



SpaceTEC[®]

SpaceTEC Partners, Inc. 2014/2015 Annual Report



Table of Contents

EXECUTIVE SUMMARY	2
KEY PERSONNEL AND ORGANIZATIONS	4
SpaceTEC Partners, Inc. Board of Directors	4
National Visiting Committee	5
National Aerospace Technology Advisory Committee (NATAC).....	6
Commercial Industry Technology Advisory Committee (CITAC).....	7
SpaceTEC® Co-PI's and Affiliates.....	8
SpaceTEC® Headquarters.....	9
BROADER IMPACTS	10
2014/2015 Goals.....	10
Strategies	10
2014/2015 Major Activities	11
KEY OUTCOMES/ACHIEVEMENTS	17
INTELLECTUAL MERIT	19
Training and Professional Development Opportunities	19
Outreach	20
Going Forward	21
SpaceTEC® Curriculum.....	22
Disciplines outside Aerospace	24
Intake Assessment Tools.....	25
Education Program Assessments.....	26
Institutional Resources	27
Information Resources that Form Infrastructure	28
Technology Transfer	29
Beyond Science and Technology.....	31
INDEPENDENT REVIEWS	32
SpaceTEC® 2014 External Evaluator Report	32
SpaceTEC® 2014 National Visiting Committee Report	33
EASTERN FLORIDA STATE COLLEGE SERVICE LEARNING PROGRAM INTERN PERSPECTIVES	34

EXECUTIVE SUMMARY

Entering the thirteenth year of a National Science Foundation (NSF) Advanced Technological Education (ATE) continuing grant, SpaceTEC® supports a growing consortium with performance-based credentialing programs. With sound financial footing and an exceptional staff, the ability to meet grant goals and provide the products and services to enable aspiring technicians interested in technology careers remains our primary focus.

SpaceTEC®, a division of SpaceTEC Partners, Inc., a 501c3 non-profit corporation based in Cape Canaveral, FL, has as its main focus support for science, technology, engineering and math education and training programs for the nation's aerospace, manufacturing and technical services industries. As an NSF National Resource Center (NRC), SpaceTEC® endeavors to foster and sustain a well-prepared pipeline of skilled workers through robust educator/technician aerospace-centric curriculum, professional development opportunities and performance-based credentialing programs.

Since 2002, SpaceTEC®, one of 42 NSF national centers dedicated to two-year STEM education programs, has supported the nation's aerospace industry, a unique and fascinating technological sector confronted with many of the same challenges other vital industries are seeing: an aging workforce, rapid technology change, increasing global competition and a shortage of skilled workers.

In a report titled "*U.S. Space Industry "Deep Dive" Assessment: Employment in the U.S. Space Industrial Base*" published by the U.S. Department of Commerce Bureau of Industry and Security (BIS) in Sept. 2014, a survey of commercial companies, universities, non-profit organizations, and U.S. government agencies saw 1,234 respondents indicating they "had 24,836 vacancies nationwide for Engineers, Scientists, and R&D Staff; Production Line Workers; and Testing Operators, Quality Control & Support Technicians." The reasons cited for these vacancies included "lack of proper skills/qualifications, geographic difficulties, variability of demand, and difficulty attracting workers to manufacturing." The importance of sustaining future aerospace industry activities is paramount and demands the very best efforts to ensure our nation continues to maintain a leadership role. In light of this, SpaceTEC®'s role as a focal point for promoting careers in aerospace, engaging students in science and technology education, providing third-party skills validation and providing resources for emerging commercial space companies to manage costs and avoid mishaps has become even more important.

In aerospace manufacturing, the situation is even more complex. The aviation industry is forecast to require 92,500 new commercial airline maintenance technicians by 2031.¹ According to the Bureau of Labor Statistics, job growth in avionics technicians, industrial machinery mechanics and aircraft structure and systems assemblers are forecast to far outpace the average growth of all occupations. The U.S. has been the global leader in aerospace manufacturing for over 100 years and this global leadership is now at risk due to the lack of qualified workers.

In its publication titled "*Aviation's second golden age: Can the U.S. aircraft industry maintain leadership?*", the National Association of Manufacturers (NAM) in partnership with the Manufacturing Institute (MI) reported US workers in Aerospace Products and Parts Manufacturing numbered 492,800 as of May 2012.²

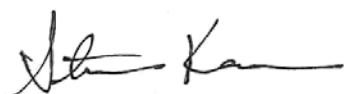
Publication 4493, titled “*Shifts in U.S. Merchandise Trade 2013*” released in October 2014 by the U.S. International Trade Commission, noted “the aircraft sector is the country's biggest net exporter, with total exports in 2012 at \$104.8 billion compared to imports, which were \$29.1 billion. This resulted in a trade surplus of \$75.7B”.³ Aircraft equipment comprises aircraft, spacecraft, and related equipment. The report went on to say "aircraft delivered in 2013 had been ordered by airlines and leasing companies in previous years, as the production time and waitlist for large civil aircraft can stretch from many months to several years." In light of these developments, much work remains to be done to ensure a robust pipeline of talented workers capable of producing and maintaining the next generation of aerospace transportation products.

Developing tools for transitioning military and unemployed/underemployed Veterans to serve as pathways to living wage jobs and accelerated access to higher education is another key area of focus for the SpaceTEC[®] NRC. Implementing new certifications in Avionics and advanced metal/composite structures to complement the existing inventory of credentials will continue as well.

Increased emphasis will also be placed on developing and deploying educator tools to excite K-12 students about space and meaningful careers available in aviation and aerospace-related industries with the primary goal of imparting foundational knowledge and skills required for credentials that can help engender a pipeline of qualified workers.

We look forward to the coming year with anticipation and resolve as we continue to work with our exceptional consortium of industry, education and military partners to leverage resources to the benefit of the nation’s technological workforce.

Sincerely,



Steve Kane
Executive Director, SpaceTEC Partners, Inc.
Principal Investigator and Managing Director
SpaceTEC[®] National Resource Center for Aerospace Technical Education
CertTEC[®] Testing and Certification Center

¹ National Industry-Specific Occupational Employment and Wage Estimates; NAICS 336400 - Aerospace Product and Parts Manufacturing. Bureau of Labor Statistics. May 2013. Online: http://www.bls.gov/oes/current/naics4_336400.htm

² Aviation's second golden age: Can the U.S. aircraft industry maintain leadership?. National Association of Manufacturers in partnership with the Manufacturing Institute. December 2013. Online: <http://www.themanufacturinginstitute.org/Research/Other-Institute-Reports/~media/D52A363E0D804DDBA5C76856DA9FA182.ashx>

³ Shifts in U.S. Merchandise Trade 2013. United States International Trade Commission Office of Economics. October 2014. Online: http://www.usitc.gov/transportation_equipment.htm

KEY PERSONNEL AND ORGANIZATIONS

SpaceTEC Partners, Inc. Board of Directors

Marshall Heard, President

Board Chairman

Aerospace Consultant;

Former VP, Int'l Sales

The Boeing Co.

Adrian Laffitte, Vice President

Aerospace Consultant;

Former Director, Florida Government Relations,

Lockheed Martin

George Hauer, Secretary

Principal Consultant, GHauer and Associates:

Former Executive, Wyle Laboratories

Richard Laird, Treasurer

Vice President, Finance and Technical Services,

Eastern Florida State College

Jerry Moyer, Board Member

Director of Florida Operations,

Bionetics Corporation

NSF National Visiting Committee

Stewart Harris, Chair

Former Director of Technology Programs,
NASA Langley Research Center (LaRC)
Hampton, VA

Richard Beagley (Ret.)

Former VP – United Space Alliance
Kennedy Space Center, FL

Mike Flynn

International Association of Machinists and Aerospace Workers (IAMAW)
Washington DC

RADM Jim Underwood – US Coast Guard (Ret.)

Business Development, Management Services Group
AECOM (formerly URS Corp.)
Merritt Island, FL

Dr. Ellen Gordon

South Seattle Community College
Kent, WA

Scott Henderson

Blue Origin

CAPT Winston Scott – US Navy (Ret.)

Former NASA Astronaut
Florida Institute of Technology

Robert Herman

Orbital ATK

Patricia Harris

Retired, Thomas Nelson Community College

Jim Swindell

Retired, Calhoun Community College

External Evaluator

Albert Schwabenbauer

NSF Program Officer

Dr. V. Celeste Carter

National Aerospace Technology Advisory Committee (NATAC)

Mark Gaedcke – Chair (A)
SpaceTEC® HQ

Mike Ennis*
Harris Corp

Jeff Manning*
STC

Kevin Vega
NASA

Mark Bontrager
Space Florida

Dale Nash
Virginia Space Authority

Rick Serfozo
Orbital ATK

Keith Davis
Calhoun Community College

Harold Cherrix
Orbital Sciences

Larry Ostarly
URS

Betty Muldowney
Vencore

Mike Powell
Titusville-Cocoa Airport Authority

Dan Ciccateri
Dan Gearing
Sierra Nevada

Pam Underwood
FAA Office of Commercial Space
Transportation

***Joint NATAC/CITAC Committees**

Commercial Industry Technology Advisory Committee (CITAC)

Kevin Gulliver – Chair
Nida Corporation
Chair, Avionics, Electricity and Electronics
Joint Subcommittee

Teresa Maher
Electronics Technician Association -
International (ETA-I)

John Shepard
Veterans Assembled Electronics (VAe)

Mike Hoke
Abaris Training

Lou Dorworth
Abaris Training

Greg Mellema
US Army
Chair, Composites Joint Subcommittee

Earl Thomas
US Army
Chair, Aviation Structures Subcommittee

Lance Rudman
Wichita Area Technical College
Chair, Aviation Mechanical Assembly
Subcommittee

Jeff Manning
STC

David Jones
Aviation Institute of Maintenance

Mark Miller
Discovery Aviation

Shane Enman
American Airlines

Terry Sampson
Tulsa Technology Center

Don Hall
Spirit AeroSystems

Dave Sandmeyer
180 Skills

Cliff Archer
Global Educational Support

Shirley Brown
Tennessee Colleges of Applied Technology

Ken Payton
Francis Tuttle Technology Center

Pete Boss
Embraer

Neill Fullbright
Embry-Riddle Aeronautical University

David Beavers
Florida Institute of Technology

SpaceTEC[®] Co-PI's and Affiliates

Robert Mabry
Allan Hancock College

Dr. Karen Cowell
Antelope Valley College

Tad Montgomery
Calhoun Community College

Jason Smith
Community College of the Air Force

Dr. Kristin Frady
Clemson University

Sandra Castillo
Doña Ana Community College

Bill Fletcher
Eastern Florida State College

John Floyd
Eastern Shore Community College

Mel Cossette
Edmonds Community College

Dr. Diane Howard
Embry-Riddle Aeronautical University

Richard Stark
Francis Tuttle Technology Center

Pat Hoppe
Gateway Technical College

Tim Kissel
MIAT Technology Center

Jonathan Beck
Northland Community and Technical
College

Dr. Sallie Kay Janes
San Jacinto College

Kim Alexander
South Seattle Community College

Shirley Brown
Tennessee College of Applied Technology

Jean Frank
Thomas Nelson Community College

Jeff Lowe
Tulsa Technology Center

Sheree Utash
Wichita Area Technical College

SpaceTEC® Headquarters

Steve Kane
Managing Director

Dave Fricton
Certification Manager

Mark Gaedcke
Quality Specialist

Carolyn Parise
Business Manager

Michelle Arieux
Certification Specialist

Sue Peterson
Documentation Specialist

BROADER IMPACTS

2014/2015 Goals

In support of its mission to continuously strive for a “Legacy of Excellence” by working through existing and future partnerships to provide valid, relevant, error-free third-party performance-based credentialing and professional development resources for America’s military, STEM educators and the technical workforce, SpaceTEC® has four primary goals:

1. Grow the National Repository for Aerospace Technical Education to include industry subject matter experts (SMEs) and their support materials, implementing a system that matches information/assistance requests with relevant experts and data.
2. Promote Science, Technology, Engineering and Math (STEM) opportunities to increase enrollments/certifications for special needs groups, including returning Veterans and unemployed/underemployed technicians.
3. Offer skill-based STEM-related professional development programs for educators, Examiners and practitioners with emphasis on assessments/KSIs, career pathways and stackable credentials.
4. Strengthen/expand the national infrastructure to increase education program articulation and the ability to offer performance-based technician credentialing that is fee-bearing and sustainable.

Strategies

For **Goal 1**, SpaceTEC® proposes to obtain NASA and industry Space Shuttle Program materials, training curricula, testing and certification protocols, and relevant collateral data plus develop registries of SMEs who would consult/assist. SpaceTEC® partner colleges further agreed to work with local and national groups, industry representatives, and government organizations to invite practitioners to access materials and available experts. The Center also planned to develop and implement methods that matched requests for assistance with relevant resources and where appropriate, develop enabling agreements with FAA, NASA, leading aerospace companies, and other entities.

For **Goal 2**, SpaceTEC® proposes to articulate appropriate elements of the national core curriculum and core certification competencies to stackable credentials of immediate use in STEM-related technician jobs by leveraging existing programs to develop test banks, lab/shop capabilities, and prep courses in related technologies. Certification exams will continue to be offered at locations accessible to qualified returning military, Veterans, and unemployed/underemployed technicians seeking hands-on work in STEM fields with new locations continuously sought and created. SpaceTEC® partner colleges planned to work with their local placement groups and area industries to implement new performance certifications in technical fields hiring in their area. Initially, SpaceTEC® proposed to offer certifications at six partner sites by 2015 and presently there are more than 20 sites capable of delivering SpaceTEC® and CertTEC® credentials nationwide.

For Goal 3 SpaceTEC[®] is focused on adapting/developing/implementing workshops, course materials and skill-related credentials with qualified SMEs to update/educate K-12 and post-secondary educators, certified Examiners and technician practitioners with relevant information. SpaceTEC[®] partner colleges have agreed to work with industry to strengthen the links between the workplace and classroom and facilities where faculty/practitioners and shops/labs are available will serve as host sites. Workshops will be designed for new partners and to qualify certified technicians as Examiners. Participation will be sought at certification examining sessions with workshops added where needed.

For Goal 4, SpaceTEC[®] proposes to manage a national system of post-secondary education programs and nationwide articulation agreements linked to workplace credentials, implementing tuition/fee systems that include all SpaceTEC[®] partners in sustainable funding initiatives and encouraging consortium colleges to seek industry partners willing to sponsor/support these programs through endorsements and job postings. SpaceTEC[®] also proposes to expand management and outreach systems to recruit new partners and extend the variety and use of certification examinations to broaden the nationwide infrastructure, providing pathways to STEM jobs.

2014/2015 Major Activities:

Strengthened Partnerships

In 2014, new college and industry partnerships significantly strengthened the SpaceTEC[®] consortium. To capitalize on this added capability, two new nationally-recognized performance-based credentials supporting the Aircraft Maintenance, Repair and Overhaul (MRO) and Aviation Manufacturing industry sectors were implemented. The addition of SpaceTEC[®] Examiners (STE's) and CertTEC[®] Examiners (CTE's) at key locations further enhances the ability for SpaceTEC[®] to deliver performance-based certification examinations nationwide.

Additional Test Sites

Based on input received at the Feb. 2014 National Visiting Committee meeting on the eastern shore in Virginia, CertTEC[®] Basic Electricity and Electronics (BEE) certification pilot programs have been implemented at three new partner college examination sites. Sites have been created at [Eastern Shore Community College](#) in Melfa, VA; at [Thomas Nelson Community College](#) in Hampton, VA; and at [Antelope Valley College](#) in Lancaster, CA. This brings the total of CertTEC[®] BEE testing sites to ten nationally.

Support for Transitioning Military

As the US military continues reducing the active duty force, pathways to civilian occupations has remained an important focus. Assisting service members and unemployed/underemployed Veterans achieve industry endorsed, nationally recognized credentials which may serve as pathways to civilian careers and enable them to find meaningful employment with living-wage jobs through the Veterans Technical Education Connection (VetTEC[®]) initiative remains a primary focus. **Through VetTEC[®]**, the SpaceTEC[®] NRC has been working to establish

partnerships in key areas at DoD, VA and educational institutions to streamline the wealth of resources available to active duty military, transitioning service members and Veterans into a one-stop, user-friendly site focused on assisting active duty, transitioning military and Veterans with aligning technical military occupational specialties with SpaceTEC®/ CertTEC® certifications. By linking to the appropriate Credentialing Opportunities Online (COOL) or VA benefits pages, the emerging portal will also provide links to college partner programs, information on preparation materials, technical training programs, and American Council on Education (ACE) credit-by-certification as a pathways to move into and accelerate through higher education as they prepare for STEM technician careers.

Additional Certification Products

Continuing the focus on fostering and supporting a well-prepared pipeline of skilled aerospace workers in 2014/2015, SpaceTEC® and sister division CertTEC® made significant progress creating products aimed at addressing the skills gap currently facing U.S aerospace industries due to an aging workforce and a shortage of qualified workers available to meet industry needs. With the aid of a vibrant national consortium of community and technical colleges, universities and industry partners, unprecedented support from NASA, DoL, DoD, and the Federal Aviation Administration, SpaceTEC® was able to successfully develop and deliver practice-based aerospace and related technology certificate programs, degrees and complementary performance-based certifications driven by industry needs and built upon real-world skills.

Support for the Department of Labor (DOL) National Aviation Consortium (NAC) Trade Adjustment Assistance Community College and Career Training (TAACCCT) Grant

In response to aviation/aerospace industry challenges, from 2012 through late 2015, Aviation and Aerospace employers at five locations across the nation contributed subject matter expert (SME) support for curriculum and content to community colleges in their local employment areas through the [National Aviation Consortium](#), a \$14.9 million investment in aviation training through a DOL TAACCCT grant with a mission to create a world-class aviation workforce utilizing industry standards, accelerated training and best-in-class, technology-enabled curriculum. Led by the National Center for Aviation Training (NCAT) located at [Wichita Area Technical College](#), the desire was to create the foundation for a next generation aviation manufacturing workforce. With industry recognizing the need for an action-based solution and building off successful efforts to re-define the education pathway in aviation manufacturing by aligning to industry-based skills certifications, NCAT invited SpaceTEC® to join with them to develop a national credential representing validation of an individual's professional competence. The result of this effort was implementation of an Aviation Mechanical Assembly Technician third-party performance-based certification in Dec. 2014, thereby strengthening the aviation manufacturing workforce pipeline and engendering a consistent level of quality across the nation.



Support for Educator and Practitioner Professional Development

SpaceTEC[®] continues to offer skill-based STEM-related professional development programs for educators, examiners and practitioners with emphasis on assessments/KSIs, career pathways and stackable credentials. In the past year, SpaceTEC[®] implemented a matching funds Instructor Professional Development Opportunity for consortium members to provide access to new technology as a means of enhancing technical education programs. The program accepts applications for professional development opportunities from consortium instructors and splits the cost of the opportunity with the instructor's institution. To-date, two consortium educators have applied for and been funded through the program.

Throughout 2014, the SpaceTEC[®] NRC experienced growing interest from the military, industry, technical training centers and community colleges for services related to performance-based credentialing for STEM technicians. In an annual survey of academic partners, industry, and certified technicians representing a variety of fields conducted in late 2014, an overwhelming majority of respondents expressed confidence in the value of SpaceTEC[®] and CertTEC[®] credentials as discriminators of technician capability and also for opening pathways to higher education.

In addition to technology center, community college, university, military and industry training programs, SpaceTEC[®] is placing increasing emphasis on developing K-12 programs that offer opportunities for primary, middle and secondary students to become involved in activities which better prepare them for STEM education as a career pathway. Capturing the attention of students by introducing them to STEM applications is seen as an important step in nurturing the next generation of STEM technicians. SpaceTEC[®] is in the enviable position of being able to engage students in space-related activities, which are fun and exciting. SpaceTEC[®] will continue to support and foster the magic of space as a motivator to engage under-represented and at-risk youth in programs that kindle the spirit of exploration and adventure

2014/2015 Significant Results

In support of Goal 1, National Repository and SME database, significant activities communicating the existence of this resource included:

- Supported the Commercial Space Conference held in Washington DC in February 2015
- Supported the Canaveral Spaceport Training Panel at Space Coast Regional Airport, Titusville, FL in April and July 2014
- Supported the DOD Maintainer's Technical Interchange Meeting (TIM) held in Huntsville, AL in June 2014
- Supported the FAA AST Commercial Space Technical Advisory Council (COMSTAC) meeting held in Washington DC in July and August 2014
- Presented to Craig Technologies, Cape Canaveral, FL in July 2014



- Conducted a poster session and exhibit booth at the High Impact-Technology (HI-TEC) Conference, Austin, TX in July 2014
- Supported an ISO Standards panel discussion as a member of the FAA AST Commercial Space Technical Advisory Council (COMSTAC) via teleconference in August 2014
- Supported the Space Coast Aviation/Space Technical Conference at Space Coast Regional Airport/Spaceport Territory in September 2014
- Exhibited at TechXpo, a job fair for students at the Florida Institute of Technology, Melbourne, FL, in October 2014
- Sponsored the National Coalition of Advanced Technology Centers (NCATC) National Conference in Houston, TX and staffed an exhibit booth in October 2014
- Exhibited at the CAMX Composites Show in Orlando, FL in October 2014
- Supported the ATE PI Conference in Washington DC in October 2014
- Sponsored an Aviation Structures Technician track at the National Educators Workshop at North Seattle Community College and staffed an exhibit booth in November 2014.
- Provided five educational institutions and two commercial companies with aerospace curriculum and certification information support through the National Repository Information Request function on the SpaceTEC[®] secure server.
 - As some files contained in the Repository are restricted under International Traffic in Arms Regulations (ITAR) rules, this is a significant feature of the program. In certain cases the source of requests must be verified before any information can be released.
- Subject Matter Expert (SME) contact information was provided to Taurus USA, a Florida armament company seeking engineering support for development of "smart gun" technology as the space program was considered by the company to be related science.
- Expanded information contained in the National Repository to include additional training materials in Composites, Adhesive Bonding, Epoxy and Visual Inspection.



High Impact Technology Conference, Austin, TX July 2014

In support of Goal 2, increasing enrollments/certifications for special needs groups, returning Veterans and unemployed/underemployed technicians, significant activities included:

- Supported returning Veterans/current military personnel through the Veterans Community Blueprint Meeting at Eastern Florida State College Cocoa campus in May 2014.
- Worked with the Navy's COOL Program to expand funding support to all SpaceTEC[®]/ CertTEC[®] Certifications.
- Worked with the Air Force to assist with implementation of a similar COOL program.
- Submitted paperwork to the Army's COOL program to implement a program to pay for all certifications up front
- Worked with the US Dept. of Veteran's Affairs to expand funding to cover all SpaceTEC[®]/ CertTEC[®] certifications
- Expanded CertTEC[®] Basic Electricity & Electronics certification to the Army's Ordnance Electronics Maintenance Training Division (OEMTD) detachments at Fort Sill, OK & Fort Lee, VA
- Initiated 20% discounts for Veterans on all certifications.

- Expanded certification offerings to relate to more military career fields as a result of input from military COOL sites regarding applicability across multiple military jobs.
- Expanded certification test sites to accommodate military personnel outside of the continental US. Recent sites in-process include Kadena Air Force Base in Japan and Marine Corps Base, HI.
- Continued support for the Army's Soldier for Life program through CertTEC[®] Basic Electricity and Electronics credentialing.
- Initiated a contract with CAST (the Center for Applied Space Technology) to support development of the VetTEC[®] web portal as a one-stop-shop of available funding and credentialing opportunities backed by the ACE CREDIT program and other options available for accelerating Veterans and near-separation active duty military into technology programs
- Supported various Veteran outreach activities such as:
 - Veterans Appreciation Day sponsored by the Titusville, FL Chamber of Commerce (May 2014)
 - Eastern Florida State College Career Day (May and September 2014)
 - Eastern Florida State College Veteran's Center group meetings (to raise awareness of SpaceTEC[®] programs among student Veterans)

In support of Goal 3, offering skill-based STEM-related professional development for educators, examiners and practitioners, significant activities included:

- Presented a performance-based computer-driven examination case study at the Questionmark Users Conference in San Antonio, TX (April 2014).
- Funded professional development opportunities for partner college faculty and staff: Associate Professor in the Engineering Technology program at Thomas Nelson Community College, Hampton, VA funded to attend the National Educators Workshop, Seattle, WA (Nov. 2014)
- Instructor in the Aerospace Technology program at Calhoun Community College, Decatur, AL funded to attend Abaris Training Advanced Composites Manufacturing and Repair training course in Griffin, GA
- Created a remote vacuum fill spacecraft fuel transfer competition event for the 2015 Aerospace Maintenance Competition (AMC) event in Miami Beach, FL to highlight the convergence of spacecraft and aircraft in upcoming sub-orbital vehicle flights.
- Sponsored a team of 4th semester Eastern Florida State College Aerospace Technology students to compete in the 2015 AMC competition.
- Sponsored events at the National Educator Workshop (NEW) in Seattle in November 2014
- Funded an Aviation Structures track
- Conducted new Examiner training/certification.
- Expanded CertTEC[®] Basic Composites at the [US Army's Aviation and Missiles Research Development and Engineering Center \(AMRDEC\)](#) Prototype Integration Facility (PIF) at Redstone Arsenal in Huntsville, AL.
- Added Abaris Training, Reno, NV and Wichita Area Technical College (WATC) in Wichita, KS as CertTEC[®] Basic Composites examination sites.

- Certified an examiner and established capability for delivering the SpaceTEC® Core exam at NASA White Sands Test Range and the greater Las Cruces, NM area through partner Doña Ana Community College. The certification exam and examiner training were conducted at SpaceTEC® HQ, Cape Canaveral, FL
- Implemented CertTEC® Aviation Structures – Francis Tuttle Technology Center, Oklahoma City, OK; Tulsa Technology Center, Tulsa, OK; WATC, Wichita, KS
- Expanded BEE certification test sites to include Eastern Shore Community College, Melfa, VA; Antelope Valley College, Lancaster, CA; US Army, Fort Lee, VA; US Army, Fort Sill, OK
- Provided the National Center for Aviation Training (NCAT) at Wichita Area Technical College (WATC) support for Aviation Mechanical Assembly Certification development as part of their National Aviation Consortium (NAC) grant.
- Provided Composites course curriculum and certification standards to South Seattle Community College.
- Provided NDT Subject Matter Expert course review for educational partner 180 Skills, Indianapolis, IN.
- Sponsored CertTEC® Examiner/SME/Composites Subcommittee Board Chair Greg Mellema with Army Aviation and Missiles Research Design and Engineering Center (AMRDEC) – Prototype Integration Facility (PIF) at Redstone Arsenal, AL to attend CAMX Conference in Orlando, FL



Aviation Structures Certification Exam Being Conducted at Francis Tuttle Technology Center April 2014



Mechanical Assembly Training in preparation for the Aviation Mechanical Assembly Certification at Wichita Area Technical College, December 2014

In support of Goal 4, increasing education program articulation and availability of performance-based technician credentialing, significant activities included:

- Expanded certification offerings to partner colleges:
 - CertTEC® Basic Composites
 - CertTEC® BEE (Basic Electricity and Electronics)
 - CertTEC® Aviation Structures
 - CertTEC® Aviation Mechanical Assembly
 - CertTEC® Avionics (in development)
- Added additional educational partners:
 - [South Seattle Community College](#), Kent, WA
 - [Northland Technical Community College](#), Thief River Falls, MN
 - [Michigan Institute of Aviation and Technology](#), Canton, MI
 - [Wichita Area Technical College](#), Wichita, KS
 - [180 Skills](#), Indianapolis, IN
 - [Aviation Institute of Maintenance](#), Virginia Beach, VA
 - [Abaris Training](#), Reno, NV

KEY OUTCOMES/ACHIEVEMENTS:

During 2014:

- The US Army Ordnance Electronics Maintenance Training Detachment (OEMTD) at Fort Gordon, GA requested 1948 vouchers for CertTEC[®] electronics testing and certification to support their Ordnance and Electronics training programs. OEMTD detachments at Fort Lee, VA and Fort Sill, OK purchased test sets and vouchers for testing an additional 423 students.
- The National Center for Aviation Training (NCAT) at Wichita Area Technical College implemented the CertTEC[®] Aviation Mechanical Assembly Technician certification for graduates in the Aviation Assembly technician track. This included successful certification of four NCAT instructors as CertTEC[®] Examiners (CTEs). Plans are underway to extend the availability of the certification at additional sites in Tulsa, OK and Indianapolis, IN.
- SpaceTEC Partners, Inc. initiated creation/implementation of a Strategic Plan. Included when complete will be elements of a:
 - Business Plan
 - Legislation and Policy Plan
 - Product Review
 - Business Development Plan
 - Relationship Management Plan
 - Outreach and Sales Plan
 - Organization Structure and Staffing Plan
 - Pricing Plan
 - Capital Equipment Plan
 - Intellectual Property Plan
- SpaceX officially recognized the SpaceTEC[®] Core certification as a preferred credential on job postings for employment as a Launch Services Technician at Cape Canaveral Air Force Station, FL. It is hoped this will be a qualification for employment at the SpaceX Commercial Launch Site under development near Brownsville, TX.
- The FAA Office of Commercial Space conducted an annual review of SpaceTEC[®] operations to ensure the conditions stated in the Safety Approval SA-011-003 were still viable. As a result of the review, SpaceTEC[®]'s Safety Approval was continued for an additional year.
- The International Certification Accreditation Council ([ICAC](#)) conducted a bi-annual review of the SpaceTEC[®] and CertTEC[®] credentialing processes to ISO 17024 requirements. As a result of the review and the fact there were no findings or significant changes, SpaceTEC[®] Partners, Inc. accreditation to ISO 17024 was continued for an additional two years.
- SpaceTEC Partners, Inc. (SPI) applied for Federal 501(c)3 tax-exempt status as an educational and charitable institution. Following submission of the necessary paperwork to the Internal Revenue Service, a request for additional information was received, the necessary documentation was prepared and sent to the agency.

- Enhanced recognition for SPI's CertTEC® division was initiated through entry in a global event called logo tournament (www.logotournament.com). SPI hoped to create a recognizable icon depicting the focus of the division in advance of implementation of the upcoming CertTEC® Avionics certification. In the two-week event, requirements for a logo were crafted and posted to the site. Once in place, graphics designers from all over the world could access them and post their interpretations of the desired "look". There are no limits on the number of contestants or entries and winners are chosen based on their creativity and talent creating the image. The event cost \$375 and in all CertTEC® received 141 entries from 14 designers in six countries. The winning design was from a designer in Indonesia and created a look that features CertTEC® in an elongated globe with meridian lines partially surrounded by an elongated "C" (for certifications), with the subtitle "Performance-Based Certifications. The new look captures the essence and potential global application of CertTEC®'s performance-based certifications. The new look will begin showing up on SpaceTEC® and CertTEC® correspondence soon.
- The US Army Ordnance Electronics Maintenance Training Detachment (OEMTD) at Fort Gordon, GA, Fort Lee, VA and Fort Sill, OK adopted CertTEC® Basic Electricity and Electronics certifications as part of the US Army Soldier for Life program in 2013. Soldier for Life encourages credentialing of soldiers on active duty with recognized national certifications to increase opportunities for employment when they return to civilian life, in 2014 and the first quarter of 2015, CertTEC® credentialed over 600 soldiers who successfully completed the DC, AC, Analog and Digital exams following electronics Advanced Individual Training (AIT).
- The AMRDEC PIF added a requirement in the Request for Quote (RFQ) for CertTEC® Basic Composites certification to support a helicopter rotor blade repair contract. 14 Yulista Aviation personnel performing repairs on helicopter rotor blades returned from overseas for refurbishment successfully completed the certification and an additional 6 Yulista employees are in the prep course preparing for certification.



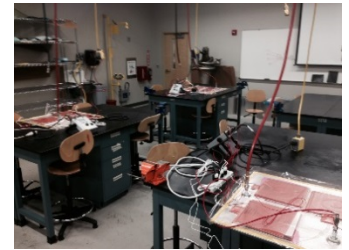
Dave Fricton, SpaceTEC Certification Manager Congratulates Earl Thomas, Redstone Arsenal, AL on achieving CertTEC® Composites Examiner Status

INTELLECTUAL MERIT

Training and Professional Development Opportunities

2014 was a year of expansion. Improvements in infrastructure, the addition of capable staff in key positions, and implementation of a new program supporting college partner professional development has allowed SpaceTEC® to remain in a strong position to provide curriculum and performance-based credentialing program support to educators preparing STEM students at all levels to become competent technicians in many important economic sectors, including electronics, aviation/aerospace manufacturing and commercial space operations. Through SpaceTEC®'s nineteen partner and affiliate colleges nationwide, opportunities for technicians to leverage education, training and on-the-job experience with performance-based credentials as pathways to good-paying jobs continues.

In March 2014, SpaceTEC® conducted a three-day Composites Technology workshop based on competencies developed by the SpaceTEC® consortium for 12 Embraer Executive Jets employees through Eastern Florida State College Workforce Training. Embraer Executive Jets, a subsidiary of Embraer Corporation, which is based in Brazil, is located in Melbourne, FL and assembles a series of light executive jets. The event featured instruction in composites theory, manufacturing methods, testing, inspection, repair and occupational safety. Through the training course, all attendees were qualified to sit for the CertTEC® Basic Composites exam.



Embraer Executive Jets Technician Projects Curing in the Composites Lab at Eastern Florida State College

Also in 2014 SpaceTEC® implemented the **Faculty Professional Development Opportunity** to offer enabling activities to partner college instructors for the purpose of building competence or “sharpening skills.” Solicitations are requested annually from faculty, instructors and staff at partner colleges to participate in activities which enhance their understanding of competencies and technology as they relate to SpaceTEC®'s overall mission. In order for the activity requested to be approved, the requestor's institution must be willing to provide matching funds to cover the cost of incidentals and transportation. To-date, three activities have been approved through this program:

1. Calhoun Community College in Decatur, AL was approved to send an instructor to the "Train the Trainer" track offered by Abaris Training, Inc. For more than 30 years, Abaris training has worked to push the limits of composites technology and is recognized as one of the premier composites training organizations in the world. SpaceTEC® provided funding for course registration and Calhoun Community College agreed to fund travel and incidentals. In all, four courses are required to complete the program. Two will be completed by April 2015, the remaining two will be completed in 2015/2016.

2. Thomas Nelson Community College in Hampton, VA was approved to send a faculty member to the National Educators Workshop (NEW), an instructor professional development workshop, which was held at North Seattle Community College, Seattle,

WA Nov. 2 - 5th, 2014. NEW brings together students, faculty and business to strengthen understanding of Science, Technology, Engineering and Math principles, especially relating to materials science, and to enhance K-20 technology education integration. A unique feature of NEW is hands-on, interactive learning which presents information in a way that engages students and teachers. Of particular interest were the workshop tracks in Composites, Electronics and Aviation Structures.

3. Eastern Florida State College in Cocoa, FL was approved to send a team consisting of Aerospace Technology program students to compete in the Aerospace Maintenance Competition ([AMC](#)) event held in Miami, FL April 12-17th 2015. The AMC is a venue for teams of Aerospace technicians and students enrolled in either FAA, EASA, CASA or equivalently authorized schools as well as personnel of any country's Armed Forces that are involved in the aircraft and spacecraft maintenance fields. The AMC is an opportunity for today's and tomorrow's skilled Aerospace Maintenance Professionals to test their combined abilities against those of their peers. The AMC is an exciting competition that will help with the constant upgrading of the standards that today's skilled Aerospace Maintenance Professionals hold themselves to. The AMC also provides a stage to highlight the knowledge, skill and integrity that is the foundation of today's and tomorrow's AMTs. By providing a stage that showcases these principles of the AMT profession, the AMC will help raise awareness of the training and skill needed for providing safe, airworthy aircraft... worldwide.

4. SpaceTEC[®] sponsored Co-PI's from Eastern Florida State College and Thomas Nelson Community College to the High Impact Technology Exchange Conference (HI-TEC) held in Austin Texas in July 2014.

In the past year SpaceTEC[®] also participated in the Eastern Florida State College Service Learning Program, which provided opportunities for Aerospace Technology students to experience a working environment to practice skills acquired in their training. Every semester 3-4 students are selected for the program. In all, Service Learning students have logged over 400 hours assisting SpaceTEC[®] HQ staff prepare credentialing equipment, kits and test specimens for certification activities nationwide.

Outreach

Operations ongoing at the Center are disseminated through a combination of workshops, outreach events, meetings and conferences, printed material including both curricular and descriptive documents (lab manuals, skill standards, course outlines, program frameworks, and all supporting materials), online courses, press releases and a quarterly newsletter sent to more than 4000 aerospace and general industry

employers, technicians, partners, and educators.



SpaceTEC Talk Newsletter Dissemination Tool

The SpaceTEC[®] website now includes access to photographs, videos, lessons learned, curriculum materials, program frameworks, course outlines; “hot links” to related sites; prep courses; reference materials; social networks; 24-hour help desk; and databases including a calendar of events.



Re-Tooled SpaceTEC Website
www.spacetec.org

During this next phase, additional materials will be developed and disseminated using some of these same techniques – namely online websites running WordPress, curricular reference materials, prep courses using open source software (Moodle), and certification examinations using **Questionmark** – a commercial testing software. Three significant additions will permit the consortium to provide directed assistance rather than the passive modes used in the past. These are: (1) A collection of NASA educational materials for technician training and certification for spaceflight; (2) A registry of at least 50 subject matter experts in the technologies required to preserve and advance technical leadership in the field; and (3) access to/possession of a NASA library of lessons learned and best practices essential to commercial space. The goal is to match requests for information with relevant sources, with an emphasis on linking specific needs to experienced subject matter experts who will serve on a SpaceTEC[®] panel being established for that purpose.

Additional “practice-based” workshops will be sponsored to increase the impact of the work in aerospace certifications on those in need of jobs in STEM careers other than aerospace using programs like the “pilot program” workshops in composites that have been very popular. The SpaceTEC[®] website will be used to create an interactive data management system to provide real-time requests from users and “on the fly” answers from qualified experts using the registry being developed for that purpose. If successful, this online initiative could become a flagship product for use in assisting everyone from educators -- needing specialized lessons, equipment or materials for classroom and lab/shop use -- to fledgling aerospace companies seeking to apply lessons learned and proven systems to build workforce capabilities more quickly and at lower cost and risk. SpaceTEC[®] will make this a priority for project activities during the coming year.

Going Forward

In the coming year, the SpaceTEC[®] NRC will seek to expand partnerships in additional fields where hands-on work requires skill testing, continue dissemination of all credentials and supporting materials, and contributing to student success by aligning partner college programs and learning outcomes with national credentials. This will include seeking more linkages to career pathways in STEM-related work, packaging certification tasks individually and in skill sets that match employer needs for performance, targeting key pilot sites for implementing operational testing and creating training/certification/verification models in many specialties for emerging industries and small to medium-sized companies.

Specific activities include:

- **Building Talent Pipelines:** Supporting aerospace manufacturing, maintenance, overhaul and repair industries in building pipelines of skilled workers through curriculum support, subject matter experts, assessments and credentialing programs. Strategies for success include leveraging programs at partner technical training centers and community colleges, industry training organizations to attract local economic development agencies and job staffing companies across the country to endorse these efforts.
- **Expanding Outreach:** Working through partners to emplace certification capabilities (additional proctors, certified examiners, examination kits, and equipment) in areas not currently served. Dissemination will be done through support at technical conferences, job fairs, outreach events and through outreach agreements with curricular material publishers and educational support organizations.
- **Streamlining the Employment Process:** Pursuing creation of task level certifications through educational and industry training partners for employers who desire specific skill verification vs. broad-based credentialing to streamline the hiring process and shorten the time to productivity.
- **Implementing Additional Performance-Based Credentials:** Targeting aerospace manufacturers, operators and service providers with additional national certifications in Avionics, Calibration, Mechatronics and others to create performance-based credentials in industries not presently served by verification of competency.
- **Supporting Professional Development:** Providing support for partner college and technical training center instructors for professional development activities to "sharpen skills" and better prepare students for entry into the nation's STEM industries.

SpaceTEC® Curriculum

Accepted by SpaceTEC® Consortium partner colleges and taught in many AAS and AS degree programs, SpaceTEC® curriculum has become the standard for aerospace technician education. Through the Consortium, partner colleges now have an opportunity to leverage their programs with the ACE CREDIT Program and a formal consortium-wide articulation agreement with Embry Riddle Aeronautical University created on behalf of all the SpaceTEC® consortium partner colleges.

Most importantly, the graduates from this program provide the emerging commercial aerospace industry a workforce uniquely qualified to assume the tasks vacated as our aging technical base reaches retirement age. This is emerging in job postings from commercial space companies such as SpaceX, which lists the SpaceTEC® certification as "Preferred Skills and Experience" for work as a Launch Pad Technician at Cape Canaveral Air Force Station, FL.

- What formerly was limited primarily to individual company programs and isolated college courses is now accepted by all the primary users.

The products of the SpaceTEC® Consortium's work, a combination of formal DACUMs, SME-supplied test banks, physical hands-on performance assessments by trained and qualified

SpaceTEC® examiners, and standardized test kits, have made this program unique in the aerospace industry.

Acceptance by the American Council on Education, the Federal Aviation Administration, NASA, the US Department of Labor, the National Association of Manufacturers, major aerospace employers, and funding for SpaceTEC® certification examinations by the military services, both directly for active duty personnel and through the Montgomery GI Bill and the Post-911 GI bill for Veterans, are testimony to the importance and extent of the impact of this work with aerospace technical disciplines.

- Formal agreements and commitments now exist for all of these aspects of the aerospace technician's career.

The SpaceTEC® NRC, through its national consortium of educational institutions, government agencies, and business/industry partners has established a national reputation that has professionalized the aerospace technician career field. Recognition events are excellent indicators of the impact of this program beyond the ATE program to not only academe but also to the technical workforce and the regulatory agencies.

- For example, the NASA Langley Research Center and Thomas Nelson Community College in Hampton, Virginia have linked graduates of the SpaceTEC® Aerospace Core technician education program with a Langley paid apprenticeship program. Together they have instituted a formal workforce development program that combines hands-on training and education in a college credit program with mentoring opportunities at NASA to produce technician candidates who - when they pass the SpaceTEC® Aerospace Core Technician Certification, they are accepted into the NASA Langley paid apprenticeship program.
 - Passing the SpaceTEC® Core certification examination is a formal prerequisite for selection to this activity.

The Federal Aviation Administration Office of Commercial Space Transportation has cited SpaceTEC®'s Certified Aerospace Technician® Program as one of only three programs recognized for preparing Reusable Launch Vehicle Aerospace Maintenance Technicians. Its Guide to Commercial Reusable Launch Vehicle Operations and Maintenance, Version 1.0 reads (page 6):

- "The RLV operator may use one or any combination of the following programs and models for RAMT approval during its rating assessment process: (1) FAA Airframe, Power Plant Mechanic, or both, certification programs; (2) SpaceTEC® Aerospace Technician Certification program; and (3) Automotive Service Excellence Certification model."

As the nation's aerospace program continues to evolve and change, commercial firms are afforded a unique and neutral source of authoritative information on all aspects of the training,

education, development, and qualification/validation of workforce skills and competencies, as well as workplace best practices and lessons learned.

These contributions result directly from the NSF ATE-funded activities that made this possible. The SpaceTEC[®] NRC will make this information available without the impediments imposed by competitive pressures and/or regulatory structures.

Disciplines outside Aerospace

Using the experiences and knowledge gained through extensive work in aerospace education through its national consortium, SpaceTEC[®] has begun to apply techniques that have been successful in aerospace education to curricula, classroom teaching, laboratory and shop activities, and credentialing practices to non-aerospace programs that serve a wide variety of technician jobs in other industries.

As a result of the relationships and linkages forged by SpaceTEC[®], NASA granted SpaceTEC[®] its approval to host the entire NASA database of technical training and certification materials developed through its human spaceflight programs. To capitalize on this potential "windfall" for other fields, this collection, which includes more than 70,000 documents and 110,000 files containing curricula (courseware, on-the-job training packages, re-certification packages, collateral instructional PowerPoint slides, hands-on demonstrations for certifying performance-based competencies, and certification criteria sheets) SpaceTEC[®] created CertTEC[®] (Certifying Technical Employee Competence) to provide parallel education and credentialing services to a broad range of STEM technician fields unencumbered by the rigorous regulations, formal agreements and agency approvals the SpaceTEC[®] Certified Aerospace Technician[®] credential is subject to.

Based on the parallel CertTEC[®] credentialing service, four certifications have been developed and pilot tested for use in manufacturing and discipline-specific work such as aviation structural repair and electronics: (1) Basic Electricity and Electronics (DC, AC, Analog and Digital), (2) Basic Composites, (3) Aviation Structures and (4) Aviation Mechanical Assembly. These have already proven useful and are being adopted by a variety of organizations, including the U. S. Army at Fort Gordon, GA; Fort Sill, OK; Fort Lee, VA and Redstone Arsenal, AL; at the National Center for Aviation Training (NCAT), through the National Aviation Consortium (NAC) at Wichita Area Technical College, Wichita, KS; Ivy Tech, Indianapolis, IN; at Francis Tuttle Technology Center, Oklahoma City, OK; at the Tulsa Technology Center, Tulsa, OK; and at the Tennessee College of Applied Technology, Hohenwald, TN.

NASA materials have been integrated into the NRC repository using special security procedures to preserve their integrity and to establish methods to protect those areas subject to export control restrictions.

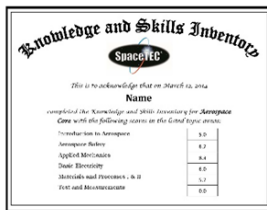
- Although there are many areas specific to aerospace practices using terms and protocols not widely employed in other industries, the majority of this material comprises basic

competencies and best practices that can be applied directly to technician employment in a wide variety of non-aerospace STEM fields.

- In order to take advantage of the vast array of materials that NASA has provided, SpaceTEC® has identified a cadre of subject matter experts qualified and willing to interpret and advise on the uses and strengths of that body of information in STEM fields nationally.
- These SMEs represent a deep and rich knowledge asset that is not available through other means. Their knowledge and experience can be key in packaging educational materials and credentialing processes that are readily and quickly customized and deployed in almost any STEM field utilizing technicians who do hands-on work.

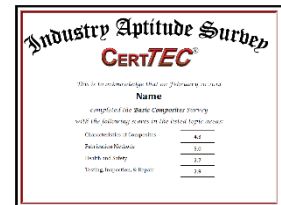
If additional resources become available, certifications can be developed and deployed in industries where hands-on skills and competencies are essential for successful job performance and career enhancements. Meanwhile, the four CertTEC® credentials already in place are being accepted in a wide range of applications well beyond their aerospace heritage. Many more credentials with far-ranging applications are expected to follow.

Intake Assessment Tools



As work to professionalize the technician career field continues, SpaceTEC® Knowledge and Skills Inventories (KSIs) and CertTEC® Industry Aptitude Surveys (IASs) have been designed as intake assessment tools to identify basic knowledge levels which can be adapted for use in any STEM field.

KSIs and IASs use derivative subsets of the SpaceTEC® and CertTEC® certification examination question banks which are then tailored for a specific purpose. Questions are delivered electronically, typically using 70 questions or less within a 90 minute timeframe. Results are available immediately to the candidate, Instructor, Training Director, or in the case of the Hiring Manager, restricted to company records for use as appropriate. KSIs and IASs are inexpensive, costing \$20 or less, easily scaled and can be applied almost anywhere with Internet access.



KSIs and IASs are being used in at least three employer HR activities:

1. As an objective third-party screening tool to narrow the field in selecting potential employees for job interviews.
2. As an internal assessment for selecting incumbent employees for training and promotion.
3. As a method for tailoring education and training to more effectively account for what individuals already know rather than employing a "one size fits all" approach to spending training resources.

Employer-based KSIs and IASs are efficient and more cost effective than traditional approaches because candidates can be screened quickly and objectively for knowledge and then training can be targeted to develop proficiency to accelerate an employee to the shop floor.

Education Program Assessments

KSIs and IASs are also employed in "before-after" assessments for educational programs.

1. Administered at the start of a course or program, a "baseline" of student knowledge can be obtained.
2. When coupled with an exit assessment to determine which course objectives were achieved, improvement in key elements of learning can be implemented.
3. Used as a program evaluation tool, results can be evaluated by faculty to target strengths and weaknesses in curriculum and delivery.

In the words of one educator "Real, valid, performance testing can quickly demonstrate the fundamental flaws in your instruction"¹

As the aerospace industry becomes increasingly global in nature, the aerospace workforce must maintain a level of competence required to successfully compete with other countries.

1. Competency-based credentialing is far more prevalent in international work.
2. SpaceTEC[®] is formally accredited to International Standards Organization (ISO) 17024: *General Requirements for Bodies Operating Certifications of Persons* and can now meet those standards for certifying individuals both domestically and internationally.

These capabilities open many doors for organizations seeking formally-approved technician education and credentialing, both in aerospace and beyond.

¹Mark McDougal, Master Instructor and Electronics and Electro-Mechanical Technology Program Chair, Tennessee College of Applied Technology, Hohenwald, TN (Ret.)

The most vital and important physical asset for the SpaceTEC[®] National Resource Center is the unique network of people who make up its national consortium and the resources and processes they manage and control.

In order to operate locally and influence nationally and/or globally, SpaceTEC[®] sustains one of the broadest and most powerful national infrastructures in aerospace. Nothing comparable exists in the U.S. aerospace industry today. The basic elements include consortium partners in education, business/industry, and government.

Each partner college has a local Aerospace Technical Advisory Committee (ATAC) that provides the focus and infrastructure for local/community operations and activities. Selected representatives from the local ATACs meet as part of the National Aerospace Technology Advisory Committee (NATAC), linking colleges and their supporting local partners together in a

national infrastructure that has proven to be extremely effective. NATAC representatives join in quarterly teleconferences and are invited each year to the National Visiting Committee (NVC) meeting.

Some of the industry representatives on the NATAC and members of the SpaceTEC[®] Partners, Inc. Board of Directors are senior aerospace executives drawn directly from national/global companies and organizations, giving SpaceTEC[®] an extremely broad reach and very influential proponents who support the work of the Center through direct contributions of their time, subject matter expertise, donations of excess equipment and supplies, curricular materials, incumbent technicians, and aerospace executives. Names of most are included in the section on Key Personnel and Organizations but key education and aerospace industry leaders and government agency representatives support the SpaceTEC[®] consortium at all levels.

SpaceTEC[®] efforts have been also been channeled to provide surplus/excess equipment; promotional materials such as flyers, brochures, and banners; and supplying test kits, consumables, and proprietary test cards for certification examinations to partner colleges. The estimated value of these contributions exceeds \$150,000 annually.

SpaceTEC[®] leases a storefront in the City of Cape Canaveral for certification testing, as well as laboratories and computer systems that now support the SpaceTEC[®] Center staff separate from the educational facilities of Eastern Florida State College, the fiscal agent for the grant. Through the College's Service Learning Program, unpaid interns from the Aerospace Technology program receive on the job experience in manufacturing, inventory control, timekeeping skills, laboratory operations and safety to bolster their educational program and to provide real-world experience for resume development and job interviews. To-date over 400 hrs. have been accumulated by students in the program and successful job interviews have resulted in placements in the local industry.



SpaceTEC/CertTEC
Storefront, Cape Canaveral, FL

Institutional Resources

Although the changing characteristics of NSF funding have impacted the Center's ability to fund continuing development activities at former levels, most programs continue to operate unabated during a transition period that has resulted in the loss of many aerospace jobs.

New partner colleges have assumed the financial burden of program startup internally, providing evidence of the validity and value of the program.

Each of the full college partners of the SpaceTEC[®] Consortium maintains an educational program that teaches the Aerospace Core and promotes the aerospace technician career field.

Many also promote the SpaceTEC[®] certification examinations, hosting Certified SpaceTEC[®] Examiners and providing testing facilities suitably equipped to support the demonstration of hands-on skills and competencies required for those exams.

In addition to maintaining faculty and staff at no cost to NSF or the Center, college partners also host workshops for faculty development, outreach events to K-12 systems, and readiness courses to prepare candidates to sit for the SpaceTEC[®] certification examinations. Some host clinics and skills workshops in support of their local industry needs. All maintain an articulation relationship to facilitate college credit for transfer students and incumbent workers who qualify through the SpaceTEC examinations in conjunction with the American Council on Education's CREDIT for experience program.

SpaceTEC[®] sponsors a variety of outreach activities that stimulate interest in learning more about STEM topics in a variety of populations. These range in focus from those designed for middle school, secondary, and post-secondary students to those intended to reach out to seasoned employees in need of up-skilling on the job.

Workshops, clinics, summer camps, internships and externships are all examples of the outreach supported by SpaceTEC[®] through its consortium partners in education, business and industry. A good example is the *Governor's Academy for Innovation, Technology and Engineering (GAITE)* providing career pathways in Electrical Engineering Technology and Mechanical Engineering Technology in Virginia.



"Young Minds at Work"
Rocket Launch, Cape
Canaveral Air Force Station

Participation by Thomas Nelson Community College in conjunction with NASA's Langley Research Center was instrumental in moving this program forward. TNCC initiated AAS degree programs in electrical and mechanical engineering technology, citing SpaceTEC[®] experiences as a key element in opening the way for this program to flourish and succeed.

In special cases such as at Thomas Nelson Community College, arrangements with local employers provide added benefits for aerospace students.

These include activities such as mentoring programs, summer internships, sponsorships to conferences and seminars, tuition assistance, and employer-hosted programs such as the paid apprenticeship program offered to graduates of the Thomas Nelson Aerospace Technology program through the NASA Langley Research Center.

All of these efforts and activities are indicative of the continuing value of the program from the perspective of the participating organizations.

Information Resources that Form Infrastructure

The SpaceTEC[®] NRC provides a national focal point for aerospace technical education that is made available to educational, business/industry, and government organizations directly.

As a recognized authoritative source, the Center provides important elements of the national aerospace information resource organized in three categories:

1. Web-based resources provided by the Center and its partner colleges in conjunction with their industry partners and relevant government agencies. See: www.spacetec.org, www.certtec.com, and www.best-in-us.com. These are extensive and include:

- Information on the structure of SpaceTEC® and the makeup of its participating partner organizations
- Information on the nature and extent of certifications, including qualifications for program participation and access to preparatory courses, sample exams, registration processes, and payment options
- Access to curricular materials including reference sources and background information
- Recommended sources of educational opportunities from Partner Colleges to allow selection of the closest options
- Contact information for further inquiries and specific questions
- Real time chat and helpdesk functions
- Links to blogs and social networking activities related to aerospace
- Hot links to other websites and relevant sources of information related to careers in aerospace
- Current information on space launch activities
- Numbers of certifications and names of Certified Aerospace Technician®

Video and audio information, including links to interactive readiness courses, blogs, and videos created and maintained by the SpaceTEC® consortium specifically for aerospace technicians and related information of value to emerging commercial aerospace companies.

- These are augmented by specialized workshops, clinics, courses, and seminars provided by SpaceTEC® Partner Colleges and, in some cases, of partnering businesses and professional organizations. See for example: <http://www.youtube.com/user/spacetec11> , and <http://www.thespaceshow.com/>

Databases and reference materials comprising a digital library; links to relevant materials from civilian and military programs providing aerospace-related information; lessons learned and best practices; and access via specific request to the information contained in the NASA database of information from human spaceflight activities outlined in the section on the impact on other disciplines, above.

Technology Transfer

Over the past year the SpaceTEC® Program has made three significant contributions that will impact technology transfer:

The database of NASA materials from human spaceflight activities outlined in the section on the impact on other disciplines above represents a unique and invaluable collection of information that is now housed in a repository managed by SpaceTEC®.

- There is no other public source for this information, and it represents the collective experience base of 50 years of spaceflight activities and the associated educational, training, and credentialing material derived from U. S. Space Program activities that took place over that period of our history.
- SpaceTEC[®] has become the "keeper of the flame" for aerospace technical education and takes that responsibility very seriously. The information on basic technology for aerospace technicians may evolve, but the principles embedded in the quality, safety, and systems thinking aspects of that work are timeless.
- These data represent an enormous investment in time, money, and human sacrifice that is among the most valuable of all known lessons learned and best practices in the aerospace community.

The implementation of competency-based aerospace educational programs culminating in performance-based credentials fashioned by a team of educators and practitioners and valued by employers is priceless.

- As the commercial space program evolves and paying customers begin to appear - an activity that will almost certainly happen in 2014 - the regulatory agencies charged with maintaining public safety will enact guidelines and requirements that require the programs already in place at SpaceTEC[®].
- The SpaceTEC[®] consortium will be preeminent in its readiness to deliver credentialing unequaled in the quality and relevance of its offerings in both credit and non-credit venues, as well as in its support for job placement.
- The transfer of information relating to how to safely and effectively operate the technologies that exist at that point will be indispensable, and SpaceTEC[®] intends to be a central part of that activity.

The recognition of SpaceTEC[®] as an organization formally accredited to the International Standards Organization (ISO) 17024: General requirements for bodies operating certifications of persons will enhance technology transfer in workforce performance certification as a key element in assuring the success not only of our nation's aerospace programs as they transition to a new focus on commercial space, but also to other STEM fields, domestically and internationally.

- While technology transfer in aerospace is constrained by restrictions due to export controls, non-aerospace industries routinely exchange technology information on a regular basis.
- Attracting and retaining any high technology industry relies heavily on the availability of a competent workforce. Hands-on certifications are a key element in that regard, and they exist in only a few of our national credentialing services.
- SpaceTEC[®], through its CertTEC[®] initiative, offers the opportunity for significant transfer of technical knowledge that will positively impact STEM work across a broad range of industries, both domestic and international.

Beyond Science and Technology

The SpaceTEC® National Resource Center for Aerospace Technical Education promotes space as a means to re-engage the American people in supporting the values of knowledge and work ethic as essential elements for our nation's continuing leadership in the world.

- Exploration in ANY field can be fun, and SpaceTEC®'s approaches fit many non-aerospace fields.
- Beyond support for learning about science and math by would-be technicians and incumbent workers who may go on to become the leading scientists and engineers of our future, SpaceTEC® has produced materials to inspire people to join in supporting the nation's space program through outstanding educational programs, college credit for experience in the workplace, and promotional efforts that include videos and printed information, field trips and site visits that clearly excite and motivate those who participate.
- The latest work can be seen at:
http://www.youtube.com/watch?v=GHka0aS_P08&feature=em-upload_owner and
<http://www.youtube.com/watch?v=bxeycbrCe3k>

Observations from SpaceTEC®'s partner colleges confirmed that hands-on educational programs inspire and empower students to go beyond their initial ambitions, often to Baccalaureate and Master's programs.

- An example at Eastern Florida State College is the decision to remove the aerospace technology AAS degree in favor of the AS degree as students who began thinking they could not succeed in math discovered that they could be successful in applied mathematics, resulting in their transfer to the more advanced degree even before the end of their first year of study.

Responses from employers in the form of requests for lists of graduates for interviews and job offers confirm that those who complete the SpaceTEC®-related aerospace technician programs are sought after in the workplace.

- These same attributes and approaches apply equally to other human endeavors. The key is learning how to transfer knowledge and lessons learned in ways that inspire and engage without intimidating.
- While it is too early to draw statistical conclusions that "prove" the worth of these efforts, enough qualitative information already exists to confirm with confidence that the SpaceTEC® Program has made a significant impact in STEM activities and will continue to do so in the future.

INDEPENDENT REVIEWS

SpaceTEC® 2014 External Evaluator Report

The SpaceTEC® 2014 External Evaluator Report submitted to SpaceTEC® in January 2015 highlights significant progress over the past year in achieving the goals set forth in the grant renewal. Specifically, "from January thru October, 2014 SpaceTEC® and CertTEC® awarded 394 SpaceTEC® and CertTEC® certifications, *an increase of over 350% compared to the total number of certificates awarded in 2013.*" A significant portion of this increase stems from a formal agreement reached with the US Army Soldier for Life program, which encourages credentialing of soldiers while on active duty to provide recognized national certifications and increase employment when they return to civilian life.

Additional certifications implemented in late 2014 and under development for 2015, which are supported by aerospace and aviation companies as well as the US Military, will serve as additional pathways to jobs for many underserved groups such as unemployed/underemployed Veterans and transitioning US military.

As all SpaceTEC® and CertTEC® certifications are accredited to ISO 17024 standards by the International Certification Accreditation Council (ICAC), this provides a measure of credibility that the examination process potentially affecting test-takers' entry into the workforce is unbiased, reliable and repeatable. As a function of this accreditation, reviews of all test banks will be undertaken by experts in the field as quality assurance the question banks remain valid and relevant.

American Council on Education (ACE) recognition of SpaceTEC® certification exams for up to 76 semester hours of college credit provides a powerful incentive for working aerospace technicians and those from comparable disciplines who qualify for the exams to continue to be life-long learners. Data from SpaceTEC®'s annual survey of certified technicians showed over 71% plan to continue their formal education.

The SpaceTEC® NASA Training and credentialing data base containing over 30 years of specialized human spaceflight training and certification documentation provides commercial space companies and other industry sectors with the unprecedented access to courseware suitable for curricular updates/instructor professional development, On-the-Job (OJT) training and skill proficiency program development. By providing links to the NASA Lessons Learned information, companies can now better assess mishaps and emplace corrective action for recurrence control. The subject matter expert database can also assist new spaceport facilities and local partner colleges to develop education and training programs for emerging operations.

SpaceTEC® will also continue working closely with the Department of Defense to implement certification programs for active duty military. This certification effort will target all branches of the service at many military installations nationally and around the world. These certification efforts provide an opportunity for our service men and women returning to the civilian work

force to earn both industry recognized credentials as well as obtain college credits toward higher education degrees.

Through formal agreements with colleges, universities, NASA, DOD, commercial aerospace manufacturing and space launch centers, industry and all key US Government aerospace agencies: Department of Defense (All DOD Service Branches—Army, Navy, and Air Force), NASA, and FAA (Commercial Space Office) SpaceTEC® is an unprecedented position to impact the availability of qualified workers in the US.

SpaceTEC® 2014 National Visiting Committee Report

In its consideration of the information presented at the 2014 SpaceTEC® National Visiting Committee meeting, four key recommendations were made.

Interning

Obtain best practices currently in place and develop a model or standard that would benefit the partner colleges. NASA-Langley could be used as a model.

In the coming year additional work will be undertaken to disseminate information on internship programs such as that adopted at NASA's Langley Research Center. This program has been briefed to other NASA facilities and also received the attention of commercial space companies such as SpaceX, United Launch Alliance and Lockheed Martin, who have expressed interest in developing similar models.

NASA Acceptance of Certifications

NASA-Langley could be a start to obtaining acceptance at other NASA centers.

With members of SpaceTEC® National Aerospace Technology Advisory Council (NATAC), Commercial Industry technology Advisory Council (CITAC) and National Visiting Committee in key leadership positions at many NASA centers, at commercial space companies and many educational institutions nationwide, their assistance with obtaining contacts for those who may be interested in developing programs will be requested.

Cost of Certifications to Students

Develop a best practice that would encourage partner colleges to include cost of certification into tuition costs.

Work to disseminate programs embedding certification costs in tuition and through voucher arrangements with testing sites will be continued in the coming year. Success in providing these credentials through education and training programs has shown successful in locations such as Tennessee Colleges of Applied Technology, Francis Tuttle Technology Center, Tulsa Technology Center, and the National Center for Aviation Training at Wichita Area Technical College.

New Technology

SpaceTEC® needs to be more involved in new technology especially smaller technology such as UAV's. SpaceTEC® needs to understand these needs and develop a plan for implementation.

SpaceTEC®'s partnership with Northland Community and Technical College in Thief River Falls, MN to support Drone technician development provides an opportunity to work with a recognized leader in Unmanned Aerial System education to design credentials for technicians employed by operators of UAV's. Initial discussions have been encouraging and work is expected to begin soon for this important technology.

EASTERN FLORIDA STATE COLLEGE SERVICE LEARNING PROGRAM INTERN PERSPECTIVES

EFSC and SpaceTEC®

My name is Charles Schenkbecher and I just graduated last May from the Aerospace Technology Program at Eastern Florida State College. I now work for an engineering firm named Cyient, and I am under contract at Pratt & Whitney in West Palm Beach as a Tooling Planner. I work with Process Engineers and Aerospace Technicians to help set up and streamline production of the F135 engine, which powers the Lockheed F35 Lightning II, otherwise known as the Joint Strike Fighter. My job is to help ensure that the proper tooling is in place to accomplish this task, including procurement, placement, and tool control. This is my first venture into the Aerospace Industry, and it has been quite a ride. But let me tell you a little about the path I took to get here.

I started two years ago by enrolling in the Aerospace Technology Program. There were 16 of us at the beginning. The first semester was quite fun, introducing our class to the fundamentals of Aerospace. In the Intro to Aerospace course we learned the basics of what the Aerospace Industry is, and where it is going. Valuable insight was provided as to proper etiquette in the industry, and what to expect. We also took a science course, which was a great basis for understanding the framework on which the high technology of Aerospace is built. And finally Applied Mechanics was to get us used to the tooling and methods used to manipulate the materials of the industry. How to read schematics and diagrams, and how to "talk the talk". Applied Mechanics also teaches valuable skills in time management, given the large set of tasks to complete.

The second semester introduced us to Safety and Quality, two capstones which are ever present in the day to day life of an Aerospace Worker. We also took an Electricity and Electronics course which provided a wealth of invaluable knowledge of how electric systems work. And the semester was rounded off with Materials and Processes 1, which gives an essential flavoring of the materials world; how materials are defined, tested, and used in a predictable manner.

The third semester was very hands on. Materials and Processes 2 had us building composite layouts, learning what composites are, why they behave the way they do, and how to get them to

do what we need them to do. We also had a wonderful journey into the world of aerospace soldering and wiring in Electronic Fabrication and Fiber Optics. We were taught to solder circuit boards and build wire harnesses to NASA standard. And the semester continued with Structural Fab 1, where we learned the essentials of working as a team against a deadline, producing a 1/2 scale replica of a wing from nothing but schematics and sheets of aluminum! And we had Aerospace Systems, where we learned how a spacecraft functions in orbit, how a rocket engine works, and how systems are integrated to make a successful space mission.

The fourth semester was by far the most challenging of the course. Four classes, three of which are centered on completing the capstone project of designing, building, and launching our own rockets, including all of the infrastructure and logistics associated with this task. It was to embody all of the skills we had learned thus far, and build upon these skills with more detailed knowledge. Fluid systems taught us the dynamics of fluid behavior, and how to manipulate this behavior to perform work. In our Structural Fab 2 course we created more complex layouts, building our rockets as well as ailerons and wing tips for the previous semester's project. We learned to repair damaged composites, and even hot bonding techniques. We took a Test and Measurements course which detailed Non Destructive Testing, giving us a taste of how to use and understand things like ultrasound, eddy currents, and magnaflux. And the big one was our Technical Task Analysis course, where we learned the processes for running a complex project, for keeping different projects on a timeline and integrating them together to achieve our goals.

I took an internship at SpaceTEC® in the fourth semester as well. Working with the staff in Cape Canaveral was a wonderful experience, building on the skills learned in class, and learning from the years of knowledge and experience that they possess. They gave me insight and advice on taking a career path that has a future in the Aerospace Industry.

And I also took my SpaceTEC® Core Certification in the fourth semester. The staff at SpaceTEC® was instrumental in helping me to succeed. Answering questions, directing me to the materials and data I needed to complete the certification process.

The two years I spent in the Aerospace Technology program were awesome. The experiences I had were essential to setting me on a career path in the industry. I cannot speak highly enough of the terrific instructors in the program, as well as the staff at SpaceTEC®. Their insight and knowledge of the Aerospace industry was not only enlightening, but truly enriched the learning experience. At Eastern Florida State College, and at SpaceTEC®, I found an outstanding group of individuals that truly helped me to succeed.

EFSC Student and SpaceTEC® Intern

My name is Michael Tang, I am 26 years old and I was born in San Jose California. Since I was a child I was always fascinated with technology and space. So I decided to pursue a degree in Mechanical Engineering. One day I was in Calculus class and I pondered, I want to learn the hands on side of the industry as well. I figured if I learned both the theoretical and the hands on aspect, it would give me an advantage in my career. After doing some research, I found out that Eastern Florida State College offered the Aerospace Technology program which was exactly

what I was looking for. Then I heard about an internship opportunity with SpaceTEC® and I didn't think twice. Since I have been an intern with SpaceTEC®, the experience and knowledge that I gained is priceless. Along with the great staff, my time at SpaceTEC® has been a pleasure. My duties include: inventory of composites materials and building test articles for the SpaceTEC® and CertTEC® Composites practical examinations. My future goals are to graduate and work as an Aerospace Technician and eventually become an Engineer. When it's all said and done, I will be living my dreams and make a contribution to Science.