

“Technology Based Distance Learning at the University of Florida, College of Engineering – Graduate Engineering Education on Demand”

Bob Mason, Dr. Fazil T. Najafi

Coordinator of Broadcasting, Outreach Engineering Education Program, University of Florida / Professor, Department of Civil & Coastal Engineering, University of Florida

The Outreach Engineering Education Program (OEEP) now in its fourth decade began with a one studio/classroom that transmitted over the State of Florida microwave backbone. The students had to gather at the closest facility with a microwave link.

The demographic coverage was south eastern Florida, the “Space Coast”, where most of the technology companies flourished. The mission was to extend the classroom for engineers seeking advanced degrees.

In 1987 the ASEE published the 1987 Compendium on Uses of Television in Engineering Education. In it we published a paper, ‘University of Florida, College of Engineering Instructional Television Facility’. This is an excellent snapshot in time. Demographics had changed, technology evolved and enrollment had increased since the beginning in 1964. The primary delivery media in 1987 was $\frac{3}{4}$ video cassettes shipped to industry site coordinators with one copy of the handouts. Students would watch the tape in groups. But, the primary mission remained the same. To extend the classroom for engineers seeking advanced degrees.

Today our mission remains the same.

The Extended Classroom, an audio/visual recording of an on-campus lecture, is what we offer as distance education because it is timely and involving. When a graduate engineering student anywhere in the world can watch a lecture on the same day as the on-campus student and has assignments due at the same time, then distance learning is immediate and involving for that distant student. This immediacy fulfills the educational objective of the institution as well as the student.

For the distance student, the proper application of technology is vital. Technology is a major influence on immediacy and involvement. The following points will be discussed in this paper as it applies to the Outreach Engineering Education Program (OEEP) at the College of Engineering, University of Florida.

- Technology budget.
- Recording technology influences clarity.
- Delivery technology influences time.
- Communications technology influences student participation, management, and marketing.
- Management technology influences recording and delivery technology.

At OEEP a team of ten staff along with a cadre of part time workers process daily about 32 hours of engineering education. Five studio/classrooms in two buildings record live lectures populated with, ranging from 15 to 100, on-campus students. Because approximately 35% of the dl students take two courses, those 32 hours of raw recorded audio/visual material serve on the average of 43 hours of raw instruction per day. The rigid cadence for daily production is set by the course schedule. And the daily manta is “The show must go on!”. At the end of the on-campus day, all recorded lectures must be available to the distance education student. That includes handouts given in class. If a quiz or exam is given during a lecture period the appropriate proctor has to be notified and the documents must be made available to that proctor as soon as possible, usually about 15 minutes after the on-campus class ends. The daily pulse is electronic and the rhythm is urgent.

Technology budget

Every year OEEP receives an operational budget directly from the Deans office. This budget is allocated to salaries and expenses. Equipment purchase monies are not part of the allocation and can only be derived from surplus funds available at the end of a fiscal cycle. This requires careful monitoring of in-use equipment for possible replacement and deciding where improvements using newer technology must be made to facilitate the mission. Because part time workers are hired from semester to semester based on courses offered, salaries vary. Expenses vary due to the enrollment. These two items must be accurately predicted so that the money for technology purchasing can be planned and determined. Large shifts in technology have to be funded separately. An example of this is the case of camera replacements needed for two of OEEP’s studio/classrooms. Currently two camera systems, each consisting of two three chip color cameras with built in pan/tilt/zoom and a joystick controller; need to be replaced because maintenance of one camera is equivalent to the cost of a newer and better block camera. Due to the nature of the current system, one of those newer cameras can not be swapped in itself without swapping both cameras and the joystick controller, a \$ 70,000 per studio price tag. This type of technology support requires a direct allocation and may only be realized over time. New technology must be carefully weighed as to the benefit versus the cost. A good example of that is when OEEP switched from mastering courses on S-VHS to mastering on DVD. When Pioneer came out with their DVD recorder that featured a one button “start” and re-writable media, OEEP purchased one unit and for one semester recorded in one studio. It became evident, almost immediately, that the quality of recording was superior, the media required less storage space and more rewrites per media were possible according to the specifications. Hence all remaining monies at the end of the fiscal cycle were allocated to swapping out all mastering units, and the beginning of the next fiscal cycle expense money was

used to purchasing the mastering media, DVD-RW. The benefit was excellent archiving with no degradation in quality.

This day and age it becomes imperative that the in-house technologists keep a constant vigil on the appropriate industry that supports the mission. By spending some of that expense money our technologists have the opportunity to go to significant trade shows such as NAB(National Association of Broadcaster) and InfoComm. This is where new innovations are found and inspiration is fostered.

Recording technology influences clarity.

A three chip color camera captures the formula written on the chalk board better than a single chip camera. A longer zoom lens can capture the instances of focus such as an element of that same formula that may have sub or super script and is even hard to see by on-campus students. A good pan/tilt system for cameras allows for smooth zooms, pan and tilts without distracting the learner. When the instructor uses a computer presentation or a document in class, the technologies to interpret those instructional elements have to be available and the results must be integrated into the delivery of the instructional package. Of course the video has to be clear and the audio has to sound good. Clarity to the distance student is critical and is highly dependant on the recording technology. If we start with a mediocre quality, by the time the signal gets processed and compressed to be served over the internet the quality would be degraded where some of the board writing would be impossible to read. A simple test to show the difference is to access a home movie (single chip camera) on the internet and right afterward access a typical television show. The quality difference in that case doesn't come from the compression ratio or bandwidth, but from the recording technology. The way technology is applied can also produce clarity. A good example of applied technology is the case of the data projector used in the classroom. It was realized that instructors are now coming with higher resolution programs and that they want to run simulations on various software. The scan converter used adequately for presentation programs was not up to par in handling the smaller fonts in large spreadsheet or simulators. An extra three chip camera was set to record the projection screen seen by the on-campus student. This camera has pan/tilt/zoom features and can now zoom to the relevant part of the screen that is mentioned in the lecture. In addition, if the instructor wants to use a laser pointer that will also be recorded, were before a mouse or electronic pen had to be used. In this case, the quality didn't improve, but the clarity did by allowing the production team to zoom into the areas being discussed.

There is a lot of good equipment out there, unfortunately some of it is currently out of budget range for educational institutions. But as these technologies become cheaper they will be adapted. For instance High Definition Television would be ideal for engineering and medical education but the current cost of the new equipment is aimed at the broadcast market. At present OEEP uses a combination of analog and digital equipment. As an input source the computer is currently the only digital device, the document camera and three instructional stage cameras are analog. There are all digital cameras available that are reasonable, but not until the last few months did the prices on digital video switchers start to approach the price that education can afford. In the next few years at OEEP there will be a slow transition to processing the signal totally digital. This will move the quality of video up a few notches, again improving clarity for the distance education student.

Delivery technology influences time.

Ten years ago we had a lag period of a week. The distance student was given a grace period of five or more days before their assignment was due back to the professor. All information exchange was handled through courier service such as UPS and Federal Express or through the US Mail. It took that long for the lecture to get to the students and the student turned in the assignment. That time lag now is on the average of three days because of email and other computer based communication tools. The goal is to get turn around time to no delay. Currently OEEP streams all the courses over the web. If the student has sufficient bandwidth he/she can watch the lecture one hour after the class is over on campus or whenever they demand to watch it. The problem is that high speed access is not available everywhere yet. Currently we offer the dl students VHS tape, CD's with the video compressed into MPG1 files, or streaming video at 256/384 kbps. Our goal is to get all dl students to use streaming video. This will eventually close that lag period to zero. If the student gets the assignment during the lecture period and watches it the same day as the on campus student, that assignment will be due at the same time as it is on campus. Last year OEEP had one professor insisting that only students who had sufficient bandwidth to watch the streaming classes could enroll for his class because he gave daily assignments and lag time was not an option for him.

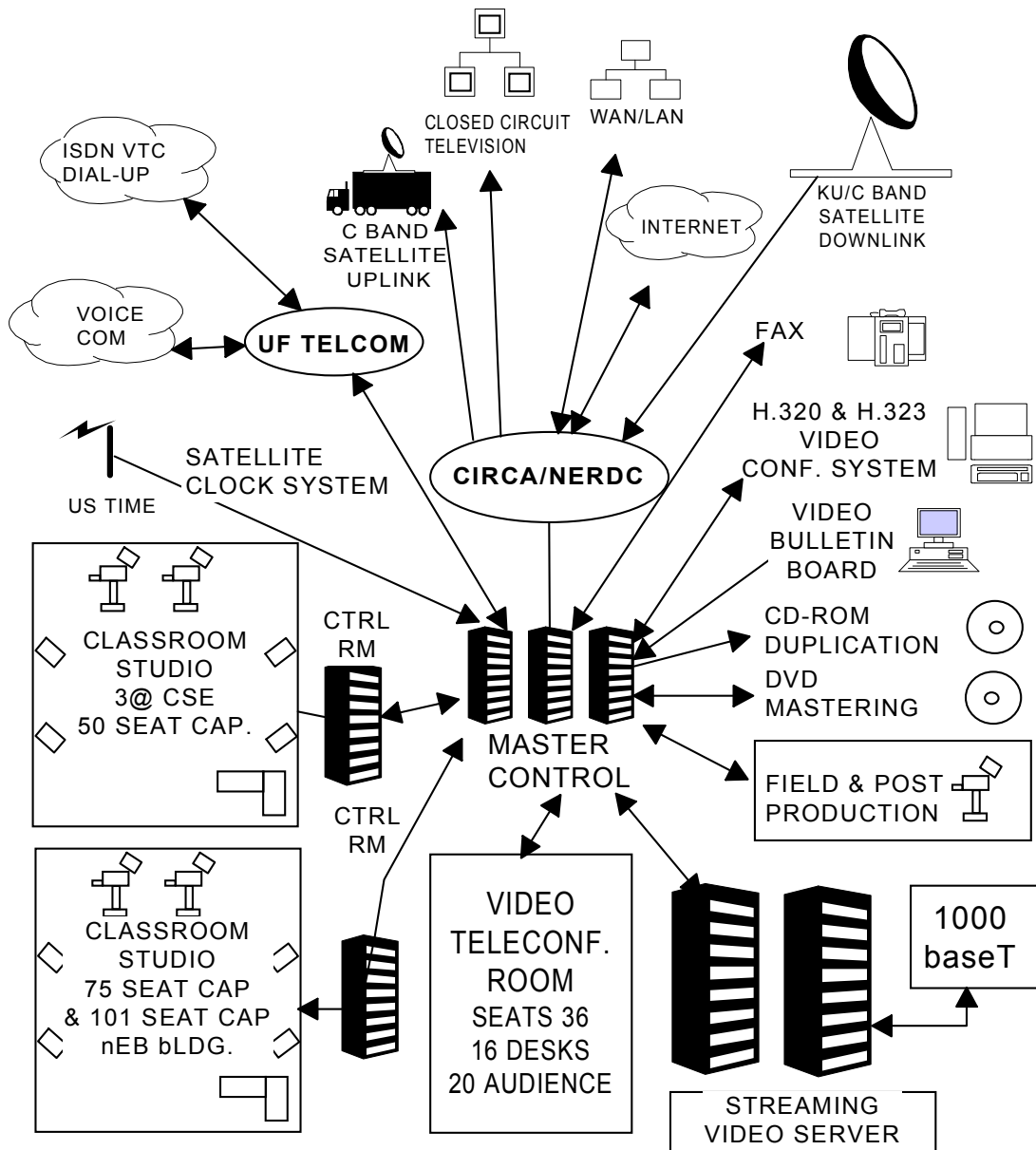
Currently slightly over 40 percent of our distance learning students still get overnight delivery of a VHS tape or CDs with mpg1 files. Handouts which earlier were copied and shipped with tape, now get scanned into the computer as a pdf file and are available from our web site along with the streaming video. Homework completed by the students is either attached to email directly to the professor or it gets faxed to the professors department. Regular communications between the professor and the student, such as questions about the lecture, is usually handled through email or chat rooms. On occasion where face to face conferences are necessary, video teleconferencing over the internet is arranged. On certain occasions video teleconferencing is used for the delivery of lectures to certain cites. Such is the case with the US Army Corps of Engineers. A course offered by the University had five students from the COE in Jacksonville. The managers at the COE decided that it was important that the students at the Corps viewed the lecture at the same time as it was given on campus allowing them to ask questions along with the on campus students. A video teleconference was scheduled for every day of the course and five minutes prior to class beginning, the five distance education were present in the form of a large screen television. A camera above the television was the students view and when the professor looked at his distance education students they saw him through the students view camera and could hold a face to face conversation. This is a perfect example where the time lag has completely disappeared. In this particular case it required the employer release his engineers for that one hour to participate. Most of the distance education students are working engineers and few get the luxury of release time every second day at the same time for one hour. Most working engineer who pursue life long learning will make an hour here or there available during their day to watch the lecture. This makes streaming video the ideal medium since it can be delivered anywhere, anytime on demand. The shift from technology regulated time to student/teacher regulated time is a much better scenario.

Communications technology influences student participation, management, and marketing.

When every third person walking around on campus is talking on a cellular phone, and your staff sends instant messages back and forth, you realize that communications technology is a major influence in the way we do things. Today the student on the other side of the country can participate as an active team member on a class project. That software project that five students from different parts of the world are assigned to can be designed produced and presented because of collaboration software used over the internet. The presentation of that software project could be given by joining these five distance education through video conferencing over the internet with the on-campus class. In one of the courses, in the field of Environmental Engineering, the professor has identified various experts in specific subjects relevant to his course. He pursued and persuaded these experts to give a live lecture during his course via video teleconferencing. The video and audio is clear in both direction, the guest lecturer can see student responses and the student of course gets relevant information direct from the field expert. In most cases the presenter feels it to be an honor to be asked as a guest lecturer in a graduate engineering course and for a student the opportunity to ask questions directed to the expert is invaluable. The above mentioned scenarios take place at OEEP several times a semester. Does this foster student participation and learning? We think so. Of course communication technology has helped tremendously in marketing. We no longer have to send expensive brochures to alumni, now we can just send them an email inviting them to come to our web site. Once there, we can help the student realize the advantage of life long learning, we can offer the courses to begin the journey of life long learning and we can register them right away. A one stop shop.

Communications plays such a vital role that OEEP invested heavily in technology and connectivity. Our technology is not just for the distance education student, it is free to the entire engineering faculty. We are constantly recording lectures for on campus faculty because they have convention to go to, or a research project to propose. We also get requests from other colleges within the University. We help the best we can. One of the reasons for our popularity on campus is because we are well connected. The following diagram illustrates the internal and external connectivity.

Outreach Engineering Education Program



Management technology influences recording and delivery technology.

When there is a color shift between cameras, or when a signal looks dark and the signal is barely viewable. Without a good test instrument the problem would be hard to determine. Test instruments are a management tool. Support software is a management tool. Without a good active database, supporting over 300 students scattered over thousands of miles, attending 40 courses for a total of 45 lectures per course, could be a problem. Without that with automatic document fed scanner and the proper scanning software handouts would still have to be copied and sent to the students. Without the server management software, security would be quickly breached and delivery failures would be immanent. Good management technology is vital for quantity, quality and consistency. At the Outreach Engineering Education Program we could easily increase our enrollment by 300 students from one day to the next. Currently, studio/classroom usage capacity is at sixty percent and could be increased to 100 percent from one day to the next given the resources. Good management technology is paramount for a good distance learning program.

The key to all this technology of course are people. People ranging from the dean of the college who supports distance learning, faculty that are willing to take up the challenges of distance learning, staff that do the day to day task of distance learning, to the actual distance learner, the working engineer, who believes life long learning is not an option, but a necessity.

The future is exciting for OEEP. There are always new challenges such as, how can we offer an undergraduate degree in engineering that requires lab time without making the dl student come on campus? How can we improve quality (this is a “forever” challenge)? What other disciplines in engineering can we support? Are there certificate programs that can be delivered to specific industry? How can we bring field experience into the classroom and into the extended classroom? How can we improve service to the college, the faculty and the students? How can immersive technology be applied to our courses? Can we or should we create our own virtual labs? How can we involve dl students in research? How can we increase our student enrollment? How can serve engineering education in the next ten years, in the next twenty years?

What is the next step?

Will the student in the future sit down at a kiosk, slip on his immersion helmet and five minutes later get up and have all the knowledge of a one hour lecture?

Will there be a lecture?

Summary

The support of Distance Education by the faculty and administration through a solid technology budget are the key to technological advances being utilized to enhance distance education. Recording, delivery, communications and management technology are vital to clarity, lag time, participation and integration. Underlying all the technology of course are the people that administer, support, apply and use it. The Outreach Engineering Education Program at the University of Florida, College of Engineering supports life long learning for engineers through a program that is immediate and involving.

Reference: Rex, Fred “University of Florida College of Engineering Instructional Television Facility” ASEE 1987 Compendium on uses of Television in Engineering Education pp 100-105

About the Authors:

HOLGER-AXEL (Bob) MASON

Mr. Mason graduated from the University of Hawaii as a Educational Producer/Director. He worked twenty years as the master educational technologist with the Health Instructional Resources Unit at the University of Hawaii supporting the College of Medicine, School of Public Health, School of Nursing and all science based institutions in Hawaii. He moved to the University of Florida, College of Engineering in 1993 where he is the Coordinator of Broadcasting in charge of technology for Instructional Television and Distance Education.

DR. FAZIL T. NAJAFI

Dr. Najafi is a professor of Civil and Coastal Engineering at the University of Florida. He earned his BSCE from the American College of Engineering, Kabul, Afghanistan, and his BSAE, MS, and PhD degrees in Civil Engineering from Virginia Polytechnic Institute and State University. He has worked for 35 years in government, industry, and education. Besides teaching during the last 14 years, Dr. Najafi has conducted research, has been a participating member of several professional societies including ASEE, has published numerous refereed and non-refereed articles, and has presented many technical papers to international, national and local organizations.