Computer Science at NCSU:
The First Twenty-Five Years

Clay Griffith
Paul D. Peterson, Jr.

March 17, 1992

PART ONE:

The Creation of the Department
and
The Paul Lewis Years

The origins of computer science at NCSU can be said to extend back to the basement of Patterson Hall when, in 1957, the Department of Experimental Statistics installed computers there. Five years later, this facility formally became known as the NCSU Computing Center. The role of computers at the university received a tremendous boost in August 1965 when NCSU joined Duke and UNC and, with the help of a National Science Foundation grant, formed The Triangle Universities Computation Center or TUCC. In less than two years, the system became fully operational. With Professor Dave Mason, from the Department of Statistics, spearheading TUCC for NCSU, the university soon had one high-speed access terminal and several medium- and low-speed terminals to interface with the mainframe.

With computers playing an increasingly active part in the administrative functions of the campus, a small group of professors from various departments favored the creation of a separate department for the study of computer science. As early as 1960, J.A. Rigney of the Department of Statistics had written to Chancellor John T. Caldwell advocating a "Department of Computing Science." Nothing concrete came of this effort. After the creation of TUCC, however, the movement for a computer science curriculum at the departmental level gained substantial momentum.

In 1965, an ad hoc committee on Computer Science was formed to include faculty member from the departments of Electrical Engineering, Mathematics, Economics, Industrial Engineering, Chemical Engineering, Statistics, and the director of the Computer Center, Paul E. Lewis from the Mathematics Department. One function of the committee was to study computer science departments from other universities such as Cornell, Purdue, and the University of California at Los Angeles. Their finding reported "a definite awareness of a rapidly growing demand for university trained individuals with considerable knowledge of computer science and who might be employed by such industries as Burlington Industries, Western Electric and numerous other concerns in the Piedmont area." Moreover, they also observed that computer studies were rapidly becoming important to many different academic disciplines at NCSU. The committee stressed that a department of computer science could meet the needs not just of computer majors, but of all students at NCSU.

In February 1966, Paul E. Lewis and John W. Cell of the Department of Mathematics wrote the report for the Ad Hoc Committee, recommending the reconstitution of the Computing Center into the Department of Computer Science within the School of Physical Sciences and Applied Mathematics (later renamed Physical and Mathematical Sciences or PAMS). According to the plan, the Computer Science Department (CSC) would offer a Bachelor of Science with a core curricula made up largely of courses renamed and adapted from existing courses in Math, Engineering, and Statistics. The faculty also would reflect this disciplinary diversity, being drawn from the various departments just as the members of the Ad Hoc Committee had been.

By the summer of 1966, the movement toward a computer science department was approaching completion. A number of details remained to be worked out. For one, the relationship between the Computer Center and the new department was unclear. After a period of debate, university

officials agreed that instead of the Computer Center BECOMING the Computer Science Department, the department was to be separate from the Center. In February 1967, with this fine-tuning complete, Chancellor Caldwell formally submitted a proposal for the Computer Science Department. In July of that year, the Consolidated Office of the University of North Carolina system, the Executive Committee of the University Board of Trustees, and the Board of Higher Education approved the new department.

<div align="center">***</div>

Instruction in the Computer Science Department began in Fall 1967 with 21 declared majors and 460 students. By Spring 1968, the number of majors had more than doubled to 49. The expanding department was housed in Harrelson Hall. As it would continue to be, space was at a premium. Although CSC actively recruited new faculty to manage increasing enrollments, it really had little additional office space to offer new faculty members.

The person in charge of the new department was Paul E. Lewis. He had a B.S. from Northeastern Oklahoma College, a M.S. from Oklahoma A&M University, and a Ph.D. from the University of Illinois. Dr. Lewis taught math at N.C. State from 1947 to 1955 before leaving to work for Digital Computer Lab and General Dynamics/Astronautics in San Diego. Returning to NCSU in 1965, he became director of the Computer Center and a professor of mathematics. Dr. Lewis served as "acting" department head from September 1967 to January 1969 and then became the official head in January 1970.

Under Dr. Lewis, the department experienced a mixture of exhilarating expansion and painful growth. The number of computer majors mushroomed from 49 in Spring 1968 to 302 in 1973, the last year Dr. Lewis served as head. The curriculum grew to match this rise in enrollment. In the first year, professors had taught courses from IBM manuals. By 1970, the department had added 17 new courses, including the first at 500 and 600 levels.

In the early 1970s, Computer Science began to enlarge its mission to the university. Two non-technical courses, CSC 200 (Introduction to Computers and Their Uses) and CSC 462 (Computing for the Social Sciences), were designed to fulfill the department's variable role of educating and familiarizing the entire university with how computers could serve all academic disciplines. Dr. David Link taught UNI 495-E (Technology in the Arts), in which he related computers to drawing, music, and choreography. Evening courses were taught through the Division of Continuing Education, and some short courses were taught at Ft. Bragg.

Yet, along with the enormous growth came sizable problems. Lack of space continued to be the primary trouble during the Lewis years, and even beyond. After beginning its existence in the cramped confines of Harrelson Hall, in 1970 the department occupied 10 rooms in the newly opened Dabney Hall. It was not long before that space became inadequate for faculty offices and laboratories. The department was actively recruiting new personnel during the period, but still had no place to put the new arrivals.

However, it was not only space problems that caused recruitment of new professors to go slowly in the early years. Because computer science was a relatively new discipline, there were few Ph.Ds in the field. And, for those that were available, it was difficult for NCSU to compete with more attractive employment, both inside and outside academia. Low salary offers, lack of a graduate program, and the undesirable location of the university in Raleigh were given as

reasons for the poor recruiting performance by the department. These problems aside, the department managed to recruit its first Ph.D.s in 1969 with the arrival of Dr. Alan L. Tharp and Dr. Robert J. Fornaro. Recruitment problems for the young department persisted for many years, increasing when it began to recruit women and minorities actively.

Dr. Lewis did not emphasize research during his tenure as department head. He informed new professors that they would only have teaching responsibilities. David McAllister later recalled that the only thing that was expected out of him when he arrived in the department in 1972 was "to perform an adequate teaching job...and above all don't disturb the Chairman while he's taking his afternoon nap." Many professors wanted to do research, but the more fundamental and tedious tasks of forging curricula and instructional standards for the young department took precedence.

Besides serious problems of space and recruiting, conflicts of personality riddled the young department. Dissatisfaction and a lack of cooperation among departmental personnel hampered Dr. Lewis' efforts. David Link was the only faculty member to be promoted. Dr. Lewis' trouble was attributed, by some, to standards that were too rigid. David McAllister recalled that when he arrived in the department in 1972 most of the faculty was "young untenured associate and assistant professors." The dissatisfaction contributed to a request from Dean Menius for Dr. Lewis to step down in 1973. He did so and assumed teaching duties in the department.

Nevertheless, Paul Lewis contributed greatly to the Computer Science Department and to NCSU in general. He was a guiding force in a small group of visionary professors who foresaw the rise of computers in our society and struggled to put NCSU in the forefront of that field. Growing pains in any new endeavor were to be expected, and it is often those who lead new ventures who must bear the brunt of the criticism.

With the return of Dr. Lewis to teaching duties, Norm Williamson, his assistant, stepped in as acting department head. Professor Williamson, an untenured professor, headed the search committee for Dr. Lewis' successor. As an example of how irregular some aspects of the department were in its early years, Professor Williamson, as acting department head, chaired the committee that voted on his own tenure. The search for a new department head lasted over a year. Finally, Dean Menius of PAMS asked Donald Martin of Chemical Engineering to become the new head of the Computer Science Department. Martin held a B.S. and M.S. in Chemical Engineering from the University of South Carolina and earned a Ph.D. from NCSU, also in Chemical engineering. Dr. Martin had experience with computers through his involvement in the Chemical Engineering Department's purchase of a computer in the early 1960s. Dr. Martin had also served as chairman of the Southeastern Section of the Analog/Hybrid Computer Education Users Group (ACEUG). In making his decision to accept the position, Dr. Martin made several demands in terms of what financing he expected the department to receive if he were to take over. Dean Menius did his best to satisfy these desires, and Dr. Martin accepted the position and became the Computer Science's new department head in July 1974.

PART TWO:

Growth and Establishment
The Donald Martin Years
1973 – 1985

Under Donald C. Martin, the Computer Science Department experienced a period of phenomenal growth. This expansion reflected the rapidly changing place of computers in American society. When Dr. Martin came on board in 1973 the general public was largely unfamiliar with computer technology. When he stepped down twelve years later, computers were becoming common in everyday life. The Computer Science Department at NCSU, through teaching and research, was at the forefront of this scientific and technological revolution.

The rise of the importance of computers in society can be easily traced through the enrollment trends of the Computer Science Department through the 1970s and early 1980s. For the first four years that Don Martin was head of the department, Computer Science averaged 350 majors and between 2000 and 2500 students enrolled in all CSC courses. In 1975, the department actively recruited students with a Computer Literacy Program, supported by a National Science Foundation grant. The grant provided for a van to travel to high schools throughout North Carolina as part of the recruiting program. NCSU recruiters extolled the virtues of the Computer Science Department and stressed the growing career opportunities in the computer science field. Beginning in 1978, with the aid of the recruiting program, the number of majors grew by increments of more than one hundred every year into the mid-80s. By 1981, the department had 740 majors, and in Dr. Martin's last year they topped the 1000 mark. By 1981 the number of applications far exceeded the departmental facilities and personnel and it was necessary to restrict enrollment. Grade Point Average requirements were boosted for becoming a CSC major and, even though attrition rates in the introductory courses were nearly 50t, little active recruiting of students was necessary. Students poured into the department both as majors and just to take classes to familiarize themselves with computers for their own benefit.

In addition to the phenomenal growth in the numbers of computer science majors, the department hosted large numbers of nonmajors taking computer courses, and for part-time students, the department continued its extension and night courses begun under Paul Lewis. Many students and graduates rightly perceived that familiarity with computers was an important asset to career advancement in the 1980s. Because of the saturated job market, many PBS (Post Baccalaureate Student) returned to school to pick up computer courses. In 1980, the department started a Certificate Program in computer programming. The program was a stunning success, with enrollment increasing from 100 to over 400 students in one year.

In addition to course work, the department also hosted two active student/professional clubs. The first was the ACM—The Association for Computing Machinery. The second was DEMA—The Data Processing Management Association. Many students were also invited to join Upsilon Pi Epsilon, the computer science honorary society.

Growth placed substantial strains on the department's facilities. Long lines and late nights caused by the shortage of terminals were common complaints of computer science students in the early 1980s. A few students actually wrote to the Chancellor and the Governor, demanding a refund of their tuition "because of inadequate computing facilities." Don Martin allowed a television crew to film the long lines waiting for computers. The news team captured one student's mother

bringing him a sandwich because he had been in line for so long. The lack of computer terminals and the inability for the Computing Center and TUCC to meet the demand led to desperate calls for more money to provide new machines and more space.

Adding to these problems was an inadequate teaching budget. The department's instructional funding remained at the 1972 level although enrollment had increased five times since then. Some support came from the PAMS dean's office budget. Still, the money was woefully inadequate to support the department's monumental task of providing excellent training and facilities for students and faculty.

During the height of this period of uncertainty, Governor James Hunt, a graduate of NCSE, became aware of these problems within the Computer Science Department. Governor Hunt wanted to attract industry to the Research Triangle and to North Carolina in general, particularly in the growing fields of microelectronics and computers. As Chancellor Bruce Poulton recalled, "The state had put $30 million into MCNC (Microelectronics Center of North Carolina); it was embarrassing to have students protesting over the pitiful lack of equipment." In response to the outcry of want at NCSE, Hunt instructed his budget director to "write them a check." It was rare, if not unprecedented, for the governor to take an interest in a single university, much less a specific department of that university. NCSU received somewhere around $500,000 virtually overnight from the state's General Fund to invest in computer equipment. Chancellor Poulton matched the amount from the Chancellor's contingency account. The department now had the money needed to move forward.

First, however, the members of the Computer Science Department had to decide exactly how to solve their problems. The majority of the burden on the system came from students in introductory courses who were required to write five to eight programs in the programming languages of PASCAL, BASIC, and FORTRAN. Although they were not complex programs, they required time on the computer.

These basic instructional needs could be better served by "microcomputers." The suggested solution was high speed local networks connecting anywhere from 6 to 16 terminals apiece.

In Fall 1982, the department dedicated its Data General MV 8000 to the support of its instructional program. The machine had been a gift from the Data General Corporation, and Don Martin had been instrumental in securing its donation. With 60 terminals, it served the approximately 1500 students in CSC 101 and 111, relieving TUCC of a considerable strain. Hardware and software problems with the MV 8000 were smoothed, and by Spring 1983, the number of simultaneous computer users on campus increased by 40%. By 1984, the department only used TUCC for graduate research and teaching.

In Fall 1983, the department acquired a section of the basement of Leazar Hall from the Design School and "built a big box" inside it. There the department installed a Sage microcomputer system with 150 new terminals which could handle 2000 students per semester in freshman, sophomore, and some junior year courses. Leazar Hall also set aside some terminals for the department's computer literacy service courses. Leazar also hosted new graphics terminals for both introductory and graduate graphics courses. Garrett Briggs, the dean of PAMS at the time, felt that acquisition of the space in Leazar was the "salvation of Computer Science."

Although Computer Science had managed to deal with severe equipment shortages, the lack of adequate space continued to trouble the growing department. Department members complained vigorously throughout much of Dr. Martin's tenure about space problems, as they had under Lewis. The outlook for better physical facilities brightened in 1979, when the department made a major move. After renovations in Daniels Hall were completed, Computer Science moved out of the basement of Dabney into accommodations that seemed spacious at first glance. But with the department's unparalleled growth, the new quarters quickly became as tight fitting as those in Harrelson or Dabney had ever been.

Classroom and lab space were lacking and much needed. The department lamented this fact year after year in Annual Reports and other communications. In 1982, the department issued a wish list of space for labs to handle general purpose programming, operating systems and graphics, projects, research, and microprocessor/ computer architecture. For the time being, Computer Science would have to manage the best it could under the existing conditions while hoping that better facilities would be realized in the future.

While the department struggled with severe shortages of equipment and space, the growth spurt both contributed to and was a victim of personnel recruitment problems. The department maintained that the lack of sufficient numbers of qualified professors forced it to curtail enrollment more than it normally might have during the boom of the late 1970s and early 1980s. One reason that it was unable to hire enough new people was because NCSU still could not offer competitive salaries. Through the 1970s, the demand of academics and private industry far outpaced the numbers of Ph.D.s in computer science. From 1979 through 1984, there were about 200 Ph.D.s granted in the field in the United States. During the same period there were between 500 and 600 openings. With this competitiveness, NCSU was unable to entice many people away from more lucrative opportunities. Most new computer science Ph.D.s received better salary offers from other universities and especially from private industry than was possible from NCSU. Additional incentives at other institutions such as summer support and lighter teaching loads made it even more difficult for NCSU to compete.

If the problems of recruiting new faculty were not enough, Computer Science also had to worry about retaining its current personnel. Department members were well aware that their salaries were behind those of other institutions, which led to some dissatisfaction. In 1983, the departmental Annual Report claimed that the only reason some faculty members did not leave NCSU was that poor interest rates made it disadvantageous for them to sell their homes.

While the department struggled with recruiting, it did manage to have some success in hiring minority personnel. Computer Science hired its first woman faculty member in 1976. Mary Jane Lee came to Computer Science as an instructor with an M.S. from Ohio State University. Soon after, the department hired Carla Savage, a Ph.D. from the University of Illinois. In 1977, Wushow Chou, Ph.D. University of California at Berkeley, was hired as a professor in both the Computer Science and Electrical Engineering Departments. Chou had taught at Berkeley, George Washington, and the State University of New York at Stony Brook, but came to NCSU from Network Analysis Corporation where he had been Vice-President for Telecommunications. That year the department also hired KuoChung Tai, Ph.D. Cornell, as an assistant professor.

In addition to these recruiting successes, under Don Martin, both new and established faculty were encouraged and supported in seeking research grants and contracts. Research grants are one of the most important aspects of any academic department, particularly one in a technical or

scientific field. In 1975, the departmental Annual Report first made mention of research contracts in the amount of $170,000. By 1980 the figure was over $500,000 and grew into the millions of dollars by the end of Dr. Martin's chairmanship. Just a few examples of the many important research contracts secured by departmental faculty included extended work with the Environmental Protection Agency in the late 1970s to develop courses on database management, ADP concepts, and minicomputers. An RADC grant to study 3D display technology gave the department positive exposure and led to several follow-on contracts and grants.

Recruitment of top faculty and the success in obtaining research grants were both made possible and necessary by the department's acquisition of a graduate program. The so-called Computer Studies program was approved in August 1977 and began operation in the Fall semester of 1977. Although not the autonomous CSC Masters program that most members of the faculty wanted, it was a significant step for the department. Computer Studies was a joint project of the Department of Computer Science in the School of Physical and Mathematical Sciences and Electrical Engineering in the School of Engineering. According to the NCSU Bulletin, "the program integrates the computer software oriented curriculum of the Department of Computer Science and the computer hardware oriented curriculum of the Department of Electrical Engineering into a single Curriculum." Computer Studies offered both the Master of Science and Master of Computer Studies degree.

The Computer Studies program was the culmination of a long, hard-fought struggle to acquire some sort of graduate program for the department When the Computer Science Department was founded in 1968, plans called for a Masters program by 1970. This optimism proved misplaced. The department's continuing troubles in recruiting faculty and developing curriculum in the early years acted as an impediment to the development of a graduate program. Conversely, the absence of a graduate degree program hampered the efforts of the department to bring in new personnel.

The chance of a graduate program becoming a reality brightened in 1972 when the NCSU Graduate Administration Board approved an M.A. proposal. But then hopes were dashed when the proposal died in the hands of the UNC Board of Governors. The UNC Board wanted to prevent duplication of effort across the state university system. The University of North Carolina at Chapel Hill already had a graduate program in computer science. Duke had a graduate computer program too and, while not in the VNC system, it was in the Research Triangle area. Since UNC-Chapel Hill did not, however, have an undergraduate program, the task of filling that important slot was left to NCSU.

Stymied in its desires to grow, the Computer Science Department turned inward and cultivated a position of strength within the university. Computer Science made natural alliances across campus that were important to a relatively new department that was both understaffed and underfunded. The department began joint teaching with Electrical Engineering (EE) in the field of microprocessors in the mid-1970s, with CSC professors teaching the software and EE professors handling the hardware. The department also forged ties with the Operations Research Department, securing the first link for its curriculum with a Ph.D. program.

This cooperation culminated in 1977 with the Computer Studies program. University officials had to weave a complex web to assure the Board of Governors that Computer Studies at NCSU was complementary to other programs in the UNC system, not conflicting.

Don Martin and Larry Monteith, then the Dean of Engineering, attached a note of explanation to the official proposal for the Computer Studies Program insisting that "to avoid duplication of teaching requirements we would prefer to have our students take some courses at Chapel Hill if the logistics can be managed." They also stressed that the areas of concentration in Computer Studies, "communications, control, and design of hardware systems...are not covered in either UNC-CH or Duke's graduate programs." The maneuvering succeeded.

The Computer Studies program, under its head Wushow Chou, served four students in its first semester. Over the next years, the program experienced rapid expansion largely due to the general enrollment explosion in Computer Science in the late 1970s and early 1980s. By 1982, seventy students were enrolled. The growth trend continued to follow that of the Computer Science Department and by 1983, the program was looking at ways to curtail enrollment.

Because of its link with EE, Computer Studies was not completely satisfying to many in Computer Science, and the department continued to lobby for graduate programs administered solely by Computer Science. In 1981 the department asked for permission to plan its own Masters and Ph.D. programs. This proposal drifted away unheeded. The battles for autonomous graduate programs would be fought successfully under Dr. Martin's successor, Robert Funderlic.

With graduate and undergraduate teaching and research on a solid footing, Computer Science at NCSU had grown in importance during Don Martin's watch. Moreover, the incredible strain placed on the system by the boom years of the late 1970s and early 1980s moderated by the end of the Martin years. Enrollment leveled out and in some years actually decreased. Part of the reason was the general decline in the number of high school graduates as the years of the baby boom waned. Plus, a new computer engineering program in the School of Electrical Engineering, renamed Electrical and Computer Engineering (ECE), attracted some of Computer Science's reservoir of students who decided to specialize the hardware aspects of computers over CSC's software specialty. By the mid1980s, there were also signs of job market saturation in the areas where computer science majors traditionally worked.

As the department grew and developed, its perception of its role in the university also changed. A 1984 CSC Self Study Report advised that it was time to begin phasing out computer literacy service courses. The department decided to postpone such actions, but clearly the university saw its role in teaching computer science changing. Having been denied graduate programs, Computer Science concentrated on creating a solid undergraduate degree track and serving the traditional role of a land grant college - service to the community - with a variety of basic computer courses. By 1986, when Don Martin stepped down as head to return to teaching in the department, the Computer Science Department could argue reasonably that it should no longer be responsible for teaching computer literacy on a wide scale any more than the English Department should be burdened with teaching general literacy. Computers had become so much a part of society, that it was assumed incoming students would have some sort of familiarity with them. The years of a dizzying rush of events would settle into a period of inexorable development and increasing complexity as the department and its science matured.

PART THREE:

Maturity
The Robert Funderlic Years
1986 - 1992

Robert E. Funderlic took over as head of the Computer Science Department in January 1986. He held a B.S. from Notre Dame in mathematics and received a Ph.D. in mathematics from the University of Tennessee in 1970. The department hired him away from Union Carbide/Martin Marietta for whom he had worked at the Department of Energy's Oak Ridge National Laboratory in Tennessee. Dr. Funderlic had been at Oak Ridge since 1959, serving as a mathematician and scientific programmer, and later as section head of the computer sciences division. While at Oak Ridge, he also taught computer science and math part-time at the University of Tennessee.

Dr. Funderlic brought a marked change to the operation of Computer Science compared with his predecessor, Don Martin. Both were immensely successful, but both had different management styles. Don Martin faced a period of chaotic growth and, according to Garrett Briggs, the former dean of PAMS, had a "crisis management" style that was "hard to live with," but that was "successful where less assertive and less persevering department heads would have failed." Dr. Funderlic, coming from private industry, was a manager concerned with both consensus building and, if necessary, some low-key political arm twisting. Dr. Funderlic presided over a period of slow growth and even a decrease in enrollment. Even so, the department received approval from the Computer Science Accreditation Commission in 1986, paving the road for the department to become the nation's largest accredited computer science program by 1988.

This decline in enrollment reflected the national trend in computer sciences as the job market, except at the Ph.D. level, was becoming saturated. The department pointed to a U.S. Department of Labor study that claimed a 50% increase in computer science jobs by 1995. Nevertheless, the economic slowdown of the late 1980s worked to dampen that prediction. The slumping job market was not the only reason for smaller enrollment, however. The sheer number of incoming freshmen had decreased while competition for good students heightened. Gone were the halcyon days of hot, crowded computer rooms full of angry students waiting for TUCC to come back on line in the small hours of the morning.

Long-range planning became an integral part of departmental policy. With the discipline becoming more and more complex, struggling to overcome each successive crisis was no longer a feasible way to run the department. First, with the Management of CSC Operations Committee (MOP) and then, with the Computer Acquisition and Planning Committee (CAP), the department began planning for purchases of new hardware, software, and teaching materials. Faculty were also looking forward to changes in curriculum designed to reflect the changing computer science field and not just react to the changing discipline, but to anticipate it.

In the late 1980s, Computer Science found its problems not with too many students or too few machines, but with technology that rapidly became obsolete in an increasingly competitive computer world. The incremental changes that computers brought to society narrowed, but the technological advances in computers themselves only quickened. The equipment and laboratories that did the job perfectly well under Dr. Martin no longer sufficed under Dr. Funderlic. For NCSU to compete with the country's best computer science programs for students, faculty, and money, the department needed state of the art technology.

The centerpiece of the department's efforts to maintain the latest technology was the Computer Systems Laboratory (CSL). The CSL, with administrative offices and research labs in Daniels Hall, opened in 1987 and was a joint venture between Computer Science and Electrical and Computer Engineering. It was designed to increase research possibilities and cooperation between CSC and ECE, and to attract and train top-flight graduate students. Ambitious from the start, the CSS hosted or had plans for work on applied and theoretical research in software development, advanced simulation techniques, computer systems architecture, optical computing, computer networks, database management systems, computer graphics, numerical analysis and algorithms, intelligent systems, neural networks, VLSI (Very Large System Integration), robotics, and performance evaluation. In its first year of operation, over 50 graduate students worked on projects at the CSL, and it provided 12 fellowships totaling $100,000. The CSL continued to grow over the years, creating a notable cornerstone for the department's growing graduate and research programs.

Meanwhile, aside from the natural march toward obsolescence that all technology experiences, (a quick march in the case of computers), there were threats of losing floor space in the department's chief teaching lab in Leazar Hall. In 1988, just as the CSL was opening, 1100 square feet of Leazar Hall reverted to Contracts and Grants, forcing certain labs and courses into other, less adapted quarters. By 1990, however, the situation was reversed and the department built four new labs on the first floor of Leazar. In addition to the space, Leazar's 150 networked workstations, DECstation 2100s, were upgraded at an expense of $3 million.

In 1988 Computer Science finally realized a long-held wish when it received its first "assigned" classroom in Withers Hall. Drs. Norman Williamson and Leslie Sims, the associate dean of research in PXNS, were instrumental in designing and developing the classroom, Withers 402, into what the department called a "smart knowledge delivery system." With outside advice from local architects and designers, Withers 402 had equipment, fitted into desks that were bolted to the floor and locked, that was suitable for both the IBM and MacIntosh machines. The integration of Artificial Intelligence (AI) technology, hypermedia, overhead projection, and LCD panel converters into the classroom environment was "a quantum leap forward in teaching technology." Another departmental wish came true after the move of the Department of Marine, Environmental, and Atmospheric Sciences out of Withers Hall in 1989. Computer Science made a bid to establish a centralized administrative and instructional presence there and in 1990 Withers became the Computer Science Department's home.

Along with the arrival of new facilities came the passing of the old. In 1990, TUCC was replaced as the primary NCSU mainframe environment by the NCSUMVS system. Old TUCC, which had been a constant companion of so many students during the formative days of the department, was no longer part of the instructional atmosphere at NCSU. This was a clear example of how central computers and computer science had become to the university since the department's creation. It was no longer necessary to combine forces among several institutions to provide suitable computation resources. Each university had to stand alone in order to be competitive.

Besides these improvements in facilities and equipment, under Dr. Funderlic, the department expanded its areas of research specialties and minor fields. Computer Science became an approved university minor in Spring 1987 with essentially the same course sequence as the Certificate in Computer Programming that had been very popular with PBS students since the early 1980s. Before the official decision to allow minors, computer science and business were

the two most requested minor fields. The CSC minor became very popular with majors in other departments on campus.

One of the most important trends in the department was the growth of an Artificial Intelligence program. Interest in the field began under Dr. Martin, but grew substantially under Dr. Funderlic. In 1986, the department made a formal proposal for a graduate minor in AI. This request became a reality in 1987. The AI minor was an interdisciplinary program that included courses from Computer Science, Computer Studies, Electrical Engineering, and Industrial Engineering. The courses covered both concepts and applications with subjects such as Computational Linguistics, Pattern Recognition, Voice Input/Output (I/O) Communication Systems, Expert Systems, and Industrial Robotics. Drawn from the departments of Computer Science, Engineering, and Philosophy and Religion, the diverse faculty demonstrated that the implications of artificial intelligence are not just technical, but also have profound meaning for the relationship between humans and machines.

While the Computer Science program was growing and maturing, deepening its research into the increasingly complex discipline, the department looked to new professors to carry an increasing workload. Even though enrollment was steady or dropping through the late 1980s, the graduate programs associated with CSC and the new minor, brought increased teaching loads to the faculty. Computer Science needed new professors to handle the growing student body and the ever more complex subject matter.

Against the background of this need, there were a number of problems that affected the hiring of new faculty. The most basic impediment was NCSU's budget crisis that began in the early 1990s and forced the department to suspend, or at least curtail, recruitment. In addition to the lack of money, there was a lack of candidates. The pool of Ph.D.s to choose from was still small. According to the departmental annual report of 1990, American universities were expected to produce only about 625 Ph.D. graduates in computer science. Of that amount, fewer than 508 would decide to enter academics. Approximately 408 of the new Ph.D.s were non-citizens, many of whom would return home after graduation. The nation's universities hoped to hire nearly twice the number of available candidates. In addition to the small absolute numbers, the graduating Ph.D.s were only 14% women and less than 1% African American, making the recruitment of minorities difficult.

Computer Science had long been trying to hire more minorities. By the late 1980s, the department had several women faculty members, including professors Dr. Carla Savage, Ph.D. University of Illinois, and Dr. Jo Ellen Perry, Ph.D. NCSU, and several instructors. Computer Science hired its first African American faculty member in 1987 after many years of searching. Kelvin Bryant, with an M.S. in Computer Studies from NCSU, was hired as an instructor. He also entered the joint ECE-CSC doctoral program. Kelvin Bryant quickly moved into a tutorial and advising role with the growing number of minority students in the department. Further minority hiring occurred in spite of budget restraints. The department, with the assistance of the Provost's Office, went to lengths to hire Dr. Ade Ola in 1990. Dr. Ola, a permanent U.S. resident from Nigeria, earned a Ph.D. from Case Western in 1988, and his concentration on data base management was consistent with the department's needs.

Perhaps the most significant addition to the faculty in the late 1980s, in terms of prestige for the department, was the addition of Donald Bitzer as a Distinguished University Research Professor. Dr. Bitzer came from the University of Illinois in January 1989. He was a member of the

National Academy of Engineering and was "world renowned" both for PLATO, a computerbased education system, and for his work on plasma display panels. The department had been searching for a scholar to fill this "superprof" position since its creation by Chancellor Poulton in 1986. The position itself, "a subtle piece of blackmail" as Chancellor Poulton referred to it, provided the department with a position that the budget did not allow for. Purdue University had already snatched one candidate away by offering him, in lab space and a research budget, several times what NCSU allocated for its Computer Science Laboratory during the entire year.

Prior to accepting the permanent Research Professorship, Dr. Bitzer had collaborated with several NCSU faculty. He had worked with Dr. Mladen Vouk on table-based data-independent error correction; with Dr. Woodrow Robbins on information compression for very large scale graphics applications for super-computers; and with Dr. Nilsson on High Definition Television. The arrival of Dr. Bitzer was a clear indication of the department's academic maturation and confirmed that the department was capable of competing on a national level.

Besides securing needed and important personnel in the late 1980s and early 1990s, the department enhanced its performance and reputation by hosting a number of prestigious conferences and seminars. For instance, in May 1986, NCSU held the "International Conference on Computer Science Systems Performance." Sponsors and participants, aside from members of the department, included the International Society for Information Processing, the National Society for Computer Science, the Applied Probability Group of the Operations Research Society of America, and IRISA/INRIA, a French Research Center in Rennes. Also, in January 1990, Dr. William Stewart organized the first international workshop on "Numerical Solutions of Markov Chains." This event attracted more than 100 participants from around the world. These were just two of a growing number of seminars, workshops, and conferences sponsored by the department during this period.

Another sign of the department's maturation was the appearance of a variety of computer research institutions associated with the department. Many of these research bodies came into being under Don Martin and grew in importance under Robert Funderlic. A few of the bodies were state funded, but many were part of a growing trend in which private industry contributed money to universities in order to provide access to research and personnel.

The department worked with the Microelectronics Center of North Carolina (MCNC), founded in 1982 in Daniels Hall and later relocated in the Research Triangle Park. Although MCNC was a private, not-for-profit corporation, it did receive most of its financial support from state funds. In 1985, MCNC completed a twoway television system that connected it with all participating institutions for graduate level "teleclasses" as well as a variety of video-presented conferences and seminars. The North Carolina state government also purchased a four processor CRAY Y-MP supercomputer and established a Supercomputer Research Center (SCRC), which is administered by the MCNC.

Faculty and graduate students from the department worked with MCNC on specific projects. The most notable accomplishment of MCNC was probably the Blitzen microchip, developed for NASA. The Blitzen, a massively parallel logic chip, i.e., it can divide complex computations into pieces and work on different aspects simultaneously, was an important development for MCNC to show some return on the money that the state government had invested.

A second associated organization was the Center for Research on Scientific Computation (CRSC). It is the only official multidisciplinary center recognized by the UNC system. CRSC was founded within Physical and Mathematical Sciences in 1986, and departmental participants include Computer Science, Mathematics, Electrical and Computer Engineering, Mechanical and Aerospace Engineering, and Statistics. The CRSC faculty concentrated on areas of scientific computing and numerical analysis as it applies to fluid mechanics and structures, aerodynamics, computer performance evaluation, and space mechanics among others. It provided a focal point for scientific computing on campus by publishing technical reports, sponsoring workshops, and making recommendations to the university administration on scientific computing programs.

The first of the joint academic-industrial research bodies was The Center for Communications and Signal Processing (CCSP), which was founded at NCSU in 1981 by the National Science Foundation. It has served as a world-renowned interface for industry and academics. Industrial members have included AT&T, BellSouth, Carolina Power & Light, Digital Equipment Company, IBM, Northern Telecom, UNISYS, and Westinghouse Electric Corporation. The Center has focused its efforts in three areas: multi-dimensional signal processing, communications and networking, and algorithms and architectures. It has at least 12 professors and 30 research assistants from NCSU working on approximately 15 projects.

The Integrated Manufacturing Systems Engineering Institute (IMSEI) was established at NCSU in 1984. IMSEI's purpose was to respond to the decline of industrial productivity through basic and applied research and technology transfer. Like the CCSP, it is also an industrial and academic cooperative effort. The academic disciplines that have played a role in IMSEI include Computer Science, most Engineering departments, and Economics and Business. The private sponsors have included AT&T, DuPont, General Electric, RJR Nabisco, and Texas Instruments. Projects at IMSEI have dealt with the use of artificial intelligence in multicell control, expert systems for scheduling, intelligent robots, robot vision, and modular programming techniques for real-time control.

One of the most significant research bodies connected to outside grants was the Precision Engineering Center (PEC) on the new NCSU Centennial Campus. The PEC was created in 1987 with funds from the Office of Naval Research and hosted projects on computer science control of realtime systems such as precision machines and instruments. Notably, the PEC was the site for work on a NSF grant worth nearly $6,000,000 concerning "Constraint Nets for Life-cycle Engineering." Awarded to Drs. Dennis Bahler and James Bowen, this grant combined the artificial intelligence work of CSC with manufacturing systems of the Industrial Engineering Department.

These cooperative bodies show how the size and complexity of research grants and contracts continued to grow into the 1990s. NCSU faculty and graduate students cooperated in cutting edge research funded by the university, by private industry, and by government sources. In many ways, the success that Robert Funderlic had in providing a more fertile ground for research work to prosper started with creating independent graduate programs and shifting the department's college affiliation. These major events worked to bolster the growing research efforts of the department's faculty.

PART FOUR:

Independent Graduate Programs
and
The Transfer to Engineering

When Robert Funderlic took the post as head of the Computer Science Department in 1986, his acceptance rested on certain conditions. First and foremost among these was the creation of a strong graduate program administered solely by Computer Science. Dr. Funderlic immediately set out to make these autonomous graduate programs a reality. Although the ultimate goal was to begin a Ph.D. program, the starting place was to redesign the jointly administered Computer Studies. Dr. Funderlic intended that Computer Studies should become, both instructionally and administratively, Computer Science's alone.

Not everyone in the department, however, favored cutting ties with their Computer Studies partner, Electrical and Computer Engineering. Some faculty members, particularly those who served in Computer Studies, argued that the program was already quite strong and that the alliance with the powerful and influential ECE assured that funding and facilities would always be forthcoming from the university. As one faculty member asserted - "I am opposed to making any changes which would aggravate the financial and space situation....If it ain't broke don't fix it." A flurry of memos followed, debating the financial viability of an independent Computer Science Masters program. A strong and convincing argument was made that the department could shoulder the burden of its own Masters as well as any school. Soon the money concerns faded from the spotlight.

Eventually the debate was reduced to the political question of how UNC Chapel Hill, which already had a computer science Masters program, would react to the creation of a Masters degree in Computer Science at NCSU. Some university officials and faculty feared that if the General Administration approved the new Masters at State, UNC would demand a new computer engineering program. "Do we want to ruffle feathers at UNC over a Master's program when what we really want is a PhD program?" asked one faculty member. Dr. Funderlic argued that concern over Chapel Hill's reaction, "carried to its logical end," would mean NCSU "should stop all new initiatives."

University officials decided to push for an autonomous Computer Science Masters, which would also test the waters for the next step—a Ph.D. They received approval for an independent Masters program, but they decided to retain the name Computer Studies. Beginning in Fall 1989, however, Computer Studies did officially become a Masters in "Computer Science." Chapel Hill did not take issue with NCSU's new Masters degree. But this did not end the debate between the two universities over graduate programs.

By this time, NCSU was already pursuing its own doctoral program in computer science. Officials at NCSU were concerned that the UNC system's member universities would create a quid pro quo too costly for NCSU to acquire a Ph.D. in computer science. This was a constant road block; every step toward the goal required scrutiny of the possible responses of other universities, notably Chapel Hill. These political landmines made the advance to graduate programs extremely hazardous for Computer Science and for the NCSU hierarchy who supported the department's expansion.

Dr. Funderlic diffused some of the potential problems by cultivating an open, working relationship with his opposite number at UNC-Chapel Hill, Dr. Jay Nievergelt. Dr. Funderlic found that Dr. Nievergelt favored a computer science Ph.D. at NCSU. Stating "personally I think that's a good idea," Nievergelt felt that the Research Triangle area would only benefit from the competition of computer science departments. Of course, Chapel Hill still wanted something in return, an undergraduate program in Computer Science. After internal debate, NCSU surrendered their monopoly on baccalaureate computer science within the UNC System in return for a clear road toward a doctoral program.

There still remained a number of problems to be solved. Even with Chapel Hill's objections cleared away, approval from the UNC General Administration was not assured. There was also friction from within NCSU over how best to coordinate a new program with the already existing computer science path within the Computer Engineering doctorate or a number of other cooperative Ph.D. programs on campus.

There was one institutional change which would help clear the field for a Ph.D. to become a reality for Computer Science. An overwhelming opinion inside the department favored Computer Science becoming part of the College of Engineering. Many other important computer science departments around the country were linked to engineering rather than math. Computer Science had been part of PAMS since its inception in 1967, but most of the department's cooperative efforts were with Engineering, particularly the Department of Electrical and Computer Engineering.

The move to engineering was not a new idea. In the early 1980s, the department had advanced the concept of a transfer to engineering. The primary supporters of the idea were Don Martin, Larry Monteith, then the dean of engineering, and Nino Masnari, then the head of Electrical Engineering. Opposition from PAMS, particularly from Dean Garrett Briggs, and the inability to link the transfer to engineering with the desired Ph.D. caused the proposal to falter. Computer Science did not receive permission to transfer, but the Department of Electrical Engineering recognized the depth of its connection to computers and created the computer engineering discipline. Computer Science remained an organizational part of PAMS while continuing to enhance its cooperative links with ECE.

Dr. Funderlic renewed the interest in moving Computer Science to Engineering in the late 1980s. There also were several propitious developments during this period that smoothed the path for the department's shift. The UNC General Administration had become much more amenable to duplication of programs throughout the system. Garrett Briggs, who had argued effectively against the transfer, resigned as dean of PAMS in 1988. Even more importantly, the level of cooperation between CSC and ECE had grown even stronger with the opening of the Computer Science Laboratory and various joint graduate programs. To demonstrate the level of desire for the move to engineering, Computer Science held a faculty vote which proved to be overwhelmingly in favor of transferring. Likewise, Computer Science students also expressed their approval of the proposed move.

With Dean Larry Monteith still vigorously supporting the idea of bringing the department into his college, the transfer rapidly approached reality. The move could no longer be stalled. Finally, Chancellor Poulton wrote to Dr. Funderlic that while the debate over moving Computer Science to engineering "has been before me for the entire tenure of my Chancellorship...the discussions have never before reached the near unanimous position they are in now." The transfer was

approved and, as of July 1988, Computer Science officially became a department within the College of Engineering.

Now that the transfer had taken place, the department was closer to its ultimate goal - a Ph.D. program. Several factors militated now in favor of a doctoral degree. The first was the department's transfer to engineering, a more logical host for computer science than math and a home more conducive to cooperative research. The second was the administrative advancement of Larry Monteith, long a supporter of the transfer, who moved from his position as dean of engineering to become chancellor of NCSU in 1990. In addition, Debra Stewart became dean of NCSU's graduate school, and she was a strong supporter of a Computer Science Ph.D. Dr. Funderlic's warm relationship with UNC-CH's Dr. Nievergelt helped to remove the obstacle of Chapel Hill's resistance. And then, in March 1989, a UNC General Administration review of the department included a positive recommendation from Dr. Donald Rose, the chairman of Duke's computer science department, who had acted as a consultant to the General Administration's review.

In late November 1989, Dean Debra Stewart instructed the department to file a formal request for a Ph.D. with the UNC General Administration. Twenty-one days later, the proposal was approved. In January 1990, all students who previously had been in the computer science "option" for a M.S. or Ph.D. in Computer Engineering were transferred into the new autonomously controlled Computer Science program. With the Ph.D. program in place, the department had acquired the one thing it had most desired since its creation in 1967.

More than anything else, the independent Ph.D. program placed NCSU on a solid footing in order to compete with the other topflight computer science programs in the country such as Cornell, Purdue, and Carnegie Mellon. Research money and students would be available for long term projects to enhance the reputation and quality of instruction in Computer Science at NCSU. Computer Science's addition of a Ph.D. improved its worldwide reputation and its ability to strengthen areas of faculty interest—Architecture and VLSI, Scientific and Parallel Computing, Algorithms and Numerical Computation, Computer Graphics, Artificial Intelligence, Theory, Software Engineering, and the Performance Evaluation of Computer and Communication Systems. New research specialty areas continue to be created. Scientific Computation became an important new interest in the department's graduate program in 1990.

Computer Science, even while coming into its own as a powerful part of the university, has continued its cooperative work with other departments. Joint doctorates were available with Computer Science and Operations Research, Mathematics, Statistics, and Biomathematics. Still, the department has not lessened its commitment to quality instruction at the undergraduate level. Computer Science recognizes that the continued existence of high level research is only made possible by a continuing flow of good students with a solid grasp of basic theory and practical application. The Ph.D. and M.S. degrees, side by side with a strong baccalaureate program, provide for a vital department, rich and complex, continually learning from new students and experiences and bringing the brilliant flashes of cutting edge research to the novice and expert alike.

During the last twenty-five years, the Computer Science Department has risen to the occasion of an increasingly complex and computerized world. Establishing the department, implementing curricula and graduate programs, hiring faculty, acquiring facilities and equipment, and recruiting and training the best students have been difficult tasks at times. But the department,

under able leadership throughout its entire existence, has responded to the challenge of this vibrant field in creative ways. There is every reason to believe that the next twenty-five years will be as exciting and, perhaps as unpredictable as the past two and a half decades.

ACKNOWLEDGEMENTS