HARTNELL COLLEGE

Engineering Program Upgrade with Project Management

An application to the NASA Curriculum Improvement Partnership Award II (CIPA II) Program

Enhancing the curricula • Training faculty • Improving underrepresented student success

PROJECT NARRATIVE

BACKGROUND AND NEED

About Hartnell College. Hartnell College is an accredited California Community College and Hispanic Serving Institution located in Salinas, Monterey County, California, 120 miles south of San Francisco. Founded in 1920, Hartnell is the only public institution of higher education exclusively serving the Salinas Valley, a vast 1,000+ square mile agricultural region. The College's 10,000+ students (Fall, 2005), are 68% minority and 53% female. Latinos comprise 54% of the total enrollment (Hartnell College Office of Institutional Research and Planning, 2003). More than 41% of the College's students are non-native English speakers and 82% are first-generation college students (*ibid.*). Nearly 60% of all Hartnell students receive some form of financial aid (Financial Aid Office, 2003). The district Hartnell serves is characterized by large numbers of migrant workers and their families, chronically high unemployment, high rates of poverty, and low educational attainment (U.S. Census data, 2000; State of California Labor Market Information , 2004, 2005). Hartnell is the only affordable and accessible postsecondary access point for underrepresented students in the region.

Hartnell College offers a wide array of academic, vocational, and technical programs, including 64 two-year associate of science and associate of arts degree programs, and 52 certificate programs. The College is geared toward serving five broad functions: transfer and general education; occupational education; developmental education; workforce and community development; and student and career development support (student services).

Commitment to STEM. Hartnell College has made a major commitment to expanding and improving its science, technology, engineering, and mathematics (STEM) programs. Over the last seven years, in partnership with federal, state, and private organizations (including a CIPA I grant from NASA), the College has: overhauled and updated selected STEM curricula; acquired new equipment; hired new faculty; and rehabilitated existing science facilities, classrooms and laboratories. In addition, thanks to local voters who passed a bond measure in 2002, Hartnell will soon be remodeling its science and technology building on the main campus. With the physical infrastructure nearly in-place, the College is aggressively working to fill STEM programs and classes. Enrolling, retaining, and transferring increased numbers of underrepresented students, particularly Latinos, in engineering majors is one of the College's long-term goals for STEM programs (Educational and Facilities Master Plan 1999-2010). Hartnell and its university and NASA partners are working toward meeting these goals through proposals like the one presented here.

Documenting progress and success to-date. As referenced above, during the last seven years, Hartnell has made a major commitment to upgrading and expanding its STEM programs;

increasing underrepresented student enrollments in those programs; and improving underrepresented student retention, persistence, graduation and transfer in those majors. With the help of grants and partnerships with organizations like NASA, NASA-AMES Research Center, the U.S. Department of Education, the National Science Foundation, Hewlett Packard, and NOAA, among others, the College is making significant progress in achieving these critical goals. Only a few years ago, Latino students comprised between only 26-41% of the students in higher-level math, physics, and engineering courses. More troubling than that, only 13% of Latino students were achieving success (grade "C" or better) in the engineering sequence, specifically (Hartnell College Office of Institutional Research, 2000). However, as a result of the institutional efforts described above, this situation is showing signs of considerable improvement. The charts below track enrollment in the engineering sequence over the last three years (per the requirement in the RFP). In addition, enrollment by ethnicity, and the percentage of student success are also shown.

Spring-Fall, 2003				
Course	Enrollment	% Success	% Latino	% Female
Engineering 1; Introduction	29	69%	56% *Entire sequence*	11% *Entire sequence*
Engineering 2; Graphics	19	84%		
Engineering 4; Materials	14	93%		
Engineering 8; Statics	17	88%		
Engineering 6; Cir. Analysis	17	94%		
Spring-Fall, 2004				
Engineering 1; Introduction	24	96%	60% *Entire sequence*	14% *Entire sequence*
Engineering 2; Graphics	14	86%		
Engineering 4; Materials	10	90%		
Engineering 8; Statics	16	100%		
Engineering 6; Cir. Analysis	17	94%		
Spring-Fall, 2005				
Engineering 1; Introduction	30	97%	61% *Entire sequence*	17% *Entire sequence*
Engineering 2; Graphics	42	95%		
Engineering 4; Materials	14	100%		
Engineering 8; Statics	21	100%		
Engineering 6; Cir. Analysis	8	100%		

Key: Engineering 1, Introduction to Engineering ; Engineering 2, Engineering Graphics ; Engineering 4, Materials Science; Engineering 8, Engineering Statics; Engineering 6, Introduction to Circuit Analysis .

Summary of progress . Since 2003, overall enrollment across the engineering sequence of courses has increased 20%. Latino enrollment has increased nearly 10% and female enrollment over 50%. In addition, the number of students achieving success across the entire engineering

sequence has increased from a commendable 83% to a nearly perfect 97%. In fact, so far in 2005, only three students have failed to achieve a final grade on C or better in these engineering courses. The College attributes the increases in enrollment and success in its engineering courses to improved academic support and teaching methods, and more extensive student support services.

Need to further improve the engineering program and curriculum. NASA has documented the need to infuse STEM curricula with principles of project management in order to improve the relevant skill sets of graduates at both the technician and professional levels. A needs assessment of Hartnell's engineering curricula confirm what NASA has reported for the nation overall – there is a lack of project management components, principals, and practical applications in the engineering academic and laboratory coursework. In addition, students do not have opportunities to apply such principles in ways that will develop the skills NASA needs to advance the nation's vital goals and objectives. In addition, while Hartnell is making great strides in improving the engineering infrastructure as well as underrepresented student enrollment and success, the overall enrollment figures are still too low. A total of 115 students enrolled in engineering courses campus-wide is too low for a college of this size and underutilizes the facilities that are and will be in-place to support these programs.

Given Hartnell's success at increasing underrepresented enrollment and success in engineering courses, the College believes it is ideally positioned to support a successful CIPA II grant that will go a long way toward fulfilling both Hartnell's and NASA's goals and objectives.

1. PROJECT IMPACT

1.1 Curriculum improvement(s) being proposed. The ***Hartnell College Engineering Program Upgrade with Project Management*** project will focus on curriculum improvements in the engineering program. These improvements will include: revising the current course Engineering 1, Introduction to Engineering by upgrading it from a general engineering survey course to an introductory major course infused with an overview of the principles of project management. In addition, this project will create three new engineering major courses : Engineering 45, Special Projects; and a two-part series, Engineering 7A and 7B, Program and Project Management in Engineering. Specifically, the project will result in:

- Updating the College's current introduction to engineering lecture course curriculum;
- Developing curriculum for three advanced engineering courses (lecture and lab);
- Acquiring a limited amount of engineering laboratory equipment to support the new lab sections and special projects course;
- Articulating the engineering program with the University of California, Santa Cruz, Baskin School off Engineering;
- Training all appropriate faculty in the principles and applications of project management; and
- Overall, improving the quality and content of the engineering program at Hartnell College.

The project's **overall goals** for this project include short and long-term goals. Short-term: upgrade and expand engineering offerings so that they meet NASA's needs for engineering

professionals; articulate with a four-year engineering degree; support faculty development; and correspond with upgrades and improvements in the College's other science, and math courses and programs to improve minority student enrollment, persistence, retention and transfer. Long-term: build the engineering program toward creating, for our underrepresented students, a seamless articulation pathway into UCSC's School of Engineering.

The project's **specific objectives** are discussed below:

Objective 1: To revise and update the curriculum for the Introduction to Engineering course by revising and upgrading the curriculum to include project management principles thus making the course a more appropriate engineering degree gateway course. Revision will include upgrading the content and integrating the course with multimedia materials provided through NASA.

Objective 2: To develop and implement curricula for two advanced, new engineering courses – *Engineering 45 –Special Projects in Engineering* and *Engineering 7A/7B – Program and Project Management in Engineering.*

Objective 3: To develop and implement new laboratory curricula to complement the revised and new engineering courses; content will include specific modules infused with NASA project management material centered around specific projects and exercises and meeting required skill standards.

Objective 4: To ensure that the new, revised, and existing engineering coursework articulates 100% with engineering degree requirements at the University of California, Santa Cruz.

Objective 5: To develop and deliver faculty development in the principles of project management so that 100% of participating faculty are qualified to deliver instruction in the new and revised courses.

Expected **long-term, quantitative, and qualitative outcomes** to be derived from the project include:

- *Long-term outcomes* – an improved and strengthened engineering program; articulation with university engineering programs; providing students with much needed project management skills; providing students with a pathway for success in engineering majors at four year institutions; preparing students for success in engineering careers; increasing both the engineering program and school-wide enrollment; maintaining relationships with outside institutions to provide students with transfer, internship, and career opportunities; and maintaining a strong relationship with the NASA organization and institutions.
- *Quantitative outcomes* – the project will result in a projected 20% increase in enrollment in engineering courses; a 25% increase in minority student enrollment (when linked to Hartnell outreach and recruiting programs); the creation of two new engineering courses, one revised course, and at least one new laboratory course; new lab equipment. These will be measured through project evaluation and standard College data collection and analysis processes.
- *Qualitative outcomes* – the project will result in improved student satisfaction with the quality and quantity of choices in engineering courses, major options, and educational value; improved faculty satisfaction with the breadth and quality of program offerings and

equipment to support those offerings. These will be measured through self-assessment surveys and other standard feedback collection methods.

1.2 The partnership arrangements being proposed. Hartnell College is working closely with the University of California, Santa Cruz (UCSC) Baskin School of Engineering and its affiliated research center at NASA-Ames. In addition connections have been established with the Center for Adaptive Optics (CfAO) at UCSC and the Naval Post Graduate School (NPS) in developing and implementing this project. This arrangement will include: cooperating on the development of curriculum for both the lecture and laboratory courses; ensuring that all courses meet University of California articulation requirements; cooperating on minority student recruitment and support in science, engineering and math programs (using both institutions' MESA programs as links and models); and ensuring updated transfer agreements are in place. Please see the enclosed letters of commitment.

1.3 The relevance of the proposed curriculum improvements to NASA. The proposed curriculum improvements directly support the needs and requirements for a CIPA II project, as detailed in the RFA and supporting documents. Hartnell's proposal, when implemented, will: infuse engineering curricula with project management content; support the development of project management skills in engineering students; provide valuable learn-by-doing opportunities as part of the new coursework; articulate with a four-year university engineering program; provide faculty with training and professional development opportunities. In addition, NASA materials and content related to the agency's ***projects and strategic enterprises*** will be incorporated into the revised introductory engineering course, the two new advanced courses, and most significantly, into, new hands-on exercises. These are all in line with NASA's stated goals and objectives.

1.4 How the proposed project will improve the college's offerings. This project will fill a critical gap in the College's engineering program offerings by making it more relevant to current industry needs (i.e. NASA). The project will result in a closer relationship between Hartnell and the UCSC Baskin School of Engineering thus improving the transfer pathway for Hartnell's students. It will create curriculum and learning experiences for students that do not currently exist in the College's engineering courses.

Strategically, this project is another key piece in the College's effort to upgrade all its science, engineering, and mathematics programs, which suffered years of neglect from the 1970's through the mid 1990's. As has been referenced, the new engineering curricula is a critical component of a comprehensive overhaul of the College's science, engineering, and math programs. This includes linking this project to efforts already underway through Hartnell College's Title V grant, its MESA program, National Science Foundation STEM scholarship program, a Department of Defense instrumentation grant, and efforts funded through the College's regular budgetary process, among others.

1.5 Project will increase quantity and quality of offerings. This project will increase the **quantity** of engineering course offerings by creating three new engineering courses using project management content (Engineering 45 and Engineering 7A/7B). To ensure the highest possible **quality** of the revised and new engineering courses, Hartnell College has worked with several well respected engineers and educators in developing this project. In addition to the co-principal investigators, Hartnell has worked with: Dr. Michael Isaacson, at UCSC, science director of the

University Affiliated Research Center at NASA-Ames; Dr. Christopher Brophy from the Naval Postgraduate School; faculty at the UCSC Baskin School of Engineering; and research scientists and engineers at the CfAO, a long-time Hartnell partner on STEM-related education.

1.6 Importance of the curriculum to long range student academic success. One of Hartnell College's major challenges is to improve the enrollment, retention, persistence, graduation and transfer rates of its Latino students, as has been discussed. This is of particular concern in STEM majors where Latino student enrollment and success have generally been below that of the rest of the student body (a trend that is changing, per documentation offered earlier). Hartnell's experiences parallels data collected by the National Science Foundation regarding women and minority students in STEM majors (NSF, Women and Minorities in Science, 2004). ***Improving and expanding course offerings in engineering is an essential step in the long range, college-wide effort to improve and modernize its science, math, and engineering programs to better serve the College's largely underrepresented student body.*** This overarching goal, and the steps to achieve it, was initially outlined in the College's Educational and Facilities Master Plan 1999-2010 (1999, Updated, 2004).

However, in Hartnell's experience, curriculum and facility improvements alone are not sufficient to increase Latino student enrollment and success in engineering and other science and math programs. This effort will be linked to Hartnell's extensive outreach and support programs in the area's K-12 schools. In that regard, the Dean of Science and Math has worked closely with Hartnell's Office of Outreach and Student Recruitment to ensure that outreach staff and counselors are fully acquainted with opportunities for students in science, math, and engineering careers. When the new and revised engineering courses are developed, Hartnell will ensure that counselors and outreach staff are briefed on the new offerings, are provided brochures and program materials, and that materials and demonstrations are placed in the College's new science outreach van (funded through the Title V grant).

1.7 Project will improve transferability. The curriculum developed through this project will be designed in close consultation with the College's partner, U.C. Santa Cruz. The new engineering courses will articulate with both the University of California and California State University systems. The new/revised engineering courses will support Bachelor of Science degree programs in engineering and other closely related STEM majors.

2. METHODOLOGY

2.1 <u>Methods to carry out the program</u>. The Hartnell College Engineering Program Upgrade with Project Management will use eleven primary methods to achieve the goals and objectives discussed earlier. These ten methods are briefly described below:

- <u>Curriculum revision</u> – revise the introduction to engineering course by infusing it with the principles of project management. Revisions will be accomplished by the co-principal investigators, project consultants, Hartnell faculty, in consultation with UCSC, NASA-Ames, NPS, and the CfAO.
- <u>Curriculum development</u> – develop curricula for three new advanced engineering courses and hands-on laboratory work and field exercises. Secure approval for all new courses.

Curriculum development will be accomplished by the co-principal investigators, project consultants, Hartnell faculty, in consultation with UCSC, NASA-Ames CfAO, and NPS.

- Practical experience – design practical experiences and field exercises to support new coursework via hands-on projects developed in consultation with NASA-Ames, NPS, and Tripoli Rocketry Association (all project partners).
- Equipment acquisition – acquire the limited equipment needed to support engineering laboratory activities and special projects as a result of the new courses developed.
- Professional development – train faculty and staff in the use and applications of project management principles, and technology and equipment in the engineering laboratory.
- Partnerships – secure partner support from UCSC and its affiliated research center at NASA-Ames (see attached letter). Partners will provide guidance on curriculum development, laboratory configuration and equipment, and professional development. UCSC will also support enhanced articulation and transfer agreements with Hartnell.
- Leveraging resources/linking programs – connect the newly expanded engineering program to the College's academic support, outreach and recruiting programs by providing hard copy materials and electronic links for staff and counselors. Develop and provide engineering demonstration materials for use in the Hartnell science outreach van.
- Project evaluation – collect and assess formative evaluation data throughout the project and perform a summative evaluation at the conclusion of the three year grant-funded period (see evaluation plan).
- Tracking – students from enrollment through to graduation and/or transfer.
- Dissemination – develop and implement a dissemination plan (see 2.7 below).

2.2 Courses to be revised, expanded, and improved, including the means by which NASA content will be incorporated into the curriculum. As discussed, this project will revise/update the introductory engineering course and create three new advanced engineering courses with lab and field activities. A description of all these courses, as they are envisioned, are detailed below:

Engineering 1 – Introduction to Engineering. Currently this course explores different areas of engineering and the realities of a career in engineering. Proposed revisions and upgrades will provide engineering students with an introduction to program and project management . This will include: Project life-cycle phases; Individual and team roles; Work breakdown structure; Planning and scheduling; Reviews and success criteria; Risk management; Project safety; Earned value and performance indicators; Configuration management

Engineering 45 –Special Projects in Engineering. This will be a special project course in which students work on individual projects and are mentored by a faculty member. The goals for Engineering 45 are to:

- Allow engineering students to develop project management skills;
- Give students experience in working on technical project teams;
- Provide students with hands-on experience in the design, fabrication, and operation of a space project;
- Expose students to career options related to the project;
- Give students experience in networking and collaborating with professionals from outside institutions;
- Enter the student designs in the ARLISS CanSat competition (Black Rock Desert, NV).

Engineering 45 will be a three unit special projects course initially offered in the spring and continued in the summer semester. Students in this course will learn both project management skills and topics in rocketry design. They will have the opportunity to learn to work together as a team as well as collaborate with professionals from outside institutions. During this course, students will organize themselves into a team to design CanSat devices and the rocket to launch the CanSats. CanSats are small, self-contained devices that are launched to high altitudes, deployed by parachutes, and mimic the functions of satellites orbiting Earth.

This course will be taught by Hartnell engineering faculty with additional support from Dr. Christopher Brophy from the Naval Postgraduate School, members of the Tripoli Rocketry Assn. (Central California Branch in Fresno), and experts from Baskin/NASA-Ames. There will be two phases to the course. During the first phase, which will occur in spring 2007, students will work as a team to write-up a detailed proposal to design the CanSat payload and launch vehicle. Their proposal will include: an introduction to the basics behind rocketry; a justification for the usefulness of their project to NASA and to the aerospace industry; design of the payload and high-powered rocket; assignment of roles; an equipment list; a budget; plan of action; and a timeline. During this phase, the students will be given instruction on the basics of high-powered amateur rocketry and learn key concepts in project management with the emphasis on the methods used in engineering. Project management topics covered in the course will include:

• Project selection, acquisition, and development • Developing/following a detailed work plan

• Developing and managing a project schedule and budget • Controlling projects for quality

• Communicating effectively with the project team, client and supervisors • Team building

• Anticipating and avoiding potential problems • Developing networking skills • Proposal writing

Engineering topics that will be covered in the course will include:

• Design and structure of rockets used by NASA • Flight mechanics • Chemistry of fuels

• Nozzle Design • Stress/strain • Aerodynamics/stability control • Heat transfer • Fin Design

• Stress analysis • Flight data acquisition • Data telemetry • Physics of propulsion

The second phase will occur during summer, 2007. During this phase, students will work on building, operating, and testing their CanSats and rocket. They will also build a portable ground station and antenna to communicate with the CanSat vehicle during descent and apply for their HAM radio licenses. A special projects lab will provide students with access to computers, modeling simulation software such as SPLASH, RockSim, CAD, and equipment and instruments for the fabrication of the rocket. In addition to working with engineering faculty at Hartnell, students will have the opportunity to work closely with Dr. Christopher Brophy from the Naval Postgraduate School, members from the Tripoli Rocketry Association, and scientists at Baskin/NASA-Ames to construct a working model of the CanSat payload and rocket. During the summer, they will make regular trips to the Naval Postgraduate School and Baskin/NASA-Ames to work with professionals on the design and fabrication of their rockets and Tripoli Central California Branch at Fresno to test and launch their rockets. After successful testing of

their CanSat device and launch vehicle, students will enter their design in the ARLISS CanSat competition which is held yearly at the end of summer in the Black Rock Desert in Nevada. The students will also participate in the October Skies Launch event in Fresno, CA.

Engineering 7A – Program and Project Management in Engineering. This course will be the first of a two semester course giving students practical experience in Program and Project Management. Engineering 7A will be designed to enable a student, acting in concert with other students, to set-up a project plan and management information system for an engineering project. In the laboratory component, students will meet in small groups to develop a complete project management plan for a new product. This plan will involve all aspects of project management presented in the lecture component of the course. Topics covered in lecture will include, but are not limited to:

- Systems methodologies
- Project life cycle
- Project planning and structure
- Project scheduling
- Project budget
- Resource management
- Risk management
- Project control
- Management issues

Engineering 7B –Program and Project Management in Engineering. This course will be the follow-up to 7A. This semester's work will be focused on project plan execution and close out. Working in groups, students will use the tools of project management as they proceed to manufacture a new product. Students will utilize project planning guides and tools such as Microsoft Project. Each team will be responsible for reporting out on progress and challenges biweekly.

- Project scheduling
- Project budget
- Resource management
- Risk management
- Project control
- Management issues

Engineering 7A and 7B will be a blended learning course that will incorporate lecture, lab activities, case studies, discussions and critical thinking activities. The faculty assigned to development of the courses will ensure incorporation of NASA content by examining the course offerings set forth by "the NASA Academy of Program and Project Leadership". Their current course offerings include:

- Foundations of Project Management
- Systems Management
- Project Management level 1 and 2
- Program Management level 3 and 4

The learning techniques identified include lectures, computer simulations, and a variety of other instruments. Central to the process of learning is a long list of case studies built on real world experiences of NASA managers and engineers. For example; TIMED case study, EOSDIS case study, VCL case study, High Speed Research case study and others. In addition, Dr. Michael Isaacson, at UCSC and NASA-Ames, will further support instructional delivery of these important courses.

Teaching methods to be used. Across the board, revised and new courses will benefit from an interactive teaching and learning format. For both classroom and laboratory segments,

there will be a passive component as students view instructor-led demonstrations using electronic media and other methods. Students will have many opportunities to engage in instructor directed hands-on exercises (learn by doing) as well as individual projects using technology. The revised course, in addition to new courses planned, will have individual web sites to provide instructional support for students both in and out of the classroom. Faculty in the revised/new engineering courses will work to deliver instruction to achieve greater retention and success for underrepresented students, based on methodologies in-place today that are resulting in high success rates in engineering. Final teaching methodologies for these courses will be refined based on the completed curricula and input from project partners.

2.3 Means for ensuring curriculum compatibility with four year institutions. As mentioned, Hartnell is working closely with its project partner, U.C. Santa Cruz, to ensure that all revised and new curricula developed through this project supports existing articulation and transfer agreements. As needed, new agreements will be concluded. The College will also work with CSU-Monterey Bay to ensure that the engineering curricula articulates with California State University programs as well.

The curriculum will also support achievement of the project's goals and outcomes by integrating content which will improve student's skills, increase transfer options, and support long-term employability. Infusing project management into the curriculum will be done using the APPL curriculum format and instructional techniques. The subject matter will make students more versatile and more attractive to four-year institutions and employers such as NASA.

In addition, as discussed earlier, Hartnell has been increasing underrepresented enrollments and student success in engineering courses. Having additional courses in an area of high demand (such as program and project management) will attract additional students and, with NASA content and links, will make more students aware of opportunities at NASA. Special Projects in Engineering as well as the special course in engineering project management will hone skills in students for leadership and problem solving.

2.4 Qualifications, capabilities, and experience of co-principal investigators and key personnel. Dr. Pimol Moth will serve as one of two co-principal investigators for this project. Dr. Moth was hired as the Physics/Astronomy instructor at Hartnell College in August 2004 as part of the CIPA I grant to expand the Astronomy curriculum. Because of this experience, she is highly qualified to help lead the curriculum development and revisions proposed here as well as highly able to meet all CIPA requirements. She obtained her Bachelor of Arts degree in Astrophysics at the University of California at Berkeley in 1997 and her Ph.D. in Astronomy at the University of Florida in 2003. During her first year at Hartnell she expanded the Astronomy curricula by developing a new astronomy special projects course (AST 45) targeting predominantly STEM students of exceptional promise who would like to apply their skills and knowledge in advanced topics in astronomy and astrophysics. She has also revised and created new laboratory exercises to the existing Astronomy 1 Laboratory course. During the spring and summer of 2005, she has worked closely with Dr. Anne Metevier from UC Santa Cruz, Center for Adaptive Optics and several graduate students and post-docs to help design research projects for Hartnell's Astronomy Short Course. She later participated in the short course as a co-

instructor and led a field trip to Lick Observatory. Her recent and intense professional experience at Hartnell distinguish her as uniquely qualified to lead this CIPA II project.

Mr. Mohammad Hussain , MS in Math and Electrical Engineering, will serve as the other co-principal investigator. Before coming to Hartnell to teach mathematics, Mr Hussain worked in telecommunications. Mr. Hussain is experienced in instructional development and delivery to underrepresented students. He is also experienced in teaching methods that support the success of underrepresented and female students in nontraditional subject areas, like higher level mathematics.

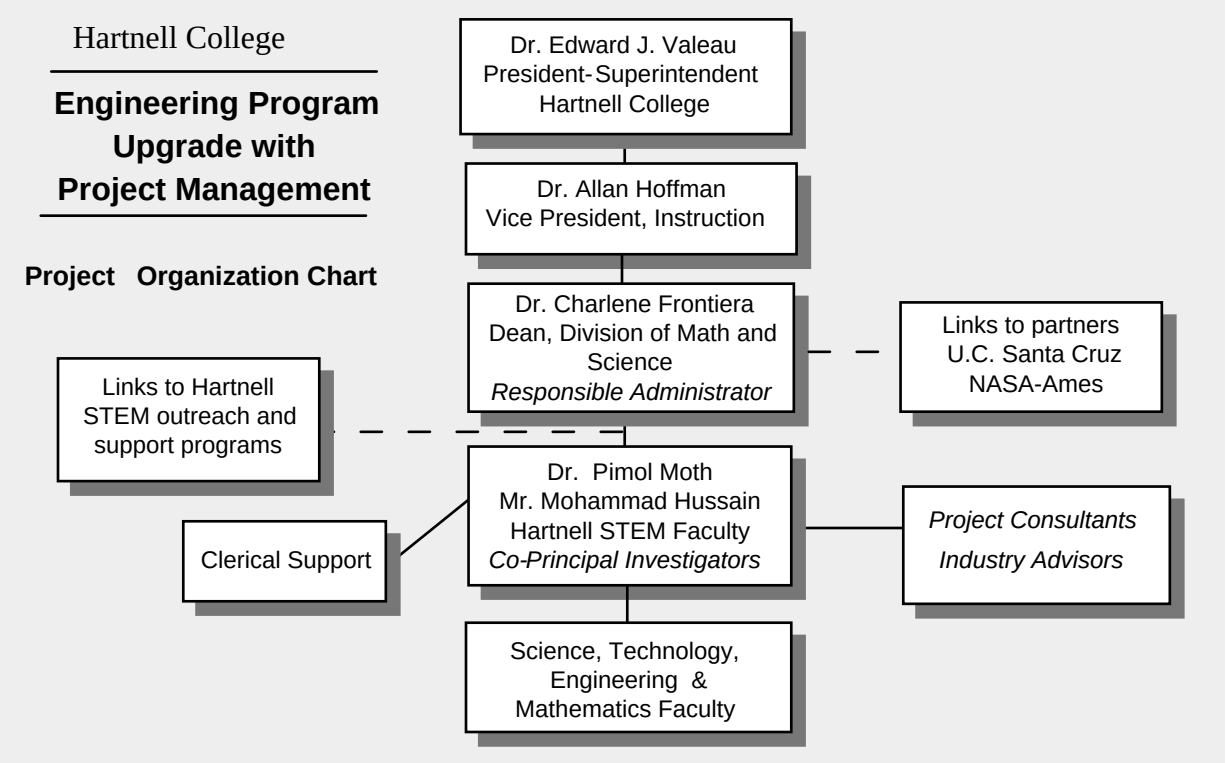
Other support personnel will include Mr. Joe Welch, Hartnell computer science instructor, and Mr. Jim Riley, Hartnell mathematics instructor, who both have worked in industry, including project management, before coming to Hartnell. Mr. Andy Newton, Hartnell Planetarium Director, functions as the partnership liaison with UCSC Educational Partnership Center, the CfAO and the Baskin School of Engineering. In addition Mr. Tito Polo, physics and engineering lab technician, will provide technical laboratory support for the project. Dr. Jesse Cude will also support and advise the project and has taught physics at Hartnell for 30 years. Dr. Cude is a highly experienced principal investigator having led the very successful CIPA I project at Hartnell.

In total, the combination of faculty identified represent people with outstanding teaching skills as well as real world experience in project management. Curricula Vitae for all key personnel are attached, as required.

2.5 Project organization and management. As referenced above, the project's **co-principal investigator** will be Hartnell College STEM faculty members, Dr. Pimol Moth and Mr. Mohammad Hussain. They will be responsible for coordinating project staff, working with partners, supervising the collection of additional data, developing and implementing the new classroom and laboratory curricula, supervising the acquisition of new equipment, and developing and implementing professional development for faculty. They will report to Dr. Charlene Frontiera, Dean of Science and Mathematics. Dr. Frontiera will serve as the project's **responsible administrator**. She will oversee the project's budget, serve on the advisory board, provide links and support to the College's other academic departments, academic support programs, student services programs, and support project evaluation and dissemination activities.

A project **advisory board** will be established and will include the principal investigators, dean, selected Hartnell faculty, project consultants, and representatives from the project's partners, UCSC, NASA-Ames, NPS, CfAO and Tripoli Rocketry Association. Project evaluation will be conducted by an **evaluation team** comprised of the principal investigators, dean, selected Hartnell faculty, project consultants, and representatives from the project's partners. They will meet to review formative project data and make project adjustments as needed and in consultation with NASA CIPA program staff. A summative evaluation report will be prepared with the guidance of an outside professional evaluator.

The chart below outlines the project's organization:



2.6 Existing facilities improvements. None requested. Lectures and labs will be assigned to our 'smartest' laboratory in Merrill Science Hall, M8. M8 was designed to support circuits lab and additional equipment, hardware and software will be added to specifically support the aims of this project. Beyond this, the project will be supported by Hartnell's growing STEM facilities, including classrooms, laboratories, and computer labs.

2.7 Project evaluation and dissemination processes. Hartnell College will implement regular, planned evaluation activities, using formative and summative processes, as discussed below. Specific activities (to be determined following consultation with NASA and an outside evaluator) may include: work statement of objectives/activities completed; identification of problems incurred; identification of effective methods used; review of all program curricular materials; assessment of performance, complete description of services provided; review of participant performance data; review of participant assessment/evaluation forms; review of faculty/instructor feedback; identification of successful project outcomes; development of recommendations, implementation and adjustments; submission of a final report, as required; financial reports and statements, as required; identification of program results for dissemination.

The **formative evaluation process** will provide a regular source of program feedback and performance information. The formative evaluation will assist in guiding on-going decision-making by the principal investigator, advisory board, dean, faculty, and others in implementing the project. The formative process will use qualitative and quantitative instruments and activities to gather data and track project progress.

The **summative evaluation process** will measure overall program effectiveness against stated goals and objectives and will make an overall assessment of project success. Through this process sufficient evaluative and assessment information will be gathered so as to determine the future of the program and recommendations of needed changes. A summative report will be written by a professional outside evaluator. The summative process will use qualitative and quantitative instruments and activities to assess progress in implementing the project and achieving stated goals and objectives.

Hartnell College will employ a multi-level strategy in the **dissemination** of the results and products generated by this project. The College will disseminate detailed information to the other 106 California Community Colleges, libraries, as well as other public and private organizations (upon request). The College will distribute project information to national organizations, as requested. The College will make use of every opportunity to present results from this project at meetings, statewide seminars, and professional development conferences, as needed. Hartnell will welcome suggestions from NASA on project dissemination.

2.8 The project's use of the UNCFSP's ICTC. The UNCFSP's Integrated Communications Technology Center (ICTC) will be used to facilitate cross-campus collaboration and distance learning components. Hartnell envisions working through ICTC to expand links with other campuses to: collect and review additional best practices information during the project's planning phase; refine curriculum development; enhance instructional delivery; expand the network of resources available for students; link with Hartnell's technology infrastructure, including smart classrooms and laboratories; modify implementation plans based on input from other participating institutions; deliver more comprehensive faculty training in project management concepts and principles; support the dissemination of product results and products.

3. COST-EFFECTIVENESS

3.1 Project timeline and responsible persons. The project's major activities, approximate timeline and responsible persons are listed below. Timeline dates are based on a February, 2006 start date. The timeline for the listed activities are based on a successful model for grant-funded projects used repeatedly by Hartnell, and most recently for its CIPA I grant. Major activities are listed first, then responsible person(s), and last the date or date range for activity completion:

- Hire/appoint principal investigator and consultants. Dean of Math and Science, Vice-President of Instruction. COMPLETED.
- Begin curriculum development (course revision, new lecture and lab courses). Co-PI, faculty, consultants, partners. In Progress, Fall 2005.
- Collect data and information on best practices in engineering programs and project management; final needs assessment. PI, Dean, partners. In Progress, Fall 2005.
- Appoint Advisory Board. Co-PI, Dean. January 2006.
- Begin project implementation/planning phase. All participants. February, 2006.
- Convene regular meetings of the advisory committee. Co-PI. December, 2005 – Ongoing.
- Link project with STEM and campus-wide academic and student support services programs. Dean, project staff. February, 2006.

- Dispatch Co-PI, others (as needed) to NASA project management boot camp and training. Co-PI. February, April, 2006.
- Finalize curriculum for revised introductory engineering course. Co-PI, advisory board, faculty. May, 2006.
- Submit final, revised course outline for approval. Dean. May, 2006.
- First offering of revised introduction to engineering course. Faculty. August, 2006.
- Begin development of new engineering courses (ENGR 45, 7A, 7B). Co-PI, faculty, partners. April, 2006.
- Finalize special projects, laboratory exercises, and field activities. Co-PI, partners. May-July, 2006.
- Articulate advanced courses. Dean, articulation officer, partners. December 2006.
- Submit advanced course to curriculum committee. Dean. June, 2006.
- First offering of new advanced course, ENGR 45. Faculty. January, 2007.
- First offering of new advanced course, ENGR 7A. Faculty. August, 2007.
- First offering of new advanced course, ENGR 7B. Faculty. January, 2008.
- Submit reports, per NASA reporting requirements. Co-PI, Dean. As required.
- Conduct project evaluation. Co-PI, Dean, outside evaluator. Annually, January 2007 – December 2008.
- Track student enrollments, progress, retention, persistence, and outcomes. Co-PI, evaluation team. August, 2006 – December, 2008.
- Develop materials for dissemination. PI, support staff. September 2008, or as requested by NASA.

3.2 Budget resources, realism and reasonableness. Resources requested through this proposal include funds to support personnel and consultants for curriculum development; required travel; a small amount of dedicated equipment to support an engineering special project lab; instructional materials and supplies; student tracking and outside evaluation. Only funds that directly support project activities, and for which no other source is available, have been requested to support this project. Every effort has been made to leverage current Hartnell administrative and faculty personnel and facilities in developing and implementing the components of this project. In addition, the recent improvements across STEM programs (as discussed throughout the text) have created an infrastructure which will support each activity included in the engineering program upgrade and expansion. Hartnell College is extremely experienced, and has an outstanding record, in managing grant funds and achieving stated outcomes within budgeted limits. Please see budget forms and budget narrative for details.

3.3 Describe the resources requested to carry out the project and justify their realism and reasonableness. Hartnell College administrative, instructional, and business office personnel calculate all grant budget requests based on solid, recent experience. All budgetary requests are within current salary levels for academic personnel, and the costs of goods and services in the Salinas/Monterey County metropolitan area. As mentioned above, only funds that directly support project activities, and for which no other source is available, have been requested to support this project.

Hartnell's experience and success as a responsible steward of federal resources was recently documented in the College's CIPA I Reverse Site Visit Report 2004 (signed by UNCFSP President,

Aaron R. Andrews). In awarding Hartnell a perfect score, the report stated, under the Project Resources section, *"The proposal was able to leverage its NASA budget tremendously to exceed the original objectives. Clearly, the original proposal adequately reflected the needs of the project. Given the major project outcomes, the budget expenditure were very reasonable."* The report concluded, stating, *"Focused objectives and a dedicated group of professionals fully supported by the administration allowed NASA seed money to be leveraged synergistically to achieve an outstanding success."* It is this experience that served as the basis for the budget proposed herein.

3.4 Measures to reduce costs, leverage funds, and plan effectively. To **reduce costs** of this project, the College will use existing personnel as much as possible. This includes the co-principal investigators, STEM faculty, and support personnel. Funds will be **leveraged** through matching support provided by Hartnell College and through grants from other sources secured by the College, including Title V, MESA, and Department of Defense. In addition, as mentioned earlier, all the College's existing, new, and remodeled STEM facilities will be use to support this project's success. By **planning effectively**, the College will link the new engineering courses with on campus programs and services that will promote minority student enrollment, retention, graduation and transfer in science, math, and engineering majors. Linked programs include Outreach and Recruitment, Financial Aid, Counseling, Articulation, Academic Learning Center, and the Transfer Center. ***In short, Hartnell College will use the basics of effective project management to implement and manage this project.*** This, as much as any factor, will demonstrate the College's capacity to deliver student instruction in this same area of study.

SUMMARY/CONCLUSION

This project represents the next, logical, critical step in Hartnell's long-term plan to transform itself to a model institution for the education of underrepresented students in STEM majors. Hartnell's recent experience among the "top performing CIPA institutions" documents the College's ability and capacity to successfully serve NASA, UNCFSP, and the local community as a CIPA II grantee. To again quote the CIPA I Reverse Site Visit Report 2004 (cited above):

> Project objectives remained focused [and] dead center on target. In addition, initial objectives were substantially exceeded. The intended outcomes for the project were clear and measurable and were achieved and exceeded and well documented.