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*Aerospace Technician Learning
for the 21st Century*

Prepared for:

38th Space Congress

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May 2001

Introduction

This paper summarizes the need for new and innovative aerospace technician training and education programs and describes a Brevard Community College initiative to resolve that need. National and global commercial and non-commercial space programs require that a more efficient and multidiscipline workforce be developed for the future, and a new learning system must be established to maintain a competitive industry position.

To address existing and future aerospace technician training and development needs, Brevard Community College established the Center for Aerospace Training and Development (CAT-D) and a new aerospace program organization. The center provides leadership in curriculum development and will serve as a clearinghouse for educational materials and methods for development of national skills and certification standards. Aerospace industry, government and academic input is provided by an Aerospace Technician Advisory Committee (ATAC) and by a national consortium of community colleges with aerospace-related industry linkages.

As the lead institution for the consortium, Brevard Community College has embarked on two major areas that are expected to significantly impact existing and future aerospace technician learning environments: (1) Establishment of industry-endorsed, standardized core and specialty learning programs, and (2) Formation of a national skills certification initiative that will help insure the availability of an efficient and productive technician workforce for both reusable and expendable space vehicles.

Aerospace Technician Learning Program

During the Cold War era, American space accomplishments often served as a manifestation of national power, and the cost for such space achievements was not considered an issue. Cost consciousness proved even less of an issue for the research and development of the strategic ballistic missiles and military satellite systems that supported national defense during that period. Within this U.S. government-subsidized environment, aerospace industry contractors hired specialized technicians who were trained to perform carefully defined operations on specific systems. When these skilled but highly specialized workers completed their tasks, they often experienced costly “idle” or “down time” between work assignments. As market conditions changed in the 1980s and 1990s, many of these workers suffered obsolescence and lay-offs as new technologies and profit-making objectives emerged in the commercial space marketplace.

Historically, a mentoring process and on-the-job training were utilized to develop the highly specialized aerospace technician workforce. Engineers would typically train several technicians in a highly specialized environment. A robust government-funded program coupled with the research and development of new and somewhat “untested” launch vehicles resulted in this mentor-based training environment in which strong engineering oversight was needed to train the workforce for maintaining technically complex launch and flight systems.

As a result of corporate consolidations, the space industry has experienced a melding of corporate cultures, each with its own tailored workforce training and education programs and methodologies. These “tailored” programs may be less efficient and problematic as a result of recent corporate mergers and acquisitions. For example, in 1995 NASA began to consolidate the Space Shuttle program contracts. At that point in time, Rockwell International was under contract for shuttle flight support and Lockheed Martin was under contract to support ground operations. In 1996 a new joint venture firm, United Space Alliance (USA), was awarded contracts utilizing resources from both Rockwell and Lockheed Martin. In

1996 Boeing became part of USA when the Rockwell aerospace assets were sold. This contractor amalgamation surfaced several corporate challenges, including issues in the standardization of training and education programs and methods. While USA continues to maintain a safe program, they recognize and support the need to establish standardized and streamlined learning programs and procedures for their technician workforce.

Issues posed by corporate consolidations and mergers to training and educating the incumbent workforce are further amplified by recent industry workforce shifts from a government-based to a commercially-based space industry. To be competitive in the world market, an efficient and flexible workforce with skills meeting industry standards is needed. Discussions with industry and government representatives indicate a strong desire to evaluate and “baseline” the skills of the incumbent workforce in order to provide the information to derive the training and education programs necessary to “standardize” competencies for the future. The industry also desires a program(s) to provide college credit for the incumbent workforce for training and experience achieved while on the job (credit for prior learning).

In 1999, NASA’s Aerospace Safety Advisory Panel reported: “...workforce issues remain among the most serious safety concerns of the Panel. Cutbacks and reorganizations over the past several years have resulted in problems related to workforce size, critical skills, and the extent of on-the-job experience.” The Panel’s 1999 Annual Report further states that there are serious concerns relating to the erosion of critical skills and experience, insufficient training, and a decreasing ability to support the Space Shuttle with a trained workforce. The Florida Space Summit held at Kennedy Space Center in January 2000 also identified issues and challenges associated with workforce training. A February 2000 letter from Florida’s Governor Bush to NASA Administrator Goldin indicated that the current training systems are inconsistent and costly. Subsequent action in Florida was aimed at developing improved approaches to providing the training needed for future aerospace employees.

Tomorrow’s aerospace technicians must have a greater understanding of basic science and mathematics, the principles of operation for the numerous subsystems of space vehicles and their support systems, and the ability to handle multi-disciplinary work assignments. To help aerospace employers remain competitive in the global space marketplace, the next generation of technicians must also embrace technological change and anticipate a career that includes a lifetime of learning in the workplace. Modular and innovative learning delivery systems that exploit information technology and are competency-based will facilitate these capabilities.

Learning System Support Organizations

In April of 2000, the Board of Trustees of Brevard Community College (BCC) chartered the Center for Aerospace Training and Development (CAT-D) to advocate and facilitate the development of curriculum and partnerships to support the training of aerospace technicians as depicted in Figure 1. To obtain direct guidance and input from the perspective employers and industries, an Aerospace Technician Advisory Committee (ATAC) was formalized in June, 2000 at the Kennedy Space Center.

The initial ATAC committee was composed of local and regional aerospace stakeholders, including 23 representatives from industry, government and academia. U.S. Florida Senator Bob Graham, U.S. Florida Representative Dave Weldon, and State Representative Randy Ball expressed strong support for this program, with industry and agency support by the Boeing Company (Delta III, IV, SEALAUNCH, International Space Station), United Space Alliance (Space Shuttle), and Lockheed Martin (Atlas II, V, Titan). NASA, Spaceport Florida Authority, and the Florida Space Research Institute provide government support. The Florida Space Institute, Embry Riddle Aeronautical University, and Brevard Community College comprise the academic institutions included.

The purpose of the ATAC was to assist with the development of a standardized Associate in Science degree for the “core” aerospace technician program. This 68 credit hour program was funded solely from a State grant and was submitted in December 2000 for State approval. At that time it became clear that the role of the ATAC should become much broader. Meetings with industry representatives confirmed consensus among the major participants that a national program was needed, and the role of ATAC was expanded and strengthened accordingly.

Based on stakeholder reviews, the ATAC was restructured to accommodate a comprehensive program to develop national standards for aerospace technician training and education. Five new subcommittees were formed to address budget and finance, strategic planning, public relations, curricula, and infrastructure. Aerospace industry representatives from United Space Alliance, Boeing, Lockheed Martin, Space Gateway Systems, and Spaceport Florida Authority chair these subcommittees, and the ATAC membership has been broadened to include stakeholders from many groups, including the K-12 educational system, workforce development, economic development, and organized labor. The new ATAC structure is shown in Figure 2. The goals of ATAC include:

- ❖ Development of a standards-based skills training system for aerospace technicians that is nationally recognized and industry-endorsed. Ideally, this system will provide a seamless, comprehensive education and training system allowing progression from secondary to post-secondary schools and with national articulation agreements between partner community colleges and four-year institutions.
- ❖ Creation of internships for K-12, Community College and 4-year College students with key aerospace companies
- ❖ Establishment of a national assessment system such as the Credit for Prior Learning (CPL) program.
- ❖ Preparation of national “Core” and “Specialty” skill standards and certifications in accordance with National Skills Standards Board requirements.
- ❖ Development of an easily updateable modular learning system that includes definitive “stop out” points.
- ❖ Completion of a national survey to quantify and characterize the skills, knowledge base, and needs for existing and future “space” technicians.

Brevard Community College is leading a national community college consortium that is establishing a delivery system for the industry-endorsed technician certification program that may be replicated worldwide. The National Science Foundation has been approached for funding for such a program, and there is strong interest because of the potential influence on science and mathematics curricula throughout the educational systems in this country. In addition, BCC is working with the Florida Space Research Institute to provide training modules using advanced information technology to enhance distributed learning capabilities that can be self-paced and interactive. Current technology promises almost unlimited application of virtual reality, artificial intelligence, and simulation capabilities to make future learning experiences richer, more responsive, and personally customized to the student’s individual needs. The national consortium of community colleges is shown in Table 1.

Figure 1. CAT-D Concepts

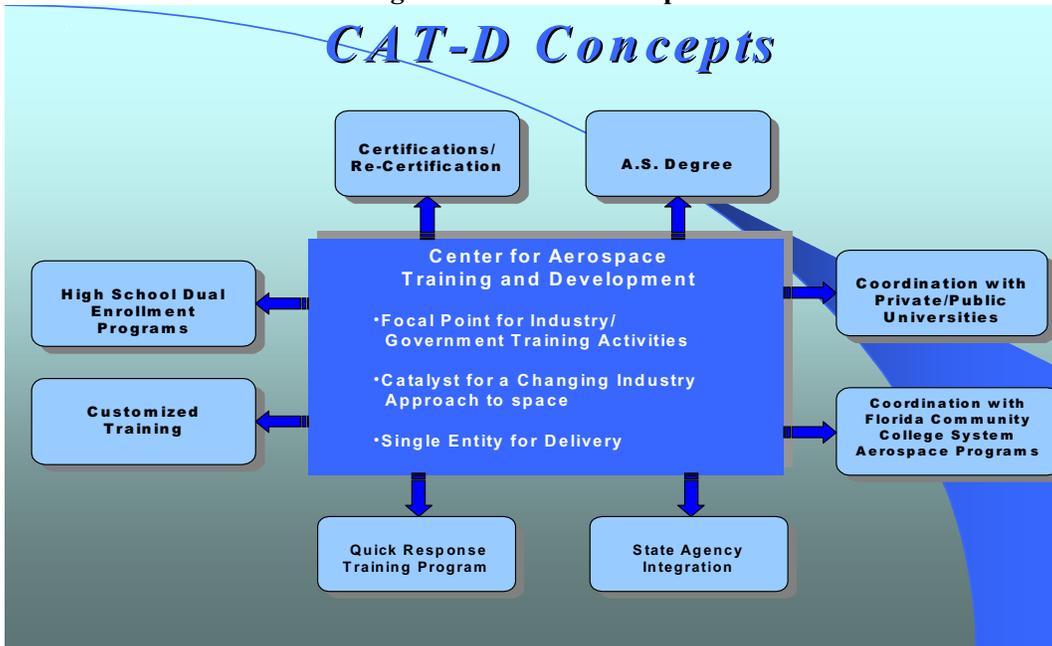


Figure 2. ATAC Organization

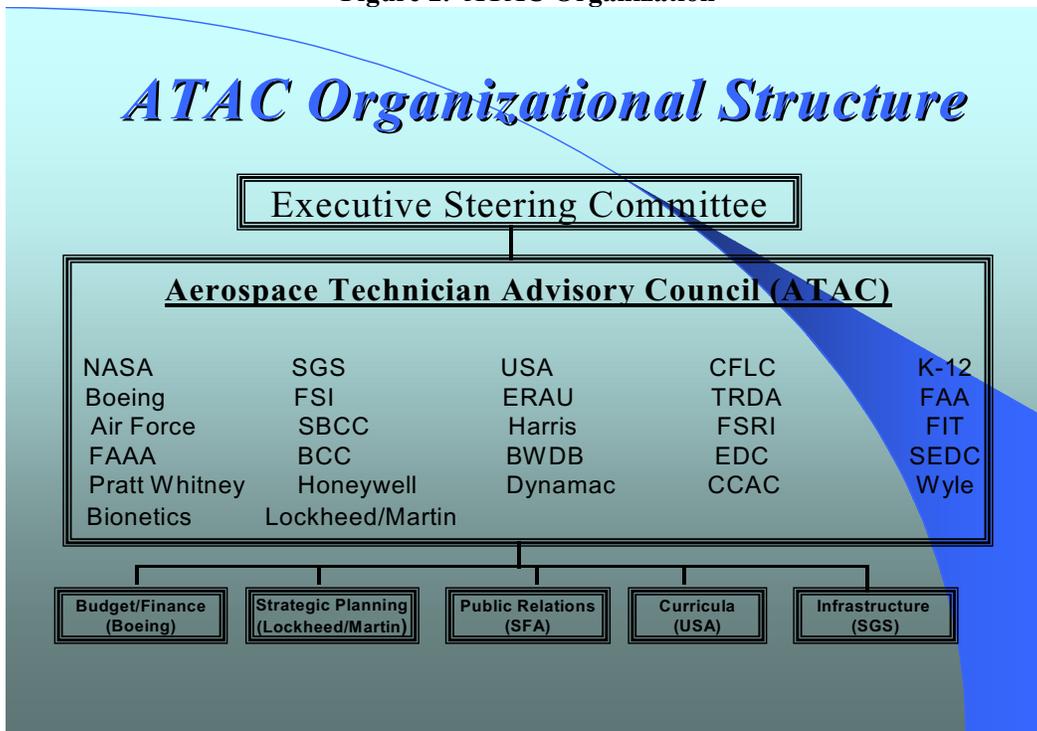


Table 1. National Community College Consortium

COMMUNITY COLLEGE CONSORTIA MEMBERS

- **Allan Hancock College, Santa Maria, CA
(Vandenberg Air Force Base)**
- **Brevard Community College, Aerospace Programs,
Spaceport Center at KSC**
- **Calhoun Community College, Decatur, AL (Boeing)**
- **Kodiak College, Kodiak, AK (Kodiak Spaceport)**
- **San Jacinto College, Pasadena, TX (JSC)**

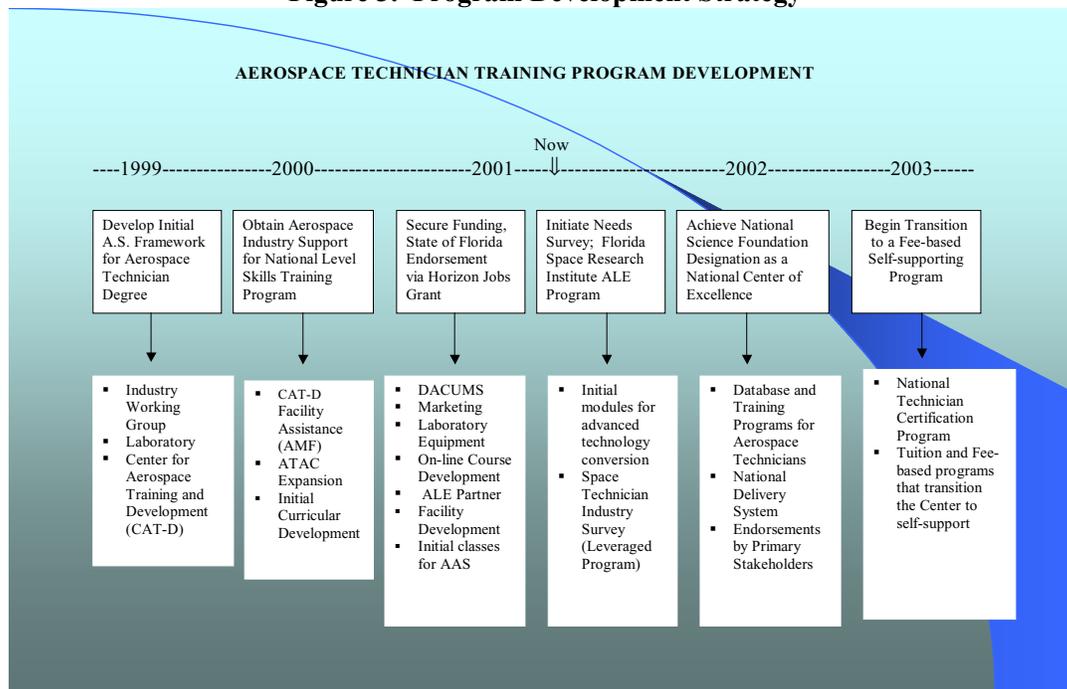
Learning System Development

Using a process called “**Developing A Curriculum**” (DACUM), the ATAC has embarked on a major initiative to baseline the duties and tasks of aerospace technicians; determine the skills, knowledge, tools, and techniques required for each job; define the scope and sequence of the learning that must take place to learn the requisite job skills; and package those learning objectives into courses and laboratories that can be evaluated, certified, and taught to students from several levels. So far, a core curriculum outline has been developed and is in the final stages of review by the ATAC Curricula Subcommittee prior to its being baselined for course material development.

The next steps in this process include submitting the first of these courses for technology enhancement and defining additional learning modules that provide specialty training in key areas for the emerging aerospace industry. While no decisions have been reached at this time, topical areas under consideration include: (1) Life Sciences Support, (2) Payload and Experiment Processing Support, (3) Launch Vehicle Preparations, and (4) Landing and Recovery Operations. Figure 2 depicts the Program Development Strategy as envisioned by Brevard Community College, with ATAC endorsement.

As shown in the timeline in Figure 3, the college has already completed an A.S. Degree framework, established the ATAC, received support from aerospace industry representatives (including financial commitments) and secured funding from the State of Florida for the DACUMs, course development, and facility and equipment needs to initiate this program. Work is underway now to define in more depth the remaining specialty modules, determine their placement in the curriculum (one option is an Advanced Technical Certificate), and contract for a national Space Technician Industry Survey to provide definitive information of the skills and needs for this career field.

Figure 3. Program Development Strategy



Learning System Benefits

As can be seen from the information provided earlier, the need for a national, industry-endorsed standardized skills training program for aerospace technicians is essential for our aerospace programs to remain globally competitive. Once established, these new training programs (at all levels) will create a high level of interest, boosting employee and employer confidence; improving reliability, efficiency, and flexibility; providing appropriate professional recognition; enhancing safety; and providing for skills standardization. A properly prepared and skilled workforce benefits the employee, the employer, the customer, and the overall competitiveness of the American space industry. Furthermore, the impact of this program goes well beyond traditional boundaries for past technician training. For example, the potential for students includes: current graduates of high schools; incumbent aerospace technicians who need and want skills upgrade training; dual-enrolled students at the junior and senior levels (grades 11 and 12) who anticipate working in aerospace technical jobs; and current aviation technicians, including A&P mechanics, who are seeking a career change to aerospace-related work. Transition programs, workshops, short courses, and a variety of distance learning options are all being considered. Each will have a vital place in the development of this new approach to training for such a dynamic industry.

The participating academic institutions also receive recognition for development of responsive, industry-endorsed programs that satisfy critical workforce needs. The aerospace industry will acquire the capability to seek graduates from this program, confident that their choices will be technically sound. This enhances the recruitment of top quality new students and provides for stability and consistency in program delivery. At the same time, job portability and personnel mobility are achieved through the development of a standardized, multi-discipline technician workforce that is credentialed nationally.

Because the training is performed in the community college system, the financial burden for such training and education is shifted away from the employer to the employee, providing an additional margin for economic competitiveness and placing the responsibility for preparation on the individual who makes his or her own career choice. Students should be empowered to pursue this approach from very early in their educational development, perhaps as early as middle school, which is why seamless linkages in the educational system are so important. This model, which is consistent with competency-based skills certifications such as the Microsoft Certified Systems Engineer training, paves the way for a life-long learning approach that meets the needs of all concerned.

The most important feature of this program is that it provides the American aerospace industry with a dependable source of well-trained and educated entry-level technicians.

For more information on this program, please contact the authors at:

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