PROJECT DESCRIPTION

1. Introduction

College of the Canyons (COC), proposes to implement a National Science Foundation Advanced Technology Education project to train advanced manufacturing and processing technicians needed to meet current and future industry demand by aligning, expanding, and upgrading three advanced, automated technology programs: Manufacturing Technology, Electromechanical Systems Technology, and Welding Technology (automated robotic and laser). The programs will use a variety of training methods and delivery formats to meet the needs of traditional and non-traditional students, unemployed workers, and incumbent workers.

About College of the Canyons. College of the Canyons is a fully accredited California Community College and Hispanic Serving Institution located in northeastern Los Angeles County, serving almost 15,000 students in Fall 2011. It offers 76 certificate and 73 AA/AS Degree programs in a variety of vocational, technical and academic disciplines. COC’s programs articulate with programs at both University of California and California State University systems. Since 2000, COC has enjoyed striking increases in diversity with the College’s non-white population nearly tripling in number to 50 percent of the student body, and Latino students nearly quadrupling to 37 percent of the student body.1

About advanced automated manufacturing and processing. In a recent book by Tom Brokaw, Dr. Ed Hughes, President of Gateway Community and Technical College (Kentucky) is quoted saying, “Twenty-five years ago, eighty percent of the factory work was brawn, twenty percent brain. Today it is ten percent brawn and ninety percent brain.”2 This quote accurately captures the significant changes in U.S. manufacturing over the last three decades, with the nature of the work shifting from manual labor to work requiring science and technology skills. The National Council for Advanced Manufacturing (NACFAM) defines advanced manufacturing as an entity that: Makes extensive use of computers, high precision equipment, and information technologies integrated with a high performance work force in a production system capable of furnishing a heterogeneous mix of products in small or large volumes with both the efficiency of mass production and the flexibility of custom manufacturing in order to respond rapidly to customer demands.3 This NSF ATE will develop a pipeline of qualified workers with essential, advanced technology skills.

2. Results of Prior NSF Support

College of the Canyons has hosted a NSF ATE Center since 2002, the California Regional Consortium for Engineering Advances in Technological Education (CREATE, NSF Awards 0202396, 0602615, and 1002653). CREATE was originally established as an NSF ATE project in 1999. Over its life, CREATE has had a significant impact on the development, implementation, quality, and evaluation of technological education in this region of California as well as across the 17 states in which it has delivered services. The ATE Center’s final evaluation provided the following samples of significant outcomes and results, including metrics to demonstrate the impact of CREATE’s activities. These include:4

- Enrollment in CREATE programs exceeded baseline goals by 62 percent during year one of the program at all six original consortium colleges. Between 1999 and 2008, enrollment exceeded baseline goals by 27 percent overall. This long-term enrollment growth was achieved despite ongoing, annual budget cuts beginning in 2003.
- CREATE’s model 2+2 articulated Bachelor of Science degree in Information Technology, in partnership with Cal State University Channel Islands, achieved a retention rate of 91 percent.
- CREATE’s Pedagogical Teaching Facilitator Training Program for Technical Faculty expanded to seventeen states.
The CREATE models for technological program development, goal-setting, retention, faculty training, and evaluation were key in the design of the programs and activities proposed herein (please see attached letter of commitment).

3. **Motivating Rationale**

The motivating rationales for College of the Canyons’ NSF ATE proposal to support the *Advanced, Automated Manufacturing and Processing Technicians Program* project are based on a comprehensive needs assessment that included review of the following key factors: national and state training needs; emerging economic trends; new technologies and applications; skill gaps and shortages; opportunities for collaboration and levering of resources; the needs of students; and the needs of the community. Altogether, the needs assessment identified the following factors and trends that support implementation of the project targeting three advanced, automated technology programs: Manufacturing Technology, Electromechanical Systems Technology, and Welding (automated robotic and laser).

**Motivating rationale #1: The importance of manufacturing in Los Angeles and California.** Los Angeles County remains the manufacturing center of the United States, employing 389,300 people in 2010, even after losing thousands of jobs during the recent recession. The gross domestic product for Los Angeles’ manufacturing industry is $153 billion, representing 38 percent of California’s first-in-the-nation manufacturing economy. Most significantly, according to a study by the University of the Pacific, manufacturing jobs in California increased in 2011, *for the first time in a decade*, and are expected to continue growing in 2012-13. Growth in manufacturing jobs can have a powerful effect on California’s economic recovery by creating more new jobs in other sectors of the economy, including suppliers and services. In fact, one new manufacturing job can create 2.34 jobs in other sectors and generate $1.43 in economic activity for every dollar spent. Both of these cited multipliers are up to twice as large as those for other economic sectors (e.g. retail).

**Motivating rationale #2: Demand for advanced, automated manufacturing and processing technicians.** Following 12 straight years of declines, U.S. manufacturers added 109,000 workers to their payrolls in 2010 and another 237,000 in 2011. In total, between February, 2010 through July, 2012, the industry has seen employment increase by 528,000 jobs. However, this growth has not occurred without challenges. Employers reported that five percent (5%) of their jobs remained unfilled simply because they could not find workers with the right skills. This five percent vacancy rate means that an astounding 600,000 jobs were left unfilled during a period when national unemployment was above eight percent according to a study conducted by Deloitte on behalf of the Manufacturing Institute (2011). Almost 20,000 of those unfilled jobs were in Los Angeles County. And, the vacancy number does not tell the entire story as the Los Angeles metropolitan area ranks second nationwide in the number of H-1B visas issued for high skilled foreign workers (Ruiz, et al, 2012). Foreign workers in STEM occupations accounted for *more than half* of all visa requests.

In addition to the current shortage, projections indicate long-term growth for employees with advanced automated manufacturing and processing skills and competencies in Los Angeles County. Occupational projections through 2020 for jobs targeted by this NSF ATE are shown below:

<table>
<thead>
<tr>
<th>Occupation</th>
<th>LA</th>
<th>CA</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Engineering and Operations Technicians</td>
<td>+2.0%</td>
<td>+1.8%</td>
<td>-2.0%</td>
</tr>
<tr>
<td>Assemblers and Fabricators</td>
<td>+2.5%</td>
<td>+10.0%</td>
<td>+5.0%</td>
</tr>
<tr>
<td>Computer Controlled Machine Operators</td>
<td>+4.5%</td>
<td>+21.1%</td>
<td>+19.0%</td>
</tr>
<tr>
<td>Computer Numerically Controlled (CNC) Operators</td>
<td>+1.3%</td>
<td>+17.4%</td>
<td>+11.0%</td>
</tr>
<tr>
<td>Electrical and Electronic Technicians</td>
<td>+4.1%</td>
<td>+8.3%</td>
<td>+2.0%</td>
</tr>
<tr>
<td>Electro-Mechanical Technicians</td>
<td>+2.2%</td>
<td>+13.9%</td>
<td>+1.0%</td>
</tr>
</tbody>
</table>
In addition to job growth in Los Angeles County, data shows that occupations targeted by this project require more than 600 replacement workers annually. Within the past 30 in Los Angeles County alone, there were 154 jobs posted. This project can support the resurgence of the manufacturing sector regionally and statewide by filling critical vacancies, reducing the need for high skill foreign workers, and supporting overall industry growth.

Motivating rationale #3: Workforce quality: skill gaps. The demand for skilled workers will not be met without action. Findings from the Deloitte survey of manufacturers cited earlier, document serious gaps in the advanced automation skills of the workforce. The survey identified the following factors that pose significant obstacles and threats to the short- and long-term competitiveness and success of the manufacturing sectors of the L.A. and U.S. economies:

- The hardest jobs to fill (skilled jobs) are those that have the biggest impact on performance.
- Many manufacturers depend on outdated approaches for finding the right people, developing their employees’ skills, and improving their performance.
- The changing nature of manufacturing work is making it harder for talent to keep up.
- The skills gap is the biggest in skilled production jobs, and will likely widen as time passes.

Motivating rationale #4: Impact of the advanced manufacturing skills gap. According to findings in the Deloitte survey, 74 percent of manufacturers face workforce shortages and skills deficiencies in production positions such as machinists, craft workers and industrial technicians, keeping them from expanding operations or improving productivity. As cited earlier (National Council for Advanced Manufacturing, 2011), U.S. manufacturing jobs previously involved manual tasks such as basic assembly. But today's industrial workplace has evolved into a technology-driven, automated factory floor that requires highly skilled workers. Without a workforce with advanced skills, employers will not be able to: maintain production levels or quality; achieve productivity targets; develop new products and innovate; or implement new technology. This NSF ATE is critical to the long-term success of regional manufacturing.

Motivating rationale #5: The need to improve representation of underrepresented populations in advanced technology occupations. While Hispanics represent over 14 percent of the total U.S. workforce, they comprise only 6.3 percent of the STEM workforce (Pew, 2010). And, while women represent 47 percent of the total U.S. workforce, they make-up only 24 percent of the STEM workforce. This data is validated by STEM enrollment statistics at College of the Canyons (COC Institutional Research data for 2011-12). While Hispanics comprise 36 percent of the student body they only represent 28 percent of students enrolled in programs targeted by this ATE proposal. And, while women comprise 44 percent of the total student body, and 50 percent of overall STEM enrollments, they represent only 12 percent of enrollments in programs targeted by this ATE project. One reason for this underrepresentation locally, is that 73 percent of incoming students are not college-ready in basic mathematics, a key gateway for nearly all STEM programs. Any project that is designed to improve STEM enrollment, persistence, and success must include activities to improve the pipeline of potential STEM students so that they arrive on campus college-ready.

4. Goals and Objectives

The overarching goals of the project are to:

- Improve the STEM pipeline from high school through community college and to the university level, resulting in increased student access to, and success in, STEM majors;
- Integrate upgraded technologies in targeted curricula to foster a qualified advanced, automated manufacturing and processing workforce;
- Prepare a new generation of engineers and technicians to address the problem of advanced, automated manufacturing skill shortages and to meet future growth.

The project’s **measurable objectives** include:

**Objective 1: Partnerships.** To form a broad consortium comprised of at least 20 partners committed to advanced, automated manufacturing and processing education that includes community college, university, K-12, industry, and other public/private entities.

**Objective 2: Curriculum Development** (degrees/certificates). To upgrade and organize current courses and develop seven new courses to create four new Associate of Science degrees and certificates: a 26 unit Advanced Manufacturing Technology program; a 32 unit Electromechanical Systems program; a 19.5 unit Laser Welding program; a 19 unit Automated Welding program; and complete equipping of an Electromechanical Systems laboratory and a Welding Inspection laboratory. Online and hybrid options of courses will be developed as appropriate, to better serve the needs of the broader region.

**Objective 3: Curriculum Development** (alternative delivery). To rapidly respond to industry and worker needs, improvements in technology, and advances in practice by adapting selected program curricula into flexible, customizable Fast-Track programs and other customized training that meets 100 percent of employer skill standards or other certification requirements.

**Objective 4: K-12 Pipeline.** To support the K-12 pipeline and STEM improvement by delivering professional development, academic and enrichment activities to at least five regional high schools resulting in a five percent (5%) increase in STEM enrollments at COC by year three of the project.

**Objective 5: Outreach and Enrollment.** To implement outreach and recruitment activities to regional high schools, manufacturing employers, and unemployed workers resulting in the following enrollments once the project is fully implemented: 25 students/year in the Electromechanical Systems program; 15 students/year in Laser Welding; 15 students/year in Automated Welding; 15 students/year in Advanced Manufacturing Technology; 15 students/year in Fast Track training; and 30 per year in customized training.

**Objective 6: Student Support.** To use the NSF CREATE Center model to deliver student and academic support services to 100 percent (100%) of participating students resulting in an eighty percent (80%) retention rate.

**Objective 7: Internships/Work-based Learning.** To develop and implement an advanced, automated manufacturing and processing internship program resulting in awarding a minimum of 12 internships to qualified community college students/year, 85% of whom continue their postsecondary education at a university or secure full-time industry employment upon graduation or certificate completion.

5. **Deliverables**

Project deliverables will include:
- Articulated course sequences and course outlines for four advanced, automated manufacturing and processing pathways in manufacturing technology; electromechanical systems; laser welding; and automated robotic welding.
- Documentation of two upgraded laboratories for electromechanical systems and laser welding;
- Evidence of significant industry and partner support, including a list of committed partners;
- Student outcome data, including enrollment, retention, and completion/graduation data;
- Research data and results from student laboratory projects;
- A model for a STEM-based project consortium including high school, community college, public and private sector partners;
- High school outreach and enrichment program materials including outreach materials, curricula, and activities; student enrollment and success outcomes;
- Formative and summative evaluation data on student participation and program success;
- All required NSF reports documenting project achievements, activities, and expenditures.

6. Activities

Achievement of the project objectives for the Advanced, Automated Manufacturing and Processing project will include implementing the following activities and components. The listed activities will be supported by this grant as well as through matching and leveraged support from College of the Canyons, industry, other grants, and other project partners:

a. Industry partnerships – the project’s foundation is a core of manufacturing and other companies that require access to a local pool of qualified technicians needed to fill high skill jobs in the installation and maintenance of automated equipment. The partnering companies represent several of Southern California’s most important industries, including medical devices, theme parks, and aerospace. These companies have driven the development of this project through needs assessment data, recommendations on skill standards and competencies, and curriculum and equipment requirements. They will also provide work-based learning opportunities and jobs to program graduates. Industry partners will serve on the project’s advisory board and support expansion to include other companies. See Management section on page 11 for a list of industry partner advisory board members.

b. Curriculum development: AS degrees and certificates – the project will reorganize, upgrade, and develop new curriculum for 4 new Associate of Science degrees and certificates: a 26 unit Advanced Manufacturing Technology core program; a 32 unit Electromechanical Systems program; a 19 unit Welding Automation program; and a 19.5 unit Laser Welding program. The core programs alone will form stackable certificates of specialization. When combined with general education requirements, the programs will form Associate of Science degrees that will articulate with several four-year university programs. The proposed program course sequences and requirements are below:

b.1 The Advanced Manufacturing Technology AS Degree and Certificate program will provide a solid foundation for jobs as a Manufacturing Technician, Industrial Technician, or CNC Operator in industries utilizing automated manufacturing, digital manufacturing and computerized machining. This curriculum includes fundamental training in essential areas of advanced manufacturing including process planning operations, program writing, CNC mill and lathe operations, maintenance, CAD/CAM programs, and industrial safety and environmental protection. The Advanced Manufacturing program will combine theory with extensive hands-on training in laboratories featuring state-of-the-art equipment.

The course sequence will combine new courses with existing courses as noted below. New courses will be developed through this project. The existing courses will be updated and upgraded to meet current industry skills standards as determined by industry.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFGT 090</td>
<td>Measurements and Computation</td>
<td>3.0</td>
</tr>
<tr>
<td>MFGT NEW</td>
<td>Introduction to Automated Manufacturing</td>
<td>3.0</td>
</tr>
</tbody>
</table>
MFGT NEW  Engineering Drawing Interpretation  3.0
MFGT NEW  Automated Manufacturing Safety  2.0
MFGT NEW  Basics of Quality Systems  3.0
MFGT121  CNC Machining 1  3.0
MFGT 122  CNC Machining 2  3.0
MFGT NEW  Automated Manufacturing Equipment Maintenance  3.0
MFGT 131  Beginning CAD/CAM  3.0

Total Units Required  26.0

b.2 The Electromechanical Systems Technology AS Degree and Certificate program will provide a sound foundation for jobs as an Engineering Technician in most industries utilizing electromechanical controls and computerized electronics. This curriculum includes fundamental training in all areas of electronics including analog, digital and microprocessor circuitry as well as motor control circuits, fluid and pneumatic systems and programmable logic controllers. The Electromechanical Systems program combines theory with extensive hands-on training in laboratories featuring state-of-the-art equipment.

The basic outlines for all courses in this program already exist. They will all be updated to meet current industry skills standards as determined by industry.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESYST 101</td>
<td>Basic Electronics</td>
<td>4.0</td>
</tr>
<tr>
<td>ESYST 102</td>
<td>Circuit Analysis</td>
<td>4.0</td>
</tr>
<tr>
<td>ESYST 103</td>
<td>Solid State Systems</td>
<td>4.0</td>
</tr>
<tr>
<td>ESYST 104</td>
<td>Digital Circuits</td>
<td>4.0</td>
</tr>
<tr>
<td>ESYST 111</td>
<td>Electromechanical Systems</td>
<td>4.0</td>
</tr>
<tr>
<td>ESYST 112</td>
<td>Industrial Robotics</td>
<td>4.0</td>
</tr>
<tr>
<td>ESYST 113</td>
<td>Industrial Controllers</td>
<td>4.0</td>
</tr>
<tr>
<td>ESYST 114</td>
<td>Automated Systems</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Total Units Required  32.0

b.3 The Automated and Laser Welding Technology AS Degree and Certificate programs will provide a sound foundation for jobs as Computer-Controlled Machine Tool Operator, Computer Numerically Controlled Machine Tool Programmer, Laser Welding Technician, or Welding Automation Technician, among others. Curriculum will include introductory laser and automated welding courses to allow for training in building basic foundation concepts and skills. Intermediate and advanced courses will also be offered to provide students with a range of knowledge, applications, and skills. The laser welding course sequence will prepare students to sit for certification exams under the AWS Process Specification and Operator Qualifications for Laser Beam Welding.

The course sequences will combine new courses developed through this project with existing courses as noted below. The existing courses will be updated and upgraded to meet current industry skills standards as determined by industry.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELD 114A</td>
<td>Introduction to Robotic Welding Automation</td>
<td>2.5</td>
</tr>
<tr>
<td>WELD 114B</td>
<td>Intermediate Robotic Welding Automation</td>
<td>2.5</td>
</tr>
<tr>
<td>WELD 114C</td>
<td>Advanced Robotic Welding Automation</td>
<td>2.5</td>
</tr>
<tr>
<td>WELD 080</td>
<td>Introduction to Nondestructive Testing</td>
<td>3.0</td>
</tr>
</tbody>
</table>
c. **Curriculum development: Fast Track** – Select courses from the Advanced Manufacturing Technology, Electromechanical Systems Technology, and Automated and Laser Welding core programs will be adapted to a Fast Track format. This model is characterized by: a) short-term intensive training; b) strong industry guidance; c) targeting low skill and/or displaced workers; d) in good paying entry-level or upgraded jobs; e) in high skill, high demand career pathways. This format will specifically meet the needs of incumbent workers, underemployed and unemployed manufacturing workers who need to quickly upgrade skills to meet the requirements of new and/or unfilled jobs. Examples of two potential Fast Track programs are shown below:

**Fast Track program: Advanced Automated Manufacturing Production Technician**
- Training duration: 250 hours of training, five days per week, over seven weeks;
- Training topics: manufacturing math; fundamentals of automated manufacturing; blueprint reading; safety; quality systems; basics of quality; basics of CNC programming and operation; overview of common CAD/CAM systems and when/how they are used; and career preparation (resume building, interview skills, applications, follow-up).

**Fast Track program: Advanced, Automated Manufacturing and Processing Equipment Maintenance and Troubleshooting**
- Training duration: 250 hours of training, five days per week, over seven weeks;
- Training topics: safety; tools; basics of electronics and circuits; electromechanical systems; robotics; pneumatics; hydraulics; programmable logic controllers; and career preparation (resume building, interview skills, application, follow-up).

d. **Curriculum development: incumbent worker training** – will feature customized training modules of 24-60 hours each. Training topics will be determined by industry need using industry request and/or need assessment results. Topics will include subjects in the degree and certificate programs or designed to meet a specific advanced automated manufacturing need in the areas of installation, maintenance, production, safety, and/or quality.

e. **State-of-the-art training facilities and equipment** – The project will be supported by state-of-the-art facilities at College of the Canyons as well as at industry partner Aerospace Dynamics International, a leading aerospace manufacturer. Extensive, existing infrastructure will be leveraged with NSF ATE funds to ensure support for all Advanced Automated Manufacturing and Processing education activities. The project’s laboratory and training facilities include:
e.1 Advanced automation manufacturing laboratory (developed with COC, Department of Commerce, and Department of Energy-funded equipment): COC will expand the current 750 square foot Electronic Systems Lab by adding 1,000 square feet, creating a 1,750 square foot Advanced Automated Manufacturing Laboratory. The lab already contains workbench equipment including power supplies, multimeters, oscilloscopes, function generators; and equipment supporting automated manufacturing and processing training, including:

- Pneumate 200 (COC has one of these machines) – supporting an introduction to pneumatic and electro-pneumatic technology training equipment;
- Pneutrainer 200 (COC has seven of these) – Supporting basic pneumatics composition;
- MAP-205 (COC has one) – didactic equipment which reproduces the most common handling applications in an industrial environment using electro-pneumatic technology;
- IPC 200 (COC has one each IPC-201C, 1 IPC-202, 1 IPC-203) – these devices control industrial processes and include a production station, bottling station, and palletizing station.

- FMS 200 (three are requested thru this proposal; see photo) – An integrated training system in industrial automation. This fully modular and flexible equipment meets today’s industrial reality. The technologies included in its different assembly stations allow students to develop professional skills required by today's automated processes. Acquiring these modules will provide capstone training and enable the program to meet required industry skill standards for advanced automated manufacturing and processing.

e.2 Automated and laser welding laboratories. The Automated Robotic and Laser Welding laboratories at College of the Canyons (COC) are part of the 5,000 square foot state-of-the-art Welding Technology facility at the College. College of the Canyons is an American Welding Society (AWS) Accredited Testing Facility (ATF). Brief descriptions of the two welding labs are below:

The Robotic Welding Automation Laboratory is an 850 square foot facility equipped with a total of 6 Lincoln Electric robotic welding cells. Each cell is equipped with FANUC manipulators and advanced power mode functions. The program is designed to provide access to industry-standard curriculum, materials and systems. The goal is to help students develop the programming and operational skills necessary to thrive in an advanced robotic welding automation manufacturing environment.

The Laser Welding Laboratory is a 550 square foot facility equipped to support 15 laser welding workstations stations produced by Laser Star, a leading manufacturer of industrial laser welding equipment. These mobile devices train students on laser programming and welding. Each workstation is equipped with an X/Y programmable motion device, digital camera, and enclosed glovebox. The program is designed to support industry-standard curriculum, materials and validation methodology. The goal is to help students develop skills necessary to thrive in an advanced laser welding manufacturing environment.

Through this NSF ATE, the laser welding lab will be upgraded with equipment for performing validation testing for robotic welding automation and laser welding to meet current skill standards. This will include: a tensile test machine; lapping/polishing machine; and a digital microscope. Qualification/certification testing will be offered for both robotic welding automation and laser welding under the college’s current status as an Accredited Testing Facility (ATF) for the American Welding Society (#60601).
e.3 Center for Applied Competitive Technologies (CACT) Laboratories: CACT is hosted at Aerospace Dynamics International, an industry partner and host since 1998. The Center operates a modern, fully-equipped facility to deliver for-credit classes and workforce training in CAD (computer aided design), CAM (computer aided manufacturing), CNC machining and additive manufacturing/3D printing technologies. The facility includes a 2,100 square foot classroom/office area; and a 950 square foot manufacturing area. The classrooms are equipped with 35 high-end engineering computer workstations. The manufacturing area holds 11 pieces of Haas equipment (4 3-axis CNC mills, 1 5-axis CNC vertical machining center, 1 CNC lathe, and 4 CNC simulators). Auxiliary equipment includes a Dimension elite 3D printer, and Roland 3D rotary laser scanner, a Microscribe 3D digitizer, and a coordinate measuring machine. Leveraging CACT labs and equipment is essential to this NSF ATE.

e.4 Additional college facilities that will support advanced automated manufacturing and processing include: a fabrication laboratory with a variety of production equipment capable of producing numerous products using a range of metals, plastics, and other materials; and a fully equipped manual machine shop useful in manufacturing one-off prototypes.

f. K-12 Pipeline Support – As documented earlier, 73 percent of incoming COC students are not college-ready in basic mathematics. This poses a serious obstacle to enrolling and succeeding in STEM programs. The key, according to the literature, is to link classroom instruction to application by contextualizing the subject matter. To overcome this obstacle, contextualized math will be a featured activity to improve the K-12 STEM pipeline. K-12 activities will:

□ Develop and implement contextualized mathematics modules for junior high and high schools;
□ Develop and implement contextualized mathematics modules for COC basic skills students;
□ Link program activities with existing high school robotics clubs;
□ Implement COC Summer Institute; week long summer programs for junior high and high school students with tracks for welding and fabrication, robotics, product design and prototyping;
□ Implement project “road shows” featuring on campus demonstrations in robotics and welding;
□ Sponsor industry speakers and demonstrations at career exploration events, math and science classes to generate interest in career pathways, skills required, and how to access them.

g. Outreach and recruitment – the Advanced Automated Manufacturing and Processing program will be marketed to high school students, industry employees, unemployed, and displaced workers through brochures, project web site, social media, classroom presentations, career days, demonstrations, and via college counselors. The project will be linked to the regional Tech Prep program (coordinated at COC), and Regional Occupation Programs (ROP). In addition, the program will work with long time partners at the regional Workforce Investment Board, One Stop Centers, and through the L.A. Worksource system. Outreach and recruitment will result in enrolling of 70 students in the degree and certificate programs; 15 thru Fast Track; and 30 in incumbent workers training during the first full year of implementation.

h. Student assessment and support – The project will be linked to COC’s enrollment and support services including new student assessment, counseling, learning skills center, financial aid, child care, and internship development, career services, and other special services and programs. The project will also use the WorkKeys assessments to pre-screen for Fast Track students and will employ pre- and post-screenings for incumbent worker training to document skill acquisition. In total, these activities will result in a 90 percent retention/completion rate.

i. Internships/Work-based learning – All advanced manufacturing and processing students will have access to industry internships and work-based training that complements their specific program of study.
j. Faculty and teacher training – College faculty and K-12 teachers will have access to training support:
- Workshops in use of contextualized math curriculum for all teachers and college instructors;
- Teaching skills workshops (using the CREATE model) for industry instructors (custom training);
- Training workshops for faculty on the new and upgraded laser and robotic welding equipment;
- A regular, half-day program, “Educators in Industry,” featuring faculty tours of manufacturing, advanced automated process, and laser welding businesses to enable faculty to better understand the skills students need for these sophisticated jobs.
- Workshops for junior high and high school teachers on establishing robotics clubs on campus.

The Advanced, Automated Manufacturing and Processing project will operate per the model shown below:

7. Timetable

The timetable for the COC Advanced Automated Manufacturing and Processing NSF ATE project is outlined below by major activity area. It is based on an estimated project start date of July 1, 2013. This will be adapted accordingly based on NSFs actual funding notification and process.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Timeline</th>
<th>Activity</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finalize industry partnerships/commitments</td>
<td>Jul 2013</td>
<td>Draft contextualized math curricula for all grade levels</td>
<td>Jan-Jun 2014</td>
</tr>
<tr>
<td>Develop, upgrade, and align program curriculum; begin equipment purchase</td>
<td>Jul-Dec 2013</td>
<td>Implement all advanced, automated mfg courses</td>
<td>Aug 2014</td>
</tr>
<tr>
<td>Adapt select curricula for Fast Track and custom options</td>
<td>Jan-Jun 2014</td>
<td>Develop COC Summer Institute program for 7-12 gr. students</td>
<td>Jan-Apr 2014</td>
</tr>
<tr>
<td>Provide teacher/faculty training</td>
<td>Jan 2014-Onward</td>
<td>Implement COC Summer Institute for 7-12 gr. students</td>
<td>Jul 2014, 2015, 2016</td>
</tr>
<tr>
<td>Deliver high school outreach and enrichment support</td>
<td>Aug 2014-Onward</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Management Plan

The College of the Canyons Advanced, Automated Manufacturing and Processing NSF ATE project will be organizationally placed in the Career Technical Education Division. Mr. Tim Baber, Chair, Welding Technology Department will serve as Principal Investigator (PI). Professor Baber will be supported by the department chairs and faculty from the three targeted programs: Manufacturing
Technology, Electronics, and Welding Technology. Mr. Joseph Gerda, Assistant Superintendent/Vice President of Instruction and Ms. Kristin Houser, Dean of Career Technical Education, will serve as senior management contact for the project. The PI will be supported by a part-time project coordinator who will handle routine and ongoing administrative and support functions for the project. Project funds will be managed by COC’s Business Office and financial reporting will be overseen by Kiyoko Koski, Accounting Manager for Grants and Categorical funds. This project will build on the ATE fiscal and audit tracking system that has been developed through CREATE’s long history of successful NSF ATE grants.

The project will be guided by an advisory board comprised of college, public and private industry partners as listed below:

Joe Schulman, PhD  Chief Scientist    Mann Medical Research Organization
Paul Aiello  Director, Education Division   Fanuc Robotics
Bill Barritt  Finance Executive  Aerospace Dynamics International
Carl Peters  Director, Technical Training   The Lincoln Electric Company
Phillip Fulgenzi  L. A. District Sales Manager   The Lincoln Electric Company
Jeryle Walters  Principal Process Engineer  Advanced Bionics
Simon Engle  President/CEO   HDE Technologies
Tim Ragus  Director, Backlot Attractions   NBC Universal
Dave LeBarron  Curriculum Director  Wm. S. Hart Union High School District
Jonas Peterson  Executive Director  Santa Clarita Economic Development Corp.
Kari Aaver  Director   Santa Clarita WorkSource Center
Kathy Alfano  Director   NSF CREATE Center

9. Roles and Responsibilities of the PI, Senior Personnel and others are outlined below:

Tim Baber, Chair, Welding Technology Department, Principal Investigator – will manage all major activities, including curriculum development and pathway alignment; Fast Track and customized training adaptations; the Summer Institute; internships; high school program activities and support; outreach, coordination with project partners; and completion of the upgraded laboratory facilities. Mr. Baber will also direct curriculum development for the Laser and Automated Welding Technology AS degrees and certificates and oversee equipment acquisition and installation in the Welding Technology Laboratories. Professor Baber has extensive grants and projects management experience.

Regina Blasberg, MS, Chair, Manufacturing Technology Department – will direct curriculum and program development and outreach for the Manufacturing Technology AS degree and certificate.

Lee Hilliard, MS, Chair, Electronics Department – will direct curriculum and program development and outreach for the Electromechanical AS degree and certificate; and oversee equipment installation.

Second, roles and responsibilities for other key personnel committed to this NSF ATE:

Kristin Houser, MBA, MA, Dean, Career Technical Education – will link and leverage program support in the Career Technical Education Division, including facilities, other grants, faculty, and equipment. She will provide budget oversight and support coordination with the project’s high school partners.

Joseph Gerda, MS, Assistant Superintendent/Vice President of Instruction – will link the project to senior college management; provide budget oversight; support institutional links; and will serve on the advisory board.
Peter Bellas, Dean of Economic Development – will ensure access to COC’s Economic Development Division programs and resources, including the Center for Applied Competitive Technologies; Employee Training Institute (contract education); Technology Incubator; and Small Business Development Center.

Joe Klocko, MBA, Director, Center for Applied Competitive Technologies – will direct the adaption and implementation of curriculum under the project’s Fast Track delivery option, and manage the CACT facility.

**Organization chart.** The organization chart for the College of the Canyons’ Advanced, Automated Manufacturing and Processing ATE project is shown below:

10. **Plan for Sustainability**

College of the Canyons only engages in projects it intends to make a regular part of its curriculum and programs. The College does not have the resources or personnel to devote to transitory projects that cannot produce long-term results. The fact that COC has institutionalized two previous advanced manufacturing and welding grants and other high skill training programs is testament to the College’s commitment and ability to develop, implement, and sustain programs and services. The following factors and strategies will sustain this project after NSF funding expires:

- Projected enrollments will generate student fees and state revenues needed to sustain classroom and laboratory instruction;
- The programs will leverage existing resources, including equipment, facilities, and personnel;
- Contextualized mathematics modules will be integrated into regular courses and updated through the standard, ongoing curriculum review process;
- COC’s Grants Development Department will generate support from public and private sources to update laboratory equipment and upgrade curriculum, when needed;
- Industry partners have made long-term commitments for space, equipment, and personnel;
- Internships will be funded through industry support and COC Foundation support;
- Outreach, recruitment and job placement will be supported by industry as well as outside agencies with their own funding streams.

11. **Evaluation Plan**

This NSF ATE project evaluation will utilize appropriate quantitative and qualitative measures in formative and summative processes to gauge the results of the program, student success in their targeted
programs, each project objective, and will serve as a basis for making program adjustments and improvements. The evaluation process will seek to clarify the impact of the program on target audiences and its potential for benefiting others. The goals of the program evaluation plan are to test and/or assess: 1) Project activities and practices; 2) Student performance; 3) Student retention, graduation, transfer and post-transfer outcomes; 4) Administrative planning and policy making; 5) Stated project objectives; 6) Program achievements; 7) Program implementation; 8) Unintended consequences; 9) Allocation of resources; 10) The expenditure of funds and cost-effectiveness; and 11) Replicability and dissemination. The evaluative process will be supported by Daylene M. Meuschke, PhD, COC’s Director, Institutional Research and Co-Chair of the Institutional Review Board. Dr. Meuschke has developed a statewide reputation for rigorous student assessment. COC’s IRB, which Dr. Meuschke chairs, is used as a role model and mentor for other colleges’ ATE projects, such as Dr. Norena Badway’s University of the Pacific targeted research grants. Dr. Jean Sando, who has long experience evaluating ATE projects and centers, and who wrote the ATE evaluation monograph on evaluation with Dr. Gloria Rogers, will serve as the project’s outside evaluator. Dr. Sando will work with the PI and STEM faculty to set baselines and benchmarks, design evaluative tools, train participants in data collection, develop student tracking procedures, guide ongoing efforts, and perform the summative evaluation.

The ongoing, formative evaluation process will include the following components:
1. Purpose: The formative evaluation will provide a regular source of program feedback and performance information and assist in guiding decision-making by the PI and others in implementing the project. Formative data will identify progress in achieving goals and objectives, and will identify deviations to which remedies can be applied.
2. Performed by: Evaluation team (senior project personnel) with support from the evaluator and NSF, as appropriate; led by the PI, and including project staff, partner representatives, and COC’s Institutional Research Office. The team will meet regularly to review data and reports.
3. Data collection: On-going, on campus and off campus sites, as appropriate.
4. Reporting thresholds: Collection will be at specific community college collection points (first census, end of the semester, etc.). Program will meet NSF reporting requirements.
5. Quantitative instruments and activities will include: copies of all reports, meeting minutes; curricula; instructional and non-instructional materials (marketing and outreach materials); student academic performance records; student participation reports; student assessments/results; faculty participation reports; attendance records; retention rates; skills certifications achieved; and other data as appropriate. Quantitative data will be collected throughout the project.
6. Qualitative instruments/activities will include: student intake information as appropriate and available; student feedback/self-evaluation forms; faculty feedback/self-evaluation forms; partner/industry feedback; faculty and student interviews; student exit interview reports; and project staff assessments and reports.
7. Formative process: Evaluation team will meet regularly to review qualitative and quantitative data, and, depending on the results, will determine adjustments to procedures or program implementation, gather additional data on areas of deviation, add or eliminate project activities after consultation with participants and NSF, as necessary. All data collected will be reviewed and assessed by the outside evaluator.
8. Formative products: Reports and tabulations will be collected and placed into separate binders and/or stored electronically. Reports that support NSF program requirements will also be made available at all times. Please also see the attached Data Management Plan.
A **final summative evaluation report** will be submitted at the conclusion of the project and will reflect all project results and meet all NSF final reporting requirements on student outcomes and program implementation. The final summative report will be prepared by the outside evaluator and will be reviewed by the principal investigator, project team, and Vice President.

**Outside evaluator.** Dr. Jean Sando will assist in finalizing the evaluation plan design and provide guidance on collection methodology and implementation. She is well qualified by education and experience in conducting evaluations of grant funded projects.

### 12. Dissemination Plan

College of the Canyons will employ a multi-level strategy in the dissemination of results and products generated by this project. Project product and results will be disseminated as follows:

<table>
<thead>
<tr>
<th>Project Product or Result</th>
<th>Dissemination Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program/course descriptions</td>
<td>Project web site; department web pages; COC catalog;</td>
</tr>
<tr>
<td>High school outreach and enrichment program materials</td>
<td>Project web site (links); high school web pages; robotics club web pages; live workshops and webinars for faculty and counselors</td>
</tr>
<tr>
<td>Instructional materials</td>
<td>Project web site; department/instructor web pages; live workshops and webinars for faculty; utilizing role as NSF Weld-Ed regional site hold webinars for Weld-Ed colleges; disseminate through CREATE’s 10 partner colleges, and through the 6 CA Community Colleges in the South Central Regional Consortium.</td>
</tr>
<tr>
<td>Photographs of program laboratories and facilities</td>
<td>Project web site; multimedia presentations during regional, statewide educational conference presentations noted above and below</td>
</tr>
<tr>
<td>Evaluation data: student outcomes, program success</td>
<td>Project web site (general outcomes); NSF reports, presentations at 2014 and 2015 ASEE national conferences; presentations at ATE PI annual conferences, with hands-on demos by students; presentations at annual NCPN conference; presentations at spring and fall California Community College Association of Occupational Educators; journal articles</td>
</tr>
<tr>
<td>Industry impacts: skill standards, productivity, growth data</td>
<td>Project web site (selected outcomes); proactive plan with COC’s Public Information Office for regular press releases on project activities and achievements; industry and business association presentations (Valley Industrial Association, Santa Clarita Valley Economic Development Corporation, etc.); industry and business articles (online, copy)</td>
</tr>
</tbody>
</table>

### 13. Merit Review Criteria

**Intellectual Merit.** COC’s Advanced, Automated Manufacturing and Processing ATE is based on the Design Principles to Expand High Education Capacity as published in *A Bridge for All: Higher Education Design Principles to Broaden Participation in STEM* (BEST, 2004). These principles, and how COC’s ATE project integrates these principles are:

- Institutional leadership – COC is committed to inclusiveness across the campus community;
- Targeted recruitment – the project will improve the STEM pipeline to feeder systems and K-12;
- Engaged faculty – classroom and laboratory courses will enhance faculty-student interaction;
- Personal attention – small laboratory sections, tutoring, and meeting learning needs of each student;
- Peer support – group projects, student interaction opportunities that build support across departments;
- Enriched research experience – internships that connect learning to the world of work;
• Bridging to the next level – institutional relationships and industry partnerships that help students and faculty envision pathways to milestones and career development;
• Continuous evaluation – ongoing monitoring of process and outcomes that guide program adjustments to heighten impact and student success.

The College has shown a long track record of successful NSF projects. The project team is strong technically and administratively, with multi-disciplinary expertise in engineering, welding, and electronics. The College is committed and the project will build on strong existing infrastructure. The evaluation includes doctoral level internal and external evaluators who are experienced in producing NSF ATE impact data.

**Broader Impacts.** The project is based on the needs of automated process employers for high skill workers able to install, operate, and maintain advanced and automated equipment essential for U.S. industry to remain competitive and grow after a long period of decline. COC’s ATE will implement a technical education model as developed by the NSF CREATE Center hosted at College of the Canyons. Based in the largest manufacturing center in the U.S. (as documented on page 2), COC’s ATE will be the only program that combines manufacturing technology, electromechanical systems, and automated/laser welding technology in a single educational resource. This will enable flexibility for: students to access the training that will lead to regional jobs; and for employers who can customize training to quickly and efficiently meet their specific needs. The project will implement a model for building a K-12 STEM pipeline and will emphasize increasing STEM enrollments by underrepresented populations by improving college-readiness. Strong industry partnerships already exist and industry partners will be actively involved in the project, serving on the advisory committee and providing internships and jobs. Strong middle and high school pathways will be built on existing school district close relationships. Dissemination will be proactive, using existing WeldEd and CREATE ATE Center partner pilot testing and regional and national peer-reviewed papers and conference presentations, as well as workshops and web-based tools.

**Integration of research and education** is supported through upgraded laboratory facilities that meet current industry standards. Research projects will be integrated into student coursework, particularly in the advanced courses. Students will have access to extensive research opportunities through internships at automated process partners with strong research facilities, including the Al Mann Foundation and Advanced Bionics. In fact the chief scientist for the Mann Medical Research Organization is a member of the project’s advisory board.

**Integrating diversity into NSF programs, projects and activities** will be achieved through COC’s service to a large and growing underrepresented population and linking the project to significant efforts to improve underrepresented student access to, and success in, STEM programs, as referenced earlier. Increasing underrepresented student access and success in STEM is a key goal of this ATE project.