

The National Center for Telecommunication Technologies: A Look Back and a Look Ahead

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I. Overview

The National Center for Telecommunications Technologies (NCTT) is a National Science Foundation (NSF) Center of Excellence in Advanced Technological Education (ATE). First funded in September of 1997 for three years, the then Northeast Center for Telecommunications Technologies (NCTT) joined ten other ATE Centers all funded by the NSF. Located on the campus of Springfield Technical Community College in Springfield, Massachusetts, NCTT's primary mission in its first three years of existence was to develop a seamless 2+2+2 high school to associates degree to baccalaureate telecommunications curricula and increase the number of telecommunications technologies associate degree programs in the New England and New York region. A three-year continuation grant was received by the center in 2000 to provide funding through September of 2003. The center has recently applied for a four-year grant to serve as an NSF resource center until September of 2007.

This paper will look back at the genesis of the Center and its activities over the past five and a half years. The Center's success in increasing the number of associate degree telecommunications programs in the New England region and elsewhere will be documented, its development of curriculum in three areas: networking, lightwave communications, and wireless will be discussed, and the Center's struggle to become self-sustaining in this period of severe economic downturn in the telecommunication industry will also be examined. The paper will conclude with a look ahead to the Center's role as a national resource center and an assessment of its impact upon the workplace, the community college where it is located, and the faculty who have been involved in its implementation and operation.

II. The Early Beginnings

Beginning in the early 1990s, a shift in policy occurred at the National Science Foundation. Until that time, the vast majority of NSF grants were awarded to faculty at four-year colleges and universities – the grantee institutions. This change in policy was embodied in the Advanced Technological Education Program that is managed in the Division of Undergraduate Education (DUE) in cooperation with the Division of Elementary, Secondary, and Informal Education (ESIE). This program has a goal of promoting exemplary improvement in advanced technology education at both the regional and national level through support of curriculum development and program improvement at both the undergraduate level and the secondary school level. The program specifically targets the education of technicians being educated for the high performance

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workplace of advanced technologies. The ATE program, a response to the concept of a “global market place” and the resulting internationally competitive nature of manufacturing and the rapidly advancing pace of technologic change, solicited proposals for projects, special projects, and Centers of Excellence from consortia of two-year colleges, four-year colleges and universities, secondary schools, industry, business, and government. The important policy change in the ATE program was that the grantee institution would be either a two-year college, or other associate degree granting institutions, or a consortium of two-year colleges along with the previously mentioned partners. Thus, two-year colleges or associate degree offering institutions were specifically targeted by the ATE program and, as a further consequence, community college faculty were being afforded greater opportunities for grant funding and the actual planning and administration of the grant [1].

The focus of ATE projects would be on curriculum development, faculty or teacher development, instructional materials development, or instrumentation and laboratory improvement. Also, considered for funding would be conferences, workshops, symposia, and other special projects that will lead to major improvements in technology education. The Centers of Excellence were to provide systemic approaches to technological education. Centers will serve as national and regional models and clearinghouses for the benefit of both colleges and secondary schools. Model curricula, instructional materials, and teaching methods will be developed at and through these centers and then disseminated through a variety of means, including, but not limited to, seminars, workshops, conferences, publications, and other means [2, 3].

Looking back at the early 1990s, one notes that Springfield Technical Community College (STCC), the only technical community college in the Massachusetts community college system, was well positioned to become involved with the ATE program. At the time, the “Electronics Group” consisted of three degree granting departments: Computer Systems Engineering Technology, Electronics Systems Engineering Technology, and Laser Electro-Optics Technology. With a faculty numbering ten full-time and several adjuncts, the group had what this author likes to term “critical mass”. Shear numbers offered the faculty flexibility to teach topics in different areas (computers, lasers, and the legacy electronics area) and to develop new courses for these rapidly changing technologies. In my experience, smaller faculty numbers usually mean that the faculty focus is restricted to the task at hand, just getting through the semester, teaching what needs to be taught. At that time, several of the faculty were also very active with after-hours consulting for a diverse cross-section of local industries and hence on the cutting edge of technology in their respective fields.

STCC also had an active and successful development office both then and now, a reflection of the college president’s progressive philosophy. In fact, one of the faculty members of the Electronics Group had applied for and received not one but several NSF laboratory improvement grants in the Laser Electro-Optics area [4, 5]. These grants were, to the best of our knowledge, some of the first that had ever been awarded to a two-year institution. During the 1995–1996 academic year several events occurred that were pivotal in the eventual creation of NCTT. The College was chosen to be the lead college for the NYNEX (now Verizon) New England Next Step Program and a fairly large NSF ATE project grant to create a Telecommunications and Networking associate degree curriculum was awarded to this author. Let us examine these events in a little

more detail. The NYNEX Corporation in conjunction with a consortium of schools in New York State had started a program for their unionized employees that would result in the eventual awarding of an associate in applied science degree in telecommunications. NYNEX desired to expand the program into the New England region and put out a request for proposals to both two- and four-year New England colleges. STCC was awarded the contract to serve as lead college for the New England program. At about the same time, the awarding of the NSF ATE project grant [6] was the culmination of over a year's effort in the preparation of a pre-proposal to submit to NSF and then the actual submission of the final proposal with its detailed organizational plan and budget. The efforts involved in developing the consortia of educational and business and industry partners for the ATE project and the details of the curriculum to be developed by the project certainly helped in the development of the NYNEX proposal and the subsequent winning of the contract. Conversely, the NYNEX contract most certainly was a favorable factor for the NSF proposal. Shortly thereafter, a curriculum for a fourth degree-granting program within the Electronics Group was submitted to the appropriate campus committee and the Telecommunications Technology department was created. Interestingly, the other three existing programs contained portions of the underpinning technologies of telecommunications (networking, electronic communications, and lightwave communications).

STCC was enjoying its success in the newest high-tech area and like everyone else saw no limit to the possibilities. During this same time span, in a related development, the college, which is located on the site of the former Springfield Armory, had acquired the site of the former Digital Equipment Corporation's (DEC) disk and tape drive manufacturing facility that had been located across the street from the STCC campus on a parcel of land that had also formerly been part of the armory complex. This site had undergone a massive rehabilitation by DEC with over 25 million dollars poured into the infrastructure of the buildings and the utilities during the 1980s. However, with the mainframe/minicomputer business in a free-fall, the complex became affordable upon its abandonment by DEC. The president of STCC had earlier conceived of the idea of an industrial technology park or incubator for local high tech industry to be located within this former manufacturing complex. With encouragement from both the college president and its chief academic officer the development office had begun to investigate the idea of applying for a Center of Excellence ATE grant that would complement the college's master plan for workforce development. With several Centers already in existence, the focus of the proposal had become an issue. It was determined that the initial Center of Excellence proposal would be somewhat broad, encompassing emerging technologies and manufacturing, mirroring the idea of the technology park. A planning proposal was submitted but it received a negative reaction from the NSF.

Not to be discouraged by the setback and with what was felt to be an impressive resume of the college in hand; a group of faculty and the chief academic officer of the college visited the NSF offices in Washington, DC. The group was looking for feedback concerning the correct focus for a new proposal for an NSF ATE Center that would receive a more favorable review. At this meeting, the NSF program officers gave the college a gentle but not too subtle hint for the need of an ATE Center of Excellence devoted to telecommunications. The group was not very surprised by this turn of events and with this message fresh in our minds; we returned to Springfield and started the development of a proposal for the Northeast Center for Telecommunications Technologies (NCTT). The framework of a new proposal for a

telecommunications technologies ATE center was put together by faculty members N. Massa and G. Mullett and the development office helped out with the budget process and the organization of partner schools. Some of the existing NextStep schools were recruited to be partner schools in what was felt to be a win-win type of situation since they were interested in starting generic telecommunications programs in addition to the industry specific NextStep program.

III. The Center's First Three Years

STCC's proposal for a new ATE Center of Excellence devoted to telecommunications was acted upon favorably by the NSF and received initial funding of three million dollars for three years with a starting date of September, 1997 (DUE-9751990). Thus, NCTT joined ten other ATE Centers already in existence. The initial organizational structure of the Center was as follows: Dr. James Masi, an engineering professor of a local four-year school retired from that position and accepted an offer to become the center's Executive Director/PI upon the awarding of the grant. N. Massa and G. Mullett, STCC faculty members with technical expertise in telecommunications (lightwave and wireless/RF, respectively), were listed as Co-PIs/Co-directors in the initial grant proposal and together with Masi would form the on-site NCTT team that would run the day-to-day operations of the Center. Both Massa and Mullett would receive 50% academic release time during the lifetime of the grant and would also receive compensation for time spent during the summer. Additionally, Dr. John Abeles, the executive director of NYNEX University (the corporate arm of the NYNEX NextStep Program) would serve as the industry/industry coordination Co-PI, and both Fenna Hanes of the New England Board of Higher Education (NEBE) (articulation and dissemination) and Dr. James Amara of the Minuteman High School (secondary school curriculum) were also listed as Co-PIs.

The initial grant proposal listed nine other New England and one New York community college as partner schools that would participate in the Center's activities. Additionally, each partner community college had a high school partner and there were also five, four-year college partners and numerous corporate partners. During the first year of the grant, a large portion of the directors' time was spent organizing the Center operations, meeting with the other Co-PIs, hiring support staff, making additional industry contacts, consulting with industry partners, convening and meeting with a National Advisory Board, and holding organizational meetings with the partner schools. Additional activities included attending and presenting at national conferences, developing curricula and low cost laboratory experiences, and planning and preparing for a three-day spring planning/curriculum conference with the partner schools and a weeklong summer workshop that would be attended by over seventy participants from the NCTT partner schools.

In the first year of NCTT operation, a concerted effort was made to create teams from the various partner schools. Every effort was made to encourage the formation of partner high school teams that were comprised of an electronics instructor and/or a science and math teacher and a guidance counselor. Post secondary teams that consisted mostly of subject matter experts from the legacy electronics and computer technology fields were also encouraged to partner with a four-year college if possible in an attempt to provide a 2+2+2 continuum. During the first through third years of the grant, educational partners were given stipends to facilitate their involvement with NCTT activities (course release time, instructor support, travel, curriculum and resource materials, etc.). Faced with an increasing workload, additional staff was hired to facilitate the

Center's operations. A STCC faculty member (G. Snyder) with networking expertise became a third Co-PI/Co-director, an assistant director of administration was hired, and a secondary education consultant was borrowed from the Springfield, Massachusetts public school system. Through his many national contacts, Dr. Masi setup a highly successful summer intern program supported by funding from the telecommunications industry. This program would place several students at locations across the country and allowed a half-dozen others to work at the Center itself over the next three summers.

Activities during year two of the grant (1998-1999) were very similar to those of the first year. However, the telecommunications boom had gained momentum and several partner schools were now ready and anxious to implement changes to their current technology programs or add new programs. These schools expressed the most interest in the areas of networking and fiber optics technology. New Center activities consisted of four regional workshops that were held at partner schools around the New England area and a two-day Technology Transfer Workshop attended by over 200 participants held during the spring. Additionally, the Center started to publish, through NEBE, a bi-annual NCTT newsletter and an annual *Telecom Tech Updates* newsletter. Another successful summer workshop with over 80 participants was held with emphasis on the core telecommunications technologies of lightwave, networking, and wireless. Building on the prior summer's workshop, the goal was to quickly ramp up the partner school's instructional staff's knowledge of telecommunications technology. The team concept also seemed to be successful with many career and guidance counselors attending the workshop to gain first hand knowledge about the fast growing telecommunications industry. The intern program was again held during the summer and again proved to be highly successful. The Co-PIs continued work on the development of a 2+2+2 telecommunications curriculum, easily replicable low cost laboratory experiences, distance-learning technologies, and an accompanying on-line competency profile for the developing telecommunications curriculum.

Year three of the grant (1999-2000) was again similar to the first two years of the grant with respect to partner school activities. However, the knowledge that all of the other ATE Centers had received funding for an additional three years (continuation grants) and that the telecommunications industry was in hyper-drive seemed to indicate that the Center was doing the right thing, that the center would receive three more years of funding, and that when the time came to become self-sufficient that issue would take care of itself. Technology stock portfolios continued to soar and the dot-com and telecomm boom continued without any end in sight.

Again, regional partner meeting were held with a focus on the partner schools and their progress in implementing their own telecommunications programs. The partner schools shared many accounts of success but there were some cases where, due to various circumstances, there had been no adoption of the Center's curriculum materials or there were no plans to implement new programs at all. The directors started to spend more time investigating fund raising possibilities for the future and dealing with the issues of the problem partner schools. A two-day curriculum specific workshop for community college faculty was held during the spring highlighting two-year associate degree programs in networking, wireless, and lightwave technology while a second concurrent workshop was held for high school instructors at Minuteman Science-Technology High School.

The third annual summer workshop was held for the partner schools and a “Camp Telecomm” was held at STCC and at UMass Boston in conjunction with the Massachusetts Telecomm Council, a highly active industry organization. The summer workshop again built upon prior summer workshops with an additional focus on the need for more telecommunications workers and culminated with the distribution of the finished NCTT curriculum materials. The summer workshop also attracted several new non-partner school participants from other areas of the United States and from as far away as South Africa [7, 8].

Over the course of grant year three, serious discussions about self-sufficiency resulted in exploratory meetings with a publishing company. After numerous discussions between the Co-directors and the publishing company, a plan was put in place to develop on-line curriculum materials and to develop a series of four on-line telecommunications texts that would cover the developed curriculum materials. To this end, the three faculty Co-directors were given full release from their regular teaching duties by the college’s chief academic officer so that they might concentrate all their efforts on the development of the on-line materials.

Towards the end of grant year three, the Center was required to apply to the NSF for an additional three year Center continuation grant that would be for a total amount of two million dollars over three years.

IV. The Next Three Years

A continuation grant (DUE-0003014) was awarded to NCTT for years 2000 - 2003 with the proposal to the NSF calling for funding of 850K for year four, 650K for year five, and 500K for year six. With visions of a vast market for on-line educational telecommunications materials, a contract was signed with the publisher for the delivery of the first drafts of the on-line textbooks for early 2001. The publisher was in the midst of creating a sophisticated on-line delivery service and at the time, the outlook and demand for these types of materials appeared excellent. It should be pointed out that numerous other companies were pursuing the same types of on-line publishing initiatives with some publishers investing millions of dollars to get their systems up and running. However, clouds were forming over the telecomm industry as 2000 headed into 2001 and during the spring of 2001, through mutual agreement the contract between NCTT and the publisher was dissolved. How bad the telecomm situation would get was still not obvious at the time.

The three Co-Directors again had full release time from their teaching duties and spent most of their time writing when not involved with activities with the partner schools. A reorganization of partner schools along with a decrease in funding from NCTT yielded some changes to the makeup of the partner schools but for the most part the changes were positive since the new schools were very committed to adding telecommunications programs or some type of core telecomm technology to their present technology programs. During year four, the number of regional partner school meetings was reduced to two, several partner schools received their own NSF ATE project grants or grants from other sources, and STCC/NCTT started a distance learning associated degree program with JDS Uniphase a fairly local major manufacturer of fiber-optic telecommunications products.

During this time, the original executive director wanted to reduce the hectic pace that he had maintained for over three years and decided to retire from the Center. A search for a new executive director yielded one of the Co-directors (G. Snyder) to fill the position and more change occurred as one of the original Co-PIs left the center to pursue his Doctoral degree. At this time, the NSF program office and the National Advisory Board expressed concern about the Center's operation, change in management, and lack of a viable business plan. With the now, so called, "telecomm bomb" continuing to worsen with each succeeding earnings report, concern about the self-sufficiency issue soon took center stage. During the second half of the grant year, the college's chief academic officer convened several focus groups (management coordinating team, business plan team, curriculum integration team, etc) that were formed from the Center's personnel and non-center college personnel in an effort to integrate the Center into the structure of the college to help in the long term survivability of the Center and to also improve the relations of the Center with the academic programs of the college. A new position of Chief Operations Officer (COO) was also created and filled by the New England Next Step coordinator on a half-time basis to aid in the overall operations of the Center. These changes proved to be somewhat of a distraction early on but eventually the goal to develop a viable Center business plan was put into motion.

A fourth annual summer workshop was held for the partner schools. Again, several new non-partner school participants from various locations across the country attended. This was a continuation of a trend that started at the prior year's workshop. Also, during the summer two separate versions of "Camp Telecomm" were again run by NCTT and UMass Boston.

During grant year five (2001-2002) a new Co-PI/Co-director was recruited from STCC's faculty to replace the former Co-PI that had left the Center, full release for the Co-PIs was reduced to 60% release time, and a new publisher for the textbooks was found. However, it soon became apparent that a great deal of work would be needed to put the original on-line works in a form suitable for textbook publication.

After a sizeable amount of work and several false starts, the Business Plan & Marketing Team delivered a plan for years 2002 – 2005 [9] that would provide guidance for the Center's operation over those years. The basic components of the business plan were industry training, academic workshops, and textbook/curriculum material sales. These activities were all expected to raise money to help sustain the Center's operations.

During year five, partner schools experience a further reduction in their funding from the Center, and a new format was developed for the summer workshops that consisted of holding two four-day workshops. The concept of an introductory and an advanced workshop would allow the Center to grow its training activities since the participants to the introductory workshop would be new "paying customers" while the partner schools would attend the advanced workshop. However, the "telecomm bomb" was still exploding and our attempt to generate funding through industry training initiatives was just not happening. Earlier promising talks with major players in the telecommunications industry became hollow promises of "we'll call you in the next quarter". The on-line degree program at JDS Uniphase disappeared as its workforce shrank from 850 to 70 over the course of a little over a year's time. The business plan needed to be revisited again.

Year six started in September of 2002 and the Center is happy to report that the first two textbooks of a five textbook NCTT/Delmar telecommunications series have been published. *Basic Telecommunications: The Physical Layer* by Gary Mullett, Co-director wireless technology, and *Telecommunications Network Infrastructure* by Gordon Snyder the present executive director were highlighted at the Center's showcase display at the annual ATE conference held in Washington DC (See Figure 1) and are now available.



Figure 1 – NCTT staff at the 2002 annual ATE conference in Washington DC

The Center's budget has been reduced further but at the same time, the stipends to the partner schools have been essentially eliminated. However, to this point, the telecommunications industry has not shown any signs of recovery and industry training is still all but non-existent.

The number of activities that involve the charter partner schools has been reduced and the Co-PIs are writing lab manuals to accompany the published texts and the writing of the next group of texts has been started. Planning has already taken place for a series of three four-day summer workshops in 2003 [10]. At this time the dates have been set for an introductory, intermediate, and advance telecommunications workshop that we hope will be well attended and provide the Center with a source of income.

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In a recent development, the Center Co-PIs have become involved in an initiative to provide a certification in the telecommunications area. The Center was approached by representatives of the National Skills Standards Board (NSSB) to participate in the development and writing of skill standards for a “network devices technician” and a “network infrastructure technician”. It remains to be seen how this initiative will evolve. However, at this time, the directors feel that is worth exploring. Finally, the Center has applied to the NSF for a four-year grant to become a National Resource Center for years seven through ten of its existence and the Center name has been officially changed to the National Center for Telecommunications Technologies to reflect our desire to have the Center take on a national presence.

V. The Future

As we look ahead to the future, NCTT has four basic goals: to continue to promote telecommunications education through the development of state-of-the-art curriculum and materials, to establish the Center as a national leader in telecommunications education and training, move the Center towards self-sustainability, and institutionalize the Center within STCC.

The maximum NSF funding for a resource center is 1.5 million dollars split equally over four years. The Center seeks this continuation funding from the NSF to expand the NCTT model developed in its first six years in the Northeast into regional centers throughout the United States. These regional centers will be located at schools that have developed a relationship with the Center over the past several years and have the proven capability to bring together academia and local industry in a productive collaboration. The regional centers will serve as outreach arms of NCTT, working with local telecommunications business and industry to provide skilled workers to the telecommunications industry on a national level. For this plan to succeed, NCTT will have to rely not only on NSF funding but also on continuing support from STCC and its own revenue producing activities.

VI. NCTT’s Impact

Since its inception, the Center has been under the observation of an external evaluator. The NSF requires that adequate funding for this purpose is included in the grant proposal and that a detailed plan of evaluation and assessment is outlined for the duration of the grant. This is a good thing since the evaluator’s comments and reports can provide the directors with timely feedback about the Center’s activities and operations. The evaluator for NCTT has done a comprehensive and detailed evaluation of the Center’s activities and the outcomes of those activities since NCTT first came into existence [7, 11, 12, 13] suffice to say that NCTT’s files contain numerous voluminous reports over a variety of reporting timeframes. In general, NCTT has received extremely favorable reviews of its activities and the focus of those activities.

The most important goal of the Center as stated earlier was to increase the number of skilled telecommunications workers available to that industry by increasing the number of degree granting programs in the telecommunications area. In assessing the Center’s impact in this area, one must look back at the state of telecommunications education in New England in the mid 1990s. A comprehensive survey at the time revealed that there were no telecommunication technology programs at the community college level. This has changed greatly over the life of the

Center. According to a report by the Center's external evaluator, by the 2000-2001 school year close to 100 telecom-related courses were being offered at the partner schools, about 1500 students took advantage of the telecom-related offerings, and about 325 students graduated in May/June 2001 with a telecom-related diploma, degree and/or certificate [11]. The only area of concern expressed in the report was the apparent lack of student exposure to wireless curricula. Fortunately, later evaluation reports have indicated a modest change in this fact [12, 13].

As is well known, presently, the telecommunications industry is in a severe downturn. When the economy improves, the educational structure will be in place to provide the needed skilled workers and NCTT will be prepared to continue to provide up-to-date curricula and assistance to the educational system.

What is interesting to this author is the effect the Center's existence has had on STCC and the faculty that have been involved in its operation. Earlier in this paper, the term "critical mass" was used to describe the personality or character of the faculty of the Electronics Group. From the perspective of the Center's Co-PIs, many of the faculty not involved with the Center became resentful of the Center's existence. This was somewhat surprising, given the fact that the Center brought national recognition to the college and was used extensively as a marketing tool to attract students to departments that have seen shrinking enrollments in recent years. One can easily pass off some of the resentment as envy or simple human nature since the Co-PIs had large reductions in their teaching loads, received faculty of the year awards, and were able to travel to attend conferences and so forth. Numerous times the three Co-PIs invited the rest of the faculty to take part in Center activities or to become involved with the Center. Expect for an occasional conversational question about what we were up to, very little interest has ever been shown in our activities by our fellow faculty.

As it turns out, it has since been revealed that the remaining faculty were more putout by the fact that they were forced to teach new courses and a new curriculum that had been developed by the Center Co-PIs. By removing the three Co-PIs (called agents of change by the development office) from full teaching loads, the critical mass of the electronics group had been dampened and the Center's creation actually exposed the fact that most of the other faculty members were content to leave their jobs in their offices after about 20 hours per week of class and office-hour time. In addition, activities that occurred outside of the 32 weeks that made up the fall and spring semester were distained. When the Co-PIs received full release during the third and fourth years of the grant, relations between the Center and the faculty became even more strained. Over the course of time, this problem has been addressed several times by the college's chief academic officer in attempts to bring the two organizations closer together. Since the Center is not co-located with the faculty offices, it is difficult to convey the fact that the Co-PIs actually put in many more hours than a regular faculty member (full release required a 37.5-hour workweek that was often exceeded). To some extent an "out of sight, out of mind" mentality exists which to this day has been very difficult to change. As pointed out earlier, one of the continuing goals of the Center will be to institutionalize it within STCC in the coming years. Hopefully, the involvement of faculty with grant activities and the prevalent culture of a teaching faculty at a community college can co-exist and flourish as more experience is gained in these types of endeavors.

For myself, I can state that my involvement with the Center has been extremely gratifying both professionally and personally and I look forward to continuing the work of NCTT over the next several years. Personally, the Center has given me the chance and the time to reinvent myself one more time after a long career in a field of technology that never stands still and demands that one truly lives the often quoted phrase of “life long learning”. Please visit the Center’s web site at www.nctt.org .

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