

# CASE STUDY: SPACETEC

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[www.spacetec.us](http://www.spacetec.us)

NSF ATE Center Awards: [1994](#) / [2002](#) / [2006](#) / [2009](#)

## EXECUTIVE SUMMARY

SpaceTEC was formed through ATE center funding by three titans of the space industry in 2002. SpaceTEC served to train and certify aerospace technicians with portable credentials. Scaling was part of the design from inception. The organization followed a strategic plan of developing a network of community colleges co-located with space centers to develop curriculum and train students, running the grant like a space contract. The Center then moved on to developing certifications until now, 20 years later and with over 100 partners, when SpaceTEC is an independent organization and serves as the certifying agency for ASTM.

## PURPOSE AND BACKGROUND

### National Context

In the early part of the 21st century, the space industry was struggling with a contract-based system in which technicians had to be trained and certified with each new contract, often moving between companies. Though the same individuals were repeatedly hired, their credentials did not follow them between contract jobs. SpaceTEC was designed to meet an *“ultimate deliverable—Aerospace Technician Certification that is portable but dovetails with the needs of the many companies that make up the aerospace industry”* (NVC report, 2004).

SpaceTEC was modeled after the portable credentialing system for the aircraft industry, managed by the Federal Aviation Administration. The FAA (CFR Title 11 part 147) stipulated requirements for training and licensing for those who work on aircrafts, particularly vehicles that are returned to service after being worked on.

### The SpaceTEC Response

The Aerospace Technical Education Center (SpaceTEC) began in the summer of 2002 at the initiative of the “The Community Colleges for Innovative Technology Transfer (CCITT),” adjacent to the NASA Centers and several DOD facilities. CCITT formed in 1994 and was governed by the college presidents. In 2000, a “Space Summit” was held at the Kennedy Space Center with NASA and Florida representatives, resulting in the identification of economic issues related to an aging workforce and the need for career development for future technicians.

The ATE grant capitalized on the political climate in which President George H.W. Bush announced a commitment to establish a permanent lunar base and plan for a long-term manned flight to Mars, stimulating renewed interest in the space program. Conceived of by three veterans of the space industry affectionately called “The Three Caballeros,” the Center was designed as “a national infrastructure system” to “link the local activities of community colleges with the national scope of the aerospace industry across government agencies and nonprofit groups.”

The infrastructure developed brought together an exceptionally broad-based group of stakeholders to coordinate:

## TIMELINE

1994 The Community Colleges for Innovative Technology Transfer (CCITT) formed during the first year of the ATE program with a one-year planning grant (NSF Award [#9454637](#)) to create a National Center of Excellence.

January 14, 2000: a “[Space Summit](#)” was held at the Kennedy Space Center to discuss the future of space as it relates to the state of Florida. Participants included Senator Bob Graham, Rep. Dave Weldon, members of Florida's State government including Gov. Jeb Bush, NASA Administrator Dan Goldin, KSC Director Roy Bridges, Gen. Donald Pettit and heads of aerospace companies.

2002: [Initial National ATE Center award from NSF](#) (NSF award [#0202398](#)). Led by PI Al Koller

2002: the Federal Aviation Administration increased the emphasis on future skilled technical workforce and the Commission on the Future of the U.S. Aerospace Industry formed, creating additional external support for the Center.

2005: The FAA released a guide to commercial space including workforce preparation requirements and licensing audits. SpaceTEC was listed as one of three programs that could serve as a model.

2006: Second National ATE Center grant awarded (NSF award [#0532618](#)) for phase 2 work which emphasized the certification process.

2007: The Federal Aviation Association's Aviation Rulemaking Advisory Committee provides [guidance](#) issued for aviation techs at schools.

2009: SpaceTEC receives its third NSF center grant (NSF award [#0903180](#)), this time with reduced funding to serve as a resource center and a focus

- Professional development
- A national curriculum
- Contact and activity databases
- Job banks
- Networking
- Access to testing for competencies

Atypical of ATE centers, SpaceTEC was established as a decentralized national Center of Excellence without having grown out of a project. Also atypical was the conception of the Center by industry representatives, rather than faculty. The Center was headquartered at Brevard Community College's Spaceport Center at the Kennedy Space Center Visitor Complex. PI Al Koller, President of the Titusville Campus and an industry veteran with 30 years of experience with NASA, was Managing Director. The Center also operated in partner colleges at nine other locations adjacent to NASA Centers and Department of Defense Installations.

The first-year evaluation report (2003) characterizes the project as follows:

*The **vision** of SpaceTEC is to be the focal point for technical education resources featuring aerospace, providing motivation for academic studies and professional development services for faculty, students, and aerospace employees. The **mission** of SpaceTEC was to create and implement an industry-driven, government-endorsed, technical education process for aerospace technicians that can be shared with other educational venues. The **goals** of SpaceTEC are to foster interest in science, mathematics, and technology education in the U.S., and to provide education for the technical workforce using a national alliance of representatives from business and industry, government, and academic institutions.*

on developed industry driven certifications rather than specifying curriculum and courses, leaving it up to the colleges to develop the curriculum that led to certification.

2009- SpaceTEC® Partners, Inc. (SPI) was formed as a Florida non-profit corporation to coordinate the activities of SpaceTEC®, the National Science Foundation (NSF) National Resource Center (NRC) for Aerospace Technical Education.

2013: Steve Kane took over as PI when Dr. Koller retired

2010: [CertTEC](#) was formed to translate competencies developed for space to general industry using the same process rigor created for human spaceflight

2014: [ASTM International](#) absorbed the aviation technician certification products that the National Center for Aerospace and Transportation Technologies developed with multiple ATE project grants.

2016: [Credential Testing Services](#) (CTS) formed to provide accredited certification and third-party computer-based testing services.

May 2017: An agreement was formalized by ASTM and SpaceTEC Partners, Inc (SPI). for SPI to become the administrator for all ASTM NCATT written exams in addition to its other job-oriented knowledge and practical-skill certification examinations. SPI also processes applications from schools and industry training providers for ASTM NCATT Training Provider accreditation.

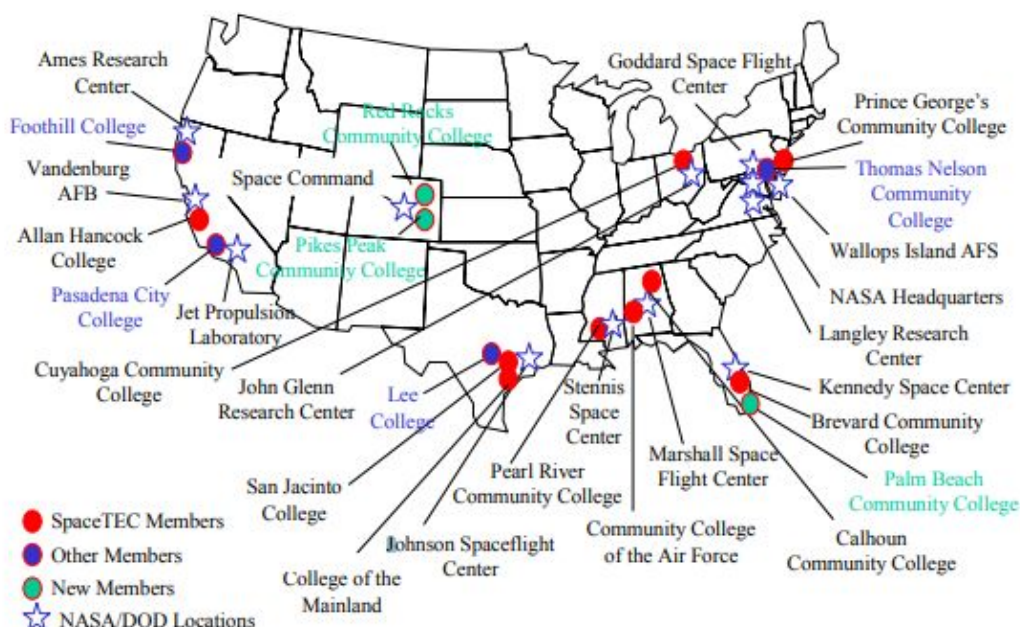


Figure 1 – CCITT Institutions and Locations

In addition to the nine colleges, participating from the beginning were the National Aerospace Technology Advisory Committee (NATAC), an organization established through the grant; local Aerospace Technology Advisory Committees

(ATACs) at each site, and a senior Program Advisor representing the CCITT Board of Directors. External oversight was provided by representatives from the Air Force Academy, the Air Force Institute of Technology, and a National Visiting Committee (NVC). The NVC included members of industry, academia, and government groups.

## Organizational Management

From its inception, SpaceTEC was preparing for scale. Designed by industry representatives who were accustomed to operating in a contract-based environment, the plan was focused, strategic, and actionable. SpaceTEC was organized and managed as one would manage an aerospace contract, with hard deliverables, time schedules, and financial constraints. There were sixty deliverables as part of the first grant, organized into five focus areas:

1. Student Recruitment and Outreach
2. Develop and Deliver National Technical Education Program
3. National Skills Assessments
4. Faculty Professional Development
5. Technician Professional Development.

The PI ran the grant as a contract, with clear benchmarks and deliverables for the Center overall and for each of the partner colleges. Subaward contracts were used to detail tasks, budgets and schedules for all participants. The evaluation team reported progress against benchmarks on an annual basis, identifying where the Center was exceeding and/or falling short on the benchmarks, as well as identifying what was happening at individual partner schools.

Managing a decentralized grant required a strong communication system. Regular updates and consistent, formal reporting of all major work processes relied on a combination of monthly teleconferences, written monthly reports, quarterly newsletters, an active website, and quarterly Co-PI meetings. Frequent, open communications assured the sharing of information, updates, and status on all current operations. Figure 2 (below) illustrates the SpaceTEC infrastructure.

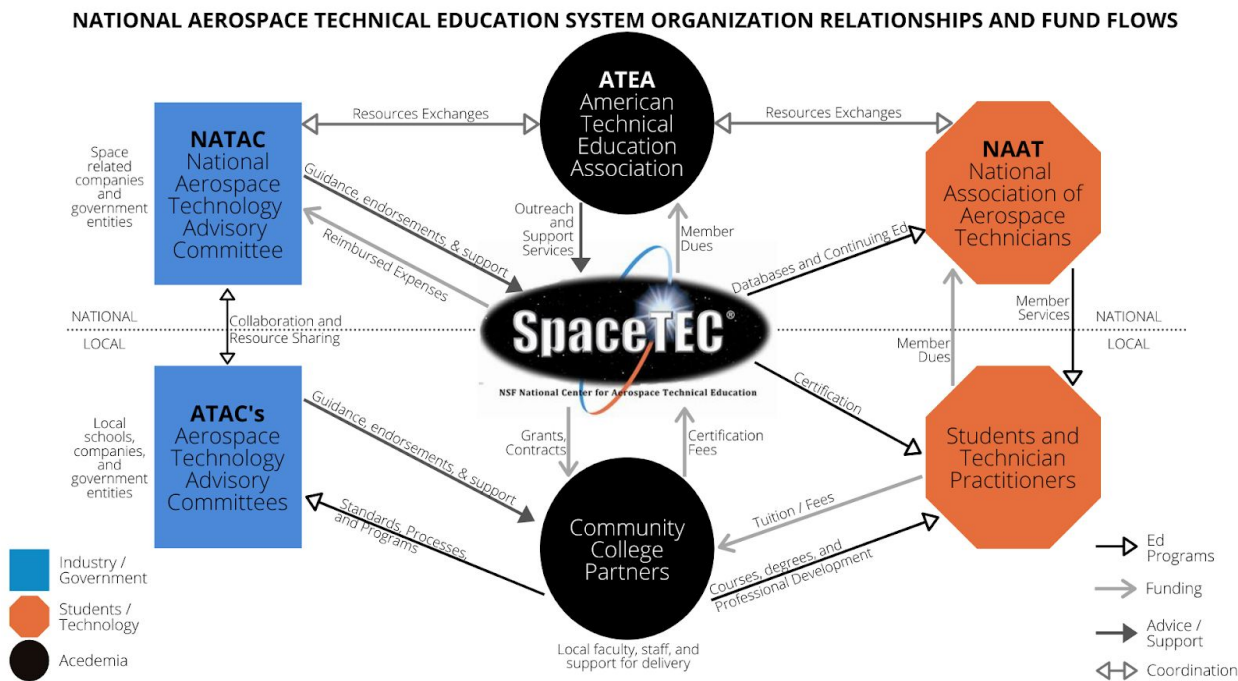


Figure 2: SpaceTEC National Technical Education Infrastructure (Koller & Cunniff, 2004)

The ultimate goal of creating a self-sustaining certification body underlay the Center. The critical need of industry representatives for a well prepared and certified workforce led to deep engagement and commitment by industry, resulting in strong local investment at each of the partner colleges.

SpaceTEC evolved to its current form as SpaceTec Partners (a non-profit organization), which has three main functional units:

- **SpaceTEC** is the commercial space division, serving as the aerospace resource center.
- **CertTEC** offers competency-based certifications for technicians. **CertTEC** has accreditation from the [International Certification Accreditation Council](#), ensuring that the certifications it provides are consistent, comparable and reliable.
- **Credential Testing Services** (CTS) offers computer-based examination administration service for a variety of professional credentials. Since 2017, CTS has offered ASTM NCATT knowledge-based certifications, third party end-of-course testing, and instructor professional development. For example, a school board will provide CTS with a list of competencies, and CTS will develop and administer testing. This is especially important for states in which the CTE contract training organization must be independent from the testing organization. CTS has testing locations around the nation and offers exams for a fee. There is also a fee to become an ASTM NCATT Approved Training Provider.

## EVOLUTION

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### Phase 1: (2002-2005)

#### Developing Training and Certification Processes for Future Technicians

In the simplest form, SpaceTEC's strategic approach for the first phase of the grant was to:

1. Develop Curriculum (year 1): A 45-credit associate degree program was developed and accepted by the partner colleges.

The emphasis on the curriculum engendered the shared expectation of content knowledge across partner colleges. Colleges opened or refreshed their programs in engineering technology, space technology, composites, meteorology and geospatial technology using SpaceTEC curriculum.

Annual reports from industry suggest that the SpaceTEC program saves employers a minimum of \$10,000-\$12,000 in orientation and training cost per employee with an associate degree.

2. Develop certification (year 3): Standards formed the foundation of all certifications. In addition to developing certification exams, SpaceTEC had to prepare individuals to

### Partnerships

In conducting this work, careful attention was paid to nurturing the network of industry and academic partners to ensure broad-based support and awareness. SpaceTEC did significant outreach through industry, governmental and academic presentations. For example, presentations were made during the year to a diverse set of interested parties, including:

- 40TH Space Congress
- AACC Convention
- NSF PI Meeting
- FAA Expert Lecture Series
- FAA/AST Sixth Annual Forecast Conference on Commercial Space Transportation

These led to additional affiliations with Embry Riddle Aeronautical University and the American Technical Education Association and the newly formed National Association of Aerospace Technicians (NAAT), the National Aeronautics and Space Administration, the Air Force, the Federal Aviation Administration, and the Department of Labor.

Partnerships also led to significant additional "in kind" support and the addition of new facilities at Cape Canaveral Air Force Station including headquarters offices in the Cape Industrial Area and a major national asset in the form of Launch Complex 47, an operational launch site designated for use in the program. SpaceTEC was originally located at the Kennedy Space Center Visitors Complex; eventually moving to Cape Canaveral Air Force Station (which was rent free, but difficult to get visitors on site due to restrictions as an active Air Force Base) and ultimately settled in commercial space in the City of Cape Canaveral. moved out of the commercial space in Cape Canaveral and now reside in rent-free space through a partnership with Brevard Public Schools and the American Space Museum Space Walk of Fame Foundation (ASM SWOFF), another advantage of the nonprofit status.

The depth of the stakeholder group led to the following findings from the first-year evaluation report:

*"The SpaceTEC industry partners have consistently provided major elements of project support at multiple locations, permitting significant leveraging of the grant funding. Included in this*

serve as examiners. The phase 1 summary report noted:

***“SpaceTEC’s certification activities are industry-endorsed skills and they provide students’ academic requirements for a two-year degree or a transfer of those capabilities toward university-level programs.”***

3. Serve as a national resource with information about job opportunities, professional development opportunities, standards and certifications. The Center developed a clearinghouse that serves as the authoritative location for dissemination of information on industry job openings, subject matter expertise, and web-based data.

*commitment are outright cash grants, scholarships, internships, equipment and supplies, mentors, instructors, curricular materials, subject matter experts, classroom and workshop space, and access to restricted locations for hands-on work. A rough-order-of-magnitude estimate places the value of this support in excess of \$1M for this first operating period.”*

### **Connection to Local Industry**

Partnerships were not just important at the national level, but critical to local institutions. Each partner college was co-located with a major aerospace employer including factories, launch centers, etc. Each college had a local aerospace technical advisory committee (ATAC) which mirrored the functions of the National Advisory Committee. By year 3, the NVC noted a distinguishing feature of the Center was the “interlocking local and national advisory committees.” The NVC also noted that the advisory committees “have done a great deal to engage industry, academia, and, most importantly, prospective students.”

### **Resources**

SpaceTEC also maintained a national focus as a resource to industry and academia by developing databases that underpinned the national infrastructure for career development and lifelong learning for aerospace technicians. For example, the Center conducted a landscape analysis of the certification programs and organizational affiliations to produce a matrix of options and opportunities.

*“The NVC and the external and internal evaluators all agree that continued funding for this project is not only highly recommended but critical to address the challenges and create a self-sustaining infrastructure to certify the aerospace technician workforce.” - NVC, 2005*

In 2005, the FAA signed a Memorandum of Understanding with SpaceTEC establishing joint activities to improve awareness of commercial space transportation activities and promote the skills required for the aerospace workforce of the future.

## **Phase 2: (2006-2008) Responding to a Changing Economic Climate & Preparing for Rapid Growth**

*“The focus of activities has greatly shifted from one of program developments of an education process for aerospace technicians which is supported by industry resulting in an acceptable and endorsed industry-based national skills certification (Phase I) to implementation of the certification process (Phase II).”*

-NVC, 2006

When NASA announced it was closing down the shuttle program, the central coast area of Florida lost 20% of its population, and the course enrollment in the region began to decline, with some classes having only two or three students in them. Brevard Community College decided it no longer wished to support SpaceTEC, as it did not align closely enough with the mission of the school as the Center transitioned away from curriculum and towards standards. The NVC also recommended early in phase 2 of the Center that SpaceTEC become an independent organization to focus on the revenue-generating certification and continuing education needs of the aerospace workforce. A new goal for the Center was set: to develop and operate a national infrastructure to support SpaceTEC operations.

Meanwhile, commercial space organizations were ready to fill the void left by NASA. For the first time, the Federal Aviation Association (FAA) was responsible for licensing all space launches. With the investment in curriculum,

certification and partnerships, SpaceTEC was well positioned to meet the needs of the FAA to verify a workforce prepared to work on space flight. According to PI Kane, at the central coast colleges there are now (2019) typically 35-40 students trying to get into each course, which is capped at 20 students. In 2019, there are over 1,500 space technician openings, and companies can't fill even a third of them.

The NVC reported that they caution "the team to prepare themselves for a major growth in requests for testing and certification" given the quality of the materials and processes developed and the partnership with the FAA. SpaceTEC continued as a decentralized operation, which leverages the strengths of each partner to help meet Center goals and objectives. It also utilized the use of contractual agreements for specific tasks (i.e., marketing and facilitation of workshops) to minimize the number of full-time staff and personnel needed. Strategies used to prepare for growth included:

- Transitioned SpaceTEC to a wholly owned subsidiary of Community Colleges for Innovative Technology Transfer (CCITT) to allow SpaceTEC to pursue funding.  
CCITT is a not-for-profit Florida-based organization, governed by a board comprised of community college presidents. Brevard Community College (BCC) serves as the fiscal agent for SpaceTEC and is a member of the Board of Directors for CCITT. With this organizational arrangement, SpaceTEC is qualified to pursue a number of funding opportunities available to educational and not-for-profit organizations. In addition to NSF funding and the collection of revenue for administration of certification exams, SpaceTEC has been able to execute a number of contractual arrangements which are vital to the Center's ongoing operation. Contractual agreements with financial implications have been executed via BCC with the college serving as fiscal agent. Separate accounts have been created to segregate the funds from the college's general revenue fund. Revenues in excess of expenses from these contractual arrangements are set aside and currently equal approximately one year of operating expenses (including salaries) for SpaceTEC as a safeguard in the event NSF funding is not forthcoming.
- Trademarked the SpaceTEC name, and closely guarded the intellectual property rights of its Certified Aerospace Technician program through the use of non-disclosure and confidentiality agreements, secured databases and internet protocol, and copyright laws.
- Worked with labor unions to get buy-in and to get direct support in building relationships with regional and local union members, particularly the International Association of Machinists (IAM).
- Ensured that all partner colleges have articulation agreements with four-year institutions that allow their aerospace courses and credits to transfer.
- Focused on dissemination of materials and sustainability rather than the development of new products or services.
- Allowed some of the business process, including marketing, to be handled by aerospace veterans "who are retired and willing to provide their services at very reasonable rates and for specific, short duration projects."
- Expanded the number of testing sites.
- Provided workplace-related professional development opportunities for incumbent technicians.

In 2008, the second grant was coming to an end. The NVC noted:

*The team will be challenged keeping the partners together with reduced funding after July 31, 2009. However, they have a one-year reserve to fund the Headquarters Office and they have submitted a proposal to NSF for additional funding, which is pending. Many of the Partners are collaborating on proposals to grow the program and are headed in a very successful collaborative direction to keep the team together with additional funding. New partners have joined the team this past year and they bring additional enthusiasm for the program, which reflects a high potential to continue the success of the past year.*

### **Phase 3: (2009-???) Doing More with Less**

By 2009, SpaceTEC and CCITT consolidated under the name SpaceTEC Inc., an independent organization managed by a board of directors. Though the third Center

### **Phase 4: Sustaining the Efforts**

SpaceTEC is currently covering the cost of operations through their certification fees. By providing services to the commercial space industry, aviation and the military, the Center has a diversified portfolio. SpaceTEC no longer focuses on curriculum; rather, they focus on standards and testing. SpaceTEC works with industry to define the standards, then translates those standards to competencies and provides the competency-based testing.

grant provided only 40% of prior-year funding, no colleges left the partnership. Reduced funding, however, did lead the Center to reconceptualize what it meant to be a SpaceTEC member. Colleges could now join affiliate colleges where little or no direct funding is provided, and full partners operating under small sub-award contracts. Proposals were submitted by SpaceTEC and partner colleges for state and federal funds to mitigate gaps.

SpaceTEC invested in a sustainability plan by identifying core technical skills that are common to other industries and businesses with which SpaceTEC may partner to develop models for skills transportability and certifications. A survey with the 11 SpaceTEC partner colleges and 19 industry partners was conducted to gather information on the impact the SpaceTEC program and being a member of SpaceTEC has had on the partners. Results affirmed that the skills included in education and certification programs were well aligned with the predominant skills required in the current aerospace workforce. Industry partners agreed it met their industry needs, with half reporting that they were using the SpaceTEC certification to develop internal training programs for the existing workforce.

With the transition away from curriculum and the changes in local industry, there are only five colleges that teach the SpaceTEC curriculum (though there are nearly 40 member and affiliate colleges still connected to SpaceTEC). There is one college that is interested in the curriculum as their local space economy is growing, and another college in Texas would like to explore opportunities as their oilfield industry shifts to aerotech.

PI Steve Kane worked with NASA to procure the credentialing standards for shuttle operations. When NASA closed the shuttle program in 2011, they made public over 100,000 files related to NASA training and certification standards required to process a space shuttle. The files now exist in a searchable database. SpaceTEC maintains the database in which skill sets for technicians working in a multi-contract environment can be easily identified. Colleges access this database through an information request system to develop their programs in alignment with industry needs (all requests are screened per an agreement with NASA).

SpaceTEC was originally located at the Kennedy Space Center; however, it eventually moved to Cape Canaveral (which was rent free, but difficult to get visitors on site due to restrictions as an active Air Force base) and ultimately settled on the Eastern Florida State College Cocoa Campus.

SpaceTEC has automated almost all of its processes, and testing can be done anywhere there is an internet connection. Where testing used to require an individual to proctor an exam, now up to 500 people at a time can be tested anywhere there is an internet connection, including other countries, Navy ships at sea, etc. A significant investment was made over the last year to ensure all cloud-based programs and testing software could operate behind military-level firewalls, allowing them to serve private, governmental and academic institutions. PI Kane reports, "When I took over, everything we did required a human—like scheduling someone for an exam, capturing results, and generating a certificate. We've automated it all now," which means the Center only has two staff members.

The next step for SpaceTEC is to create a testing program for high schools. The K-12 environment is focused on job skills as much as comprehensive education. PI Kane reports he has received requests from high schools seeking to develop curriculum that meets industry standards, so that end-of-course testing can lead to certifications.

## LESSONS LEARNED

- The PI experience and credibility among both the academic and industry partners was essential for SpaceTEC to achieve its long-term vision. PI Koller came to the SpaceTEC award with a deep knowledge of systems and systems change. The Center had a strategic set of initiatives that built capacity over time, working towards the ultimate goal of a self-sustained certification body.
- The partnerships between the community college partners and the local ATACs promoted strong commitments among the local workforce stakeholders. The local ATACs promoted cross-institutional collaboration. The Center acted as a hub that could disseminate the promising practices and lessons learned across local sites.
- The Center was managed like a contract. There were clear expectations and deliverables for all parties. Frequent and formal communication structures facilitated the execution of deliverables. Shared metrics across sites added to the culture of accountability.
- Data from each of the sites was used to measure progress goals and inform the NVC. The NVC was well positioned to make strategic recommendations on an annual basis to ensure the longevity of the Center.
- Creating an independent entity that still had a connection to the college allowed the program to pursue revenue-generating activities while maintaining the organizational capacity to receive federal grants.
- Local governance/partnerships (TBD)- strong partnerships critical with local ATACs, cross-institution collaboration.

