Through the proposed Cal Poly Pomona Aerospace Vehicle Laboratory STEM Pipeline Project, California State Polytechnic University Pomona (Cal Poly Pomona, or CPP) proposes to carry out activities to improve our STEM pipeline by incorporating programs involving education, hands-on training and outreach activities. We propose to carry out two activities during the period of performance. The first activity is outreach; we will send groups of students to local high schools to speak to and with the students and give them a flavor of the engineering profession. The second activity is to create a student-run mentoring workshop which will train engineering students in practical use of electronics for engineering projects, a topic that is not well covered in Cal Poly Pomona’s engineering curriculum. These activities will be conducted in CPP facilities on campus and at outreach sites. The program will benefit regional K-12 schools in the Pomona area, as well as provide practical training to science and engineering students at CPP. We request project funding to support student interns and faculty advisors in developing outreach activities and student training facilities.
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Enhancing University Accessibility and Career Development through Mentoring of Underrepresented Student Populations in the Sacramento Area
Susan Ustin and Pia van Benthem
Center for Spatial Technologies and Remote Sensing (CSTARS)
University of California, Davis (UCD)
Email: slustin@ucdavis.edu

The objective of this proposal is to enrich a ‘College Access through Mentoring’ program with 9th-12th grade students of Encina High School in the Sacramento San Juan School District. The proposed activities will enhance youth education in earth sciences and S.T.E.M. disciplines and provide university access to underrepresented students through mentorship programs with UCD graduate and undergraduate students.

Program Motivation & Goals:

Mentoring in science is fundamental to guide students from socio-economically challenged backgrounds towards higher education at the college and university levels. High school students are in clear need for cross-disciplinary training and career guidance through mentorship programs to stimulate interest in the field of earth sciences and science, technology, engineering, and mathematics (S.T.E.M.) disciplines.

A continued precipitous drop in engineering, scientific and aerospace undergraduate and graduate enrollments over the last several years forces governmental agencies to focus on innovative programs to attract high school students to higher education. In order to remain the leader in aeronautic and engineering innovation, NASA needs to establish high profile STEM science learning at high schools.

Sacramento communities in the San Juan School District consists of a high population of underrepresented African American, Hispanic and socioeconomically disadvantaged families. The majority of young students from these groups do not excel their education to college or university levels. The major reason for this lies in the lack of attention provided to the development of long-term, strategic efforts targeted at cultivating interest for college degree programs. The goal of the proposed mentoring program is to foster and sustain prolonged interest and stewardship in earth sciences and STEM education disciplines to facilitate hands-on education and develop a roadmap for college access. Specifically, the four major goals are:

1. Development of a relationship between undergraduate and graduate students of mutual benefit with underrepresented youth in the Sacramento region
2. Enhance earth science and S.T.E.M. education in local high school settings
3. Increase the opportunities for students from underrepresented communities in the greater Sacramento area to access college and university degree programs
4. Incorporate community service and outreach into the undergraduate and graduate education experience at UC Davis
Summer Engineering Experience: A Program to Increase Gender Diversity in STEM Fields
Dr. Ram Nunna, Interim Dean, Dr. Maria Sanchez, and Nell Papavasiliou
California State University, Fresno (CSUF)
Phone: (559) 278-8111

Fiscal Contact
Thomas McClanahan
Associate Vice President, Research and Sponsored Programs
California State University, Fresno

California Space Grant Consortium (CASGC) is providing partial support for the third annual Girls Summer Engineering Experience (GIRLS SEE), a week-long residential camp for high school students to be held in Summer 2011. GIRLS SEE is a recruitment and retention effort to increase the number of female applicants into the different disciplines of engineering and to increase retention of the current female engineering students. The second objective is accomplished by providing Lyles College of Engineering (LCOE) female engineering students with a service learning experience by assisting in the administration of the camp and mentoring the participants.

GIRLS SEE was conceived in 2009 in response to the small number of females pursuing engineering and other STEM fields. At Fresno State, only 14.2% of students receiving an engineering degree during the academic year 2007-2008 were female, roughly corresponding to the percentage of female student population in LCOE programs. The Lyles College of Engineering believes that it is necessary to create local programs aimed at exposing female students in their final three years of high school to basic concepts within different areas of engineering and construction management in order to open the possibilities for these students to choose a technical major. Because retention of students is another major concern, GIRLS SEE was designed in such a way that current female engineering students can participate as mentors and assistants for each activity. The faculty in charge of the different activities trained the students while providing a service learning experience and giving leadership opportunities to them.
STEM Outreach Focused on Research in the Control of Lagrangian Mixing in Fuel Injector Flows into Supersonic Cross-Stream

Gustaf Jacobs
San Diego State University (SDSU)
Email: gjacobs@mail.sdsu.edu
Phone: (619) 594-6074

This proposal addresses a collaborative initiative between the San Diego MESA (Mathematics, Engineering, Science Achievement) Alliance (SDMA) and the Department of Aerospace Engineering at San Diego State University (SDSU). We aim to develop outreach activities that are focused on integrating and motivating students from underrepresented groups into Aerospace research and development. The SDMA with partner community colleges San Diego City College and Southwestern College provides the ideal platform to identify students from underrepresented groups from grades K-12 to college and interest them in STEM education and research. The Aerospace Department at SDSU provides the credible and relevant research projects to interest these students in Aerospace Research in particular. We focus on the involvement of MS and PhD student mentors that are working on the research proposed in a related CaSG Workforce Development proposal on “Control of Lagrangian Mixing in Fuel Injector Flows into Supersonic Cross-Stream”. Through seminars, campus visits, and mutual mentoring from K-12 to the graduate level, we will motivate and integrate underrepresented students from K-12 up to the PhD level into Aerospace research and development.

Nature and Design of the Project

Introduction: In order to increase the number of underrepresented students entering STEM fields and graduating with STEM degrees, this project will partner with all divisions of the Mathematics Engineering Science Achievement (MESA) program in San Diego making up the San Diego MESA Alliance (SDMA). This partnership will foster faculty interaction, student engagement in research, mentoring/tutoring from graduate level to K-12, and local field trips to air, space, and science museums/centers. The San Diego MESA Alliance (SDMA) is a statewide model for effective collaboration between regional MESA programs. The SDMA creates a supported pipeline from pre-college, through community college, university and ultimately the technical workforce.
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Improving the STEM Pipeline at Sonoma State University
Lynn Cominsky
Department of Physics and Astronomy
Sonoma State University (SSU)
Email: lynnc@universe.sonoma.edu
Phone: (707) 664-2655

Sonoma State University (SSU) uses Science, Technology, Engineering and Mathematics (STEM) Pipeline funds from the California Space Grant to support faculty and students in two outreach programs that strive to increase the number of underrepresented STEM students in the pipeline: SSU’s Summer High School Internship Program (SHIP) and SSU’s MESA program. For SHIP, funds will be used to support five faculty mentors in aerospace-related projects. For MESA, funds will be used to support (the spring semester salary of) the MESA Student Assistant who tutors during the academic year and a summer research internship for a MESA member who will work on an aerospace-related project. The results of both projects will be evaluated by WestEd.

Summer High School Internship Program

For the past three years, the School of Science and Technology (SST) at SSU in partnership with the Sonoma County Office of Education (SCOE) has created a summer research internship program for Sonoma County high school juniors under the mentorship of SST faculty to stimulate interest in STEM fields. The most talented and interested students from these high schools are selected competitively. These students are given opportunities to work on challenging projects, become familiar with excellent state-of-the art research and development facilities, experience the university education environment, and interact with the faculty and SSU undergraduate students. The high school students then act as ambassadors to relay their experiences to their classmates and friends, counselors, teachers, and principals during their senior year.
Support for NASA Content Dissemination for Summer Residential Program for Elementary School Teachers

Lily Gossage, PI, Director
Engineering Recruitment & Retention Center
California State University, Long Beach (CSULB)
Email: lgossage@csulb.edu
Phone: (562) 985-2498

Eric Besnard, Co-PI, Professor
Mechanical and Aerospace Engineering Department
Email: besnarde@csulb.edu
Phone: (562) 985-5442

Aside from introducing engineering to K-12 students, there is great need to offer learning opportunities to K-12 teachers. Like many engineering colleges, the College of Engineering at California State University, Long Beach (CSULB) promotes engineering awareness through a variety of outreach programs. While existing engineering outreach programs serve teachers, occasions for in-depth learning and expanding K-12 State curriculum via these programs is limited. This proposal will support ten elementary school teachers’ participation in a women-in-engineering outreach program called, “My Daughter is an Engineer”; the program is offered through CSULB’s Department of Mechanical & Aerospace Engineering. While “My Daughter is an Engineer” was specifically designed to serve fifth-grade girls and their mothers, teachers will gain an understanding of the importance of early career awareness and learn how best to reach young girls during the formative school years. And while teachers will be engaged in most of the “My Daughter is an Engineer” activities, they will be provided with additional intensive learning and projects-based workshops focused on training them to weave NASA content into existing K-12 curriculum. A program outcome will involve the development of a comprehensive binder of materials that integrate NASA content while conforming to K-12 California State content standards. These materials will serve as contextual vehicles for K-12 lesson plans for classroom use; resultant materials will include exemplars of lessons plans and resources for enhancing the enjoyment of NASA content learning. Aerospace-related fieldtrips will offer teachers with a real-world glimpse of engineering as well as strengthen K-12 ties to NASA Centers. This funding will support the training of teachers for incorporating NASA content via creative activities using low-cost materials. The capacity to expose elementary school students to the excitement of engineering as well as NASA’s space program is an over-riding goal.
Space Science and Engineering Outreach through the MESA Schools Program
Professor Nosang V. Myung
Principal Investigator Authorized Representative
University of California, Riverside (UCR)
Email: myung@engr.ucr.edu
Phone: (951) 827-7710

The MESA Schools Program at UCR operates a number of outreach initiatives to schools in Riverside and San Bernardino counties designed to increase the number and diversity of students pursuing studies and careers in science, technology, engineering, and mathematics (STEM) fields. MESA works with individual students, their families, teachers, schools, and school districts to increase enthusiasm for math and science, and to enhance student skills in these areas. Major MESA initiatives and services include the following:

- Individual Academic Plans. The plans help MSP counselors to monitor individual student progress.
- SAT/PSAT Preparation. Students review and prepare for these important tests.
- Study Skills Training. Students learn the most effective techniques for academic achievement.
- MESA Day Academies. Hands-on math and science competitions at local and regional levels give students a chance to meet like-minded students and vie for awards.
- Career and College Exploration. Guest speakers and field trips show students different college and career options.
- Parent Leadership Development. Parents learn how to become effective advocates for their children's academic success.
- MESA Periods. These classes, held during regular hours in some schools, allow Advisors (usually math or science teachers) to work with students on academics and MESA activities.
- Teacher Training Opportunities. Annual institutes are offered for MESA pre-college Advisors (teachers) to learn hands-on curriculum and new techniques to teach math and science. Most MSPs are housed at universities and have ties with campus faculty members. MSP sites are located throughout California and serve hundreds of schools and school districts.

UCR has support from the California Space Grant Consortium for an outreach project to expand the number of schools that it serves. With this grant, MESA will be able to (1) fund at least one undergraduate student mentor to work with K-12 students in the area, (2) support more teachers in professional development, and (3) sponsor more school groups in competitions such as the robotics competition.
Project ASTROTM is the signature formal education program of the Astronomical Society of the Pacific (ASP), providing professional development, instructional materials, and volunteer astronomers for classroom teachers in grades 3-9. In the San Francisco Bay Area, this project’s goals and objectives are to add a new cohort of at least 25 new ASTRO partnerships each year, increase the amount of astronomy and space science taught in classrooms, encourage the use of inquiry-based resources and instructional strategies, and encourage student awareness of science careers and avocations through exposure to community resources, such as volunteer astronomers. This proposal seeks 2011 funding to ensure the availability of Project ASTRO and its resources to educators in the Bay Area.
Public schools in the United States need to improve in order to enable students to compete in the global economy and sustain our democratic way of life. Low-income students of color are particularly vulnerable in the current highly stratified educational environment where the least well-prepared receive the fewest educational resources while the best-prepared receive the most educational resources.

The educational discourse since the passage of ‘No Child Left Behind’ has been dominated by an obsession with students' performance on short answer, rapid fire standardized tests and assertions that poor teachers are the reason for poor student performance. Studies of countries with the highest student performance demonstrate that an entirely different orientation can lead to successful school improvement. Instead of trying to fire poor performing teachers or privatizing public schools, the most successful nations invest in improving teachers' content knowledge and professional expertise by fostering teachers' professional learning communities.

The formation of professional learning communities is especially well suited to address the lack of alignment in curriculum between elementary, middle, and secondary schools, including those in the San Diego Union School District (SDUSD). Currently, each segment of the K-12 system designs and implements its own version of curriculum, which disables students when they are promoted to the next segment of the system. Furthermore, the independence of the segments also often requires middle school and high school teachers to cover materials they had anticipated would have been covered in the students' previous grades.

We propose TPDS, a collaborative project between Science Education Association of San Diego (SEASAND), UCSD, SDUSD to build a model system to demonstrate the viability of "vertical teaming" among K-12 teachers in order to align the science curriculum and instruction in elementary, middle, and secondary schools. Our pilot program will be situated in the San Diego cluster of high schools, middle schools, and elementary schools within the San Diego Unified School District. We have chosen the science curriculum, starting with Earth Sciences, to test our model because of the expertise and years of experience in vertical teaming of the educators associated with SEASAND, which is the California Subject Matter project serving San Diego County. We will leverage the work done by SEASAND on Climate Change last summer. The California Math Project has expressed an interest to extend this model to their subject matters. The sustainability of this effort will be ensured by the involvement of UCSD Extension in structuring the process and learning from this pilot into courses that can be offered to teams of teachers who can develop this type of teaming model and create positive STEM outcomes in their own school cluster and subject matter. CREATE will manage this project and will work on this pilot project to its
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successful completion including evaluation and, in parallel, record and abstract the knowledge for future use by UCSD Extension.
CSUS Outreach to Girls and Minorities for Excellency in Engineering and Computer Science

Professor Jose J. Granda
Department of Mechanical Engineering
California State University, Sacramento (CSUS)
Email: grandajj@ecs.csus.edu
Phone: (916) 278-5711

The time is right to outreach to the middle schools, high schools and community colleges to motivate students to attend the California State University, Sacramento. This proposal is intended to reach out to students at Modesto Junior College and two high schools that serve girls and Hispanic students. This year, CSUS has begun a partnership with Modesto Junior College with the objective to join talents and develop a systems engineering team to design and build a Lunar Excavator. This machine is part of a national competition sponsored by NASA ESMD directorate and is known as LUNABOTICS competition. What is proposed herein is to support students enrolled in the junior college and the two high schools with the objective to feed the pipeline of women and minority students to CSUS. The proposal offers that opportunity by supporting a robotics club at one of the high schools and as well as scholarships to women and minority students to continue their studies at CSUS. Integrating the Modesto Junior College students into the CSUS Lunabotics team and supporting them has the same objective to motivate them to continue their studies in Mechanical Engineering, Electrical Engineering, and Computer Science.

OBJECTIVES

This proposal is intended to fulfill several of the STEM Pipeline Outreach Program objectives.

It will:

- Address the critical need to train skilled engineers and computer scientists with an orientation towards aerospace related careers.
- Support for the LUNABOTICS project will promote interdisciplinary team work between the Modesto and CSUS teams in Mechanical, Electrical, Civil engineering and Computer Science students.
- Promote a solid partnership between CSUS and a minority serving institution like Modesto Junior College. The ECS Dean has expressed his intention to create an open door policy to the Modesto students- to welcome them and admit them into ECS specialties. Impacted directly is the participation of women and minority students by allowing CSUS to offer scholarships specifically directed toward students to study careers in ECS.
The UCLA STEM Pipeline Program consists of a three-pronged approach to attracting students into aerospace engineering and space science. First, it provides support of open house activities at UCLA meant to attract both those outside the University and uncommitted University students to consider careers in Science. This will be led by Joe Wise of New Roads School in Santa Monica and Gary Glesener of the Graduate School of Education at UCLA. The second prong is the development of general education courses in space science and engineering that introduce non-majors to the discipline. This effort will be spearheaded by Prof.-in-Residence R. J. Walker of the Earth and Space Sciences Department. Finally, we establish a cubesat working group that helps students solve real-world space engineering problems. This project is led by Prof. Angelopoulos with the help of UCLA engineer Ryan Caron.
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Art and Visualization Program
Enrico Ramirez-Ruiz
Astronomy and Astrophysics Department
University of California, Santa Cruz (UCSC)
Email: enrico@ucolick.org
Phone: (831) 459-3400

Visual data analysis is central to the scientific knowledge discovery process. To meet the challenges of visualization for future data sets, UCSC intends to play a leading role in bringing sophisticated visualization tools to the science community. UCSC’s space scientists will provide cutting-edge, scientific simulations which will serve as raw material for research collaborations between digital-art students and computational science students.

The proposed program will also conduct an aggressive knowledge transfer program, providing the broader public with the opportunity to do and see space sciences. The visual appeal of astrophysics simulations will be used as a tool to engage students in research, develop high school curriculum materials, connect communities as disparate as space sciences and the visual arts, and disseminate the scientific messages of the via partnerships with three distinguished high schools, Planetaria, the NASA Ames Hyperwall, GalaxyZoo, and Google Sky.

Partner arts programs include UCSC’s MFA in Digital Arts and New Media and UCSC’s top-ranked program in Science Communications. This basic design advances diversity by linking two very different communities, applied computational science, and digital arts. Including the latter field, better balanced with regard to gender and ethnicity, will immediately create a more diverse and vibrant student body. Engaging students in exciting projects that link these two communities will further strengthen these bonds.