

# **A General Engineering Technology Program For Navy Technical Personnel: A CD-ROM Based Curriculum**

**Gary R. Crossman, William D. Stanley, David L. Chase  
Old Dominion University**

## **Abstract**

Old Dominion University (ODU) has offered Bachelor of Science degrees in engineering technology for over 30 years. The programs in Civil, Electrical, and Mechanical Engineering Technology have maintained continuous accreditation by TAC of ABET since 1976. These programs have been delivered via ODU's interactive video TELETECHNET system to distance learning students in Virginia and other selected sites for more than 10 years.

In 1999, the Department of Engineering Technology saw a need to develop a General Engineering Technology (GET) program to provide educational opportunities to students with a wide variety of educational and work backgrounds. The availability of this program and communications with the U. S. Department of the Navy resulted in the formulation of an asynchronous CD-ROM based General Engineering Technology program under the auspices of the Navy College Rating Partnership program. ODU is partnered with other institutions to provide the program to personnel located aboard ships and at other facilities. Naval experience and schooling are used extensively to satisfy some of the lower-division technical credits. The upper-division courses will be offered on CD-ROM, with both audio and video. The program has an Electro-Mechanical orientation, and along with the major in General Engineering Technology, a graduate will earn a minor in Engineering Management.

A description of the program is provided within this paper. Some of the problems encountered and possible solutions will be described. The program is believed to offer significant educational opportunities for Naval personnel in many technical ratings.

## **I. Introduction**

Old Dominion University began offering Bachelor of Science degrees in engineering technology in 1970. Initial accreditation of the programs in Civil, Electrical and Mechanical Engineering Technology by TAC of ABET was achieved in 1976 and continuous accreditation has been held since that time. In 1989 the University began offering these programs (upper-level only) via interactive video to a single remote site in Virginia. By 1993 the number of sites had expanded to three and in 1994 ODU's broad based interactive video TELETECHNET system was initiated, encompassing these as well as several other non-technical programs. Today, TELETECHNET offers its programs to over 50 sites in Virginia and other states. Several papers have been published regarding distance delivery of these engineering technology programs including laboratory components.<sup>1, 2, 3, 4, 5, 6</sup>

Due to the proximity to some of the country's largest Naval facilities, Old Dominion University in Norfolk, Virginia, has provided support to the United States Navy in many different ways over the years and the association has been mutually beneficial to both organizations. During the past

few years, the association has been strengthened through formal agreements in which the institution has become one of the official partners in the Navy College Rating Partnership program. Under this agreement, Old Dominion University has made a commitment to cooperate with other institutions within the Navy College consortium to offer certain degree programs. The lower-division portion of the degree programs not covered by naval experience or schools would be obtained through arrangements with other institutions and Old Dominion University would provide most of the upper-division portions and award degrees in certain areas.

The following conditions and requirements were established at the outset: (1) Credits would be awarded to sailors based on their rating rank and the successful completion of various Navy schools. (2) All courses would be offered on an asynchronous basis, permitting an "any time-any place" profile.

## **II. General Engineering Technology**

The General Engineering Technology program, initiated in 1999, provides educational opportunities to individuals with a wide variety of technical educational and work backgrounds. The curriculum was designed to accept courses and experiential learning from various disciplines to be applied toward lower-level credit. The upper-level curriculum requires some specific courses from an existing engineering technology discipline and courses required to obtain a minor in Engineering Management. This curriculum would assist the graduate in advancing within his/her company or branching into other careers such as sales engineering and plant engineering. Since the GET program is relatively new, the major population of students in the Department of Engineering Technology (both on and off campus) is still within the accredited programs. A few students (less than 20) who came from non civil, electrical or mechanical backgrounds have entered the GET program. Another paper at this ASEE conference further expands the description of that program.<sup>7</sup> This program was also attractive to U. S. Navy technical personnel on active duty in the area. Norfolk, Virginia is home to one of the largest naval bases in the world.

There are more than 20 specialties within the enlisted ranks of the U. S. Navy that can be considered loosely as "engineering technology" ranks. This includes such ratings as electronics technician, fire control technician, machinist mate, and many others. According to Navy data, there are over 100,000 enlisted personnel in these ranks. Most are first-term enlistees, but many are career sailors. The Navy is making a special effort to encourage the enlistees to further their education, and ODU has assumed the challenge to provide a baccalaureate program to achieve that goal.

The typical sailor in one of the applicable technical ranks will have outstanding technical and practical "hands-on" abilities, but in most cases, will be lacking in the mathematical and analytical aspects of his or her specialty area. Moreover, unless the sailor has completed some college prior to or during military service, he or she will need to complete lower level general education requirements commensurate with college studies.

Most of the applicable ratings fall within the electrical, electronics, and mechanical umbrellas, and as a result, a decision was made to create a program that would have an Electro-Mechanical

type of emphasis. Since the department already had approval to offer a General Engineering Technology degree concentration, it was decided to use that degree designation for the Navy College Rating Partnership program.

### **III. Engineering Management Minor**

Old Dominion University is fortunate in having a strong Engineering Management program offering an undergraduate minor and graduate degrees through the Ph.D. in that field. One of the goals of the U. S. Navy in promoting a baccalaureate degree for technical personnel is the role that these personnel will play as they move up in ranks. When they reach the first-class and chief petty officer ranks, they will often serve more in a management capacity than in a purely technical capacity. Therefore, the concept of building in the engineering management minor as a part of the program seemed to be a very natural one and was well received by the Navy.

### **IV. Program Goals**

In developing the program, the department was requested to provide a goal statement. The statement that follows provides the basic philosophy of the program:

"The primary goal of this program is to provide broad-based engineering technology studies at the advanced level combined with complementary engineering management studies and general education. This combination should provide a strong base to enhance the individual's technical career progress in either the military or in a civilian capacity. In particular, the graduate should be well prepared to progress into technical leadership or management positions requiring both a knowledge of the technology as well as the ability to manage personnel and projects of an engineering nature."

That goal remains as the primary thrust of the program. To accomplish the technical portion of the program, careful scrutiny of available courses within the department was made. It was decided, wherever possible, to utilize existing courses. The following criteria were utilized in selecting the courses: (1) Courses should be as broad-based as possible to accommodate a variety of technical ratings. (2) Courses should be calculus-based as appropriate, but should require a minimum number of specific prerequisite courses. (3) Since the amount of work involved in developing asynchronous courses is substantial, courses should be selected on the basis of their fundamental importance and expected longevity as opposed to "trendy" subjects.

### **V. Program Composition**

Initially, the Old Dominion University portion of the program was set at 36 semester hours of credit. Each course is a 3-credit course and the basic program composition established at the outset is shown as follows:

#### Engineering Technology Studies (Calculus prerequisite for all courses)

EET 350, Fundamentals of Electrical Technology (prerequisite for all EET courses)

EET 360, Electrical Power and Machinery

EET 410, Communication Principles

EET 415, Programmable Machine Controls

MET 300, Thermodynamics

MET 305, Principles of Mechanics (prerequisite for all MET courses except 300)

MET 310, Dynamics

MET 330, Fluid Mechanics

### Engineering Management

ENMA 301, Engineering Management

ENMA 302, Engineering Economics

ENMA 401, Project Management

ENMA 420, Statistical Concepts (Calculus prerequisite)

The remaining part of the program consists of all the general education requirements, mathematics through differential and integral calculus, physics, chemistry, electives, and credits awarded on the basis of military schools and rank. It was originally anticipated that all of these credits would be earned through the other participating institutions along with the military schools.

## **VI. Asynchronous CD-ROM Course Development**

The asynchronous CD-ROM courses have been primarily developed by current ODU faculty who have regularly taught existing live courses. Since this development was in addition to their normal academic load, a method of re-numeration has been developed. Faculty who develop a CD-ROM course are paid \$5K upon satisfactory completion of the CD-ROM and another \$5K when they have taught 25 students, or one year of course offerings, whichever comes first. Faculty members responsible for a course offering will grade tests and other work submitted by the students as well maintain communication with students. When faculty other than the one who developed the CD-ROM administers the course, the developer will receive a five percent residual from a percentage of the tuition received by the department.

The program development would not be possible without the strong support of ODU's Center for Learning Technology (CLT). Various formats for asynchronous courses have been investigated. Since sailors generally have limited facilities for storing and utilizing course materials, it has

been desirable to keep the format as compact as possible. Yet most studies of the learning process indicate that the combination of both aural and visual stimuli provide the best learning paradigm.

While there have been some variations in the development processes, most faculty have utilized a combination of Microsoft Power Point slides coupled with an audio track obtained by software such as Goldwave. Since different faculty are at different levels in their CD-ROM development skills, CLT provides as much training and assistance as necessary to assist each faculty member in the production of high quality disks. Many faculty have produced the raw materials for the courses at home and then supplied them to CLT for final "massaging" and production. The result has been that the lectures for a 3-credit course will easily fit on a 650-MByte CD-ROM with room to spare.

In some sense, the material on the CD-ROM emulates a classroom environment in that there are slides coupled with a voice. Since the slides are prepared in advance of the lectures, a great deal of efficiency has been obtained in the presentation. Indeed, the amount of material typically covered in about 45 hours of class time can be covered in much less time when the slides are prepared in advance and when there are no classroom distractions and questions. Of course, students may not be able to absorb the material at the higher rate, but one of the outstanding advantages of this delivery mode is that a student may stop at any time, review as necessary, and repeat the lecture at will. As in a conventional class, textbooks and/or coursepacks are provided along with the CD-ROMs. Students are able to email or call instructors as necessary to obtain additional help. At the time this paper is being prepared, approximately half of the courses have been prepared and others are currently in production.

## **VII. Challenges Encountered**

Since Old Dominion University initially planned to offer only 36 credits of the total program, which would ideally be offered near the end of the sequence of studies, it is very important that paths be developed for students to acquire all the necessary general education courses and, in particular, the mathematics and science courses considered as prerequisites to advanced technical courses. While many of the partner institutions offer many courses in the general education arena, the absence of suitable asynchronous mathematics and science courses became evident during the program's formulation. Moreover, most of the mathematics courses tend to be the conventional classical types that are not ideally suited for an engineering technology program of this nature. As an *ad hoc* procedure, some students have been referred to institutions not part of the Navy College Rating Partnership program that appeared to offer correspondence courses in mathematics that might be appropriate. The latest development is that the College of Engineering and Technology will develop some special technical mathematics modules that could be offered by the institution as part of the program. A study is currently underway as a prelude to the development of such modules.

Another challenge has been the implementation of appropriate starting and ending dates for individual courses. Since this program was designed to be delivered "anytime, anywhere", students should be able to start the course anytime, rather than at the beginning of the traditional

semester. This presents difficulties in determining faculty academic loads for those faculty who are teaching these courses as well as traditional semester long courses. Also, if courses do not end at the end of a normal semester, final grades submission for students who complete a course does not meet normal university guidelines. The current policy is to submit a grade of “Incomplete” at the end of the semester in which the students start a course (if it has not been completed) and submit a final grade when they complete the course. The logistics of assigning faculty loads and course scheduling is still in the developmental stages since the number of Navy students currently in the GET program is small. It is anticipated that equitable arrangements will be achieved as enrollments increase. The faculty, thus far, is enthusiastic about its involvement in the program.

Also, it is important to ensure the proper supervision of tests and final examinations at the site of each student. Currently, arrangements have been made with the Navy Education Officer at each ship or naval facility to provide the proper supervision. Most completed tests and other assignments are currently sent to the faculty as hard copies. Experimentation is underway with electronic submission of student materials.

### **VIII. Accreditation Issues**

The other departmental programs in Civil, Electrical, and Mechanical Engineering Technology are accredited by TAC of ABET. However, the General Engineering Technology program is new and has never been subjected to an accreditation review. Moreover, the composition and asynchronous nature of the program may create some difficulties with potential TAC accreditation issues. This does not appear to be a problem with the U. S. Navy. Therefore, for the foreseeable future, this program will be offered without TAC of ABET accreditation until a full assessment of the outcomes can be made. It should be noted, however, that the composition and program requirements were built around some of the past TAC of ABET requirement areas to posture the program for future possible accreditation if it is deemed desirable. Under new TAC outcome based assessment procedures, there appears to be some possibility for future submission for accreditation. There may also be the possibility of submitting the program for accreditation by the RAC.

### **IX. Summary**

The Department of Engineering Technology at Old Dominion University has created a General Engineering Technology program that can be pursued by a significant number of technical enlisted personnel in the U. S. Navy. A very important element of the program is that the courses are offered on an asynchronous basis utilizing CD-ROM technology with both visual and audio components. Courses may be taken by Naval personnel both on land and at sea. Approximately half of the courses have been developed and others are under current development. Although the program has already begun with modest enrollments thus far, most Navy enlisted personnel do not yet have the necessary calculus and science courses to pursue upper-division engineering technology courses. The few students enrolled thus far are those that have two or three years of college with a strong base in mathematics and science. Thus, it is expected that there will likely be a slow ramping process before the full impact is reached. However, the number of inquiries has been high and interest is definitely strong. The number of possible students is very

substantial and the program has a great deal of potential to serve an important need for the military and for the country.

---

## Bibliography

1. Crossman, G. The Logistics of Teaching an Interactive Television Course to Remote Sites, *Proceedings of the 1997 ASEE Annual Conference, Session 1649*, Milwaukee, WI, June 1997.
2. Verma, A. & Crossman, G. A Mobile Instructional Laboratory to Supplement the Televised Program in Engineering Technology, *Proceedings of the 1995 ASEE Annual Conference*, Anaheim, CA, June 1995.
3. Crossman, G. Teaching Laboratories in Distance Education Programs, *Presentation-Engineering Technology Leadership Institute*, Orlando, FL, October 1996.
4. Crossman, G. How Far Can We Go with Distance Learning?, *Proceedings of the 1999 ASEE Conference for Industry and Education Collaboration, Session ETD 443*, Palm Springs, CA, February 1999.
5. Lewis, V. Experiences With a Virtual Laboratory Class in Materials Testing for Civil Engineering Technology, *Proceedings of the 2000 ASEE Annual Conference*, St. Louis, MO, June 2000.
6. Crossman, G. A CD-ROM Based Laboratory in Fluid Mechanics, *Proceedings of the 2001 ASEE Annual Conference, Session 2247*, Albuquerque, NM, June 2001.
7. Lewis V. and Kauffmann, P. General Engineering Technology. A Broader Spectrum of Student Needs, *Proceedings of the 2002 ASEE Annual Conference Session 2247*, Montreal, QB, June 2002.

## GARY R. CROSSMAN

Gary R. Crossman is an Associate Professor of Engineering Technology at Old Dominion University in Norfolk, Virginia. He also serves as Director of the Mechanical Engineering Technology program. Professor Crossman received his B.S. degree from the U.S. Merchant Marine Academy in 1964 and his M.E. degree in 1970 from Old Dominion University, where he has served on the faculty for over 30 years. Professor Crossman is a Fellow of ASEE and the recipient of the James H. McGraw Award for leadership in engineering technology education.

## WILLIAM D. STANLEY

William D. Stanley, Eminent Professor Emeritus, retired during the 2000-2001 academic year after about 35 years of service at Old Dominion University, of which he held the position of Chair of the Department of Engineering Technology for 27 years. He holds a B. S. degree from the University of South Carolina and M. S. and Ph.D. degrees from North Carolina State University, all in Electrical Engineering. He is also a registered Professional Engineer in Virginia and author of more than a dozen textbooks. Since retiring, he has continued to work part-time with the Navy College program and has developed two of the asynchronous courses for the program.

## DAVID L. CHASE

David L. Chase is a career educator with extensive experience as a teacher and administrator. He taught secondary school social studies prior to entering military service. While on active duty, he held a variety of assignments in the education and training arenas. He served on the staff and faculty of two prestigious institutions of higher education prior to joining Old Dominion University as the Director of Military Distance Learning Programs. In his last assignment with the United States Air Force, he served as Dean of Students at the Air War College. Mr. Chase earned his baccalaureate degree from the University of New Hampshire and a graduate degree in Education from the University of Main. Mr. Chase is a graduate of the Joint Forces Staff College and the Air War College. He retired in the grade of colonel after nearly thirty years of military service. He was instrumental in implementing the Navy College Rating Partnership for Old Dominion University, and has significant experience in distance learning.