Apr 24th, 2:00 PM - 5:00 PM

# Paper Session II-C - The Evolution of Space Training

Dana Atkins
*Air Force Space Command*

## THE EVOLUTION OF SPACE TRAINING

by

Capt Dana Atkins, Air Force Space Command

The military has been developing formal training programs for decades. The continual need for quality personnel to perform in a variety of positions has driven the development of several organizations dedicated solely to training. The space operations environment has been no exception.

Military participation in space operations has visibly grown over the past ten years. To accommodate the growing need for qualified space operations personnel, programs aimed at space training have matured rapidly. Current training programs stress formal courses designed to train a maximum number of students in the most efficient manner possible.

As the military entered the world of space operations, no formal training programs existed. Space systems manufacturers provided the bulk of technical expertise through informal classes conducted at their respective factories. This effort was primarily in support of the missile warning and space surveillance roles of the North American Aerospace Defense (NORAD) Command and the Aerospace Defense Command (ADC). While training was partially provided by civilian manufacturers, on-the-job training played a far bigger role in producing qualified personnel.

The increasing demand for larger numbers of space systems operators and the previous success of the concept of centralized training led to the decision to combine all space training at one location. Following the lead of the US Air Force Air Training Command and numerous operational flying and missile launch training programs, the Air Force Space Command instituted the first crew training school for space systems operators. In December of 1985, the 1013th Combat Crew Training Squadron (CCTS) was activated. The squadron is headquartered at Peterson Air Force Base, Colorado, and has an operating location at Holloman Air Force Base, New Mexico. The squadron serves as the Department of Defense unit to conduct initial qualification training to all branches of the United States military and selected allied military forces. The squadron also serves as the primary Air Force unit that provides space operations orientation training to general officers and staff personnel. The Space Operations Orientation Course (SOOC) and the General Officers Course provide information ranging from basic satellite subsystems to the Soviet integrated threat against North America. Finally, the 1013 CCTS serves as the focal point for Quality Assurance Evaluator training for Air Force Space Command.

Twenty-four Air Force personnel were assigned the mission of providing initial training for operators assigned to the Missile

Warning, Space Surveillance, and Space Defense Operations Center at Cheyenne Mountain as well as operators assigned to Phase Array (PAVE PAWS) sites and the Ballistic Missile Early Warning System (BMEWS) operations centers. The activation of the 1013 CCTS brought Space Command in line with methods used for combat crew training in the rest of the Air Force. Additionally, the newer training squadron greatly improved the operational capability of Space Command units.

Air Force expansion into satellite operations and the associated training required for its support followed a pattern similar to that seen in missile warning and space surveillance. Initial training was provided by the satellite manufacturers. Instruction focused primarily on satellite subsystems design and operation. However, the bulk of actual knowledge was gained through on-the-job training and experimentation. Engineers provided the systems corporate knowledge and actually acted as the initial system operators. It was only a matter of time before satellite operations training was included as part of the 1013 CCTS mission.

It quickly became apparent that training missile warning and space surveillance operations was far different from training personnel to operate satellites. While students destined for positions at Cheyenne Mountain required relatively short courses training on low fidelity simulators, satellite operators spent months in courses which employed high fidelity, state-of-the-art main frame simulators.

Space Command realized the difficulties involved in managing both types of courses within one organization. In June 1990, these drastically different training functions were split. The 1013th Combat Crew Training Squadron retained the responsibility for training future space surveillance/missile warning personnel and was organizationally assigned to its host unit, the 1st Space Wing. Instruction of satellite operations became the responsibility of the newly activated 1022d Combat Crew Training Squadron assigned to the 2d Space Wing, Falcon AFB, Colorado.

A closer examination of the evolution of training for satellite operations gives a more detailed look at how training in the field of space operations has been refined to achieve the most efficient instruction possible. Initial instruction started in the research and development environment. Engineers associated with a particular satellite design project received informal training from the satellite manufacturers engineering team. As previously mentioned, on-the-job training added further knowledge. This on-the-job training lasted anywhere from 18 to 24 months. At this point, the Air Force engineers were the satellite system operators.

While the next logical step was a transition from manufacturer training to formal military instruction, Air Force Systems Command lacked adequate numbers of trained people to

develop and instruct these courses. The solution to this was a gradual transition which meshed Air Force management, civilian contractor instruction, and small amounts of on-the-job training to produce qualified satellite operators. This, essentially, was the start of the change from engineer operators to dedicated satellite operations officers and the beginning of formal military instruction for satellite operators designated as Initial Qualification Training (IQT).

The first course taught under this new approach began in 1984. Cadre I-IV training was conducted by civilians under contract to the Air Force to develop courseware and instruct students for future assignments in the Defense Satellite Program (DSP), Global Positioning System (GPS), North Atlantic Treaty Organization III (NATO III), and Defense Satellite Communication System Phase II (DSCS II) programs. Cadre training was conducted in San Jose, CA and was limited to a single course designed to provide a one-time input of operators and instructors into Space Command positions.

In the same time frame, similar contractor training was conducted to support the Global Positioning System Master Control Station. This course, conducted between June and November 1985, was similar in nature to the Cadre I-IV training. Both efforts were one time, off-site courses which were interim solutions to Air Force Space Command's training needs.

On-site satellite operations training at the 1013 CCTS began in January 1987. While courses were still contractor taught, the effort had now turned to continuing courses on a rotating schedule verses a single one time class. Satellite Operations Course I-IV provided Initial Qualification Training for satellite operations crewmembers assigned to Falcon AFB, Colorado. This program, which lasted through April 1990, provided civilian contractor support for courseware development and instruction. Air Force personnel still managed and attended these courses.

During the time period when contractor personnel conducted training, the instruction development process was not fully implemeted. Once students completed initial qualification training and reported to their assignments, instruction in the form of on-the-job training was still required to increase their knowledge level to a point where they were qualified to perform satellite operations.

The use of civilian contractors to train military space operations personnel was part of a comprehensive plan that would eventually allow total conversion to Air Force "blue-suit" instructors. Initial training by the satellite's manufacturer provided the initial cadre of military officers with enough knowledge to conduct satellite operations. However, hands-on experience as satellite operators was essential to the successful development and implementation of a high quality training program.

Contractor instructors allowed the initial group of military operators to gain valuable experience in the operational environment prior to returning to fill the role of an instructor. The experience gained through on-the-job training guaranteed the successful transition to an all military training organization.

Air Force "blue-suit" instruction, the final step in the establishment of formal courses, started in September 1987. GPS/MCS courses were the first to be taught by Air Force instructors. The remainder of the courses transferred to "blue-suit" instruction in April 1990. Formal Air Force satellite operations instruction, as it exists today, was finalized when the 1022 CCTS was activated in June 1990.

Currently, the structure of satellite operations training requires the 1022 CCTS to conduct all Initial Qualification Training while the respective operational squadron training divisions complete Unit Qualification Training (UQT). When training is complete, squadron Standardization and Evaluation Division personnel evaluate crewmembers who will perform as operators. Follow-on or recurring training is conducted by individual squadrons to insure crews maintain peak knowledge levels.

The benefits of a formal training program for satellite operators have been remarkable. Centralized training has proven to be critical to training the highest quality operators in the most efficient manner. This is an essential goal in an era of shrinking budgets and manpower caused by cuts in defense spending.

Perhaps one of the most visible results of centralized training in the space operations environment is the reduction in the amount of time required to train a student. Instruction that first took in excess of 425 calendar days in an on-the-job training environment only took 370 days in a contractor-run training environment. Today, Air Force instructors demonstrate that they can train qualified satellite operators to a level required for an evaluation in only 108 to 170 calendar days, dependent on the difficulty of each particular program.

The extended period of time needed to conduct on-the-job training is driven primarily by the use of a one-to-one student/instructor ratio and students train on operational equipment which is not available for training 100 percent of the time. By moving training to a central location, a five to one student/instructor ratio can be realized. This, and the added efficiency of using dedicated equipment, greatly reduces overall training time. Current courses are broken into Initial Qualification Training conducted at a central facility and Unit Qualification Training or a formalized on-the-job training (80 percent IQT and 20 percent UQT). The savings in time speak for themselves.

The transition to "blue-suit" instruction brought more qualified instructors into the training environment. CCTS instructors come directly from the operational units. They bring with them the expertise of satellite operations as each is required to have served on crew for a specified amount of time (depending on the particular satellite program or position). Additionally, 25-50 percent of all CCTS instructors are required to maintain certification in their respective programs, which facilitates keeping training materials current at all times. These certified instructors also augment the operational squadrons' crew forces when required by 2d Space Wing. The Air Force "blue-suit" instruction, along with the assignment of 1022 CCTS to the 2d Space Wing, created better communications channels and eliminated the disconnect that existed when training courses were conducted by contractors. It also has greatly improved support for the centralized training squadron.

Instructor utilization is improved with centralized training. Where on-the-job training requires a student to instructor ratio of one to one, centralized training allows a five or six to one ratio. This in itself allows more students to be trained over the same period of time.

CCTS instructors are responsible for developing courseware and simulation scenarios, along with conducting classroom instruction and simulator training. The simulator operator function was also previously accomplished by contractors. Now, each instructor is trained in simulator operation and is responsible for conducting simulations for their own training courses as well as helping out other programs when possible. This allows a more efficient use of valuable instructor assets and a great savings of 2d Space Wing resources.

One of the most notable values of a centralized training facility is the ability to standardize training and courseware. On-the-job training is, by its very nature, informal and varies from instructor to instructor. There is no guarantee that required material will be covered or, if it is, what quality the instruction will be. Centralized formal training courses ensure that each student will be trained the same as the previous one and that a systematic approach will be taken to develop and maintain course materials that present all the information necessary to produce qualified operators.

This approach is invaluable as future programs such as the Milstar and UHF Follow-on (UFO) satellite systems come on-line. Personnel involved in training development for these new programs do not have to re-invent the wheel when it comes to designing operator training programs. There is a vast amount of information available from a pool of experts in one location which can be applied to these new projects.

Economies of scale play a major factor in driving the efficiency of centralized training. Shared facilities such as

classroom, simulators and office space eliminates the costly need for duplication. Common organization overhead ensures all courses have access to courseware development experts as well as administrative support and supervision.

The increased use of high fidelity main frame simulators in space operations training underscores the need for a formalized training in a central location. The cost of simulation management drives the need to eliminate duplicate efforts. The most efficient use of computer time is by common scheduling, software maintenance, and configuration management. Future requirements and issues can be developed in a coordinated effort allowing the greatest benefit for the most people.

The high fidelity simulator used for training satellite operators allows approximately 90 percent duplication of the operational environment. Students can be exposed to actual satellite telemetry displays and can get hands-on experience for virtually every type of satellite support, including anomalous conditions and satellite control planning tasks. Ground system procedures and anomalies can also be simulated.

Use of simulators also allows the students to make mistakes and see the impact of those mistakes without any degradation to the equipment or system. Training using operational equipment and satellites certainly does not allow this luxury while a multi-million dollar satellite is being operated at the end of the communications link. Simulation training is the key to eliminating extensive on-the-job training and allows students to become certified with minimal unit qualification training.

The bottom line for any training organization is the quality of instruction. Removing training from the operational environment (common to on-the-job training) and placing it in a controlled location dramatically improves quality. A dedicated training environment places the focus on training and removes the distractions which are common to training on the operations floor. It also allows instructors at the operational units to focus on their primary job of operations and not on instruction.

Training in Air Force Space Command has matured very quickly in a short period of time. Efficiency has improved as instruction has transitioned from one-on-one on-the-job training to contactor instruction to "blue-suit" formalized instruction. Savings in manpower and money have been significant while quality of students is at an all time high.

As the structure of satellite operations squadrons and concepts of satellite control operations changes, training will become even more important. Future plans call for a conversion from commissioned officer operator to enlisted operators. The goal is to have an approximate crew force officer-to-enlisted ratio of one to three. Positions once filled by college graduates possessing engineering degrees, will be assumed by

individuals with a minimum of a high school diploma. The importance of quality training is easily seen.

The future evolution of training in space operations will continue to emphasize efficiency improvements. Continued refinement of courses will ensure all duplicate instruction is eliminated. Training objectives will be polished to optimize the materials presented and instructor usage will be increased to ensure maximum efficiency. The final result will be high quality satellite operators receiving exacting instruction performed within an all Air Force environment.