortiz University of Puerto Rico *Senior, Ch/Ma* *MURF*	Detailed Mapping of the Upper Lip Patch in Cerebellar Folium Crus IIa of the Sprague-Dawley Rat: A Preliminary Study	James M. Bower *Associate Professor of Biology*
Sudipta Bardhan *Sophomore, Bi* *Richter Scholar*	An Investigation of the Enzymatic Mechanism of β–lactamase	John H. Richards *Professor of Organic Chemistry*
Jason W. Barnes *Sophomore, Ay*	Chemical History of Jupiter's Atmosphere During the Impacts of Comet Shoemaker-Levy 9 Fragments	Glenn S. Orton *Member of the Technical Staff, JPL*
Jamey B. Bass University of California, Santa Cruz *Junior, Ph* *NASA SURF Fellow*	The Measurement of the Angle of Divergence for Magnetic Flux Regions Emerging from the Solar Surface	Harold Zirin *Professor of Astrophysics; Director, Big Bear Solar Observatory*
Sara A. Beaber *Sophomore, Ch* *Arthur A. Noyes SURF Endowment Fund*	Development of a Silver-Based Sensor for the Chemical Nose	Nathan S. Lewis *Professor of Chemistry*
Cyrus H. Behroozi *Junior, Ph* *Richter Scholar*	Estimation of Our Sensitivity to CP Violation in Tau Decays	Alan J. Weinstein *Associate Professor of Physics*
Steven P. Bennett *Junior, Bi/Ch* *Mr. and Mrs. Robert L. Noland SURF Fellow*	Photolysis of Caged Arachidonic Acid and Caged Nitric Oxide in Studies of a Retrograde Message in LTP of the Hippocampus	Erin M. Schuman *Assistant Professor of Biology*

STUDENT	TOPIC	RESEARCH SPONSOR
Jamal I. Berry Lincoln University *Senior, Ch* *MURF*	FT-ICR Determination of Proton Affinities for Common Matrices Used in Maldi-MS DNA Sequence Determination	Jesse L. Beauchamp *Professor of Chemistry*
Dorota E. Blat Cooper Union *Senior, EE*	Wavelet Analysis of the Structure of Interstellar Medium	Thomas N. Gautier *Member of the Technical Staff, JPL*
Catherine E. Boone *Junior, Ph* *NASA SURF Fellow*	Optical Feedback Stabilization of Near IR Diode Lasers	Geoffrey A. Blake *Associate Professor of Cosmochemistry*
Liubomir A. Borissov *Sophomore, Ph/CS* *Richter Scholar*	Simulation Study of Higgs Boson Searches with the CMS Detector at the LHC	Harvey B. Newman *Professor of Physics*
Lisa D. Bourne Washington University *Junior, Ch/Spanish* *MURF*	Characterization and Evaluation of Fe(III)-doped, Quantum-Sized TiO_2 Photocatalyst for Use in an Optical Fiber Reactor	Michael R. Hoffmann *Professor of Environmental Chemistry*
Walter F. Brisken *Senior, Ph/Ay* *NASA SURF Fellow*	Running Penumbral Waves in Sunspots	Harold Zirin *Professor of Astrophysics; Director, Big Bear Solar Observatory*
Jane R. Brock *Senior, Ch* *Richter Scholar*	A New Aminoborollide Ligand	John E. Bercaw *Centennial Professor of Chemistry*
Jun Cai *Junior, Ph*	Electron Atomic Screening in Fusion Reactions	Karlheinz Langanke *Senior Research Associate in Theoretical Physics*
John Joseph M. Carrasco *Junior, Ph* *Dr. and Mrs. Lew Allen, Jr.* *SURF Fellow*	On the Nature of the Universe; a Modeling of Gravitational Lenses	Roger D. Blandford *Richard Chace Tolman Professor of Theoretical Astrophysics*
Merceditas V. Castillo California State University, Long Beach *Senior, Microbiology* *MURF*	Expression and Purification from *E. coli* of a Cyclin Dependent Kinase Inhibitor	Raymond Deshaies *Assistant Professor of Biology*
Pratap Chakravarthy *Senior, Ch/ChE*	Development of a Beam of ClOOCl: A Vital Step in the Understanding of Stratospheric Ozone Depletion	Mitchio Okumura *Associate Professor of Chemical Physics*
Raymond S. Chan *Senior, Ph* *Flintridge Foundation SURF Fellow*	Rotation of Magnetic Degenerate Dwarfs	Peter M. Goldreich *Lee A. DuBridge Professor of Astrophysics and Planetary Physics*

STUDENT	TOPIC	RESEARCH SPONSOR
Christopher J. Chang *Junior, Ch* *Peter A. Lindstrom SURF Endowment*	Synthesis, Spectra, and Structure of Novel Nitridomanganese(V) Salen Complexes	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
Connie Chang *Junior, Ph*	Infrared Data Analysis	Michael W. Werner *Senior Research Scientist, JPL*
Amalavoyal N. Chari *Senior, Ph/Ma* *Richter Scholar*	Algorithms for a Quantum Computer	John P. Preskill *Professor of Theoretical Physics*
Steven M. Chase *Junior, APh* *Allied Signal SURF Fellow*	Design and Development of a Test Cell to Study Light Scattering	Paul E. Dimotakis *Professor of Aeronautics and Applied Physics*
Ann W. Chen *Junior, Bi/History* *Howard Hughes Medical Institute*	Investigation of Mating-Related Chemotaxis by the Nematode *Caenorhabditis elegans*	Paul W. Sternberg *Associate Professor of Biology; Associate Investigator, Howard Hughes Medical Institute*
Larry J. Chen *Junior, ChE* *Richter Scholar*	Plasma Assisted Chemical Vapor Deposition of Thin Tungsten Oxide Membranes	Konstantinos P. Giapis *Assistant Professor of Chemical Engineering*
Tak G. Cheung *Sophomore, APh* *Richter Scholar*	Characterization of the Photorefractive Materials for Holographic Data Storage	Amnon Yariv *Thomas Myers Professor of Electrical Engineering and Professor of Applied Physics*
Lon Wake Christensen *Junior, EE* *Arthur E. Lamel Memorial SURF Fund*	The Design and Construction of a Research Platform for Experiments in Biologically Inspired Locomotion	Rodney M.F. Goodman *Professor of Electrical Engineering*
Jenny S. Chu *Junior, Bi* *Howard Hughes Medical Institute*	A New Technique for Monitoring Gene Expression in Living Cells	Andrew Ransick *Senior Research Fellow in Biology* Eric Davidson *Professor of Biology*
Michael W. Chu Johns Hopkins University *Senior, Biophysics* *Howard Hughes Medical Institute*	Examining Microtubule Arrays in *Arabidopsis tso1-1* and Wild Type Cells	Elliot M. Meyerowitz *Professor of Biology*
Soon-Ghee Chua *Senior, EE/Ec*	Variable-Rate Variable-Power MQAM for Fading Channels in Wireless Systems	Andrea Goldsmith *Assistant Professor of Electrical Engineering*
Kenneth B. Cooper Harvard College *Junior, Ch/Ph*	The Application of Proton-Proton NMR Couplings to Determining Conformational Preferences of 3-Methylpentanedioic Acid and 3-Hydroxypentanedioic Acid at Varying pH	John D. Roberts *Institute Professor of Chemistry, Emeritus*

STUDENT	TOPIC	RESEARCH SPONSOR
Kenvor J. Cothey Oxford University *Junior, Ph*	Satellite Altimetry Analysis for Oceanographic Determination	Victor Zlotnicki *Research Scientist, JPL*
David A. Cuthbert *Senior, EE* *AstroTerra Corporation SURF Fellow*	Identification and Correction of Errors in Optical High-Speed Digital Communications Links	Eric Korevaar *President, AstroTerra Corporation* Glen A. George *Lecturer in Electrical Engineering*
Neal K. Dalal *Junior, Ph* *NASA SURF Fellow*	Gravitational Lens Modeling	Roger D. Blandford *Richard Chace Tolman Professor of Theoretical Astrophysics*
Jeremiah K. Darling *Senior, Ph* *NASA SURF Fellow*	A Search for High-Redshift Quasars Using the Second Palomar Observatory Sky Survey	S. George Djorgovski *Associate Professor of Astronomy*
Warren K. Davidson Pomona College *Sophomore, Ph*	The Photometric Accuracy of MIRLIN	Michael E. Ressler *Member of the Technical Staff, JPL*
Vandana R. Desai *Junior, Ay* *NASA SURF Fellow*	Millimeter Emission from the Youngest Protostars	Susan Terebey *Research Staff, IPAC*
Boris D. Dimitrov *Sophomore, Ma/CS*	Greedy Programming Archetype	K. Mani Chandy *Professor of Computer Science*
Markus Dippel University of Kassel *Junior, EE* *Hugh F. and Audy Lou Colvin International Fellowship Endowment*	Simulation of the Dynamic Behaviour of a Mountain Biker	Paul A. Robinson, Jr. *Professor of Physics, Principia College*
Roopesh R. Doshi *Sophomore, EAS*	Inflatable Structures Technology	Joel C. Sercel *Program Element Manager, JPL*
Timothy M. Doyle *Sophomore, CS* *Richter Scholar*	The Chemistry Animation Project	Nathan S. Lewis *Professor of Chemistry*
Kevin L. Du *Junior, Bi/Lit* *Samuel P. and Frances Krown SURF Endowment Fund*	Characterization of *sli-1*, a Negative Regulator of the LET-23 Signalling Pathway in *C. elegans*	Paul W. Sternberg *Associate Professor of Biology; Associate Investigator, Howard Hughes Medical Institute*
Robert J. Duff *Sophomore, ChE* *Hugh F. and Audy Lou Colvin SURF Endowment Fellowship*	Release of Macromolecules from Polymer Hydrogels of Varying Composition	Jeffrey A. Hubbell *Professor of Chemical Engineering*

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Michael Dunderdale University College London *Junior, Ph*	Water Vapour Analysis Using the Global Positioning System	Adam P. Freedman *Member of the Technical Staff, JPL*
Alexander R. Dunn *Sophomore, Bi/Ch* *Mr. and Mrs. Charles Pankow SURF Fellow*	Molecular Quadrupole Interactions Between Polymer Chains	Robert H. Grubbs *Victor and Elizabeth Atkins Professor of Chemistry*
Leonard Dvorson *Senior, Ph*	Weak Localization in GaAs Nanostructures	Michael L. Roukes *Associate Professor of Physics*
Christopher R. Echols *Senior, ME*	Technology Transfer and Commercialization at JPL	Joan C. Horvath *Commercial Programs Liaison Officer, JPL*
Amanda L. Eckermann *Junior, Ch* *Edward W. Hughes SURF Endowment*	Preparation and Spectroscopic Properties of Iron Salen Complexes	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
Daniel A. Eckstein *Junior, Bi* *Richter Scholar*	Identification of Mouse G Protein α Subunits	Melvin I. Simon *Benjamin F. Biaggini Professor of Biological Sciences*
Judy N. Edwards Norfolk State University *Senior, CS* *MURF*	Image Recognition and Classifiers	Rodney M.F. Goodman *Professor of Electrical Engineering*
Daniel T. Egnor *Senior, CS*	Improving Spacecraft Sequence Program Translation for the Cassini Mission to Saturn	Joan C. Horvath *Commercial Programs Liaison Officer, JPL*
Heidi L. Eldenburg *Junior, Ma/Ec*	SURF Retrospective	Carolyn A. Merkel *Director, SURF Program*
Bryce M. Engelbrecht *Senior, EAS* *Shirley and Carl Larson SURF Fellow*	Automated Sample Changing System for Caltech Paleomagnetics Laboratory	Joseph L. Kirschvink *Professor of Geobiology*
Lael L. Erskine *Sophomore, Ch*	Polarization Properties of Marine Aerosols	Mary S. Quinby-Hunt *Staff Scientist, Lawrence Berkeley Laboratory* Lynn M. Russell *Graduate Student in Chemical Engineering*
Jarah M. Evslin *Junior, Ph* *Richter Scholar*	Electron and Photon Identification to Detect Higgs Boson Decays in the CMS Crystal Calorimeter	Harvey B. Newman *Professor of Physics*

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Mintao Fan *Senior, Bi/Ma* *Richter Scholar*	Stochastic Averaging of Chemical Exchange in Nuclear Magnetic Resonance	Daniel P. Weitekamp *Associate Professor of Chemical Physics*
Gary L. Fay II *Senior, Ae/CS* *Howell N. Tyson, Sr. SURF Fellow*	Aggressive Maneuvering with a Vectored Thrust Ducted Fan Engine	Richard Murray *Assistant Professor of Mechanical Engineering*
Xandra-Marie S. Gabucan Occidental College *Senior, Ph*	Antenna Modeling and Data Analysis of the SURFSAT Ka- Frequency Band	Sami Asmar *Technical Group Supervisor, JPL*
Marcel Gavriliu *Junior, Ma/CS*	Parallel-NEWGEN: Towards Higher-Level Shape Specification for Computer Graphics	Alan H. Barr *Associate Professor of Computer Science*
Bob M. Gingrich University of California, Santa Cruz *Senior, Ph*	Exploring the Opposition Effect in Bright Particulate Materials	Robert M. Nelson *Research Scientist, JPL*
Eleftherios Gkioulekas *Senior, AMa*	Protein Sequence Classification Algorithms	Jerry E. Solomon *Member of the Beckman Institute*
James E. Glore *Sophomore, EE* *Richter Scholar*	The Chemistry Animation Project	Nathan S. Lewis *Professor of Chemistry*
Matthew J. Goff *Senior, ChE* *Kinetics Technology International Corporation SURF Fellow*	Modeling of the Coking Process in Industrial Ethylene Reactors	Eric S. Wagner *Visiting Associate in Chemical Engineering, Manager Pyrotec Division, Kinetics Technology International Corporation*
Natalie Y. Goodman Norfolk State University *Senior, Bi* *MURF*	Metabolic Engineering of *Methylobacterium extorquens* AM1: Growth on Trichloroethylene	Mary E. Lidstrom *Professor of Applied Microbiology*
Sonya D. Goodwin Alabama State University *Junior, Ch* *MURF*	The Design of Polyamides for Minor Groove Recognition of DNA Sequences Containing Contiguous G-C Base Pairs	Peter B. Dervan *Bren Professor of Chemistry*
Robert A. Granat *Senior, EE* *Ford Motor Company SURF Fellow*	Motion Recovery from a Monocular Sequence of Images	Pietro Perona *Assistant Professor of Electrical Engineering*

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Timothy O. Gunter *Junior, Ph* *Logicon, Incorporated SURF Fellow*	Improving the Client-Server Architecture	Arde Bedjanian *Manager of Satellite Programs, Logicon, Incorporated* Edwin T. Upchurch *Member of the Technical Staff, JPL*
Francisco J. Gutierrez *Senior, ME* *First Quadrant Corporation SURF Fellow*	Niching and Speciation of Genetic Algorithms	David Leinweber *Director, First Quadrant Corporation* Scott E. Page *Assistant Professor of Economics*
Eugene Ha *Junior, Ma*	Image Sieves	Brian Lau *Member of the Technical Staff, JPL*
Farouk O. Hadeed Yale University *Junior, Ph/EE*	Inflatable Structures Technology	Joel C. Sercel *Program Element Manager, JPL*
Zoran Hadzibabic Trinity College *Junior, Ph*	Modeling the Spectrum of Hydrogen Pressurized Ammonia in the Far Infrared Region	Glenn S. Orton *Member of the Technical Staff, JPL*
Michael D. Hartl Harvard University *Senior, Ph* *NASA SURF Fellow*	Transient Brightenings in Solar X-rays and Microwaves	Dale E. Gary *Senior Research Associate in Astrophysics*
Karl A. Haushalter Rice University *Senior, Ch*	An NMR Investigation of the Interaction Between Ureas and Carboxylate Salts	John D. Roberts *Institute Professor of Chemistry, Emeritus*
Dennis M. Hausmann University of California, Irvine *Senior, Ch*	Design, Characterization, and Catalytic Properties of High Potential Manganese Porphyrins	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
Stephanie D. Haussmann *Senior, Bi* *Samuel P. and Frances Krown SURF Endowment Fund*	Effect of Oligonucleotide Length on Hybridization to Solid-Phase DNA Arrays	John D. Baldeschwieler *Professor of Chemistry*
Hoai-Ky V. Ho University of Oregon *Senior, Bi* *Howard Hughes Medical Institute*	The Expression and Functional Analysis of Mammalian Olfactory Receptor	Kai Zinn *Associate Professor of Biology*
Jeffrey L. Ho *Sophomore, CS*	Animated Presentation for GEC Plasma Reactor Simulation	Stephen Taylor *Assistant Professor of Computer Science* B. Vincent McKoy *Professor of Chemistry*

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Jennifer S. Ho Stanford University *Junior, Bi* *Howard Hughes Medical Institute*	Structure-function Relationship of Cyclic Nucleotide-gated Channels	Henry A. Lester *Professor of Biology*
Heidi J. Hofer *Senior, Ph*	Investigation of Soil Chemistry Along a Climate Gradient	Oliver A. Chadwick *Research Scientist, JPL*
Ryan S. Hoffman Colgate University *Senior, Ge*	Ephrata Fan as Earth-analog to Mars Ares Vallis	Matthew P. Golombeck *Mars Pathfinder Project Scientist, JPL*
Justin H. Howell *Senior, Ay*	Processing and Analysis of IR Images of High Redshift 3C Radio Galaxies	Peter Eisenhardt *Member of the Technical Staff, JPL*
Jason C. Hsu *Senior, AMa/Ec*	Experiments in Interdependent Markets	Charles R. Plott *Edward S. Harkness Professor of Economics and Political Science*
Victor Y. Hsu *Senior, Bi* *Howard Hughes Medical Institute*	The *Drosophila* Bithorax Complex	Edward B. Lewis *Thomas Hunt Morgan Professor of Biology, Emeritus*
Yufang Hu Texas A&M University *Senior, Ch*	Flow-Induced Alignment of Block Copolymers	Julia A. Kornfield *Associate Professor of Chemical Engineering*
Chou P. Hung *Senior, Bi* *Howard Hughes Medical Institute*	A Study of the Role of N-Cadherin in Synaptic Plasticity in the Adult Rat Hippocampus	Erin M. Schuman *Assistant Professor of Biology*
Andrew S. Huntington *Junior, Ch* *Richter Scholar*	Characterization of Poly-L-Lysine Folate as a Carrier Molecule for DNA Targeted at Human Cancer Cells	John D. Baldeschwieler *Professor of Chemistry*
Hoa T. Huynh *Sophomore, Ay* *Richter Scholar*	Effects of Lattice Strain on the Giant Magnetoresistance of Manganite ($La_{0.7}Ca_{0.3}MnO_X$) and Cobaltite ($La_{0.5}Co_{0.5}MnO_X$) Thin Films	Nai-Chang Yeh *Assistant Professor of Physics*
Xinh X. Huynh *Senior, Ph*	A Prototype Neutron Counter to Investigate Fast Neutron Production from 100-250 GeV Muon Interactions with Nuclei Using the CERN SPS M2 Muon Beam	Felix H. Boehm *William L. Valentine Professor of Physics*
Minneola P. Ingersoll Stanford University *Sophomore* *First Quadrant Corporation* *SURF Fellow*	Bidding for Computer Time	David Leinweber *Director, First Quadrant Corporation* Scott E. Page *Assistant Professor of Economics*

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Hiroshi Ishii *Sophomore, EE* *Richter Scholar*	Creation of Software for a SQUID Magnetometer System	Joseph L. Kirschvink *Professor of Geobiology*
Roman Jarosiewicz *Senior, ME* *Dr. Chandler C. Ross SURF Fellowship*	Active Control of the Rijke Tube	Fred E.C. Culick *Professor of Mechanical Engineering and Jet Propulsion*
Patrick D. Jewell *Sophomore, Ph*	A Sampling of New Millennium Activities at JPL	Michael Hecht *Member of the Technical Staff, JPL*
Lin Z. Jia *Junior, Bi* *Howard Hughes Medical Institute*	Localization by Immunocytochemistry of Postsynaptic Density Proteins in Dissociated Hippocampal Neurons	Mary B. Kennedy *Professor of Biology*
Alexis M. Johnson *Sophomore, EnvE*	KidSat	JoBea Way *Member of the Technical Staff, JPL*
Elizabeth D. Johnson *Junior, EAS*	Transferring JPL Technology to the Private Sector	Joan C. Horvath *Commercial Programs Liaison Officer, JPL*
Neil C. Jones *Sophomore, Ch*	The Synthesis of Cobalt Acacen Derivatives as Drugs	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
Prakash J. Jothee Reed College *Senior, Ch/Ph*	Laser-Induced Fluorescence Spectroscopy of Al...H_2 van der Waals Systems	Mitchio Okumura *Associate Professor of Chemical Physics*
N.W.G.M.M. Kanchana *Junior, EE*	Two and Three Dimensional Discrete-Element Soft Particle Simulation	Melany L. Hunt *Associate Professor of Mechanical Engineering*
Anuraag R. Kansal *Junior, ChE* *NASA SURF Fellow*	Kinetic Modeling of the Impact of Comet Shoemaker-Levy 9 with Jupiter	Yuk L. Yung *Professor of Planetary Science*
Adil M. Karim *Senior, APh*	Application of Optical Reflectometry to the Identification of Biological Cells	Michael S. Shumate *Lecturer in Optics*
Brian L. Katon *Senior, EAS/Ec* *Mr. and Mrs. Victor V. Veysey SURF Fellow*	Welfare Policy Decision Making, a New Approach?	D. Roderick Kiewiet *Professor of Political Science*
Kenneth A. Kharma *Junior, ChE* *Samuel P. and Frances Krown SURF Endowment Fund*	Poly-L-lysine Directed Microencapsulation of Islet of Langerhans Cells	Jeffrey A. Hubbell *Professor of Chemical Engineering*

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Brian S. Kim *Senior, Bi* *Howard Hughes Medical Institute*	Analysis of Forse-1 in the Early Brain Development of Rat Embryos	Paul H. Patterson *Professor of Biology*
Diana D. King *Sophomore, Ch*	Femtochemistry Studies	Ahmed Zewail *Linus Pauling Professor of Chemistry*
John D. King *Senior, ME*	Modification of an Electrical Aerosol Analyzer/Electrometer System	Glen R. Cass *Professor of Environmental Engineering and Mechanical Engineering* Richard C. Flagan *Professor of Chemical Engineering*
Adam K. Kisor University of California, San Diego *Junior, Cognitive Science/Visual Arts*	Development of Thin Films for Use in Thermoelectric Infrared Detectors	Roger M. Williams *Technical Group Leader, JPL*
Kimberly L. Komisarek *Senior, Ch* *Class of '36 Endowment Fund*	Scanning Chemical Microscopy: An Atomic Force Microscope Study of Chemically Patterned Surfaces	John D. Baldeschwieler *Professor of Chemistry*
Vincent J. Kong *Sophomore, Ph*	X-Ray Emissions in Solar Flares	Haimin Wang *Senior Research Fellow in Solar Astronomy*
Arvindh Krishnaswamy *Senior, EE/Ph* *Richter Scholar*	Helicopter Control	Rodney M.F. Goodman *Professor of Electrical Engineering*
Roshan M. Kumar *Senior, Bi/Ch* *Samuel P. and Frances Krown SURF Endowment Fund*	Purification, Characterization, and Crystallization of the *Xenopus* Upstream Binding Factor Protein - Towards a High-Resolution Crystal Structure	Barry L. Stoddard *Assistant Member, Fred Hutchinson Cancer Research Center* Douglas C. Rees *Professor of Chemistry*
Karen Kustedjo *Senior, Ch* *Bristol-Myers Endowment Fellowship*	Design and Synthesis of Optimized Nonlinear Optical(NLO) Compounds	Seth R. Marder *Member of the Beckman Institute*
Donald Y. Kwak *Junior, ME*	Inflatable Reflecting Integrated Structure (IRIS)	Joel C. Sercel *Program Element Manager, JPL*
Kelvin Y. Kwan *Junior, Bi* *Richter Scholar*	Bending and Flexibility of DNA at Replication Origins	Judith L. Campbell *Professor of Chemistry and Biology*
Wai P. Kwan *Junior, Ch/EnvE*	Copper Uptake by Type I Methanotroph *Methylobacter Albus* BG8	Mary E. Lidstrom *Professor of Applied Microbiology*

STUDENT	TOPIC	RESEARCH SPONSOR
Eileen E. Lau *Senior, EE*	A 300-Watt 7-Megahertz Class E Solid-State Amplifier	David B. Rutledge *Professor of Electrical Engineering*
Margaret D. Ledyard Harvard University *Junior, Ch*	Synthesis and Characterization of Well Defined Polymers	Robert H. Grubbs *Victor and Elizabeth Atkins Professor of Chemistry*
Charles C. Lee *Senior, Bi/Ch* *Richter Scholar*	Investigation of a Putative Protein Tyrosine Kinase Receptor Gene in Sea Urchin Coelomocytes	L. Courtney Smith *Member of the Professional Staff*
Jason C. Lee *Senior, Bi*	Colocalization of Proteins in the Post-Synaptic Density	Mary B. Kennedy *Professor of Biology*
Mina M. Leung *Junior, ME/CE* *Donald S. Clark SURF Endowment Fund*	Optical Requirements for *in vivo* Microscopy: Lens Design	J. Harold Wayland *Professor of Engineering Science, Emeritus*
Keng Guan Lim Imperial College *Junior, Ae*	Comparison of Near-Infrared Images of Jupiter	Glenn S. Orton *Member of the Technical Staff, JPL*
Robert H. Lin *Junior, EE*	Characterization of a High Power Laser as a Tool for Generating Patterned Masks	Imran Mehdi *Member of the Technical Staff, JPL*
Hansel Lo *Senior, ChE*	Synthesis and Characterization of Vanadium Silicates with MEL Structure	Mark E. Davis *Warren and Katharine Schlinger Professor of Chemical Engineering*
Tao Long *Sophomore, ChE*	Macromolecular Evolution	Frances H. Arnold *Associate Professor of Chemical Engineering*
Jeffrey C. Lowe *Senior, ChE* *William N. Lacey SURF Endowment Fund*	Copper Exchange Characteristic of ZSM-5 and its Catalytic Activity in NO Decomposition	Mark E. Davis *Warren and Katharine Schlinger Professor of Chemical Engineering*
Morrison R. Lucas *Junior, ME* *Ford Motor Company SURF Fellow*	Silicon Microproperties Project	Yu-Chong Tai *Assistant Professor of Electrical Engineering*
Anh Q. Ly *Senior, EE* *Hilite, Incorporated SURF Fellow*	1. Overview of the Proposed US HDTV System 2. Experimenting with the Vertical Blanking Interval Data in NTSC Broadcasts	Wing Leung *President, Hilite, Incorporated* Michelle Effros *Assistant Professor of Electrical Engineering*

STUDENT	TOPIC	RESEARCH SPONSOR
Jeffrey J. Mach *Senior, Ae* *Lester Lees Aeronautics SURF Fellowship*	The Study of Combustion Driven Shock Tube Flows with Laser-Induced Thermal Acoustics	Hans G. Hornung *Kelly Johnson Professor of Aeronautics; Director, GALCIT*
Rahul Malhotra *Senior, Ph*	Evaluation of the Radiation Pattern Outside a Dielectric Hyperhemisphere Due to a Twin-Slot Antenna at the Base	Jonas Zmuidzinas *Assistant Professor of Physics*
Noah Malmstadt *Junior, ChE* *Richter Scholar*	An Assay of the Stereoregularity of Four Enzymes in a Nonbiological Environment	Frances H. Arnold *Associate Professor of Chemical Engineering*
Peter J. Manca *Senior, Ph* *Northern California Associates SURF Endowment Fund*	Resonance Cones on a Tokamak Edge	Paul M. Bellan *Professor of Applied Physics*
Scott Mandelsohn *Sophomore, CS* *NASA SURF Fellow*	Waves from the Impacts of Shoemaker-Levy 9 with Jupiter	Andrew P. Ingersoll *Professor of Planetary Science*
Jeremiah M. Mans *Sophomore, APh*	Data Archival Retrieval and Enhancement Generalized	Susan W. Hess *Acting Technical Group Supervisor, JPL*
Christopher R. Marsh *Senior, ME* *Mr. James A. Ross SURF Fellow*	Silicon Microproperties Project	Yu-Chong Tai *Assistant Professor of Electrical Engineering*
Nathan J. Mates *Senior, EAS* *Mr. and Mrs. Douglas B. Nickerson SURF Fellow*	Improving Scientific Visualizations	Stephen Taylor *Assistant Professor of Computer Science*
Sean P. Mauch *Senior, AMa* *Richter Scholar*	A Text for AMa 95b	Philip G. Saffman *Theodore von Kármán Professor of Applied Mathematics and Aeronautics*
Sebastian M. Maurer *Senior, Ph* *Richter Scholar*	Vortex Pinning by Cylindrical Defects in Type-II Superconductors - Numerical Solutions to the Ginzburg-Landau Equations	Nai-Chang Yeh *Assistant Professor of Physics* Thomas A. Tombrello *Professor of Physics*
Caer-Eve Mc Cabe University of Leicester *Senior, Ph*	Measuring Pollution: The Development of an Engineering Curriculum	Paul A. Robinson, Jr. *Professor of Physics, Principia College*
Alan L. Mc Conchie *Junior, Ay* *Dr. Arden L. Albee SURF Fellow*	Analysis of Topographic Profiles	Brian P. Wernicke *Professor of Geology*

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Michael J. Medaglia *Senior, CS*	The Chemistry Animation Project	Nathan S. Lewis *Professor of Chemistry*
Pedro P. Melo California State University, Los Angeles *Senior, EE* *MURF*	Building an Experimental Platform for Analog VLSI Motion Sensors	Christof Koch *Professor of Computation and Neural Systems*
Nick A. Melosh Harvey Mudd College *Senior, Ch*	A Model of Ocean Currents in the Pacific Ocean	Victor Zlotnicki *Research Scientist, JPL*
Jeffrey C. Miller *Junior, Bi* *Howard Hughes Medical Institute*	Incorporation of Caged Compounds into the Acetylcholine Receptor	Henry A. Lester *Professor of Biology*
Jennifer A. Miller *Senior, Ch* *Mrs. Hannah Bradley SURF Fellow*	Copper Uptake in the Type I Methanotroph *Methylomicrobium albus* BG8	James J. Morgan *Marvin L. Goldberger Professor of Environmental Engineering Science*
Tessa R. Miller *Junior, Bi* *Thomas Hunt Morgan SURF Endowment Fund*	Genetic Analysis of *S. Purpuratus* Population Dynamics	R. Andrew Cameron *Senior Research Associate in Biology*
Christina Molodowitch *Sophomore, Ch* *Mr. and Mrs. Downie D. Muir, III SURF Fellow*	Investigation of the Arrhenius Activation Energy of the Rotation About the C(O)-N Bond in N,N-Dimethylformamide Through NMR Spectroscopy	John D. Roberts *Institute Professor of Chemistry, Emeritus*
Penny L. Muir *Senior, EAS*	Pollution Modeling Projects for High School Science Classes	Paul A. Robinson, Jr. *Professor of Physics, Principia College*
Laura M. Muñoz *Junior, ME*	Inflatable Structures Technology	Joel C. Sercel *Program Element Manager, JPL*
Esmeralda Nava *Senior, EAS* *Richter Scholar*	Measuring Success of Caltech YESS	James M. Bower *Associate Professor of Biology*
Bradley D. Nelson *Sophomore, EAS*	XHawk Project	Stephen Taylor *Assistant Professor of Computer Science*
Pauline C. Ng *Junior, Bi* *Howard Hughes Medical Institute*	Sequencing of the Structural Protein Region of the Mayaro Virus	Ellen G. Strauss *Senior Research Associate in Biology*

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Scott C. Noble *Junior, Ph* *Mr. and Mrs. Ralph W. Jones SURF Fellow*	A Study on the Performance of the Crystal Calorimeter for BaBar at SLAC	Ren-Yuan Zhu *Senior Research Associate in Physics*
Barbara A. Novak *Sophomore, Bi* *Howard Hughes Medical Institute*	Construction of a Full-length cDNA Clone of the Dengue Type 2 Viral Genome	James H. Strauss *Ethel Wilson Bowles and Robert Bowles Professor of Biology*
Sarah J. Osborne University of Leicester *Junior, Ph*	The Development of an Interactive Welcome to the Data Distribution Laboratory on a Compact Disc	Susan W. Hess *Acting Technical Group Supervisor, JPL*
Siddhartha Padmanabha *Sophomore, Bi* *Richter Scholar*	The Honeybee's Sensitivity to DC-Anomalies in the Earth's Magnetic Field	Joseph L. Kirschvink *Professor of Geobiology*
Navin T. Parasram University of London *Junior, ME/EE*	Ekman vs. Geostrophic Currents in Equatorial Pacific	Victor Zlotnicki *Research Scientist, JPL*
Mercedes F. Paredes Harvard-Radcliffe College *Sophomore, Bioch* *MURF*	Making Prp's 9, 11, and 21 Detectable in the Spliceosome	John N. Abelson *George Beadle Professor of Biology*
Kartik C. Parija Drake University *Junior, CS/Ma*	Temporal Evolution of Tropospheric Temperature Perturbations Resulting from the Impact of Comet Shoemaker-Levy 9 with Jupiter	Glenn S. Orton *Member of the Technical Staff, JPL*
Jae I. Park *Junior, Ph*	Grating Shadows and their Application to Cavity QED - or - Here's Looking at You, QED	H. Jeff Kimble *Professor of Physics*
Fay Fei Peng *Sophomore, ChE* *Professor Fredrick H. Shair SURF Endowment*	Steady Shear Viscosities of Hydrogen Bond Associating Polymers, Using a Zimm Viscometer	Julia A. Kornfield *Associate Professor of Chemical Engineering*
Alberta L. Perry Alabama State University *Senior, Bi* *MURF*	Specification of Pigment Cells in the Purple Sea Urchin	Eric H. Davidson *Norman Chandler Professor of Cell Biology*
Arlene P. Pons *Junior, ChE* *AeroVironment, Inc. SURF Fellow*	Design Specifications of the P_2O_5 Electrolytic Cell for Use as an Atmospheric Moisture Detector	Paul B. MacCready, Jr. *Chairman, AeroVironment, Inc.* Geoffrey A. Blake *Associate Professor of Cosmochemistry*

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Amy W. Poon University of California, Davis *Sophomore, Bi* *Howard Hughes Medical Institute*	The Role of BDNF in *Xenopus* Visual System Development	Susana Cohen-Cory *Senior Research Fellow in Biology* Scott E. Fraser *Anna L. Rosen Professor of Biology*
Alice L. Presley Southwest Missouri State University *Senior, Ch*	Resolution of 2-amino-2'-hydroxy-1,1'-binaphthyl	Erick M. Carreira *Assistant Professor of Chemistry*
Elizabeth M. Price *Senior, EAS* *Mr. and Mrs. Robert L. Noland* *SURF Fellow*	Isolation and Characterization of a Copper Repressible Protein, Possibly Involved in Copper Transport in *Methylomicrobium albus* BG8	Mary E. Lidstrom *Professor of Applied Microbiology*
Wei Qin *Junior, EE* *Richter Scholar*	Olfaction Data Analysis	Rodney M.F. Goodman *Professor of Electrical Engineering*
James J. Quallen *Junior, Ch*	Synthesis of Hexadeca-butoxyanthralocyanine	Seth R. Marder *Member of the Beckman Institute*
Aimee L. Quan *Senior, Bi* *Howard Hughes Medical Institute*	Expression and Investigation of the *Strongylocentrotus purpuratus* Transcription Enhancer Factor (SpTEF-1)	Jun Xian *Research Fellow in Biology*
Priyamvada Rai *Junior, Bi* *Howard Hughes Medical Institute*	Study of the Influence of MELAS Mutation in Mitochondrial (Mt) DNA on Expression of the Three Isoforms of the Adp/Atp Translocase	Giuseppe Attardi *Grace C. Steele Professor of Molecular Biology*
Anandi Raman *Senior, Bi/Ch* *Samuel P. and Frances Krown* *SURF Endowment Fund*	Progress Towards the Structural Elucidation of Molecular Recognition	Roland K. Strong *Assistant Member, Fred Hutchinson Cancer Research Center* Pamela Bjorkman *Assistant Professor of Biology*
Adam C. Readhead University of California at Berkeley *Sophomore* *Howard Hughes Medical Institute*	SSLP Mapping of *Multipetala*	Elliot M. Meyerowitz *Professor of Biology*
Evan J. Reed *Sophomore, APh* *Sidney R. and Nancy M. Petersen* *SURF Endowment*	Lattice Gas Cellular Automata with Almost Periodic Initial Conditions	Oliver Knill *Olga Tausky - John Todd Instructor in Mathematics*
David R. Relyea *Junior, Ph* *Dr. York Liao SURF Fellow*	A Study of the Charge Properties of Resistive Plate Counters (RPCs)	Douglas Michael *Senior Research Fellow in Physics*

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Kimberly K. Riley Iowa State University *Senior, Zoology* *Howard Hughes Medical Institute*	Using Green Fluorescent Protein to Visualize Neurons	Steven M. Potter *Research Fellow in Biology*
Josef D. Ringgenberg *Senior, Ch* *Ernest H. Swift SURF Endowment Fund*	Studies Directed Toward a Synthesis of Chebulagic Acid	Erick M. Carreira *Assistant Professor of Chemistry*
Albert R. Robinson III University of Florida *Senior, EE* *MURF*	Muscle Modeling: Behavior of an Elbow Joint Determined by Physical Properties	John J. Hopfield *Roscoe C. Dickinson Professor of Chemistry and Biology*
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On the cover: Thomas J. Meade with his SURF students Roshan Kumar, Cindy Chen, Harry B. Gray, and Karen Kustedjo. Photo by Bob Paz.

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