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Paper Session III-A - Evolution of the Aerospace Technician

Thomas Steffen
Palm Beach Community College

Albert Koller
Brevard Community College

Evolution Of The Aerospace Technician:

Teaching The Right Stuff

By Dr. Thomas Steffen, Engineering Department Chair
Palm Beach Community College
And Dr. Albert Koller, Executive Director
Aerospace Programs
Brevard Community College

The contractors to NASA and the Air Force at Cape Canaveral Spaceport in Florida, teach and train new aerospace technicians specialized job skills on a continuing basis. They provide over 3000 courses, taking from a few hours to several weeks to complete. However, learning the history, culture, building locations and vocabulary specific to the Cape can take years. It has been estimated that it costs from $40,000 to $80,000 to fully train an aerospace technician. This large cost and long lead-time in technician training are the reasons Brevard Community College (BCC) was asked to teach "The Right Stuff."

The State of Florida saw a need to protect its vast involvement in the space business. In 2000, the State, through a "Horizon Jobs" grant, asked Brevard Community College to create a program focused on aerospace technicians at Cape Canaveral Spaceport. The goal set forth by the State was to create an aerospace technician-training program encompassing a two-year Associate in Science Degree (A.S.) and an Associate in Applied Science Degree (A.A.S.). Many of the skills, and much of the knowledge possessed by the Cape work force are unique and were acquired over long periods of time by extended experience. About 5,000 of the 15,000 people working at the Cape are technicians. As in many other mature industries, the older technicians are retiring and there are few individuals entering the work place to replace them. It is estimated that there are twice as many technicians at the Spaceport over age 60 as there are under age 30. Because of this age diversity, the size of the workforce, and the unique workforce capabilities, it became apparent that the initial goal was too encompassing in order to teach **all** "The Right Stuff" in a two-year community college timeframe. So the goal was refined to create a "work ready, entry level aerospace technician." Even this task was a mighty venture considering the diversity of the skills, knowledge and abilities of the Spaceport workforce.

To learn what the new workforce needed to know, the BCC Group had to find out what made up "The Right Stuff" by implementing a DACUM (**D**eveloping **A C**urricul**um**) process**.** This method, also known as occupational analysis, is based on the philosophy that content experts are able to identify valid, reliable and non-discriminatory outcomes and competencies. Then, any job outcome can be described in terms of competences that workers in that occupation perform. All the competences identified have a direct implication as to the knowledge and attitudes the technicians need to perform the work correctly. During this process the technicians define duties and tasks on an ongoing basis. A duty is defined as two or more tasks and a task is a work activity that has a definite beginning and end, is observable, consists of two or more definite steps and leads to a product, service or decision.

The DACUM process put nine Cape technicians, who do hands–on technician work, representing the three major contractors, together in a room. Then, with the guidance of the professional facilitator, these technicians were asked what they do, how they do it, what tools they use, and what mental and physical skills are required. The facilitator, through the use of widely accepted methods, as well as doing hundreds of DACUM around the U.S., sorted out just what the technicians did in their everyday jobs. Through this process of interviewing the technicians, and then feeding their answers back to them in common, easy to understand concepts for approval, this core group created the framework of knowledge

and skills (KS's) used or demonstrated in their day-to-day-activities. One of the underlying premises is that if one knows what KS's the present day technicians have and if those KS's are provided to the new technicians, then there should be congruency between the two groups. The results of this DACUM, representing the knowledge and skills required by an aerospace technician, are shown in Figure 1. Further details indicating traits, attitudes, tools and equipment are shown in Figure 2.

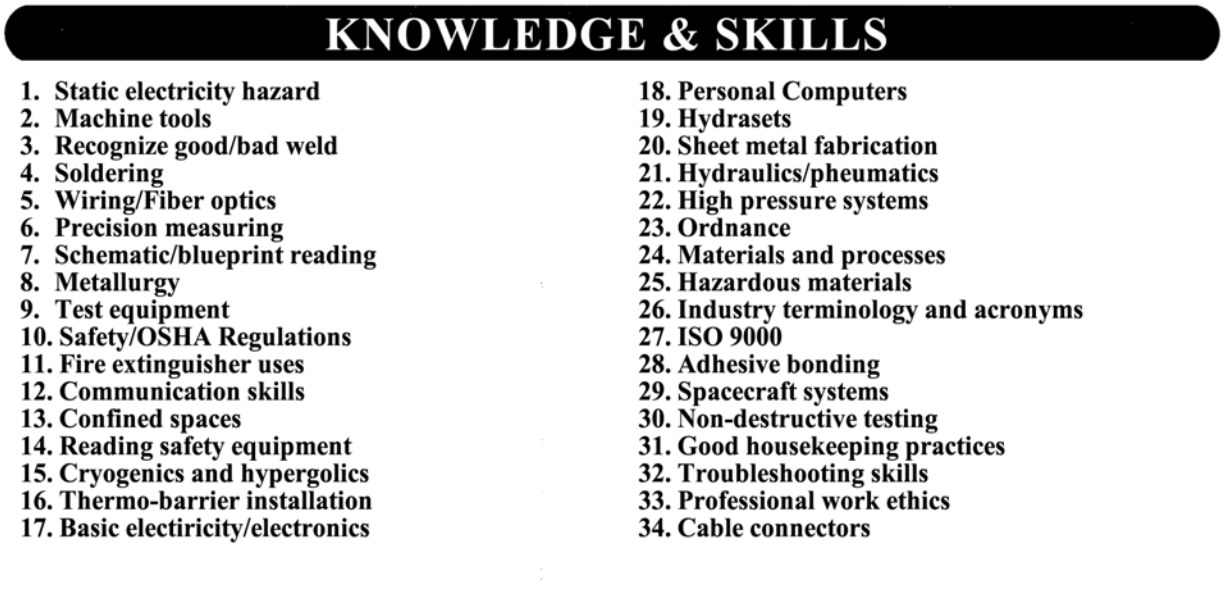

Figure 1

Figure 2

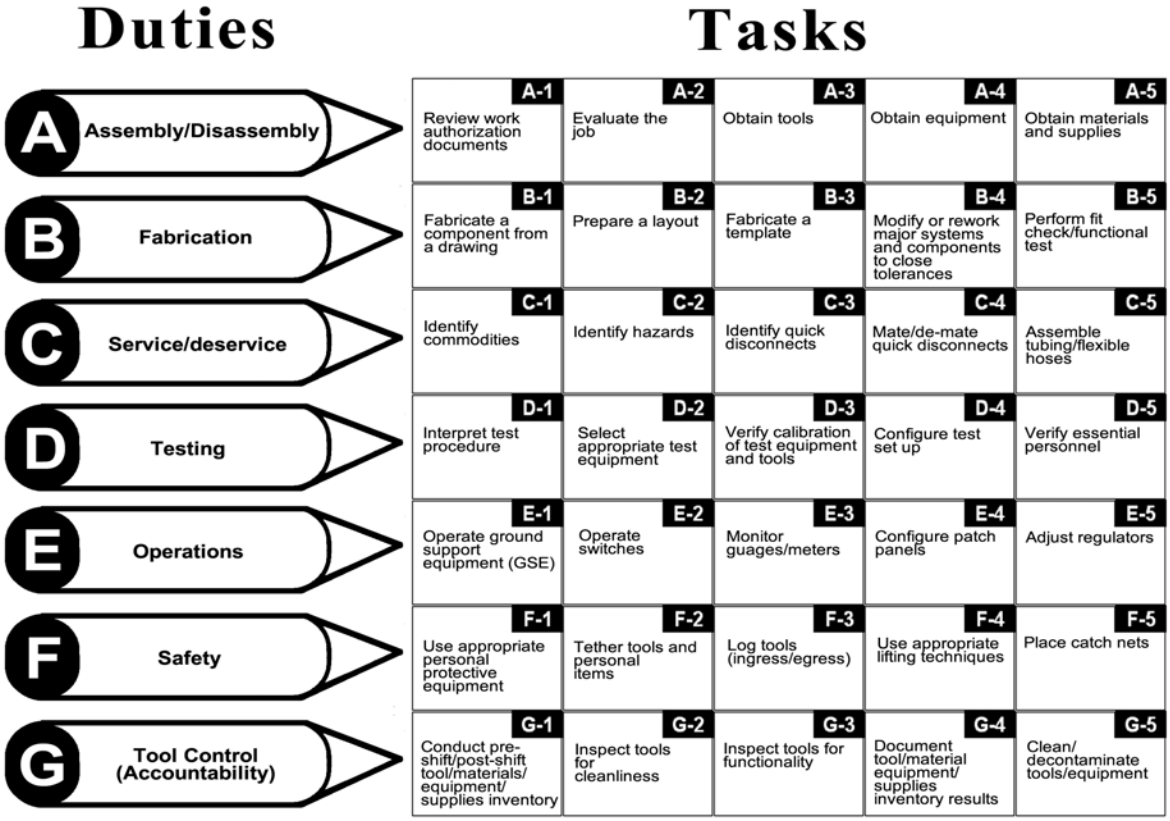

Figure 3

Since this DACUM information is in a format different than the required teaching for the community college, it was necessary for the BCC team to create or find the courses to match the DACUM requirements and to put these courses together in a curriculum format.

The team created a first semester curriculum using 12 of the 15 credit hours required in a community college curriculum, MATH, SCIENCE, ENGLISH, and COMPUTERS (Figure 4). It was felt that these first semester basic courses would help the students obtain a knowledge foundation required in the later semesters. Then from the DACUM information, the remainder of the courses were developed covering the topics such as Aerospace Systems, Aerospace Materials and Processes, and Applied Mechanics. This material did not exist in a course format and, therefore, "The Right Stuff" courses had to be developed. With the help of local space contractors, subject matter experts were identified for 15 separate courses. These subject matter experts were given a course template that met the format requirements of the college but left a considerable amount of flexibility to the course writer.

These subject matter experts were recruited from local industry serving the Cape. For example, an individual who was familiar with Aerospace Systems (in this case, an instructor who taught the astronauts Aerospace Systems) was asked to put together a course divided into 16 weekly meetings with each meeting being three hours long. It was stressed that the course developer should rely heavily on what was used in industry. The same concept was applied to all the special courses.

Other course development examples include the person who presently teaches aerospace fabrication to the engineers at the Cape. He created the BCC Aerospace Fabrication courses. The lead materials person for the Space Shuttle created the Materials course and the individual who put together

the Electronics and Applied Mechanics courses has extensive electronics/mechanics industry experience. In this manner, these subject matter experts created new courses based on the information supplied in the DACUM.

Since the subject matter experts (SME's) were current in their field and some were already teaching industry courses, the plan was that these same individuals would teach the college courses. In the first year of the program this happened 75% of the time. Obviously, having the individual who created the course also teach the course added depth and almost guaranteed that the student was learning "The Right Stuff."

Brevard Community College

Two Year A.S. and A.A.S. Aerospace Technician Program

1ST Semester English ENC 1101 – 3 crs. Intro to Aerospace Workplace – 3 crs. Technical Math MTB 1321 – 3 crs. (Algebra, MAC 1105)* Physical Science PSC 1341 – 3 crs. Computer Applications CGS 2100 – 3 crs. Evolution of the Aerospace Industry AFR 1250 – 1 cr. Total: 16 crs.	2nd Semester Basic Electricity/Electronics – 4 crs. Applied Mechanics – 3 crs. Aerospace Systems I – 4 crs. Materials and Processes I – 3 crs. Safety and Quality – 3 crs. (speech, SPC 2600)* Total: 17 crs.
Summer A Internship – 3 crs. Total: 3 crs (Humanities/Cultural Arts Elective – 3 crs)*	Internship – 3 crs. Summer B (Social Science Elective – 3 crs.)* Total: 3 crs.
3rd Semester Structural Fabrication I – 3 crs. Electronic Fabrication and Optics – 3 crs. Aerospace Systems II – 4 crs. Technical Writing – 3 crs. Materials and Processes II – 3 crs. Total: 16 crs	4th Semester Structural Fabrication II – 3 crs. Technical Task Analysis – 4 crs. Fluid systems – 4 crs. Tests and Measurements – 4 crs. Total: 15 crs. Program Total: 70 Credits

Figure 4

Providing the right courses, and the right instructors is not enough. Another important aspect of "The Right Stuff" is the involvement and attitude of the students. The students also need to know they are part of a very special program. Keeping a positive attitude and a sense of excitement is accomplished in several ways. First, the students are welcomed into the program by the Executive Director on the first day. This initial contact is important to set the tone for the rest of the semester. The BCC support staff is introduced even though most of the students have already talked with many of the staff by phone. Also, on that first day, several dignitaries are on hand to provide a more formal welcome. In the recent past, astronauts, NASA officials, the Cape Deputy Commander and representatives from the Astronaut Memorial Foundation were on hand for the official welcome. This formal celebration of arrival into the aerospace program adds another element into teaching "The Right Stuff."

A factor adding to the strength of the program is the faculty interchange. At the beginning of the semester, all the faculty members get together for lunch to meet one another, exchange syllabi and explore ways that the courses might interact. For example, the English teacher might give an assignment to write up the results of an experiment or exercise in the science class. The math instructor might ask that an assignment be turned in using one of the computer spreadsheet applications learned in the computer class. This interdisciplinary program has added to the engaging atmosphere of the program.

The timing and grouping of the classes were also considered. The first year students were grouped together so they all would participate in classes together. On Monday, they take Introduction to the Aerospace Workplace; on Tuesday, Math; Wednesday, Science; Thursday, English; and on Friday, Computers. In this manner a cohort group is created. Research indicates that cohort groups achieve higher grades and better retention than non-cohort groups (1). This grouping has created students who interact with one another frequently, often work in teams between classes, and has created an atmosphere of family due to the amount of time they spend together.

Another very important aspect of creating and maintaining interest in the program is the focusing of the common courses on an aerospace theme. For example, the beginning English course was themed so that the daily exercises, readings and homework revolved around space related topics. Assigned readings and writing came from the new collection of space related books installed adjacent to the classroom. Since these students already have an interest in space, these English assignments created more enthusiasm for the subject. The incumbent teacher has not encountered such enthusiasm in his non-themed classes.

"The Right Stuff" program does not end after a two-years of community college training; there are provisions for continuing education, which is accomplished by two methods. The first is a formal articulation between BCC and the University of Central Florida for the Bachelor of Science in Aerospace Technology degree. The articulation calls for the acceptance of almost all of the courses in the BCC two-year program, allowing the student to finish his B.S. degree in an additional two years. The second method is a planned series of seminars on space related subjects for technicians and others seeking broadened knowledge about the aerospace industry.

It is necessary that the students make the connection between "The Right Stuff" and the right place. For this reason, the classrooms and the three new laboratory-training facilities are located in the right place. This location at the Kennedy Space Center Visitor Complex is ideal, with offices and classrooms located in the Astronaut Memorial Foundation Building. The Headquarters of NASA's K-12 education program, the Florida Space Research Institute, the University of Central Florida, and the Florida Space Institute are all located there. Every day, just walking into the facility past the historic Rocket Garden brings home the idea that "The Right Stuff" is in the right place.

Another very important part of this focused teaching process is the advisory committee. This group is composed of national space contractors, educators and representatives from many of the local and state organizations responsible for developing a workforce. This group is called "The Aerospace Technology Advisory Committee" (ATAC) and was formed to act as an advisor to this Aerospace Technician Program. The many important and influential people on this committee made the procuring of subject matter experts, teachers and equipment easier. During the formation of the committee it was stated repeatedly by BCC personnel that the program was driven by industry and that a substantial amount of support was required to create success. The advisory group, from the beginning, was in general agreement that the students of today were going to be their employees of tomorrow.

In summary, the teaching of "The Right Stuff" involved:

1. Determining what is "The Right Stuff"
2. Creating or adapting the courses to teach it
3. Selecting the right instructor
4. Encouraging an active advisory committee
5 Choosing a suitable location
6 Focusing standard course material on aerospace themes
7 Creating a cohort group through scheduling
8 Creating enthusiastic first impressions
9. Maintaining a positive attitude
10. Monitoring the weekly progress of students and instructors
11. Maintaining an active advisory committee

These 11 items contributed heavily to the evolution of the Florida aerospace technician by teaching "The Right Stuff."

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Questions or requests for additional information should be directed to Dr. Thomas Steffen at Palm Beach Community College, 4200 Congress Avenue, Lake Worth, Florida 33461 or to Dr. Al Koller at BCC-A, Building M6-306, Kennedy Space Center, Florida 32899. Contact may also be made by email at steffent@pbcc.edu or kollera@brevard.cc.fl.us.

To view current program status, please access the reports updated on a periodic basis at the BCC web site: http://www.spaceportcenter.org.

Biographical:

Dr. Steffen holds B.S. and M.S. degrees in Mechanical Engineering, an M.S. in Industrial Administration, and a Doctorate in Business Administration. His employment history includes both aircraft and aerospace assignments in industry; executive level assignments in construction and economic development both domestically and abroad; research and teaching assignments at the university level; and teaching and administration at Palm Beach Community College, Florida for 15 years.

Dr. Koller holds a B.A. in Math/Physics, an M.S. in Systems Management, and a Doctorate in Business Administration. For more than 30 years he was an engineer and program manager for NASA at Kennedy Space Center; has taught for five universities; is president of e3 Company, a private consulting firm; and has worked at Brevard Community College for 10 years.