



Office of Research & Commercialization

August 11, 2017

Enterprise Florida
800 N. Magnolia Ave
Suite 1100
Orlando, FL 32803

RE: Florida Job Growth Grant Fund

Dear Program Manager,

On behalf of The University of Central Florida Board of Trustees (UCF), we are pleased to endorse the proposal entitled “Sustainable Training and Education in Advanced Manufacturing (STEAM)”, by Dr. Ranganathan Kumar, Department of Mechanical and Aerospace Engineering.

We have reviewed the SOW and its budget. In the event this proposal is awarded, we will perform the tasks outlined in the attached proposal. Additionally, we are committed to administer the project with the understanding that UCF will receive 30 percent facilities and administrative costs.

If you have any questions concerning the technical content of this proposal, please contact Dr. Kumar at (407) 823-4389 or via e-mail at Ranganathan.Kumar@ucf.edu. For budgetary or administrative questions, please contact me.

Sincerely,

A handwritten signature in blue ink that reads "Emily Bennett".

Emily Bennett
Proposal Manager

Phone: (407) 882-0066
Emily.Bennett@ucf.edu



Florida Job Growth Grant Fund Workforce Training Grant Proposal

Proposal Instructions: The Florida Job Growth Grant Fund Proposal (this document) must be completed and signed by an authorized representative of the entity applying for the grant. Please read the proposal carefully as some questions may require a separate narrative to be completed.

Entity Information

Name of Entity: The University of Central Florida Board of Trustee

Federal Employer Identification Number (if applicable): [REDACTED]

Contact Information:

Primary Contact Name: Emily Bennett

Title: Proposal Manager

Mailing Address: 12201 Research Parkway, Suite 501
Orlando, FL 32826-3246

Phone Number: 407-882-0066

Email: Emily.Bennett@ucf.edu

Workforce Training Grant Eligibility

Pursuant to 288.101, F.S., The Florida Job Growth Grant Fund was created to promote economic opportunity by improving public infrastructure and enhancing workforce training. This includes workforce training grants to support programs offered at state colleges and state technical centers.

Eligible entities must submit proposals that:

- Support programs and associated equipment at state colleges and state technical centers.
- Provide participants with transferable and sustainable workforce skills applicable to more than a single employer.
- Are offered to the public.
- Are based on criteria established by the state colleges and state technical centers.
- Prohibit the exclusion of applicants who are unemployed or underemployed.



1. Program Requirements:

Each proposal must include the following information describing how the program satisfies the eligibility requirements listed on page 1.

A. Provide the title and a detailed description of the proposed workforce training.

SUSTAINABLE TRAINING AND EDUCATION IN ADVANCED MANUFACTURING (STEAM)

Partnering with Machining Training Solutions (MTS), we propose a customized training program in advanced conventional manufacturing called “Sustainable Training and Education in Advanced Manufacturing (STEAM) with an emphasis in additive manufacturing (AM), also called 3D printing to create a strong technical workforce in Florida that will address the State’s current and future needs. While workforce needs to be trained in advanced conventional manufacturing using computer-aided design for large scale production, additive manufacturing (AM) has started to lower the costs and the need for tooling. AM builds a part layer by layer from the geometry described in a 3D computer-aided design model. In comparison, traditional manufacturing methods start with a block of metal and cut away the excess by etching, cutting, drilling, milling or other subtractive methods. AM is the fastest growing segment of the \$1.3B market rising from 4% in 2003 to 20% in 2010¹. Since AM has unique capabilities, it is considered to be superior to conventional manufacturing of some products with complex geometry. Firms that sold just 10 AM machines per year are now selling hundreds of machines as different types of industries are beginning to adopt 3D printing to manufacture key parts². In 2017, AM is 12% of GDP in this country. Therefore, our workforce training program will include both advanced conventional methods for large-scale production leading into the modern additive manufacturing methods.

AM process melts metal alloys in desirable locations, and makes complex shapes eliminating unnecessary bulk. It involves computer aided design (CAD) modeling software (also used in conventional methods) that takes a series of digital images of an objects and transmits this data to the 3D printer. This machine uses the data as blueprints to create the 3D object layer by layer with micrometer resolution. In addition, it is possible to produce parts on demand without the need for tooling, which helps with supply chain management. This type of manufacturing is also environmentally sustainable since it contributes to energy savings of nearly 50% compared to the old methods of casting, molding, etc.³.

Across the 21 manufacturing sub industries, Florida employs 328,000 people with average compensation significantly higher than Florida average⁴. Florida leads in export intensity⁵.

¹ Scott, J., et al., *Additive Manufacturing: Status and Opportunities*, Science and Technology Policy Institute, 2012, pp. 1-29

² Wohlers Report 2012, 83

³ USDoE, *Additive Manufacturing: Pursuing the Promises*, Aug 2012, 2

⁴ National Association of Manufacturers, 2014 www.nam.org

⁵ 2014_Florida_International_B.pdf

However, there is a shortage of workforce with technical skills in advanced manufacturing processes despite the fact that premium blue collar workers could make 20% more than average white collar workers. On a broader scale, by 2025 there will be 2 million unfilled jobs in manufacturing in the US. Manufacturers are reporting that one of the driving factors behind selection of location for a manufacturing facility is the availability of a talent supply chain.

Five pathways published by the Manufacturing Institute are CAD, welding, industrial maintenance, machining and quality defined by both academic certificates and occupational training.

Work plan for the proposed training program

Florida worker talent pool is diverse with both advanced degrees as well as with associate degrees. To be relevant in advanced conventional manufacturing and also in the additive manufacturing revolution of the 21st century, our education and training programs must cater to the diverse public seeking mechanical/industrial/manufacturing degrees in state colleges, community college students and public at large. With this in mind, we propose a 3-pronged manufacturing education/training certificate program (Figure 1) to train a total of 200 students that include university students, state/community college instructors, community college students, and unemployed/ underemployed people and high school graduates:

- 1) Train **40** manufacturing engineering students at UCF with an engineering degree in Mechanical or Industrial engineering. Part of their accredited curriculum will consist of specific courses in manufacturing: 1) CAD/CAM, 2) Manufacturing engineering, 3) Machine design, 4) Laser materials processing, 5) Entrepreneurship and 6) Capstone Senior design in a manufacturing project. See complete details of the courses in [Appendix A](#). The hands-on training in some of these courses will be given using the equipment listed in [Appendix B](#). There will be a hands-on training in 3D metal printing ([Appendix C](#)) associated with the SolidWorks project the students developed and designed in CAD/CAM project which will also be used in their Capstone Senior Design. The students will also get hands-on training at Machining Training Solutions (MTS) and will go 800 hours of internship program in a manufacturing company in the junior and senior years. These students will receive a certificate in manufacturing at the end of their senior year. With this training, internship and an entrepreneurship course, the students are expected to be well-rounded manufacturing engineers.
- 2) Train **40** community college or state college instructors at MTS for a certificate program that involves courses in CNC (Computer Numeric Control) simulation of a) multichannel lathes, b) machining on lathes and mill-turn centers, c) programming and simulation of multi-spindle CNC machine tools, d) universal machining cycles for turning and milling. More details of the MTS course curriculum are provided in [Appendix D](#). They will also be given training at UCF on the 3D printer. In addition to training the instructors, **40** community college students will be selected for the program. These students will receive a certificate in manufacturing training upon completion of the program.
- 3) Train **40** unemployed/underemployed individuals from the general public will be pre-screened for this program by MTS and UCF for a certificate program that involves courses given in Item (2) and hands-on training in UCF's 3D printer [[Appendices A through D](#)]. This program may also involve other remedial training in fundamental courses, depending on the skillset of these students pre-screened. This group of unemployed/underemployed students may also hold associate degrees from community colleges or degrees from state

colleges in different disciplines. In this category, we will also target **40** additional high school graduates or anyone from the general public wanting to make a career transformation on a certificate program. Pre-screening tests and ACT scores will be used for admission to the training program. As in the categories described in the previous two items, these students will receive a certificate in manufacturing training upon completion of the program. In addition, MTS will pre-select these students for an apprenticeship program in one of the manufacturing companies in Florida.

With this training, students will be able to take 2 certification courses, IHK CNC Production Specialist, IHK BZ001 and MSFC-CPT. As part of this program, each student trainee will be given paid internship in a manufacturing company for 400 hours. They will also qualify Recently, several Florida companies (Metal Essence, Ashland Technologies, Jet Machine, Skybolt Aeromotive Corp, GW Schultz Tool and Exatech) were certified to provide 7200 hours (3.5 years) of paid apprenticeship. These manufacturers will pre-select students from our proposed program for this apprenticeship. Students can earn national certifications in manufacturing through this registered apprenticeship program, which would allow them to work in any manufacturing facility in the country.

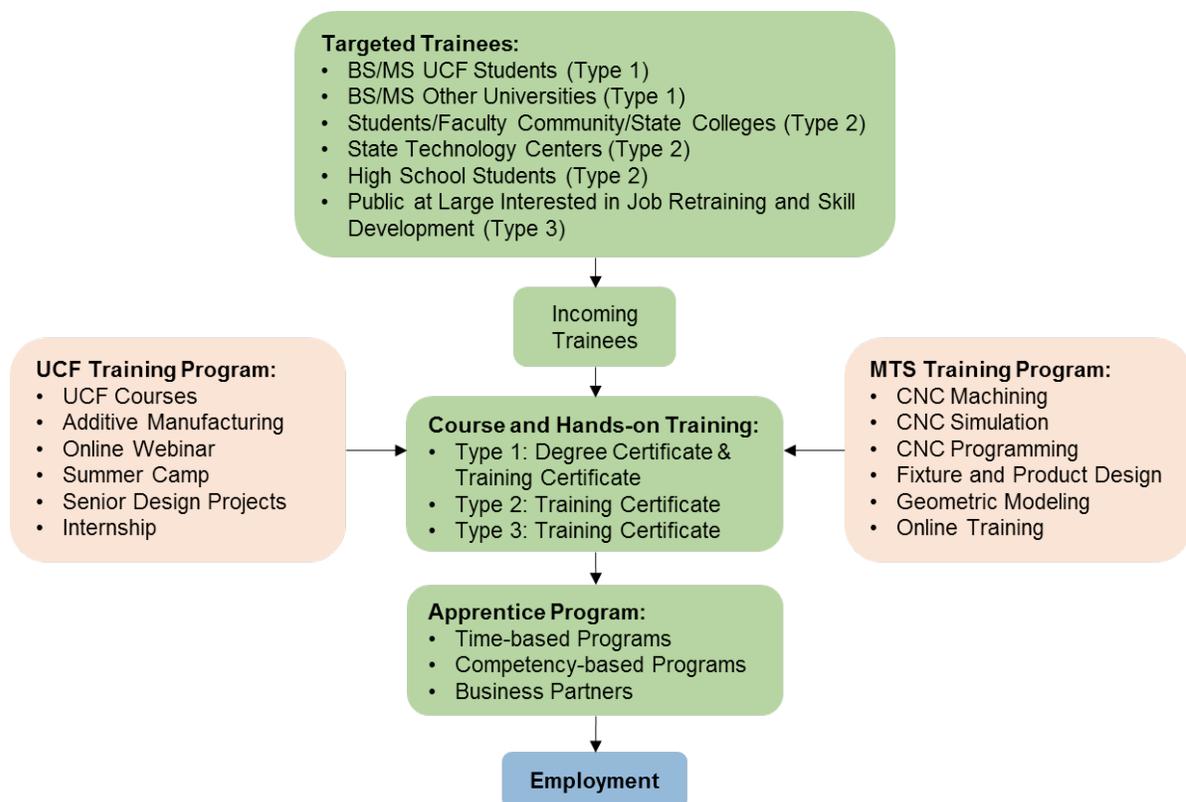


Figure 1: Workforce development and training in advanced manufacturing



B. Describe how this proposal supports programs at state colleges or state technical centers.

It is important to train not only students but also instructors who can train many more students in our state and community colleges, technical centers and high school students. Currently there are many community colleges and technical centers trying to create their own manufacturing programs. The proposed project will unify these efforts by training the instructors in the state colleges and training centers, additionally training other students in the state colleges and high schools and other unemployed/underemployed individuals by holding the training program to a higher standard to make a significant change.

Recently our partner company, MTS, worked with Lake Technical Center to create a 600 hour program that has been approved by DoE and qualifies for PELL funding. MTS also trained instructors in Valencia College that has now opened an Advanced Manufacturing Training Center. Many community colleges are gravitating towards this format as it provides more value to potential employers in various manufacturing industries. The proposed project will support these programs in the state and also provide additional training in additive manufacturing and a pathway to advanced degrees in a state university like UCF.

C. Describe how this proposal provides participants transferable, sustainable workforce skills applicable to more than a single employer.

Advanced manufacturing has already been embraced by aerospace, automotive, medical, defense, nanotechnology industries. Therefore our unique curriculum with a comprehensive training plan is specifically designed so that the skills are transferable. Since additive manufacturing is capable of fabricating high value-added parts with complex geometry, there is also potential for sustainable long term employment for workers.

Table 1. Metal additive manufacturing used in industries

Industry	Company	Example Product	Key Benefit
Aerospace	General Electric	Jet Engine Nozzle	Complex Geometry, Reduced Time and Cost
Automotive	Metal Technologies Inc	Car Engine Part	Reduced Time and Cost
Medical	Emerging Implant Technologies	Titanium Implant	Customized to Patient
Consumer Products	Proto Labs	Bike Frame	Customized to Transportation Needs



There are many examples of the use of additive manufacturing in the aerospace, automotive, medical and consumer goods industries (Table 1). Complex structures can be created to perform multiple functions (e.g., landing gear in aerospace industry; organ on a chip or biocompatible heart valves in medical industry). For example, GE mass-produces critical aluminum, titanium and nickel-chromium alloy parts such as nozzles in jet engines using 3D printing since it reduces production, labor costs and scrap metal. Oak Ridge National Laboratory (ORNL) 3D-printed the Shelby Cobra with 20% carbon fiber reinforced ABS material and a Class A surface finish using a big area AM machine. Ford has produced prototypes of cylinder heads, brake rotors and rear axles in less time than by traditional manufacturing.

Florida has over 5000 manufacturing companies. Employers are constantly seeking industry-recognized credentials with cross-cutting manufacturing skills. Despite the fact that the US government has spent billions of dollars in workforce development programs, the impact has been limited⁶. ***Our proposed program will place a high priority in education (provided by educators at the state university level) and hands-on industry training (provided by the industry) to maintain global leadership of the Florida industries.*** The program is offered to the trainees by professionals from UCF and MTS solutions with several decades of conventional and advanced additive manufacturing experience. This will bridge the knowledge gap between traditional and modern manufacturing technologies.

The hands-on training that is proposed for the workforce here on Computer Aided Design/Computer Aided Manufacturing (CAD/CAM), CNC simulation of complete machining on lathes and mill-turn centers and 3D printers will be tailored to the needs of machine operators, welders, assemblers, inspectors, and maintenance professionals. The machine operations learned in this program are transferrable to multiple industries in Florida provided in Section 2B.

The equipment used to provide the training are available both at UCF (Appendix B) and MTS (Appendix D) and the new 3D metal printer equipment (Appendix C) that is proposed for additional training will be housed at UCF so that training can be provided to manufacturing students in community college and state college as well as to the general public. This general platform and framework will make the program sustainable. In addition, the standards of the apprenticeship program were recently approved for manufacturing companies like Metal Essence Inc. which is a partner in this proposal. The 3.5 year apprenticeship provides the workforce with national certifications that will attract more workers to join these manufacturing training programs given at various technical centers and state/community colleges in Florida and thus will sustain the program.

⁶ <http://www.nam.org/Issues/Workforce-Development-and-Training/>



D. Does this proposal support a program(s) that is offered to the public?

Yes No

Yes. This proposal enhances many programs in manufacturing offered to the public. However, this is the only unique curriculum that includes both advanced conventional manufacturing techniques and additive manufacturing which is the wave of the future as explained in Sections A and B. MTS already offers courses and training in different manufacturing skills that companies need.

This project will also target **40** high school graduates or anyone in the general public wanting to make a career transformation on a certificate program. Pre-screening tests and ACT scores will be used for admission to the training program. These students will receive a certificate in manufacturing training upon completion of the program. In addition, they will be pre-screened for the Apprenticeship program that 7 manufacturing companies recently received approval to provide paid apprenticeship to 7200 hours including national certifications [IHK CNC Production Specialist, IHK BZ001 and MSFC-CPT].

E. Describe how this proposal is based on criteria established by the state colleges and state technical centers.

The state colleges and technical centers offer short-term training for promising careers. Our partner company MTS has trained instructors in Valencia College and Lake Technical College in Orange county. The criteria established by these state and technical colleges in advanced manufacturing initiative are that the in-class programming is aligned with industry standards and is developed with the guidance and support of manufacturers in Florida. Since the CEO of MTS, Al Stimac, is also the President of Florida Manufacturers association, his web-based and in-class programs and hands-on training, as proposed here, are well aligned with the criteria established by the state colleges, state technical centers and the manufacturers' association.

The 250-hour program listed here leads to 2 industry certifications (these certifications are on the state CAPE funding list: IHK CNC Production Specialist, IHK BZ001 and MSFC-CPT). Our program will provide to the students all software, curriculum and tools for the course. In addition, the state colleges can also direct their students to our online web portal where they attend class and use the LMS for course work. The program also provides VPN software access to students, manuals and certification testing.



F. Does this proposal support a program(s) that will not exclude unemployed or underemployed individuals?

Yes No

Offering manufacturing training to the general public, in particular to the unemployed or underemployed individuals with a desire to make career transformation is the hallmark of our STEAM program. The unemployed and underemployed individuals will be sought after, trained and given apprenticeship. The budget reflects supporting 40 such individuals including veterans needing to transition into the workforce and career source. We have prescreening tests and use ACT work keys to prequalify for this program.

G. Describe how this proposal will promote economic opportunity by enhancing workforce training. Please include the number of jobs anticipated to be created from the proposed training. Further, please include the economic impact on the community, region, or state and the associated metrics used to measure the success of the proposed training.

Manufacturing helps maintain a diverse economy; creates and sustains high-paying jobs. The training we provide in this project will promote economic opportunity for the young workforce as well as individuals in mid-career transformation. It also promotes investment in capital equipment because of the need to move into advanced methods such as additive manufacturing, research & development. This program generally helps build and maintain a high quality of life for those employed in the industry and for the larger community from which they purchase goods and services.

There are 28 community colleges and other state colleges in Florida. We will train 40 instructors from these colleges in this program. Since the program pays to train these instructors, there will be immense interest in these colleges to develop their own training programs as Valencia College and Lake Technical College did after MTS training. A 10 week/ 250-hour course that nets 2 industry certifications (these certifications are on the state CAPE funding list). Colleges can easily run this class 3 times a year. Across the board, community colleges are purchasing the ability to train 20 students per class making the potential per instructor to teach/train 60 students in advanced manufacturing. For 40 instructors, there is a potential to impact 2400 manufacturing trainees. Further, our apprenticeship program along with national certifications will get these students ready for job search at higher salaries than even white collar workers as mentioned earlier in Reference 4. In all, this program has the potential to train 2500 individuals per year for high-paying manufacturing jobs in Florida.



The Florida Manufacturing Association (in particular, manufacturing companies, Metal Essence, Ashland Technologies, Jet Machine, Skybolt Aeromotive, GW Schultz Tool, Exatech) has received approval from the State to administer the Apprentice Program to provide extensive manufacturing training which will last 7200 hours or 3.5 years [Appendix E].

One metric is that our training should lead to 100% success in IHK CNC Production Specialist (IHK BZ001) and MSFC-CPT for those who desire to take these 2 CAPE certifications.

MTS has provided a full listing of courses to nearly 200 students so far and has a success rate in job search in advanced manufacturing of 98%. UCF engineering students also are well placed in industry, but with the certificate that we provide at the end of the program, they will be sought after by Florida industries. The industry has high demand for such workforce. Hence, our metric will be student placement in Florida manufacturing companies at a success rate of at least 90%. They also have experience in training high school teachers (For example, Mr. Das from Winter Park High in Orange County) who, in turn, delivered the in-class and web-based manufacturing program to High School Honors program that prepares them to continue their education at the college level and also provides them the employability skills when they graduate from High School.

2. Additional Information:

A. Is this an expansion of an existing training program? Yes No

If yes, please provide an explanation for how the funds from this grant will be used to enhance the existing program.

The training program consists of UCF students who will follow the existing B.S. program with the exception of taking specialized elective courses related to advanced manufacturing as put forth in Appendix A. For these students, funds are requested so these students will take web-based training courses as well as hands-on training in advanced equipment that already exists in MTS. These courses and equipment are already put together and will be used in the existing program. The unique part of our enhanced program is the training provided in 3D printing for which the prerequisites will be the existing courses. We request additional funds for this 3D printer which is most sought after now and is likely to be the centerpiece in any advanced manufacturing facility in the future. For all trainees from the Florida counties, more extensive course training may be needed depending on their background. These students will be pre-screened for a flexible training program for which funds are requested for web-based training and hands-on training. The trainees will receive a manufacturing certificate at the end of this training. Funds are requested to provide free manufacturing training to 200 students which will have an impact of training an additional 2500 per year for the workforce. Most of the funds will be used to blend the existing programs with the new courses and ensure high quality of manufacturing training in Florida. More details are provided in the budget justification.



B. Does the proposal align with Florida's Targeted Industries? (View Florida's Targeted Industries here.)

Yes No

If yes, please indicate the targeted industries with which the proposal aligns.

The proposal is aligned with Florida's Targeted Industries such as life sciences, biotechnology, medical device, pharmaceutical manufacturing, photonics, microelectronics and defense & aerospace industries. UCF already has the reputation of being this nation's #1 workforce supplier to the aerospace and defense industry⁷. Through this program, UCF and our partner companies will strive to move the needle up to reaffirm Florida as the top State for advanced manufacturing.

C. Does the proposal align with an occupation(s) on the Statewide Demand Occupations List and/or the Regional Demand Occupations List? (View Florida's Demand Occupation Lists here.)

Yes No

If yes, please indicate the occupation(s) with which the proposal aligns.

493011	HSHW	Aircraft Mechanics and Service Technicians
493021		Automotive Body and Related Repairers
491011	HSHW	First-Line Supervisor of Mechanics, Installers, and Repairers
499041	HSHW	Industrial Machinery Mechanics
514041		Machinists
173023	HSHW	Electrical and Electronics Engineering Technicians
172071	HSHW	Electrical Engineers
499051	HSHW	Electrical Power-Line Installers and Repairers
472111	HSHW	Electricians
172072	HSHW	Electronics Engineers, Except Computer
172112	HSHW	Industrial Engineers
172141	HSHW	Mechanical Engineers

Note 1: Workforce selection Criteria: FLDOE Training Code 3 (PSAV Certificate), 4 (Community College Credit/Degree), or 5 (Bachelor's Degree)

Note 2: HSHW indicates High Skill, High Wage

⁷ Aviation Week, 2005, 2006



D. Indicate how the training will be delivered (e.g., classroom-based, computer-based, other).

If in-person, identify the location(s) (e.g., city, campus, etc.) where the training will be available.

If computer-based, identify the targeted location(s) (e.g. city, county, statewide) where the training will be available.

The training will be both in-class, web-based with hands-on training. Since the proposal contains different student categories, the training will be held in different locations as follows.

1. UCF students will undergo course training as per schedule on UCF campus. They will undergo additional web-based software training from anywhere, and hands-on training at MTS at the Longwood campus in Sanford, FL.
2. State/Community college instructors will receive instruction and hands-on training at MTS and 3D printing on UCF campus.
3. State/Community college students and qualified high school students and individuals from general public will receive instruction and hands-on training at MTS and 3D printing on UCF campus.

E. Indicate the number of anticipated enrolled students and completers.

The number of anticipated enrolled students from UCF, state/community colleges and general public is 200. All are expected to complete the program as the program is free for them with paid internship and possible 3.5 year paid apprenticeship which will qualify them for high paying jobs in the State.

F. Indicate the length of program (e.g., quarters, semesters, weeks, etc.), including anticipated beginning and ending dates.

Begin Date: October 1, 2017 End Date: Sept 30, 2019

UCF students will undergo the training on a semester basis. Their internship will be scheduled at the end of their junior and senior years during the summer for 10 weeks. They may opt for the State Apprenticeship program. Other students can start the program on a flexible basis. In general, the courses will start first of every quarter starting in March, June, September and December. Participant recruitment and selection process is provided in greater detail in Section 2J.



G. Describe the plan to support the sustainability of the proposal.

The program is sustainable since it is a unique combination of conventional and modern training in advanced and additive manufacturing. Most of the funds will be used to blend the existing programs with the new courses, and ensure high quality of manufacturing training in Florida which will attract hundreds of individuals in the future to take this training program.

In addition, MTS has received approval from the State of Florida to offer a registered apprenticeship program. This program will provide apprenticeship for 7200 hours (3.5 years) in manufacturing to selected students from the trainees in this project (UCF students with BS degree in manufacturing, students from state colleges and community colleges and unemployed, underemployed people and high school students). This on-the-job training upon completion of our traineeship program will provide incentive to attract and retain highly qualified workforce in manufacturing and improve productivity in Florida and US. All the trainees would have received certificates upon completion of the program and would be encouraged to seek national certifications in manufacturing [IHK CNC Production Specialist (IHK BZ001) and MSFC-CPT] which can be earned through this registered apprenticeship. See the support letters from companies in Appendix G interested in offering the Apprenticeship program to qualified individuals from the proposed program, STEAM.

H. Identify any certifications, degrees, etc. that will result from the completion of the program. Please include the Classification of Instructional Programs (CIP) code if applicable.

The students from UCF will receive a Bachelors' degree in engineering (either Mechanical or Industrial engineering) along with a certificate from the proposed program. This certificate will be given upon completion of the required in-class, web-based courses and 400 hours of internship.

The students from community/state colleges, high school students and unemployed/underemployed individuals will also receive a certificate upon completion of the required in-class, web-based courses and 400 hours of internship.

In addition, the students will have enough training to opt for two national CAPE certifications, ***IHK CNC Production Specialist (IHK BZ001)*** and ***MSFC-CPT***.



I. Does this project have a local match amount?

Yes No

If yes, please describe the entity providing the match and the amount.

Salary match from UCF for faculty and students of \$256,293 will be cost-shared. In addition, support letters from 6 manufacturing companies (Appendix G) show their enthusiasm in accepting several interns in the second year. This commitment is for a total of 30 interns with an estimated cash match of \$180,000 (30 students @ \$15/hour; 40 hours/week for 10 weeks).

J. Provide any additional information or attachments to be considered for the proposal.

PROJECT PERSONNEL

Dr. Ranganathan Kumar will serve as the PI of this project and coordinate the efforts between UCF and MTS Solutions in providing manufacturing training to students from UCF, state colleges and public at large in several of the counties, community colleges and UCF that are assisting the manufacturing companies with job creation and capital investment in Florida.

Dr. Kumar currently serves as the Associate Dean for Research and Administration in the College of Engineering and Computer Science (2012-now) and Pegasus Professor of Mechanical and Aerospace Engineering. Previously, he also served as Chair of the MAE department (2003-2008). He has coordinated manufacturing efforts in his department and the college, and has directed large nationally funded centers such as Research Experience for Undergraduates (2007-10), Research Experience for Teachers (2004-08), Industry-University Cooperative Research Center (2005-08) and the state-funded SUMMIT (Science Understanding Math Mentoring Integrated with Technology - 2012-14). He has both academic and industrial (Lockheed KAPL Inc) background, and has increased collaborative efforts with different departments in the Colleges of Engineering, Sciences, Education and the various schools and state colleges in Florida, and is reflected in this proposal. He has written over 200 technical articles. Dr. Kumar is a Fellow of the American Society of Mechanical Engineers, and currently serves as the Associate Editor of ASME Thermal and Sciences and Engineering Applications and also on the Editorial Board of Scientific Reports, a Nature publication.

Mr. Al Stimac is President & CEO, Metal Essence, Inc. and Machining Training Solutions, LLC and President, Manufacturers Association of Florida, and has several years of experience in manufacturing companies since the 1970s. He will oversee the training programs and apprenticeship programs of all the students selected by a Selection Committee in this project. The standards for Mr. Stimac's Advanced Manufacturing Apprenticeship program were recently approved and registered by the Florida Department of Education. Mr. Stimac has founded companies that specialize in training workforce and in the production of high volume, high tech



parts used in the automotive, aerospace and electronics industries. Al has served as President of the Board of the Manufacturing Association of Central Florida (MACF) and continues to serve as a board member. To help fill the growing need for skilled manufacturers, Mr. Stimac resides on the Higher Education Coordination Council (HECC) representing the Florida Senate, to which he was appointed by President of the Senate, Andy Gardiner.

Dr. Aravinda Kar leads the Laser Advanced Manufacturing and Materials Processing (LAMMP) laboratory in CREOL, The College of Optics and Photonics at the University of Central Florida. He will serve as a co-PI of this project in charge of the 3D printer installation and maintenance in CREOL facility. Dr. Kar has been working on various aspects of laser materials processing and manufacturing for more than 30 years, and published over 100 technical journal papers, over 150 conference papers and received over 25 patents. He has graduated 12 Ph. D. and 8 M. S. students. He is a Fellow of the Laser Institute of America. He has written a book entitled, Theory and Application of Laser Chemical Vapor Deposition.

Dr. Dazhong Wu is an assistant professor in the Department of Mechanical and Aerospace Engineering at the University of Central Florida. He will serve as a co-PI on this project expanding existing courses in mechanical engineering, in particular CAD/CAM and manufacturing labs. He will also be part of a team advising senior design student teams that are involved in manufacturing design. Prior to joining UCF, Dr. Wu was a senior research associate in the Department of Industrial and Manufacturing Engineering at Pennsylvania State University. He received his Ph.D. from Georgia Tech in Mechanical Engineering. His research interests focus on sensor-based smart manufacturing, data-driven prognostics and health management, additive manufacturing, and engineering design. Dr. Wu has served as a guest editor for the Journal of Manufacturing Systems and the International Journal of Computer Integrated Manufacturing. He serves as a symposium organizer in the area of high performance computing and data analytics in cyber-manufacturing for the International Manufacturing Science and Engineering Conference. He also serves as a scientific committee on manufacturing systems track for Society of Manufacturing Engineers.

Dr. Xiaoming Yu is an assistant professor at CREOL, the College of Optics and Photonics, University of Central Florida. He will serve as a co-PI on this project expanding existing courses in laser manufacturing. Dr. Yu leads the Ultrafast Laser Processing group. His research focuses on ultrafast laser – matter interaction, and laser-based micro-/nano-fabrication. He has published over 20 technical papers, and presented in various international conferences. He actively engages in student training, and promotes partnership between industries and academia through CREOL's Industrial Affiliates Program.

Dr. Thomas O'Neal is UCF's Associate Vice President of Research and Commercialization. He will serve as a co-PI on this project teaching entrepreneurship to students and will work towards building sustainability of this workforce program. Nationally recognized as an "entrepreneur in the business of helping Entrepreneurs", Dr. O'Neal is dedicated to creating and supporting sustainable innovation ecosystems in Florida. Tom's efforts focus on building strong research programs at UCF and the transfer and commercialization of research results into the marketplace. He serves as the Executive Director of the UCF I-Corps Program, is the founder and the Executive Director of the UCF Business Incubation Program (UCFBIP) and oversees UCF's Office of Technology Transfer, the UCF Venture Accelerator and Florida's Economic Gardening Institute. Under Tom's leadership, The UCF Business Incubation Program has expanded to eight locations



and earned "Incubator of the Year" in 2004 and "Incubator Network of the Year" in 2013 by the National Business Incubator Association (NBIA) where he currently serves as board member. Through Dr. O'Neal's efforts, UCF has recently been awarded the Department of Commerce i6 Challenge funds to extend the UCF I-Corps pilot program across the five economically challenged Central Florida counties, and to help transition Central Florida's engineering workforce into high growth technology companies that design, manufacture and export innovative products. As part of his current role at UCF he is able to support the team beyond the funded effort.

Participant Recruitment and Selection

A selection panel including the PI, Co-PIs, and representatives from MTS will be established to determine applicant selection. An application deadline at the end of each semester will be maintained for UCF students, and the selection procedure will be concluded by the beginning of Fall semester. We will maintain a rank list of the next 10 applications in the event vacancies are created due to unforeseen circumstances. The same selection panel will select trainees from community college instructors, state/community college students, and unemployed underemployed individuals with deadlines at the beginning of every quarter, i.e., December 1, March 1, June 1 and September 1. The program will be flexible to accommodate these trainees at different times so that they can complete the training program and begin their Internship program. The Internship program will start immediately following the courses in batches for 10 weeks. Students from this program will be encouraged to apply for the State Apprentice program which was approved in July 2017. The program will run 7200 hours (3.5 years) with strict guidelines as shown in [Appendix E](#) which will result in two national certifications. The jurisdictional areas covered by the Apprentice program are Brevard, Marion, Lake, Orange, Osceola, Palm Beach and Seminole counties. Two of the companies, a state college and a training center are already located in Orange and Seminole counties. Although the Apprenticeship program itself has county restrictions, the proposed program will solicit applications from all over Florida.

A one-page solicitation will be drafted to include details on the program, the web address, and contact information from which potential applicants can obtain additional details. Each applicant must fill out an application form on-line; this form will include pertinent contact information. Each application will also include a resume portion for details such as educational background including GPA, current employment, teaching experience (where appropriate). Two professional letters of reference will also be required for each applicant.

Clearly stated within the solicitation will be wording that assures the potential applicant that prior manufacturing/machining experience is not a prerequisite of the program, although such details might determine which courses the trainees will attend.

Minority Recruitment

The historical under-representation of women and minority groups in machining provides an additional impetus for their inclusion. It will be essential to the success of the project to ensure that there is active recruitment of women and minorities. That these under-represented groups are part of the project will be one of the essential indicators of community outreach as they in turn will be mentors and role models to the large number of students who will ultimately benefit from the project, providing program sustainability.



Data Collection

Diagnostic, operational, and critical-juncture data collection will establish baseline and outcome measurements. Data will be periodically collected from questionnaires, surveys, structured interviews, focus groups, observations, and counts of substantive activities. Data analysis will be ongoing, generating information to be provided to the appropriate stakeholders on a timely basis. An essential outcome of this program is to increase the workforce and hence the PIs and the companies will be working towards placement of our trainees in many manufacturing facilities around Florida.

Entrepreneurship training and commercialization

UCF's proactive technology transfer office works closely with the UCF Venture lab, Incubation program, and industry to license technologies to new and existing companies driven by the goal of economic development. The UCF Venture Lab is a partnership between the university and Orange County. Since its inception in 2004, the UCF Venture Lab has mentored hundreds of students and community entrepreneurs in validating their business ideas and intellectual property assets. The UCF Incubation Program has proven instrumental in the creation of more than 1,000 new jobs with earnings in excess of \$46 million annually in the Metropolitan Orlando region. UCF's Center for Entrepreneurship and Innovation will educate the entrepreneurial spirit of the UCF students. The goal is to ensure that the proposed workforce training program has the best educational, experimental and tactical support available to create and realize opportunities.



3. Program Budget

Estimated Costs and Sources of Funding: Include all applicable workforce training costs and other funding sources available to support the proposal.

A. Workforce Training Project Costs:

Equipment	\$754,645	
Personnel	\$1,032,426	
Facilities	\$	
Tuition	\$67,398	
Training Materials	\$80,000	
Other	\$1,894,502	Please Specify: MTS, travel, AM project, Internships and Overhead
Total Project Costs	\$3,828,971	

B. Other Workforce Training Project Funding Sources:

City/County	\$	
Private Sources	\$	
Other (grants, etc.)	\$256,293	Please Specify: UCF contribution
Total Other Funding	\$256,293	See letters of support estimated to be 30 internships worth \$180,000. Additional apprenticeship will also be considered for these trainees.
Total Amount Requested	\$3,572,678	

See budget details in the next two pages

Note: The total amount requested must equal the difference between the workforce training project costs in 3.A. and the other workforce training project funding sources in 3.B.



PI Name:	Dr. Ranganathan Kumar			Program:	
Agency:	Enterprise Florida (Dept. of Econ Opp)				
Proposal Title:	SUSTAINABLE TRAINING AND EDUCATION IN ADVANCED MANUFACTURING (STEAM)				
Project Dates:	October 1, 2017 – Sept 30, 2019				

Budget Cost Category	RATE	Funds Requested						Federal Total Project	Cost Share NonFederal Total Project	Federal + NonFederal Total Project
		Cost share NonFederal (UCF)		Cost Share NonFederal (UCF)		Federal				
		Federal	NonFederal	Federal	NonFederal					
		Year 1	Year 1	Year 2	Year 2					
A. Direct Labor - Key Personnel										
PI: Dr. Ranganathan Kumar	2.9	\$ 74,244	\$ -	\$ 76,471	\$ -	\$ 150,716	\$ -	\$ 150,716		
Co-PI: Dr. Arvi Kar	2	\$ 24,182	\$ -	\$ 24,907	\$ -	\$ 49,089	\$ -	\$ 49,089		
Co-PI: Dazhoung Wu	2.0	\$ 21,111	\$ 15,833	\$ 21,744	\$ 16,308	\$ 42,856	\$ 32,142	\$ 74,997		
Co-PI: Xiaomin Yu	1	\$ 8,698	\$ 13,047	\$ 8,959	\$ 13,438	\$ 17,656	\$ 26,485	\$ 44,141		
Co-PI: Tom O'Neal	0.01	\$ 243	\$ -	\$ 250	\$ -	\$ 493	\$ -	\$ 493		
Subtotal Salary		\$ 128,478	\$ 28,880	\$ 132,332	\$ 29,746	\$ 260,810	\$ 58,626	\$ 319,436		
Direct Labor - Other Personnel										
Post Doctoral Associate	2	\$ 100,000	\$ -	\$ 100,000	\$ -	\$ 200,000	\$ -	\$ 200,000		
Graduate Student	4	\$ 100,000	\$ -	\$ -	\$ 100,000	\$ 100,000	\$ 100,000	\$ 200,000		
Undergraduate Student	0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Program Coordinator (A&P)	1	\$ 35,000	\$ -	\$ 36,050	\$ -	\$ 71,050	\$ -	\$ 71,050		
Sr. Engineering Technician (USPS)	1	\$ 34,500	\$ -	\$ 35,535	\$ -	\$ 70,035	\$ -	\$ 70,035		
OPS Personal	0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Subtotal OPS		\$ 269,500	\$ -	\$ 171,585	\$ 100,000	\$ 441,085	\$ 100,000	\$ 541,085		
B. Fringe Benefits										
Faculty	26.00%	\$ 33,404	\$ 7,509	\$ 34,406	\$ 7,734	\$ 67,811	\$ 15,243	\$ 83,053		
Post Doc	16.00%	\$ 16,000	\$ -	\$ 16,000	\$ -	\$ 32,000	\$ -	\$ 32,000		
Students	2.00%	\$ 2,000	\$ -	\$ -	\$ 2,000	\$ 2,000	\$ 2,000	\$ 4,000		
A&P	32.00%	\$ 11,200	\$ -	\$ 11,536	\$ -	\$ 22,736	\$ -	\$ 22,736		
USPS	43.00%	\$ 14,835	\$ -	\$ 15,280	\$ -	\$ 30,115	\$ -	\$ 30,115		
OPS	8.00%	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Subtotal Fringe		\$ 77,439	\$ 7,509	\$ 77,222	\$ 9,734	\$ 154,662	\$ 17,243	\$ 171,904		
Total Labor Costs (A+B)		\$ 475,417	\$ 36,389	\$ 381,139	\$ 139,480	\$ 856,556	\$ 175,869	\$ 1,032,426		
C. Direct Costs - Equipment										
		\$ 754,645	\$ -	\$ -	\$ -	\$ 754,645	\$ -	\$ 754,645		
D. Direct Costs - Travel										
Domestic Travel		\$ 5,205	\$ -	\$ 5,205	\$ -	\$ 10,410	\$ -	\$ 10,410		
Foreign Travel		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Total Travel Costs		\$ 5,205	\$ -	\$ 5,205	\$ -	\$ 10,410	\$ -	\$ 10,410		
E. Direct Costs - Participant/Trainee Support Costs										
Tuition/Fees/Health Insurance		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Stipends- Internships*	30	\$ 180,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Travel		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Subsistence		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Other	0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Total Participant/Trainee Support Costs		\$ 180,000	\$ -	\$ -	\$ -	\$ 180,000	\$ -	\$ 180,000		
F. Other Direct Costs										
Materials and Supplies		\$ 40,000	\$ -	\$ 40,000	\$ -	\$ 80,000	\$ -	\$ 80,000		
Software		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
MTS-Vendor		\$ 567,974	\$ -	\$ 443,750	\$ -	\$ 1,011,724	\$ -	\$ 1,011,724		
Computer Services		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
OCO or Facility Rental		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Tuition	4	\$ 39,736	\$ -	\$ -	\$ 27,663	\$ 39,736	\$ 27,663	\$ 67,398		
Advanced Manufacturing Projects for UCF Seniors Students		\$ 20,000	\$ -	\$ 20,000	\$ -	\$ 40,000	\$ -	\$ 40,000		
Total Other Direct Costs		\$ 667,710	\$ -	\$ 503,750	\$ 27,663	\$ 1,171,460	\$ 27,663	\$ 1,199,123		
G. Total Direct Costs (A+B+C+D+E+F)		\$ 2,082,977	\$ 36,389	\$ 890,094	\$ 167,144	\$ 2,973,071	\$ 203,533	\$ 3,176,604		
Modified Total Direct Costs		\$ 1,108,596	\$ 36,389	\$ 890,094	\$ 139,480	\$ 1,998,690	\$ 175,869	\$ 2,174,560		
H. Indirect Costs	30%	\$ 332,579	\$ 10,917	\$ 267,028	\$ 41,844	\$ 599,607	\$ 52,761	\$ 652,368		
I. Total Direct and Indirect Costs (G+H)		\$ 2,415,556	\$ 47,305	\$ 1,157,123	\$ 208,988	\$ 3,572,678	\$ 256,293	\$ 3,828,971		
TOTAL CUMULATIVE BUDGET						\$ 3,572,678	\$ 256,293	\$ 3,828,971		

*See letters of support from companies to provide internship in the second year.



MTS Budget Details

MTS BUDGET	Rate	Year 1	Year 1	Year 2	Year 2	Total
software (30 licenses)			\$ 124,224			\$ 124,224
hands on site visit (20 stu)	\$750					\$ -
40 UCF stu		1	\$ 3,750	1	\$ 3,750	\$ 7,500
40 State Col instructors		1	\$ 3,750	1	\$ 3,750	\$ 7,500
40 State Col students		1	\$ 3,750	1	\$ 3,750	\$ 7,500
40 high school students		1	\$ 3,750	1	\$ 3,750	\$ 7,500
40 unemployed, underemployed		1	\$ 3,750	1	\$ 3,750	\$ 7,500
per student cost	\$ 550	100	\$ 55,000	100	\$ 55,000	\$ 110,000
VPN licensing for 24/7 software access (\$200)						\$ -
LMS access (\$150)						\$ -
Student manual (4) (\$200)						\$ -
Instructor training						\$ -
40 State Col instructors	\$3,500	20	\$ 70,000	20	\$ 70,000	\$ 140,000
Classroom training						\$ -
40 UCF stu	\$1,500	20	\$ 30,000	20	\$ 30,000	\$ 60,000
40 State Col students	\$1,500	20	\$ 30,000	20	\$ 30,000	\$ 60,000
Classroom training						\$ -
high sch	AMPS1 (250 hours of instruction)	20	\$ 120,000	20	\$ 120,000	\$ 240,000
unemployed/underemp	AMPS1 (250 hours of instruction)	20	\$ 120,000	20	\$ 120,000	\$ 240,000
			\$ 567,974		\$ 443,750	\$ 1,011,724



C. Provide a detailed budget narrative, including the timing and steps necessary to obtain the funding, how equipment purchases will be associated with the training program, if applicable, and any other pertinent budget-related information.

Budget Justification

Key Personnel

Dr. Ranganathan Kumar (PI), salary support requested at \$150,716 is allocated for 2.9 months over the project period of two (2) years, including a 3% escalation, effective August of each year, based on historical data. The salary calculation is based on his current academic year contract.

Dr. Arvi Kar (Co-PI), salary support requested at \$49,089 is allocated for two (2) months over the project period of two (2) years, including a 3% escalation, effective August of each year, based on historical data. The salary calculation is based on his current academic year contract.

Dr. Dazhoung Wu (Co-PI), salary support requested at \$42,856 is allocated for two (2) months per year over the project period of two (2) years, including a 3% escalation, effective August of each year, based on historical data. The salary calculation is based on his current academic year contract.

Dr. Xiaomin Yu (Co-PI), salary support requested at \$17,656 is allocated for one (1) month per year over the project period of two (2) years, including a 3% escalation, effective August of each year, based on historical data. The salary calculation is based on her current academic year contract.

Dr. Tom O'Neal (Co-PI), salary support requested at \$493 is allocated for 0.01 month per year over the project period of two (2) years, including a 3% escalation, effective August of each year, based on historical data. The salary calculation is based on her current academic year contract.

Other Personnel

Salary support for one (1) Program Coordinator at 40 hours per week over the project period of two (2) years. The salary amount (\$35,000 Year 1) was determined using pay for similar projects at UCF and includes a 3% escalation, effective August of each year, based on historical data. The Program Coordinator will support the project by coordinating meetings, selection committees, payment to vendors, scheduling training throughout the year for various types of students and instructors.

Salary support is requested for one (1) Sr. Engineering Technician at 40 hours per week over the project period of two (2) years. The salary amount (\$34,500 Year 1) was determined using pay for similar projects at UCF and includes a 3% escalation, effective August of each year, based on



historical data. The Engineering Technician will support the project by supporting senior design efforts and machine shop efforts and maintaining the 3D printer.

Salary support is requested for two (2) Post-Doc to support the research efforts. The salary amount was determined using Post-Doc pay for similar projects in the College of Engineering. They will work under the supervision of the PIs to develop 3D printing projects for senior design and all students in general, evaluate them and demonstrate the inner workings of the printer.

PhD Student salary support is requested for four (4) Ph.D. level students to support the project research efforts at 20 hours per week during Year 1. The salary amount was determined using graduate student pay for similar projects at the UCF. The students will work under the supervision of the PI for the specific aims of the project as described in the project description.

Fringe Benefits

The fringe rate is 26% for faculty, 8% for OPS staff, 32% for A&P staff, 43% for USPS staff and 2% for all students.

The Composite Fringe Benefit Rate percentages represent actual (not estimates) fringe benefit costs and will be assigned to all sponsored projects, and is effective July 1, 2017. Documentation of rates may be found at the following website: <http://www.fa.ucf.edu/CG/Publications/Publications.cfm>

Travel

Funds of \$10,410 are requested for travel purposes for the PI, or Co-PIs to attend education and workforce related conferences, coordinate efforts with state colleges and community colleges, industries and for dissemination of results and recruiting efforts. All travel estimates are based on UCF travel guidelines as well as historical costs as determined by the PI. The UCF Travel manual is found at

http://www.fa.ucf.edu/Travel_Payables/Publications/Travel_Manual.pdf

Participant Support Cost

Funds totaling \$180,000 for the first year are allocated to support student internship. During the 10 week summer semester, thirty (30) students will work at 40 hours per week. Funds for the internship (estimated to be \$180,000 for 30 trainees) is the proposed match by the industry (see Appendix G).

Other Direct Costs: Equipment

Funds totaling \$754,645 are allocated in Year 1 to acquire a metal 3D printer based on the LENS (Laser Engineered Net Shaping) technology. The funds include a 15% contingency to the quote provided in Appendix F. LENS uses nozzles to spray metal powders onto target position and use



a laser beam to melt the powders to build fully dense parts. LENS is identified as the ideal technology for the project because it has advantages over the powder bed method, such as using different powders to build graded materials and the capability of repairing damaged parts, e.g., the turbine blades of jet engines. This printer will be the preferred type by manufacturers to print complex 3D parts in various industries. This 3D printer will be used to train students and professionals in various aspects of metal additive manufacturing. More details on the use of this equipment are given in Appendix C.

Other Direct Costs: Material and Supplies

Funds totaling \$80,000 are allocated over the project period of two (2) years to purchase the necessary materials, instrumentation, and supplies such as various microscale and nanoscale metallic powders for melting in the 3D printer for various batches of students throughout the year.

Other Direct Costs: Senior Projects

Funds totaling \$40,000 are allocated over the project period of two (2) years to support two (2) teams at \$10,000 per year for the design and fabrication of Advanced Manufacturing Senior Projects which are required for both B.S degree in engineering as well as to complete the certificate program.

Other Direct Costs:

MTS: Funds totaling \$1,011,724 are requested for student/instructor training by MTS. They will work with the PIs to provide classroom training, site visits and necessary software for 200 students per year. The details of the courses taken by B.S. students at UCF are provided in Appendix A and those at MTS in Appendix D. The funding requested by MTS are for software (30 licenses), hands-on site visit for each batch of 20 students, per student cost, instructor training, classroom training and training of high school students and unemployed and underemployed. The itemized budget to MTS is provided following the main budget page.

Other Direct Costs: Tuition

Funds are requested to pay tuition each year for the graduate students. Based on historical data, the tuition has been escalated by 5%, beginning in August of each academic year. Documentation of rates may be found here: <http://tuitionfees.smca.ucf.edu/>

F & A (Indirect Costs)

Facilities and Administrative costs are calculated at 30% on a Modified Total Direct Cost basis: excluding equipment over \$5,000/item, tuition, and that portion of each subcontract in excess of \$25,000. UCF's has a current federally negotiated indirect cost rate agreement with DHHS. The current rates are effective July 5, 2017. Documentation of rates may be found at the following website: <https://fa.ucf.edu/contracts-grants-guidelines/>



Cost Share

Matching funds will be provided in the amount of \$256,293. This amount includes 1.5 academic months salary for Dr. Wu and Yu in both years (\$58,626); salary for four (4) graduate students (\$100,000); associated fringe (\$17,243); base tuition at 24 credits per student (\$27,663) and associated overhead (\$52,761).

Matching funds for internship in Year 2 (estimated to be \$180,000 for 30 trainees) is the proposed match by manufacturing companies for 30 selected students for 10 weeks.



4. Approvals and Authority

A. If entity is awarded grant funds based on this proposal, what approvals must be obtained before it can execute a grant agreement with the Florida Department of Economic Opportunity (e.g., approval of a board, commission or council)?

None.

B. If approval of a board, commission, council or other group is needed prior to execution of an agreement between the entity and the Florida Department of Economic Opportunity:

i. Provide the schedule of upcoming meetings for the group for a period of at least six months.

N/A _____

ii. State whether that group can hold special meetings, and if so, upon how many days' notice.

N/A _____

C. Attach evidence that the undersigned has all necessary authority to execute this proposal on behalf of the entity. This evidence may take a variety of forms, including but not limited to: a delegation of authority, citation to relevant laws or codes, policy documents, etc.

I, the undersigned, do hereby certify that I have express authority to sign this proposal on behalf of the above-described entity.

Name of Entity: The University of Central Florida Board of Trustees

Name and Title of Authorized Representative: Emily Bennet, Proposal Manager

Representative Signature: _____

Signature Date: _____

APPENDIX A

Courses that UCF students can take as elective courses that are already accredited in the curriculum to earn a manufacturing certificate in this program in addition to getting an engineering degree:

1. EML 4535C – CAD/CAM (3 Credits)

This course covers topics fundamental to CAD and CAM hardware and software, geometric modeling, finite element method (FEM), and CAD/CAM/FEM analysis/applications. Emphasis is placed on understanding how CAD/CAM systems work as well as learning CAD software such as Solidworks and CAM software such as MasterCAM.

2. EIN 4391 - Manufacturing Engineering (3 Credits)

This course covers an introduction to manufacturing processes and manufacturing systems including assembly, machining, injection molding, casting, thermoforming, and more. An overview of computer-integrated manufacturing. Emphasis is placed on the fundamentals of manufacturing processes, tooling and fixture design, and manufacturing information systems.

3. EML 3500 – Machine Design (3 Credits)

This course covers modeling, design, integration and best practices for use of machine elements such as bearings, springs, gears, cams and mechanisms. Modeling and analysis of these elements is based upon extensive application of physics, mathematics and core mechanical engineering principles (solid mechanics, fluid mechanics, manufacturing, estimation, computer simulation, etc.). These principles are reinforced via (1) hands-on laboratory experiences wherein students conduct experiments and disassemble machines and (2) a substantial design project wherein students model, design, fabricate and characterize a mechanical system that is relevant to a real world application.

4. EMA 5610 – Laser Materials Processing (3 Credits)

This course provides students with a fundamental understanding of the lasers and the physics in various laser-based manufacturing and materials processing techniques. Students will also be exposed to different analytical and numerical models that capture the physics in laser-based material processing techniques. The basics of laser physics, laser optics, and laser-material interaction will also be covered.

5. ENT 3613 – Creativity and Entrepreneurship (3 Credits)

This course covers techniques for improving the flexibility and originality of their thinking and will explore approaches used by managers and organizations to create and sustain high levels of innovation. Topics include: personal thinking preferences, everyday creativity and eliminating mental blocks, creative thinking techniques, idea selection approaches, teaming techniques for creativity, conditions that promote creativity, design for interaction, disruptive technologies, and intellectual property. The course uses fun and hands-on activities to stimulate innovation.



6. EML 3500 – Senior Design (3 Credits)

The senior design course (EML 3500) provides students with hands-on experience on advanced manufacturing technologies such as computer-aided manufacturing, rapid prototyping (i.e., metal and polymer additive manufacturing), smart sensors, instrumentation, control, and computer numerical control. Students will have opportunities to synthesize and showcase their technical, communication, leadership, and teamwork skills for success as engineering professional.

APPENDIX B

Equipment associated with UCF hands-on training



Laser systems for materials processing



Cameras and detection systems



Femtosecond laser for micromachining



3-axis motorized stage



Spatial light modulator



Metallurgical optical microscope

Figure B1 Laser-based manufacturing equipment

Fig. B1 shows a laser system for advanced manufacturing and materials processing, a high-speed camera with 1280x800 resolution, an infrared camera, a femtosecond laser for micromachining, a 3-axis motorized stage for sample motion control, a spatial light modulator for spatial beam shaping, and a metallurgical optical microscope for sample characterization. The laser-based manufacturing equipment will be used for additive manufacturing training. In addition, these equipment will be used in two manufacturing courses offered by UCF: EMA 5610 (Laser Materials Processing) and EML 4535C (CAD/CAM). EMA 5610 will provide students with a fundamental understanding of laser-based manufacturing and materials processing techniques. Fig. B2 shows a CNC turning center, three CNC milling centers, two manual mills, and two manual lathes. These machining equipment will be used for CNC machining and programming training. In addition, these equipment will be used in two courses offered by UCF:

EIN 4391 (Manufacturing Engineering) and EML 4535C (CAD/CAM). EIN 4391 will provide students with hands-on machining experience as well as fundamental understanding of machining processes such as milling and turning and manufacturing systems such as CNC controls.



CNC turning center



CNC milling center



CNC milling center



Manual Mill



CNC Mill



Manual Mill



Manual Lathe



Manual Lathe

Figure B2 Machining equipment

APPENDIX C

Acquisition of an LENS Metal 3D Printer for the Proposed Project

Additive manufacturing or 3D printing is a manufacturing process where a computer-aided-design (CAD) model is sliced into a series of 2D images and then built by adding materials in a layer-by-layer fashion. Additive manufacturing differs from traditional manufacturing in that the part is built by using additive methods (e.g., binding, sintering, and photopolymerization) instead of subtractive methods (e.g., cutting, drilling, and shearing). This enables on-demand manufacturing without the need for tooling, greatly reduces manufacturing time and cost, and makes possible the fabrication of parts with complex structures that are not achievable using traditional manufacturing.

Commonly-used materials in additive manufacturing are polymers (e.g., ABS, PC, acrylates), ceramics (e.g., SiC, Si₃N₄, ZrB₂), composites (e.g., fiber-reinforced composites), and metals (e.g., stainless steel, titanium, alloy). Among these, it is the metal materials that manufacturers pay attention to because of their broad applications in automobile, aerospace, medical, consumer product, and other industries. Training workforce in metal additive manufacturing will leverage this promising technology to promote economic opportunities in Florida. This project will focus on training students and professionals in metal 3D printing, and developing a talent pool for various Florida industries that will benefit from metal additive manufacturing. In this project, we propose to acquire a metal 3D printer based on the LENS (Laser Engineered Net Shaping) technology. LENS uses nozzles to spray metal powders onto target position and uses a laser beam to melt the powders to build fully dense parts. LENS is identified as the ideal technology for the project because it has advantages over the powder bed method, such as using different powders to build graded materials and the capability of repairing damaged parts, e.g., the turbine blades of jet engines.

This 3D printer will be used to train students and professionals in various aspects of metal additive manufacturing. First, they will learn how to convert the digital models they have created in the EML4535C-CAD/CAM course into the 3D printing (STL) format. Second, lectures will be given introducing the key elements of LENS, such as powder spraying mechanisms, laser induced thermal transfer, and metal cooling processes. The trainees will relate their learning from the courses (EIN4391, EML3500 and EMA5610; also see Appendix A) to the physical processes taking place in the machine. Third, hands-on experience with this machine will be provided to get the trainees proficient in the basic operation of a metal 3D printer, including tool path planning, powder feeding, atmosphere control, laser parameter setting, online monitoring, and post-processing. The training will conclude with presentations by the trainees showcasing what they have learned and the parts they have built.



APPENDIX D

State-of-the-art CNC Manufacturing Training Program at MTS

1. Overview

Using simulation software represents a revolutionary approach for CNC training that is highly engaging for the new generation mindset of learning. This low cost, low risk approach to CNC training is highly flexible and provides broad exposure to a wide range of equipment, controls and tooling options. The simulation software significantly shortens the learning curve given the built in proprietary learning assist features while allowing multiple students to be trained at the same time.

Introductory classes acquaint students with the basic manufacturing operations, such as, safety, shop math, blue print reading, basic GD&T, and metrology. Students then transition into performing tasks encountered in a manufacturing environment on a MTS virtual CNC simulator. Tasks include selecting tools, raw materials, work holding, and the steps involved in preparing CNC equipment for operation. Also, CAD/CAM software is provided as part of the turnkey package to introduce students to software that is used by industry in the design and CNC programming process. Additionally, students will perform tasks associated with running production on a CNC machine, such as, quality measurement and tool compensation to obtain accuracy.

In order to gain the best possible experience for its students UCF will have access on an agreed upon schedule of visits to the MTS manufacturing facility. These visits get UCF students critical hands on time on MTS state of the art CNC turning and milling machines to demonstrate and exercise the skills gained in the classroom using the simulation and curricula tools. A typical training class consists of 5 site visits of 6-hour duration per visit.

2. SCOPE OF SERVICES

MTS's turnkey package includes:

- A low cost-effective approach to classroom training using MTS simulation software and MTS interactive software thus eliminating the immediate need for additional large capital investments in CNC equipment.
- CAD/CAM software to introduce students to the CAD design and CAM CNC programming process used by industry leaders
- Access to a train-the-trainer program, designed to familiarize instructors with all the software tools provided in the package and prepare instructors for future IHK instructor certification.
- Software support for one (1) year, which includes all software updates and 24/7 technical support. The support program insures that UCF will be able to remain abreast of the latest innovations in CNC technology.

3. MTS SIMULATION SOFTWARE

The following is a description of the simulation software package and training features. CNC-Simulator TopTurn, TopMill, TopTrain, NC Test, and Control Panel.

TopTurn, TopMill

License for CNC-Simulator TopTurn and TopMill, version 8.0 in English language, running with USB license key with the programming codes:

- Turning: UTC (5 axes Z, X, Y, B, C))
- Turning: HAAS and FANUC (2 axis Z, X)
- Milling: UTC (5 axes X, Y, Z, A, C)
- Milling: HAAS and FANUC (3 axis X, Y, Z)
- and the features:
 - Programming of any CNC control programming code feasible
 - Control independent neutral user interface
 - Interactive NC programming mode with resetting the activated simulation to any NC program line
 - Contour editor for the input of complex contours without geometric calculations; setup: contour editor for the input of a rotationally symmetric work piece contour without geometric calculations
 - NC editor with dialogue programming and automatic support
 - CAM interface for import of turning and milling profiles by using an integrated 2D CAD system with DXF for- mat
 - 3D machine room and 3D material removal simulation with adjustable machine detail level
 - 3D collision monitoring with highlighting of colliding components
 - 3D representation of the machined part with selectable contour edges and selectable coloring of the work piece with specific colors for each tool and selectable work piece sections
 - 2D simulation for turning with driven milling tools and milling (if C axis given)

- NC program analysis for milling and turning (if C axis available), the analysis extends to the driven milling tools with calculation of the chip volume, tool path length and time calculation
- Display of a technical work piece clamping drawing in SVG format
- 2D display of the work piece's surface roughness in work piece sections as well as 3D and roughness display of the turning work piece
- Selectable tool path display during the ongoing 2D and 3D simulation
- Work piece measuring at any time during the simulation in different sections
- Graphical 3D comparison of actual and a given final work piece as reference during ongoing simulation
- Setup mode with 3D clamping device and 3D tool management system
- Transmission of NC programs to serial interfaces of the CNC controls
- Clamping and machining of several workpieces
- Programmable activation and deactivation of collision test
- All NC axes can be operated manually
- Work piece comparison during the ongoing 2D and 3D simulation
- Comfortable dialogue for fast machine setup
- Turning and milling control with canned cycles programming

TopFix

A graphically interactive workpiece clamping with the clamping components of a modular clamping system (action- oriented approach)

- Simple dialog with toolbar, menu functions and special keyboard functions Selection of the clamping components with assembly filters: no assembly error Internal collision analysis when inserting and moving
- No assembly collision with the workpiece No assembly collisions with each other
- Automatic determination of heights, lengths and directions by internal collision analysis
- Action-oriented learning entry into modular clamping systems

TopTrain

TopTrain: Extension of the license TopTurn und TopMill version 8.0 by the eLearning module TopTrain

- Multi-media based learning system for CNC Basics, CNC Turning and CNC Milling according to UTC including exercises
- Getting to know CNC techniques independently
- Integrating the MTS simulators TopTurn and TopMill with direct integration of the virtual MTS machines and optional change between the programs
- Control of learning results

Special Note concerning TopTrain: TopTrain requires a minimum screen resolution of 1440 x 900 pixel

NCTest

NCTest enables the close test NC examinations according to the PAL-examination standards* to be carried out paper free on PC.

- NCTest distinguishes between a mode for exam preparation and a mode for the exam itself.
- The exam mode may have the examination start and duration times preset.
- The examination programs as well as the model solution and the examination drawings are created automatically in encrypted form with the examination preparation module NCPrint.
- At the start of the examination they are decrypted and are re-encrypted and stored as examination documents when the exam time has elapsed.
- The exam evaluation happens automatically at the end by calculation of the points achieved.

NC Control Panel

As a benefit to the CNC training experience, we have developed within TopMill and TopTurn, a control panel/user interface with standard industry names and buttons controlling operation of the simulation software. This control panel can be operated by the user the same way the standard CNC control panel would be used on actual CNC machines.

4. CAMWORKS STUDENT EDITION

CAMWorks was the first fully integrated CAD/CAM solution designed exclusively to operate in SolidWorks. CAMWorks boasts knowledge-based, feature recognition, and fully associative machining capabilities. CAMWorks uses the same SolidWorks geometry to generate toolpaths to ensure the part you machine is the same part you've modeled.

CAMWorks is an intelligent and intuitive CAM application that eliminates the drudgery of CNC programming. Hours of complex programming time are eliminated by Automatic Feature Recognition (AFR) automatically defining machinable features while the TechDB (Technology Database) defines operations to automatically generate accurate toolpaths at the click of a button. CAMWorks helps manufacturers across aerospace, automotive, electronics and medical industries optimize and evolve their CAM automation process.

CAMWorks modules included are:

- 2 ½ Axis Milling
- 3 Axis Milling
- Turning
- Mill- Turn
- CAMWorks VoluMill
- CAMWorks Nesting
- Wire EDM

5. MTS INTERACTIVE

An electronic student and teacher presentation prepared to guide classroom discussion on preparatory subjects necessary for entry into manufacturing. Discussion topics include;

- Introduction to manufacturing
- Safety
- Math for machining
- Blueprint reading
- Geometric Dimensioning and Tolerance
- 5S, Lean and Six Sigma
- Fixtures
- Tooling



- Surface finish
- Metrology
- ISO (International Organization of Standards)

6. MTS Learning Management System (LMS)

A cloud based curricula and student management system with full manufacturing content ready to be used as a classroom management system, teaching aid or self-paced learning platform. Students have access to video, reading, presentation and test resources. The MTS LMS gives the teacher complete visibility of their students' progress throughout the duration of their learning path.

7. MTS Virtual Private Network (VPN) Access

The MTS VPN access is designed to provide students with 24/7 access to the MTS simulation products. In situations where the school is not at liberty to grant the students access to the school's network outside of the school day, the MTS VPN can fill the need. Students are given a password and setup instructions that will allow them to read the licenses on the MTS server wherever and whenever they have internet access to use the CAD, CAM and simulation tools.



APPENDIX E

Apprenticeship Standards as approved by the State of Florida



State Board of Education

Marva Johnson, *Chair*
Andy Tuck, *Vice Chair*
Members
Gary Chartrand
Tom Grady
Rebecca Fishman Lipsey
Michael Olenick

Pam Stewart
Commissioner of Education

Rod Duckworth, Chancellor
Career and Adult Education

July 5, 2017

Mr. Al Stimac, Chairman
Advanced Manufacturing Apprenticeship Program, GNJ
910 Waterway Place
Longwood, FL 32750

Dear Mr. Stimac:

The standards for Advanced Manufacturing Apprenticeship Program, GNJ (Registration Number 2017-FL-68555), were approved and registered by the Department of Education, Division of Career and Adult Education effective this date. The original copy of the standards is retained for the state file.

We appreciate your interest in the apprenticeship system and look forward to your continued support.

Sincerely,

Richard "Ted" Norman, Program Director
Apprenticeship

RN/pw

Enclosures

cc: Ms. Betsy Wickham, Bureau Chief
Mr. Steven Lindas



State Board of Education

Marva Johnson, *Chair*
Andy Tuck, *Vice Chair*
Members
Gary Chartrand
Tom Grady
Rebecca Fishman Lipsey
Michael Olenick

Pam Stewart
Commissioner of Education

Rod Duckworth, Chancellor
Career and Adult Education

DATE: July 5, 2017

PROGRAM SPONSOR: Advanced Manufacturing Apprenticeship Program GNJ

SUBJECT: Modification of Related Instruction

This is a program in a non-construction occupation whereas extenuating circumstances are involved that permit modification of related instruction hours for the fourth year of the program. Advanced Manufacturing Apprenticeship Program GNJ is requesting a variance from the related technical instruction as outlined in Chapter 6A-23.004(4)(d). In recognize of the unique and varying training requirements of this program, we hereby grant a variance to the related instruction.

Richard E Norman III, Program Director
Apprenticeship



State Board of Education

Marva Johnson, *Chair*
Andy Tuck, *Vice Chair*
Members
Gary Chartrand
Tom Grady
Rebecca Fishman Lipsey
Michael Olenick

Pam Stewart
Commissioner of Education

Rod Duckworth, Chancellor
Career and Adult Education

DATE: July 5, 2017

PROGRAM SPONSOR: Advanced Manufacturing Apprenticeship Program GNJ

SUBJECT: Variance from the Apprenticeship Hours

This is a program in a non-construction occupation whereas extenuating circumstances are involved that permit lower hours. Advanced Manufacturing Apprenticeship Program GNJ is requesting a variance from the standard 8,000 hour program to 7,200 hours. In accordance with Chapter 446.071(3), to recognize the unique and varying training requirements of such programs, we hereby grant a variance to the standard 8,000 hours as specified in Chapter 6A-23.004(2)(b)(1) FAC.

Richard "Ted" Norman, Program Director
Apprenticeship

STANDARDS OF APPRENTICESHIP

FOR

ADVANCED MANUFACTURING APPRENTICESHIP PROGRAM GNJ

2017-FL-68555

REGISTERED BY

FLORIDA DEPARTMENT OF EDUCATION
DIVISION OF CAREER AND ADULT EDUCATION –
APPRENTICESHIP

Standards of Apprenticeship

for

Occupation / Trade	Term of Training in Hours	NAICS Code	DOT Code	RAPIDS Code (4 digit trade #)	SOC Code
Machinist (Precision Machinist)	7200	332710	600.280-022	0296	51-4041.00

PROGRAM SPONSOR

Advanced Manufacturing Apprenticeship Program GNJ

JURISDICTIONAL AREA

Brevard, Lake, Marion, Orange, Osceola, Palm Beach & Seminole
(counties)

Time Based Program:	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Competency Based Program:	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
Hybrid Program:	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
VA Approval Requested:	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Vocational Education Linkage:	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

SIGNATURE PAGE

PROGRAM NAME: Advanced Manufacturing Apprenticeship Program GNJ
ADDRESS: 910 Waterway Place, Longwood, FL 32750
PHONE: 407-478-8480 FAX: 407-830-4485
EMAIL ADDRESS: info@machiningsolutions.com

Al Stimac 6/8/2017 Yvonne Stimac 6/8/2017
Chairman [*] Date Secretary [**] Date

COMMITTEE MEMBERS

Al Stimac, CHAIRMAN [*]
Metal Essence, Inc.

Yvonne Stimac, SECRETARY [**]
Metal Essence, Inc.

Richard Sweat, MEMBER
.decimal

Bill Wydra, MEMBER
Ashland Technologies, Inc.

Tomas Roman, MEMBER
GW Schultz Tool, Inc.

Drew Helseth, MEMBER
Jet Machine

Alan Garey, MEMBER
Decimal Engineering

Debra Bowers, MEMBER
SkyBolt Aeromotive Corp.

Ryan Loftus, MEMBER
Exatech, Inc.

SIGNATURE AUTHORITY
FOR COMMITTEE

NA

Name (Please Type)

(Signature)

Title: _____ Affiliation: _____

REVIEWED BY:

Steven H. Lindas

6/13/17

Steven H. Lindas
Apprenticeship & Training Representative

Date

REVIEWED

APPROVED

REGISTERED

FLORIDA DEPARTMENT OF EDUCATION
DIVISION OF CAREER AND ADULT EDUCATION - APPRENTICESHIP

Rick E. Brown

Authorized Official - Registration Agency

7/5/17

Date

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DEFINITIONS

1. Gender Reference - all references in these standards to the male gender are used for convenience only and shall be construed to include both male and female.
2. Apprentice - means a person at least 18 years of age who is engaged in learning a recognized skilled trade through actual work experience under the supervision of journeyworkers, which training should be combined with properly-coordinated studies of related technical and supplementary subjects, and who has entered into a written agreement, hereafter called an apprentice agreement, with a registered apprenticeship sponsor who may be either an employer, an association of employers, or a local joint apprenticeship committee. **6A-23.002(1) FAC**
3. Apprenticeship Agreement - means a written agreement between an apprentice and either his participating employer or an apprenticeship committee acting as agent for participating employer(s), which contains the terms and conditions of the employment and training of the apprentice. **6A-23.002(2) FAC**
4. Apprenticeship Committee - means those persons designated by the sponsor to administer the program. **6A-23.002(14) FAC**
5. Apprenticeship Representative - is an individual representative of the Florida Department of Education, properly authorized to act on behalf of the Department in matters concerning apprenticeship, preapprenticeship, and on-the-job training. **6A-23.002 (4) FAC**
6. Apprenticeship Standards - means the minimum requirements established uniformly for each craft under which an apprenticeship program is administered and includes standards of admission, training goals, training objectives, curriculum outlines, and objective standards to measure successful completion of the apprenticeship program and shall mean this entire document, including these definitions. **6A-23.002 (5) FAC**
7. Journeyworker - means a person working in an apprenticeable occupation who has successfully completed a registered apprenticeship program or who has worked the number of years required by established industry practices for the particular trade or occupation. Use of the term may also refer to a mentor, technician, specialist or other skilled worker who has documented sufficient skills and knowledge of an occupation, either through formal apprenticeship or through practical on-the-job experience and formal training. As defined in Chapter 6A-23, F.A.C., journeyworker applies to ratios, wage surveys and qualified apprenticeship trainers. The term "journeyworker" is synonymous with "journeyman" as defined in Section 446.021(4), F.S. **6A-23.002 (12) FAC**
8. Jurisdiction - means the specific geographical area for which a particular program is registered. **446.021(11) FS**
9. On-the-Job-Training - (OJT) - means supervised trade-specific employment. OJT becomes a monitoring responsibility of the sponsor. OJT training providers must be participating employers. **6A-23.002 (15)**
10. Participating Employer – means a business entity which: (a) is actively engaged by and through its own employees in the actual work of the occupation being apprenticed; (b) employs, hires and pays the wages of the apprentice and the journeyworker serving as qualified training personnel training the apprentice; (c) evaluates the apprentice, and (d) is signatory party to a collective bargaining agreement or signatory to a participating employer agreement with the program sponsor which will be registered with the Registration Agency in the Department. **6A-23.002(16) FAC**
11. Registration Agency - the term "Department" and "Registration Agency" are synonymous and shall mean the, Division of Career and Adult Education - Apprenticeship, Florida Department of Education. **6A-23.002(3) and 6A-23.004(2) (p) FAC**

12. Sponsor - means any person, association, committee, or organization operating an apprenticeship program and in whose name or title the program is or is to be registered, irrespective of whether such entity is an employer. **6A-23.002(21) FAC**

CONFORMANCE WITH STATE AND FEDERAL LAWS

No section of these standards shall be construed to permit violation of any law or regulation of the State of Florida or the United States. This program shall adhere to all local, state and federal laws pertaining to apprenticeship, which include but may not be limited to - Chapter 446, Florida Statutes; Chapter 6A-23, Florida Administrative Code; Title 29 Code of Federal Regulations, Part 29; and Title 29 Code of Federal Regulations, Part 30.

REGISTRATION OF APPRENTICESHIP PROGRAM

These standards shall be submitted to the Servicing Representative in the area to review and forward to the Registration Agency for approval and registration. Upon approval by the Registration Officer, the apprenticeship program shall be issued a Certificate of Registration, which shall remain effect; subject to the Apprenticeship Committee's adherence to the conditions of these rules. Prospective apprentices will be given the opportunity to read these standards before they sign the Apprenticeship Agreement.

An apprenticeship program may be registered in one or more occupations simultaneously or individually with the provision that the program sponsor shall, within one (1) year of registration, be actively training apprentices on the job in each occupation for which registration is granted. Each occupation for which a program sponsor holds registration shall be subject to cancellation if no active training of apprentices has occurred within one (1) year. **6A-23.003 FAC**

Section I COMPOSITION OF THE COMMITTEE

The apprenticeship committee shall be composed of 9 member representatives of the participating employers. The committee shall include a Chairman and a Secretary. The Committee shall meet quarterly and as often as necessary to conduct business. The committee shall determine such matters as a quorum, and the time and place of regular and special meetings.

Section II DUTIES OF THE COMMITTEE

- 1) Screen and select applicants for apprenticeship.
- 2) Maintain all records for a period of at least five (5) years.
- 3) Determine credit to be granted (if any) to applicants for previous experience or education, according to policy stated in this document.
- 4) Enter into apprenticeship agreements between the apprentice and the committee as program sponsor and to submit these agreements to the Apprenticeship Representative of the Registration Agency for registration.
- 5) Maintain a record of each apprentice's training progress on-the-job and in related classroom instruction.
- 6) Review regular progress reports for apprentices and recommend such actions as appropriate.

- 7) Arrange tests for determining the apprentice's progress in manipulative skills and technical knowledge.
- 8) Notify the Registration Agency of any other apprentice actions including registrations, reinstatements, cancellations, and repeat periods.
- 9) Notify the Registration Agency when apprentices have satisfactorily completed their apprenticeship and to request the issuance of a Certificate of Completion to such apprentices.
- 10) Provide for continuous employment of apprentices insofar as possible.
- 11) Secure, if applicable, Participating Employer agreements from designated employers and notify the Registration Agency by copy.
- 12) Hear and adjust complaints of violations, and make rulings as deemed necessary.
- 13) Recommend such changes in the program as are deemed necessary to improve effectiveness and efficiency.
- 14) Notify the Registration Agency's Apprenticeship Representative of all apprenticeship committee meetings and make available, upon request, the official minutes of such meetings.
- 15) Provide apprenticeship records for review, upon request of the Apprenticeship Representative.
- 16) In general, be responsible for the successful operation of the program and the welfare of the apprentices by performing the duties listed herein.

Section III RESPONSIBILITIES OF THE APPRENTICE

- 1) Work faithfully and diligently at the occupation.
- 2) Complete promptly and carefully all lessons, assignments and school tests required by the committee.
- 3) Protect the property of the employer.
- 4) Respect and comply with all rules, regulations and policies of the employer affecting their employment.
- 5) Keep adequate records of work experience and related instruction as required by the committee and submit properly completed records to the committee in a timely manner.

Section IV SUPERVISION OF APPRENTICES AND HOURS OF WORK

Apprentices when engaged in on-the-job training shall be under the direct supervision of a journeyworker.

The hours of work for apprentices shall be the same as those for journeyworkers in the occupation covered by these standards and in conformity with State and Federal Laws. In assigning work to apprentices, however, due consideration shall be given to the variety of operations necessary to develop their occupational skills.

Overtime will not interfere with the apprentice's attendance in related technical instruction. **6A-23.004(1) FAC**

Section V WORK PROCESS

The employer agrees to provide the apprentice adequately supervised instruction and work experience of which a record will be kept and periodically evaluated, in accordance with the work process outline.

Work experience will be provided in approximately the number of hours shown, but not necessarily in the order shown on **Page 14. 6A-23.004(2) (c) FAC**

Section VI TERM OF APPRENTICESHIP

The term of apprenticeship shall be 7,200 hours, approximately 42 months, of continuous on the job employment (including the probationary period). Hours for related instruction are excluded from those in OJT. **6A-23.004(2) (b) FAC**

Section VII RELATED INSTRUCTION

Apprentices employed under these standards shall be required to complete a minimum of 219 hours each of the first three years and 111 hours for year four (partial year) of supplemental instruction in technical subjects related to the occupation.

In case of failure, without due cause, on the part of the apprentices to fulfill their obligations as to school attendance and conduct, the committee shall take necessary disciplinary action.

A related instruction outline for the occupation(s) will be defined by the sponsor and outlined as part of these standards on **Page 15. 6A-23.004(2) (d) FAC**

Related Instruction Delivery Method (mark only one):

- | | |
|---|--|
| <input type="checkbox"/> Sponsor's Classroom | <input type="checkbox"/> Employer's Shop |
| <input type="checkbox"/> Vocational Education Classroom | <input type="checkbox"/> Community College Classroom |
| <input type="checkbox"/> Correspondence Course | <input checked="" type="checkbox"/> Other (i.e. Electronic Media, etc) |

Related Instruction Provider Type (select all that apply):

- | | |
|---|--|
| <input checked="" type="checkbox"/> Sponsor | <input checked="" type="checkbox"/> Technical School |
| <input type="checkbox"/> Vocational School | <input type="checkbox"/> Community College |
| <input type="checkbox"/> Correspondence Course | <input checked="" type="checkbox"/> Web Based |
| <input checked="" type="checkbox"/> Other (specify) <u>Lake Technical College</u> | |

Related Instruction hours are provided (mark only one):

- During Work Hours During Non-Work Hours During Work & Non-Work Hours

Are Wages Paid to the Apprentice During Related Technical Instruction? Yes No

Address where related instruction classes occur:

Online and/or at Metal Essence, Inc.
910 Waterway Place
Longwood, Florida 32750

Section VIII APPRENTICE WAGE SCHEDULE

No apprentice shall receive an hourly wage that is less than the period of training in which he is serving. The employer agrees to pay not less than the following wage rate to the apprentice during each period of apprenticeship. Wage rates are required to be expressed in percent of journeyworker's wage, and may not be less than 35% of the journeyworker's rate during the first period or less than 75% in the last period. In no event shall the apprentice wage rate be less than the minimum wage prescribed by Federal or State Law.

Period of Training	Percent of Journeyworker's Rate	Apprentice's Hourly Rate	Period of Training	Percent of Journeyworker's Rate	Apprentice's Hourly Rate
Year 1	45%	\$10.80			
Year 2	55%	\$13.20			
Year 3	65%	\$15.60			
Year 4	75%	\$18.00			

Journeyworker Hourly Wage Rate \$24.00, as of 1/31/2017, work week is 40 hours.

A wage survey of all active and/or current Participating Employers has been completed on the above date to arrive at the established journeyworker hourly rate listed above. The journeyworker hourly wage rate shall be reviewed and adjusted annually. **6A-23.004(2) (e) FAC**

Section IX APPRENTICE RECORDS

Records of the apprentice's on-the-job work experience and related instruction shall be kept and maintained by the committee. This information shall be furnished by the apprentice from his work record.

An examination of apprentices may be given at such time as determined by the committee. In these examinations, consideration shall be given to school attendance, progress and the daily employment record of the apprentice.

All records regarding each and every apprentice shall be presented for review when requested by the Registration Agency or its authorized representative(s). **6A-23.004(2) (f) FAC**

Section X RATIO OF APPRENTICES

The ratio of apprentices to journeyworkers consistent with proper supervision, training, safety, and continuity of employment or applicable provisions in collective bargaining agreements, but in a ratio of not more than one (1) apprentice to the participating employer in each apprenticeable occupation, and two (2) apprentices for every three (3) journeyworkers thereafter. It shall be the responsibility of the apprenticeship committee/sponsor to ensure that the allowable ratio of apprentices to journeyworkers is consistently maintained in the program as a whole, by each participating employer, and on the job site. **6A-23.004(2)(g) FAC**

Section XI PROBATIONARY PERIOD

Apprentices employed under these standards shall be subject to a probationary period during the first 90 days of the apprenticeship program, which can not exceed twenty-five percent of the length of the program or one (1) year, which ever is shorter. During the probationary period, the Apprenticeship Agreement may be terminated by either party of the agreement upon written notice to the Registration Agency without stated cause. The probationary period must be reasonable in relation to the full apprenticeship term; with full credit for such period toward completion of apprenticeship. **6A-23.004(2) (h, s) FAC**

Section XII SAFETY

The Apprentice shall be provided safety training both on the job site and in related technical instruction. The Participating Employer shall instruct the Apprentice in safe and healthful work practices and shall ensure that the Apprentice is trained in facilities and other environments that are in compliance with the Occupational Safety and Health Standards promulgated by the Secretary of Labor under Public Law 91-596, dated December 29, 1970, or state standards that have been found to be at least as effective. **6A-23.004(i) FAC**

Section XIII QUALIFICATIONS OF AN APPRENTICE

Applicants for apprenticeship shall possess the following minimum qualifications, which are directly job related:

1. Applicants must be at least 18 years of age.
2. Applicants must be in good health and physically able to perform all phases of the work.
3. Applicants must be able to read, write, and speak the English language in order to comprehend instructions on the job and in related training classes, and to ensure personal and co-worker safety on the job.
4. Applicants must possess a current and valid drivers' license. This license to remain current during the entire term of apprenticeship.

6A-23.004(j) FAC

Section XIV APPRENTICESHIP AGREEMENT

The Apprentice and the Sponsor shall sign an Apprenticeship Agreement which shall set forth the terms and conditions of employment, indicate what credit is to be granted for previous experience, if any, and shall meet the requirements of and be registered with the Registration Agency.

Every Apprenticeship Agreement entered into shall contain a clause making the terms and conditions of these standards a part of the Apprenticeship Agreement. **6A-23.004(2)(k) FAC**

Section XV CREDIT FOR PREVIOUS EXPERIENCE

Credit for previous experience, training, skills or aptitude in the occupation may be allowed, such credit to be stated on the Apprenticeship Agreement. Apprentices who receive credit for previous experience or training shall be paid, upon entrance, the wage rate of the period to which such credit advances them.

The Registration Agency recognizes that the program Sponsor has authority to establish procedures for granting credit to Apprentices for previous work and/or training experience. However, to ensure consistency among program sponsors in awarding credits, the Registration Agency requires that these procedures include the following basic requirements:

- A. No more than fifty percent of the apprenticeship program duration can be awarded to an Apprentice, i.e., number of months credited to an Apprentice for prior work and/or training experience, unless the Apprentice is transferring from another registered apprenticeship program in a related trade.
- B. All credit granted of more than 1000 hours of on the job training will require an evaluation method which, at a minimum, shall incorporate the following:
 1. Consideration of time worked in the specific occupation, or in a related occupation; and
 2. Consideration of wages earned by the incoming Apprentice.
- C. Program sponsors must maintain documentation as to how credit was granted to an Apprentice for a period of five (5) years. Documentation must be made available to the Registration Agency upon request.
- D. Individuals who receive credit toward the completion of an apprenticeship program must enter a related instructional program at a level commensurate with the amount of credit awarded. Before an Apprentice who was awarded credit for prior work and/or training experience can receive an Apprenticeship Completion Certificate from the State of Florida, he shall be required to demonstrate a mastery of the same instructional material as those apprentices who have completed the entire training program.
- E. All program sponsors who want to award credit to an apprentice for a registered apprenticeship program must develop and include procedures for meeting the standards of that program and have these available for review.

Exceptions to the above policy may be granted when requested by a program sponsor and a determination is made by the Registration Agency that such exception does not undermine the quality of apprenticeship training and favors the welfare of the Apprentice. **6A-23.004(2) (l) FAC**

Section XVI TRANSFER OF APPRENTICES

It shall be the duty and responsibility of the Apprenticeship Committee to provide, insofar as possible, continuous employment for all apprentices. Where it is impossible for one employer to provide the diversity of experience necessary to give the apprentice total training experience in the various branches of the occupation, or where the employer's business is of such character as not to permit reasonable continuous employment over the entire period of apprenticeship, the Apprenticeship Committee shall have authority to transfer the Apprentice to another Participating Employer, who shall assume all the terms and conditions of these standards and the Apprentice must receive full credit for satisfactory time and training earned.

Should an Apprentice be transferred from one registered apprenticeship program to another, the Apprentice must be provided a transcript of his completed related technical instruction as well as his completed on-the-job training from the originating Sponsor. The transfer of the Apprentice must be to the same occupation. The Apprentice must be cancelled from his originating Sponsor's program and a new Apprenticeship Agreement must be executed between the Apprentice and the subsequent program sponsor and registered with the Registration Agency. **6A-23.004(2) (m) FAC**

Section XVII ASSURANCE OF QUALIFIED TRAINING PERSONNEL

Every apprenticeship instructor providing related technical instruction to apprentices must meet the Florida Department of Education's requirements for a career-technical instructor per Section 1012.55 F.S., or be a subject matter expert, which is an individual who is recognized within an industry as having expertise in a specific occupation, as demonstrated by being a journeyworker, or by holding the licensure or certification required in the given occupation; and have training in teaching techniques and adult learning styles, which may occur before or after the apprenticeship instructor has started to provide the related technical instruction. **6A-23.004(2) (n) FAC**

Section XVIII CERTIFICATE OF COMPLETION OF APPRENTICESHIP

Upon satisfactory completion by an Apprentice, of their term of apprenticeship, the Apprenticeship Committee will request from the Registration Agency, through the Servicing Representative, that a Certificate of Completion of Apprenticeship be awarded. **6A-23.004(2) (o) FAC**

Section XIX MODIFICATION OF STANDARDS

These standards may be modified or amended at any time by action of the Apprenticeship Committee upon approval of the Registration Agency. Such amendments shall be promptly submitted to the Servicing Representative for review and shall not alter apprenticeship agreements in effect at the time of such change without the express consent of all parties to such agreement. **6A-23.003(7); FAC 6A-23.004(2) (q) FAC**

Section XX PROGRAM CANCELLATION AND DEREGISTRATION

Cancellation of this program may be effected upon the voluntary action of the Sponsor by requesting such a cancellation in writing from the Registration Agency.

Deregistration of this program shall be upon written notice by the Registration Agency to the Sponsor, stating cause and instituting formal deregistration proceedings in accordance with the provisions of Chapter 6A-23.006 Florida Administrative Code.

In either event, the Sponsor shall notify the apprentices within fifteen (15) business days of the effective date of the event that will deprive the apprentices of their individual registration. **6A-23.006 FAC**

Section XXI NOTIFICATION

The Registration Agency shall be notified through the Servicing Representative of all actions affecting apprentices, such as new indentures, suspensions, cancellations, completions, and other actions as reflected on the Apprentice Action Reporting Form. **6A-23.004(2) (r) FAC**

Section XXII ADJUSTING DIFFERENCES

In case of dissatisfaction by the Participating Employer or the Apprentice, either party has the right and privilege of appeal to the Apprenticeship Committee for such corrective action and adjustment of such matters as come within these standards. The Apprenticeship Committee will have full authority to supervise the enforcement of these Standards. Its decision will be final and binding on the employer and the apprentice. The Registration Agency is available to receive, investigate and resolve any complaints the Apprentice has about the apprentice training program in which the Apprentice is registered. *Apprentices may contact the Program Coordinator listed in the front of these Standards for information and assistance with submitting grievances before the Committee.*

The Apprentice and his Participating Employer shall be notified by the Sponsor within five (5) business days of the date of any proposed adverse action, with stated opportunity to the apprentice during such period for corrective action. **6A-23.004(2) (t, u) FAC**

Section XXIII MAINTENANCE OF RECORDS

All records pertaining to the administration, selection, employment and training of apprentices shall be kept for not less than five (5) years from the date of departure from or completion of the program. The maintenance of private sector apprenticeship program records shall be the sole responsibility of the Sponsor / Apprenticeship Committee and are to be kept at the following address, which is a facility that allows and provides governmental access for auditing purposes as outlined in Ch. 119 F.S. (Florida Public Records Law): **6A-23.004(2) (v) FAC**

Metal Essence, Inc.
910 Waterway Place
Longwood, Florida 32750

Section XXIV LISTING OF PARTICIPATING EMPLOYERS

Each Employer wishing to participate in this registered apprenticeship program shall sign a Participating Employer’s Agreement with the Sponsor, unless otherwise provided for in a collective bargaining agreement and in so doing, will accept the requirements of the program standards. The Program Sponsor shall provide an executed copy of the signed Participating Employer’s Agreement to the Registration Agency and the cancellation thereof. **6A-23.004(2) (w) FAC**

Metal Essence, Inc.	.decimal
Ashland Technologies, Inc.	GW Schulz Tool, Inc.
Jet Machine	Decimal Engineering
Skybolt Aeromotive Corp.	Exatech, Inc.

Section XXV FUNDING

Each participating employer will contribute an equitable amount to the funding of the program as set by the Apprenticeship Committee. **6A-23.004(2) (x) FAC**

Section XXVI EQUAL EMPLOYMENT OPPORTUNITY PLEDGE

The recruitment, selection, employment and training of apprentices during their apprenticeship shall be without discrimination because of race, color, religion, national origin, or sex. The Sponsor will take affirmative action to provide equal opportunity in apprenticeship and will operate the apprenticeship program as required under Title 29 of the Code of Federal Regulations, Part 30. **6A-23.004(2) (y) FAC**

Section XXVII AFFIRMATIVE ACTION

The Apprenticeship Committee enters this program with the understanding that it will be sincere in making a good faith effort to increase and maintain the number of minority and female apprentices necessary to at least equal the percentage of minorities and females in the area. This program consists of affirmative acts that may be altered and supplemented as experience indicates. The Apprenticeship Committee shall provide equal opportunity in apprenticeship for those indentured to or seeking entrance into this apprenticeship program for the purpose of learning the occupation.

To provide equal opportunities in the recruitment, selection, employment, training and advancement of minority and female apprentices, the committee agrees to make the following affirmative action commitments:

1. Disseminate information concerning the nature of apprenticeship, availability of apprenticeship opportunities, sources of apprenticeship applications, and the equal opportunity policy of the committee. Such information shall be disseminated at least 30 days in advance of the earliest date for application at each interval. Information will be disseminated to government employment service offices, local schools, women's centers, outreach programs, principal minority groups, women's organizations and community organizations which can effectively reach minorities and women. This information shall also be published in newspapers which are circulated in the minority community and among women as well as the general areas in which the program sponsor operates. Copies of this information shall be sent to the Registration Agency field office that services the respective program.
2. When possible, participate in workshops conducted by employment service agencies for the purpose of familiarizing schools, and the employment service with apprenticeship training and its current opportunities.
3. Cooperate with local school boards and vocational education systems to develop programs for preparing students to meet the standards and criteria required to qualify for entry into apprenticeship programs.
4. Encourage the establishments and utilization of pre-apprenticeship, preparatory trade training, or other programs, designed to afford related work experience or to prepare candidates for apprenticeship, the committee shall make appropriate provision in its Affirmative Action Plan to assure that those who complete such programs are afforded full and equal opportunity for admission into the apprenticeship program.
5. Utilize present minority and female apprentices and journeymen to assist in the implementation of the programs Affirmative Action Plan.
6. Grant advance standing or credit on the basis of previously acquired experience, training, skills or aptitude for all applicants equally.
7. Engage in such other activities, when identified, that may further the entry of minorities and/or females into apprenticeship. **Title 29 CFR Part 30, 6A-23.004(2) (y) FAC**

Section XXVIII SELECTION PROCEDURE

The committee shall select apprentices from the qualified applicants as follows: **6A-23.004(2)(y)(2) FAC**

- 1) Applicants for Apprenticeship must apply to the GNJ Sponsor Committee.
- 2) Applicants are screened by the GNJ Sponsor Committee on the basis of selection criteria approved by the Registration Agency.
- 3) Applicants who meet the screening requirements and are accepted by the GNJ Sponsor Committee as eligible for apprenticeship, are then referred to signatory participating employers who are hiring.
- 4) If the employer states in writing to the GNJ Sponsor Committee their intent to hire an eligible applicant referred, that applicant is indentured by the GNJ Sponsor Committee and hired by the employer.

Veterans and pre-apprentices will receive equal consideration in the selection process.
A list of participating employers will be kept current by the sponsor.

Selection records kept for at least five (5) years.

Section XXIX TITLE 29 CFR PART 30, UTILIZATION ANALYSIS

Advanced Manufacturing Association Apprenticeship Program GNJ
(Name of Program)
Longwood, Florida
(City) (State)

Jurisdictional Area Covered by Program (counties): Brevard, Lake, Marion, Orange, Osceola, Palm Beach & Seminole.

a)

1.	Total labor force:	* <u>2,441,930</u>
2.	Total minorities in labor force:	* <u>1,085,048</u>
3.	Total females in labor force:	* <u>1,166,181</u>
4.	Percentage of minorities:	* <u>44.43%</u>
5.	Percentage of females:	* <u>47.76%</u>

* (Source of information compiled from the Agency for Workforce Innovation Labor Market Statistics 2010 Census.)

b) Under utilization Factors:

1.	Total number of employers:	<u>8</u>
2.	Total of employers workforce in the trade:	<u>268</u>
3.	Total journeyworkers employed by the employers in the craft:	<u>57</u>
4.	Total minority journeyworkers employed by the employers in the craft:	<u>37</u>
5.	Total female journeyworkers employed by the employers in the craft:	<u>5</u>
6.	Total youth journeyworkers age 16-22 employed by the employers in the craft:	<u>1</u>
7.	Total apprentices:	<u>NA</u>
8.	Total minority apprentices:	<u>NA</u>
9.	Total female apprentices:	<u>NA</u>
10.	Under utilization of minorities:	<u>NA</u>
11.	Under utilization of females:	<u>NA</u>

c) Goals and Timetables:

1.	Percentage of all future accessions to be minorities:	<u>44.43%</u>
2.	Percentage of all future accessions to be females:	<u>23.88%</u>

WORK PROCESS OUTLINE

OCCUPATION/TRADE: Machinist (Precision Machinist)

Occ. Code: 0296

Year 1	Hours	Year 3	Hours
Blueprint Reading		CNC Machine Setup	
Geometric Dimensioning and Tolerance		CNC Machine Process Troubleshoot	
Metrology		First Article / PPAP Inspection	
The CNC Control Panel		Complex CAD / CAM Integration - Mill	
Lean Manufacturing		2D CAM Program Generation - Turn	
Workpiece Clamping		Complex CAD / CAM Integration - Turn	
Tool Change Systems		3D CAM Workpiece Creation	
Speed-Position Control Circuit		Workholding Design Technique - Mill	
Path Measuring Systems		Workholding Design Technique - Turn	
Subtotal:	2100 hours	Subtotal:	2100 hours
Year 2		Year 4 (partial year)	
Sawing Technology		Intro to Post Processor	
Grinding Technology		CAM 4 Axis Programming Technique	
Geometric / Technological Basics - Mill		CAM 5 Axis Programming Technique	
Drilling Cycles – Mill		Mill Turn Programming Technique	
Programming Milling Cycles – Mill		Cutting Tool Design	
Geometric / Technological Basics – Turn		Subtotal:	900 hours
CAD – Drawing Methods and Technologies			
CAD – Management of CAD Drawings			
Problem Solving – Critical Thinking			
Subtotal:	2100 hours		
		TOTAL HOURS:	7200 hours

RELATED INSTRUCTION OUTLINE

OCCUPATION/TRADE: Machinist (Precision Machinist)

Occ. Code: 0296

	Year 1	Classroom Hours		Year 3	Classroom Hours
1	Introduction to CNC	9	1	Safety	9
2	Safety	9	2	Six Sigma Green Belt	7
3	Math for Machining	8.5	3	Simulation Break Test Exercise	10
4	Blueprint Reading	8.5	4	CNC Machine Set up	10
5	Geometric Dimensioning (GD&T)	8.5	5	CNC Machine Process Troubleshoot	10
6	Metrology	8.5	6	First Article / PPAP Inspection	10
7	ISO Standards	9	7	OSHA 10	9
8	CNC Control Panel	8.5	8	Basics of Automation in Manufacturing	9
9	Employability Skills	8.5	9	CAM - Drawing to Finished Workpart	9
10	Manufacturing History	8.5	10	2D CAM Program Generation - Mill	9
11	Surface Finish	8.5	11	Complex CAD / CAM Integration - Mill	9
12	5S Method	8.5	12	2D CAM Program Generation - TURN	9
13	Lean Manufacturing	8.5	13	Complex CAD / CAM Integration - Turn	8
14	Six Sigma Method	8.5	14	3D CAM Workpiece Creation	8
15	Manufacturing Maintenance	8.5	15	3D CAM Available Machining Planes	8
16	Construction of Machine Tools	9	16	3D CAM Associative Programming	8
17	Controllable Feed and Rotational Axis	9	17	Workholding Design Technique - Mill	8
18	Feed Drives	9	18	Workholding Design Technique - Turn	8
19	Main Drive	9	19	Six Sigma Black Belt	8
20	Workpiece Clamping Device	9	20	Troubleshooting on Lathe	9
21	Tool Change Systems	9	21	Troubleshooting on Mill	9
22	Tool Change Procedures	9	22	Process Development	8
23	Speed-Position Control Circuit	9	23	Macro B Programming Technique	9
24	Path Measuring Systems	9	24	Intro to Post Processor	9
25	Sequence of CNC Programming	9	25	CAM 4 Axis Programming Technique	9
	Subtotal:	219 hours		Subtotal:	219 hours
	Year 2			Year 4 (partial year)	
1	Safety	9	1	Safety	9
2	Secondary Process	10	2	CAM 5 Axis Programming Technique	9
3	Swain Technology	9	3	Common Industry CAM Technology	9
4	Grinding Technology	10	4	Mill Turn Programing Technique	9
5	Program Structure-Address Letters - Milling	9	5	Cutting Tool Design	9
6	Geometric/ Technological Basics - Mill	10	6	Manufacturing Resource Management	10
7	Linear Interpolation - Mill	9	7	Broaching using CNC machine	9
8	Circular Interpolation - Mill	9	8	Automation in Manufacturing	9
9	Drilling Cycles - Mill	10	9	Robotics in Manufacturing	10
10	Programing Cycle Calls (3 Digit)	10	10	Troubleshooting on lathe	9
11	Programming Milling Cycles - Mill	9	11	Troubleshooting on mill	9
12	Program Structure - Programming Rules - Turn	9	12	Process Development	10
				Subtotal:	111 hours
13	Geometric/ Technological Basics - Turn	9			
14	Linear Interpolation - Turn	9			
15	Circular Interpolation - Turn	10			
16	Turning Canned Cycles - Turn	9			
17	Basics of CNC Maintenance and Troubleshooting	9			
18	CAD - NC Compatible Geometrical Representation	10			
19	CAD - Drawing Methods and Technologies	10			
20	CAD - NC Compatible Dimensioning	10			
21	CAD - Management of Cad Drawings	10			
22	Leadership - Teamwork Skills	10			
23	Problem Solving - Critical Thinking	10			
	Subtotal:	219 hours			
				TOTAL HOURS:	768



APPENDIX F

3D PRINTER EQUIPMENT LENS MODEL MR-7 QUOTE FROM OPTOMEC

PREPARED FOR:
Xioming Yu
University of Central Florida
4303 Scorpius Street
Orlando, FL 32816
Indianapolis, IN 46222

Quote Date: August 1, 2017
Quote in effect until: 90 days
Prepared by: Jim Cann

QUOTATION NO.:
Q-MR7-UCF-080117

Item	STANDARD LENS MR-7 SYSTEM	Qty	Unit Price	Extension
1	LENS Model MR-7 Hermetically Sealed Class 1 Laser Enclosure - (300 x 300 x 300 mm process work envelope) 3 Axis PC based CNC Motion Control System Isolated Pass Thru Chamber (Antechamber) Integrated Gas Purification System (Dri-train) Integrated Dual Powder Feeders Standard Deposition Head & Powder Delivery System Vision system Computer Control System 500W IPG Fiber Laser Laser Delivery & Control System LENS MR-7 Workstation Control Software LENS PartPrep Software & STL Editor Spares Kit	1	\$654,750	\$654,750
2	Install Package; shipping, set-up, basic training System Shipment, including insurance, from factory to USA customer dock Installation and set-up of System Basic Training on Operation of Equipment Up to 3-days at customer's facility including T&L expenses	1	\$36,000	\$36,000
3	Annual Hot Line Service Agreement System Online & Telephone Support Limited Application Online & Telephone Support Software Updates & System Field Change Orders	1	included	included
LENS MR-7 SYSTEM TOTAL				\$690,750
CUSTOMER DISCOUNT				(\$34,538)
LENS MR-7 SYSTEM GRAND TOTAL				\$656,213

Item	SYSTEM OPTIONS	Qty	Unit Price	Extension
1	Laser Upgrade to 1 kW & Chiller From 500W Fiber Laser to 1kW Fiber Laser with chiller	0	\$37,000	\$0
2	Extra Powder Feeder Two powder feeders are included in the base system Up to two additional feeders can be added	0	\$19,500	\$0
3	4th Axis Rotary Stage	0	\$14,500	\$0
4	Melt Pool Sensor Includes half-day initial training	0	\$39,000	\$0

5	3-day Basic Equipment Training Class	0	\$8,200	\$0
	Up to Four Students per Class			
	Training conducted using Customer LENS Equipment			
	Includes Travel & Living for Optomec Trainer			
LENS MR-7 SYSTEM TOTAL				\$0
CUSTOMER DISCOUNT				\$0
LENS MR-7 SYSTEM GRAND TOTAL				\$0

Quotation Notes	
1	Prices are quoted in US DOLLARS; FOB US Destination
2	Price includes shipment and cargo insurance to USA customer dock or port
3	Payment Terms: 50% Down payment at time of Order; 40% on Shipment; 10% on Installation.
4	Each party is responsible for their own travel and expenses.
5	Customer responsible for providing electrical, gas, and other facilities required prior to installation
6	LIMITED WARRANTY: Warranty period of 1 year after installation.
7	Customer is responsible for all government taxes, duties and other levies including but not limited to VAT, sales tax, import/export duties, and withholding taxes imposed on Optomec.
8	Delivery is expected to be 16-18 weeks after receipt of down payment; to be confirmed at the time of order receipt
9	All other Optomec Terms and Conditions apply

Please direct all inquiries regarding this quotation to:

Jim Cann
 Tel: (248) 880-6752
jcann@optomec.com



APPENDIX G

Letters of Support from Manufacturing Companies

The manufacturing companies that have provided letters of support are 1) Ashland Technologies, 2) Metal Essence, 3) MTS, 4) GW Schultz Tool, 5) Decimal Engineering and 6) Manufacturing Association of Florida. These companies have committed to working with 30 of our trainees and provide internship for at least 30 weeks. The internships committed to in the second year is estimated to be worth \$180,000 which is equal to the budgeted amount requested in the first year for internships. Moreover, many of these companies also have received approval to provide the apprenticeship program for 3.5 years, and have committed to take several qualifying apprentices in their program.



August 9, 2017

Dr. Ranganathan Kumar
Associate Dean for Research and Administration
College of Engineering and Computer Science
Pegasus Professor, UCF
Room 307, Engr 1
4000 Central Florida Blvd.
Orlando, FL 32816

Machining Training Solutions (MTS) is pleased to support the University of Central Florida and write this letter of support as a collaborator for the proposal entitled "Sustainable Training and Education in Advanced Manufacturing (STEAM)".

MTS specializes in advanced manufacturing training. Our services include training in CNC turning and milling processes from aluminum to titanium metal alloys. We offer the most advanced CNC simulation-based training enabling students to master machining operations, tooling, and digital manufacturing systems utilized in machine shops. Partnering with University of Central Florida, we would be delighted to develop a workforce training program that will train manufacturing workers with transferrable and sustainable skills.

MTS commits to participating in the 10-week internship being offered in relation to the universities program. We acknowledge that the interns are to be compensated for their time. We understand the funding for the initial year will be provided by the university with the expectation that employers will be responsible for compensation for the second year.

The interns participating in the universities program may possibly be offered the opportunity to participate in the approved *Advanced Manufacturing Apprenticeship Program GNJ (2017-FL-68555)* offered by MTS. The apprenticeship program is a 3.5-year 7200-hour program.

By signing below, I acknowledge that MTS will participate in the student selection process and provide training to different trainees from university, community/state colleges and unemployed/underemployed individuals. I agree to undertake the tasks associated with me as described in the project description of this proposal. I look forward to collaborating with Dr. Kumar and other professors at the University of Central Florida on this project.

A handwritten signature in black ink, appearing to read "Al Stimac", is written over a light blue rectangular background.

Al Stimac
President



August 9, 2017

Dr. Ranganathan Kumar
Associate Dean for Research and Administration
College of Engineering and Computer Science
Pegasus Professor, UCF
Room 307, Engr 1
4000 Central Florida Blvd.
Orlando, FL 32816

Metal Essence is pleased to support the University of Central Florida and write this letter of support as a collaborator for the proposal entitled "Sustainable Training and Education in Advanced Manufacturing (STEAM)".

As a precision metals and plastics fabricator located in Longwood, Metal Essence specializes in advanced manufacturing. Additional capabilities include laser cutting, fixture and product design, and rapid prototyping. Partnering with University of Central Florida, we would be delighted to develop a workforce training program that will train manufacturing workers with transferrable and sustainable skills.

Metal Essence commits to participating in the 10-week internship being offered in relation to the universities program. We acknowledge that the interns are to be compensated for their time. We understand the funding for the initial year will be provided by the university with the expectation that employers will be responsible for compensation for the second year.

The interns participating in the universities program may possibly be offered the opportunity to participate in the approved *Advanced Manufacturing Apprenticeship Program GNJ (2017-FL-68555)* offered by Machining Training Solutions. The apprenticeship program is a 3.5-year 7200-hour program.

By signing below, I acknowledge that Metal Essence will participate in the student selection process and provide training to different trainees from university, community/state colleges and unemployed/underemployed individuals. I agree to undertake the tasks associated with me as described in the project description of this proposal. I look forward to collaborating with Dr. Kumar and other professors at the University of Central Florida on this project.

Yvonne Stimac
President



August 9, 2017

Dr. Ranganathan Kumar
Associate Dean for Research and Administration
College of Engineering and Computer Science
Pegasus Professor, UCF
Room 307, Engr 1
4000 Central Florida Blvd.
Orlando, FL 32816

The Manufacturers Association of Florida (MAF) is pleased to support the University of Central Florida and write this letter of support for the proposal entitled "Sustainable Training and Education in Advanced Manufacturing (STEAM)".

As Florida's leading manufacturing association, MAF promotes all opportunities that will improve the business climate for our industry leaders, including increased educational programs aimed at training students in order to develop a skilled workforce. We happily support the University of Central Florida's efforts for a new advanced manufacturing program which will produce manufacturing workers with transferrable and sustainable skills.

We recognize the importance of promoting advanced skills for high school and college students, as well as the current workforce, demanded by the diverse types of new job opportunities in Florida. The University of Central Florida's STEAM program will assist in creating a statewide resource for employers to seek skilled talent for years to come. This endeavor will propel Florida's workforce forward for one of the state's primary economic drivers—advanced manufacturing.

Thank you for your consideration and support.

Amanda Bowen
Amanda Bowen
Executive Director

BOARD MEMBERS

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BASF
Crowe Horwath LLP
Enterprise Florida, Inc.
Lockheed Martin
Sparton DeLeon Springs LLC
Taminco



595 County Road 448
Tavares, Florida 32778
Phone: (352) 343-8778
Fax: (352) 343-8311
www.gwschultz.com

August 7, 2017

Dr. Ranganathan Kumar
Associate Dean for Research and Administration
College of Engineering and Computer Science
Pegasus Professor, UCF
Room 307, Engr 1
4000 Central Florida Blvd.
Orlando, FL 32816

G.W. Schultz Tool is pleased to support the University of Central Florida and write this letter of support as a collaborator for the proposal entitled "Bridging Industry and Academia: Advanced Manufacturing for Sustainable Workforce Development and Training".

As a manufacturer located in Tavares, Florida, G.W. Schultz Tool specializes in Carbide Cutting Tool. Our services include precision carbide cutting tool manufacturing, design, development and reconditioning. Partnering with University of Central Florida, we would be delighted to develop a workforce training program that will train manufacturing workers with transferrable and sustainable skills.

G.W. Schultz Tool commits to participating in the 10-week internship being offered in relation to the universities program. We acknowledge that the interns are to be compensated for their time. We understand the funding for the initial year will be provided by the university with the expectation that employers will be responsible for compensation for the second year.

The interns participating in the universities program may possibly be offered the opportunity to participate in the approved *Advanced Manufacturing Apprenticeship Program GNJ (2017-FL-68555)* offered by Machining Training Solutions. The apprenticeship program is a 3.5-year 7200-hour program.

By signing below, I acknowledge that G.W. Schultz Tool will participate in the student selection process and provide training to different trainees from university, community/state colleges and unemployed/underemployed individuals. I agree to undertake the tasks

associated with me as described in the project description of this proposal. I look forward to collaborating with Dr. Kumar and other professors at the University of Central Florida on this project.

Regards,

A handwritten signature in black ink, appearing to read "Rick McIntyre". The signature is fluid and cursive, starting with a large loop and ending with a long, sweeping tail that extends to the right.

Rick McIntyre
Chief Executive Officer
G.W. Schultz Tool

*Since the time that the letter was written, the proposal title was changed to "Sustainable Training and Education in Advanced Manufacturing (STEAM)"



August 7, 2017

Dr. Ranganathan Kumar
Associate Dean for Research and Administration
College of Engineering and Computer Science
Pegasus Professor, UCF
Room 307, Engr 1
4000 Central Florida Blvd.
Orlando, FL 32816

Decimal Engineering Inc., is pleased to support the University of Central Florida and write this letter of support as a collaborator for the proposal entitled "Bridging Industry and Academia: Advanced Manufacturing for Sustainable Workforce Development and Training".

As a CNC Machine and Precision Sheet Metal Fabricator located in Pompano Beach, Florida, Our services include Advanced Manufacturing, CNC Machining, 9-Axis Mill/Turn Machining, Sheet Metal Fabrication, Metal Stamping (Compound Die, Progressive, Single-Hit), Wire EDM, 2D/3D Laser Cutting, Certified Mil-Spec Welding, Engineering & Design Services, Value-Added Assembly, Tool & Die Work, Reverse Engineering, 3D Printing, Design for Manufacturability, SolidWorks and AutoCAD Friendly. Partnering with University of Central Florida, we would be delighted to develop a workforce training program that will train manufacturing workers with transferrable and sustainable skills.

Decimal Engineering, Inc., commits to participating in the 10-week internship being offered in relation to the universities program. We acknowledge that the interns are to be compensated for their time. We understand the funding for the initial year will be provided by the university with the expectation that employers will be responsible for compensation for the second year.

The interns participating in the universities program may possibly be offered the opportunity to participate in the approved *Advanced Manufacturing Apprenticeship Program GNJ (2017-FL-68555)* offered by Machining Training Solutions. The apprenticeship program is a 3.5-year 7200-hour program.

By signing below, I acknowledge that Decimal Engineering, Inc., will participate in the student selection process and provide training to different trainees from university, community/state colleges and unemployed/underemployed individuals. I agree to undertake the tasks associated with me as described in the project description of this proposal. I look forward to collaborating with Dr. Kumar and other professors at the University of Central Florida on this project.

Alan L. Garey
President

A handwritten signature in black ink, appearing to read "Alan L. Garey", is written over a light blue horizontal line.

*Since the time that the letter was written, the proposal title was changed to "Sustainable Training and Education in Advanced Manufacturing (STEAM)"



August 7, 2017

Dr. Ranganathan Kumar
Associate Dean for Research and Administration
College of Engineering and Computer Science
Pegasus Professor, UCF
Room 307, Engr 1
4000 Central Florida Blvd.
Orlando, FL 32816

Ashland Technologies, Inc. is pleased to support the University of Central Florida and write this letter of support as a collaborator for the proposal entitled "Bridging Industry and Academia: Advanced Manufacturing for Sustainable Workforce Development and Training".

As a manufacturing company located in Orlando, Florida, Ashland Technologies, Inc. specializes in machined parts and custom fabrication. Our services include CNC Machining, Mig, Tig, and Stick Welding, fabricated parts from prototype to production, CNC Brakes, Water-Jet, Laser, and Plasma Cutting. Partnering with University of Central Florida, we would be delighted to develop a workforce training program that will train manufacturing workers with transferrable and sustainable skills.

Ashland Technologies, Inc. commits to participating in the 10-week internship being offered in relation to the universities program. We acknowledge that the interns are to be compensated for their time. We understand the funding for the initial year will be provided by the university with the expectation that employers will be responsible for compensation for the second year.

The interns participating in the universities program may possibly be offered the opportunity to participate in the approved *Advanced Manufacturing Apprenticeship Program GNJ (2017-FL-68555)* offered by Machining Training Solutions. The apprenticeship program is a 3.5-year 7200-hour program.

By signing below, I acknowledge that Ashland Technologies, Inc. will participate in the student selection process and provide training to different trainees from university, community/state colleges and unemployed/underemployed individuals. I agree to undertake the tasks associated with me as described in the project description of this proposal. I look forward to collaborating with Dr. Kumar and other professors at the University of Central Florida on this project.

A handwritten signature in black ink, appearing to read 'Bill Wydra', is written over a horizontal line.

Bill Wydra
President and Owner

*Since the time that the letter was written, the proposal title was changed to "Sustainable Training and Education in Advanced Manufacturing (STEAM)"