

ENGINEERING EDUCATION IN NEBRASKA

A Report to the Board of Regents

of

The University of Nebraska System

March 10, 1994

I. INTRODUCTION

In October, 1993, the University of Nebraska Board of Regents authorized the establishment of a Review Team which it charged with undertaking a "comprehensive review of engineering and related programs of the University of Nebraska." The Regents' full statement of the charge to the Review Team is attached as Appendix 1.

The members of the Review Team are:

- o Dr. Donald N. Langenberg, Chairman of the Review Team, Chancellor of the University of Maryland System
- o Dr. John T. Christian, Vice President, Stone and Webster Engineering Corporation
- o Dr. James E. Halligan, President, New Mexico State University
- o Dr. Charles F. James, Dean, College of Engineering and Applied Science, University of Wisconsin-Milwaukee

Drs. Christian, Halligan, and James are engineers and Dr. Langenberg is a physicist.

Drs. Langenberg and Christian visited the Lincoln campus on December 8 and 9, and Dr. Christian visited the Omaha campus on December 10. Drs. Langenberg, Halligan, and James visited both campuses on January 4-6. During these visits, members of the team met with students, faculty, members of the administrations of the College of Engineering and Technology (including Dean Liberty), of each campus (including Chancellors Spanier and Weber), and of the University System, and also with representatives of the engineering and business communities of Lincoln and Omaha. We estimate that we met with several hundred individuals altogether.

Arrangements for our visits were ably handled by Dr. Lee B. Jones, Provost and Executive Vice President, and by Dr. Donal Burns, Associate Vice President. We thank each of them for their expert attention and help.

In the next section we present our findings and observations, based on our visits to Lincoln and Omaha. The following section contains our conclusions and recommendations. We have not attempted to record and respond to each and every piece of information and assertion we received. Rather, in order to create a concise and, we hope, useful report, we have attempted to synthesize a general and broadly accurate picture of the situation and to derive from it reasonable and defensible recommendations for action.

We note that the Regents' establishment of the Review Team followed a series of events connected with the emergence of proposals for the establishment of an independent college of engineering at the Omaha campus of the University System. Although the Regents' charge to the Review Team contains no specific request that these proposals be addressed, the Team found them to be the focus of its discussions with most of the persons it interviewed. Consequently, this report addresses this issue explicitly.

II. FINDINGS AND OBSERVATIONS

Twenty six years ago the University of Omaha became part of the University of Nebraska System as the University of Nebraska at Omaha (UNO). Several years later, the existing engineering and technology programs in Omaha were administratively merged with the engineering programs of the University of Nebraska-Lincoln (UNL) to form a single College of Engineering and Technology headed by a dean headquartered in Lincoln. The subsequent evolutions of the Lincoln and Omaha elements of the College are viewed somewhat differently in Lincoln and in Omaha.

Particularly over the past decade, the UNL element of the College has increased its graduate enrollment and has succeeded in substantially increasing its external funding for research and development. The Nebraska Research Initiative has been an important factor in these favorable developments. The College's UNL physical facilities appear to be quite good. The College's undergraduate enrollment at UNL has declined in recent years, as have engineering enrollments nation-wide. The College, UNL, and the University of Nebraska System as a whole have suffered the effects of unusually severe fiscal constraints during recent years. Nevertheless, our picture of the College in Lincoln is of a typical traditional research-university engineering school in fairly healthy condition that has made considerable progress over the past decade and is in a good position to make further progress to the extent allowed by its constrained financial resources. Dean Liberty and his faculty and administrative colleagues deserve considerable credit for the relatively strong condition of the College in Lincoln.

The UNO element of the College presents a rather different and more mixed picture. It has about half the College's undergraduate enrollment at UNL, and that enrollment is exhibiting a slow decline similar to that in Lincoln. It no longer has several programs it once had, e.g., Administration of Fire Protection Technology, Drafting Design Engineering Technology, and B.S. programs in general and industrial engineering. Although the College as a whole is evidently considering several possible new programs, none appear to be contemplated for Omaha. The physical facilities of the College at UNO are grossly inadequate. Most Omaha-based faculty are not strongly research oriented, but the Omaha-based Center for Infrastructure Research, one of six engineering research centers created in response to the Nebraska Research Initiative, has been very successful and leads its sister institutes in the generation of external research funds.

In general, therefore, the UNL element of the College of Engineering and Technology appears to be in relatively good shape and to be making steady progress despite its fiscal limitations. The same cannot be said of the UNO element. Many Omaha observers would characterize the present condition of the College in Omaha as the result of a quarter century of steady erosion of programs, facilities, and funding. Most Lincoln observers would be less harsh and more sanguine, but many in both Omaha and Lincoln appear to agree with the assertion by UNL Senior Vice Chancellor for Academic Affairs Joan Leitzel to the Regents

last September that the College of Engineering in Omaha needs "a new facility, new laboratories, additional equipment, additional faculty, clerical staff, technical staff, and increased operating resources."

That statement is about the only thing in this matter about which there seems to be general agreement between UNL and UNO. At the risk of oversimplifying matters, the Lincoln view is that the present unsatisfactory Omaha situation is an unfortunate but unavoidable consequence of the College's drastic budgetary constraints coupled with the necessity of preserving and enhancing the high quality instructional and research programs the College has been able to develop in Lincoln. The Omaha element of the College has not been unfairly treated; it has simply been required to bear a share of the consequences of the College's budget problems which is appropriate given the lower priority of its programs and functions relative to those in Lincoln. When and if times get better, Omaha's needs will be attended to.

The situation is seen very differently in Omaha. There, the present situation is seen as evidence of a persistent and deliberate twenty-five year effort by Lincoln to starve Omaha in order to fatten Lincoln. Omaha's needs have not been and will not be attended to, regardless of whether times are good or bad.

Members of the Review Team have heard dozens of impassioned defenses of both the Lincoln and Omaha points of view on this matter, accompanied by enough alleged evidence and asserted facts to choke a horse. Given more time and more investigative capability than the Team had, it might be possible to winnow an accurate history from the evidence and facts, but we don't believe that would be particularly relevant to the questions at hand. What is important is that the Lincoln- and Omaha-based faculty no longer view each other as colleagues in a common enterprise working toward common goals, their shared administrative structure to the contrary notwithstanding. The Lincoln-based administration at both the campus and College level is not seen as credible in Omaha. A serious gap in credibility and trust has thus developed between the UNL and UNO elements of the College of Engineering and Technology. Whatever might be the factual historical basis for this gap, it is very real, and it lies at the root of the drive to create an independent college of engineering in Omaha.

While these internal differences of view between Lincoln and Omaha are important and have created serious tensions, in our opinion they are ultimately not as important as the views of the College's clients about the scope and quality of the services they now receive from the College, and the expectations they have of the College in the future. The team heard from numerous representatives of two important client groups both in Lincoln and in Omaha, students and the business community.

The College's students at UNL appear to be generally pleased with their educational programs. Those at UNO also made positive comments about some aspects of their programs, but they are not pleased with the limited scope of engineering and technology

programs available to them in Omaha. They do not find television courses an adequate substitute for courses delivered by on-site faculty. Their principal complaint about television courses seems to be the low level of personal interaction between Omaha-based students and Lincoln-based faculty.

In Lincoln we heard several expressions of the view that any really serious engineering student in Omaha should be prepared to commute the relatively short distance to Lincoln to get the courses and programs he/she needed. Those not willing to do so are in any event being adequately served by the UNO-based faculty of the College supplemented by courses delivered by television from UNL.

The Omaha students are very strongly of the opposite view. Many are mature adults with jobs in the Omaha area, substantial family responsibilities, and severely constrained personal finances. They simply feel unable to make the long journey to Lincoln several times a week in all kinds of weather to participate in Lincoln-based programs. They also expressed frustration with several administrative consequences of their status as students of the single College of Engineering and Technology. They asserted that they are required to journey to Lincoln in order to register, and pay fees to cover the cost of student services provided in Lincoln that they cannot use, in addition to fees for Omaha services that they do use. They find it difficult to think of themselves as part of a College community that appears uncaring and insensitive to their circumstances as Omaha-based students.

Another consequence of the present administrative arrangement in the College should be mentioned. Omaha-based students of the College are reported as part of Lincoln's enrollment, despite the fact that most take all their courses, both in engineering and in other departments, in Omaha. Important elements of cost related to these Omaha-based College students are incurred in Omaha and are reported as part of UNO's budget rather than UNL's budget. These include physical plant costs, student services costs, and educational costs in the Omaha departments outside the College in which Omaha College students take courses. All this results in substantial distortions of certain important administrative statistics for both UNO and UNL. These include enrollment statistics and cost-per-student statistics. The distortion due to the College of Engineering and Technology is offset in part by similar distortions connected with other bi-campus programs like home economics, social work, nursing, and criminal justice, but the net distortion appears to be sizeable and to advantage UNL and disadvantage UNO.

The Team's principal objective in its discussions with the other important client group, the business community, was to assess the degree of depth, the "seriousness" if you will, of that community's belief in the necessity of change and of its commitment to support change in engineering education in Nebraska. Within the University of Nebraska System, the present debate over engineering and technology education exhibits the characteristics of a classic academic internecine struggle over turf, status, and resources. Outside the System, the Team was made aware of the existence of a long-standing condition of civic chauvinism and political competition between Omaha and Lincoln. If the present situation were nothing

more than a manifestation of such eternal features of the human condition in the arena of engineering education, then the Team might have been led to the conclusion that "all parties should simply quit squabbling and get on with it." However, our conversations with business leaders suggest that there is more to it than that.

We must first say that we were told by several individuals within the University System that the business community is not of a single mind on this issue, and our conversations with business leaders confirm this. Nevertheless, there does appear to exist in the Omaha business community a broadly-based and deeply-held view that a strengthened and expanded engineering education enterprise in Omaha is necessary to the economic development of both Omaha and Nebraska.

The basis of this view is this: Agriculture has long dominated the economy of Nebraska. However, as Nebraska prepares to enter the 21st century, non-agricultural engineering-based industries are widely seen as becoming of increasing importance to Nebraska's economic development. Much of Nebraska's present strength in engineering-based industry is in the Omaha area. It is natural, therefore, that the Omaha business community should take the position that the future of the Omaha area depends critically on its ability to attract and develop new businesses in areas that depend on engineering and engineering technology. This ability in turn requires readily-accessible high-quality engineering education opportunities in Omaha. This is important for two reasons. First, as Nebraska's largest population center, the Omaha area constitutes a major source of employees for Omaha businesses. If those businesses are going to become increasingly technology based, their employees must be educated in engineering and technology. Second, while it can be argued that Omaha's new industries might simply recruit engineers educated elsewhere, the accelerating pace of technology development today demands that a working engineer engage in near-perpetual continuing education. (By "continuing education" we mean programs leading to the master's degree plus an array of non-credit technical short courses.) That continuing education must be conveniently available near the engineer's work site and/or home. Without ready access to continuing education opportunities in engineering, Omaha's new businesses will find it difficult if not impossible to recruit and retain top-flight engineering personnel.

A business community can also benefit significantly from the presence of first-class university engineering programs through the potential they provide for collaborative research and development aimed at the solution of important industry problems and for the ready availability of highly competent technical consultants. Where there is a determined spirit of cooperation and interaction between a university and a business community, an academic engineering program can be shaped over time as an effective and responsive partner to the business community.

An anecdote will illustrate these points. The Team was told of Omaha's unsuccessful recent efforts to attract several major industries. One was an assembly plant for Mercedes Benz vehicles that ultimately went to Alabama. In its October 1, 1993 story on that site selection,

the Washington Post report quoted the Daimler Benz official who led the site search as saying, "The selection....had as much to do with Alabama's advances in public education as it did with the \$250 million package of financial incentives -- tax abatements and planned state and county spending on items such as roads and water lines -- offered by the state."

Several Omaha business leaders told the Team that the Omaha business community was prepared to provide vigorous political and even financial support for the establishment of an independent engineering school at UNO.

If an independent engineering school were to be established at UNO, what kind of school would it be? What programs should it offer? What would it really cost? In short, what is the vision, the strategic plan for such a school? In the Team's opinion, no clear vision, no strategic plan worthy of the name now exists. We were given a document titled "The Reestablishment of an Independent College of Engineering in Omaha: A Proposal Prepared by the Ad Hoc Committee," but we did not find this to be a true plan of the kind that would be needed to guide the development of such a college. Some important elements of a vision were evident in what we heard from Omaha faculty, Omaha students, and, especially, Omaha businessmen. In the next section, we present some of our own views of what an Omaha College of Engineering should be like. But the present absence of a real vision and a real strategic plan is a factor that must be taken into account in reaching any decision about this issue.

Finally, we wish to note an important feature of Nebraska's present engineering education enterprise. The Team was given detailed statistical information about engineering enrollments and budgets in Nebraska and in some other comparable states. These data make it abundantly clear that, by any measure, Nebraska's present investment in engineering education is relatively small. Engineering education budgets and enrollments in most comparable states are substantially greater on a per capita basis than they are in Nebraska. This observation is important because it suggests that Nebraska can probably well afford to enhance engineering education opportunities for its citizens -- if only it can muster the political will to do so.

III. CONCLUSIONS AND RECOMMENDATIONS

Based on the findings and observations above, the Team members unanimously offer as their principal recommendation:

THE STATE OF NEBRASKA AND THE UNIVERSITY OF NEBRASKA SYSTEM SHOULD INITIATE A DELIBERATE AND CAREFULLY PLANNED PROCESS LEADING TO THE ESTABLISHMENT OF AN INDEPENDENT COLLEGE OF ENGINEERING AT THE UNIVERSITY OF NEBRASKA AT OMAHA.

The recommended process should include the following elements:

1. The first action should be a clear and unequivocal commitment by the Nebraska state government and the University of Nebraska System to establish and support an independent college of engineering at the University of Nebraska at Omaha. Without such a commitment, the enormous effort required to plan in detail and to implement the establishment of such a college is unlikely to be truly fruitful. This does not necessarily mean the immediate formal establishment of the college. For reasons we describe below, simply performing the surgical separation of the Lincoln and Omaha elements of the present College of Engineering and Technology is likely to leave the Omaha element in life-threatening condition. But the Team believes it is essential for all the major players to commit to the goal of an independent college so as to forestall corrosive and counterproductive rear-guard actions aimed at aborting the developmental process.
2. A clear and compelling vision and at least the outlines of a real strategic plan for the new college must be developed immediately. This will be necessary in the development of support for the commitment to create the new college. However, that commitment should not be held hostage to a requirement for a plan that would spell out every imaginable detail of the development of the college into the indefinite future. The development of the vision and the strategic plan should be in the hands of a knowledgeable team including persons from both inside and outside the University. The plan should address the important question of whether the technology programs now present in Omaha would be continued as is, transformed into engineering programs, or transferred to some other institution.

The Team believes that the UNO college should be deliberately designed to be very different from the UNL college. Nebraska and Omaha do not need and should not create another of the latter. Instead, the UNO college should reflect the metropolitan character of its host university and the metropolitan area which it serves. It should have full fledged undergraduate baccalaureate programs in a few basic areas, such as mechanical, computer/telecommunications, and civil/environmental engineering, as well as graduate programs at the master's level and a diverse array of continuing education offerings. All of its programs should be adapted to the special needs of a student body that will include a high proportion of working adults who need access to courses and faculty at non-traditional times and places. Consideration should be given to including strong cooperative education programs at the baccalaureate level, or even the master's level. (Institutions like Northeastern University, the University of Cincinnati, and Drexel University may provide useful models.) Faculty should be expected to engage in research and development, but not basic engineering research of the sort commonly associated with doctoral programs. Rather, application-oriented research and development projects in close collaboration with local industry should be emphasized.

3. It should be understood from the outset that additional financial resources will be required. Some of the proponents of the establishment of an independent UNO college purport to believe that the administrative division of the Omaha and Lincoln elements would leave in Omaha an academically viable engineering and technology college which could become what is needed in Omaha with only very modest additional expenditures. The Team disagrees. We believe that what would be left from such an administrative division would leave UNO more nearly in the position of having to create an engineering school from scratch. We do believe that the needed additional resources are within the ability of the state of Nebraska to provide, if it has the will to do so, given its current notable underinvestment in engineering education. It is essential that the Nebraska political establishment understand the fiscal consequences of developing engineering programs in Omaha and unequivocally commit to their support.

Further, in the Team's opinion, the financial plan for any UNO college should be accompanied by guarantees that the UNL element of the College will not be expected to pay the price. That part of the College has achieved a great deal in recent years, and needs and deserves continued and even enhanced support. Increased state appropriations will surely be needed. The University of Nebraska System as a whole may be able to contribute something through redeployment of existing resources. And the Omaha business community can, we believe, be expected to make substantial contributions to the establishment of the new college, perhaps by helping to provide an adequate physical facility. The business community can probably not be expected to bear a large share of the continuing operating costs of the college. That should be the responsibility of the state and the University System. All parties will need to understand and appreciate that, as with most things, it's not the initial cost of a new college that'll matter the most, it's the upkeep.

The Team believes that, if the foregoing things can be accomplished, and soon, Nebraska and its University System can both continue the development of a strong traditional engineering school in Lincoln and build a new kind of engineering school in Omaha, one carefully adapted to the special needs of the Omaha area's citizens and its business community. It should be possible, we believe, to bring that new school to a state of full service to its community and to full accreditation before the end of this decade. If Nebraska succeeds in this, it will have made a major contribution toward ensuring its own economic competitiveness in the 21st century.

The alternative is continuation of the present situation. The Team believes that alternative is unacceptable. We hope our Nebraska friends will agree.

IV. ACKNOWLEDGEMENT

The Team would like to thank the many Nebraskans, both old friends and new, who contributed to our understanding of the circumstances of engineering education in Nebraska. Though they hold different and often conflicting views of what is and what should be, all are dedicated and committed to making Nebraska a vital and economically strong place to live and work.

ISSUES PRESENTED FOR COMPREHENSIVE REVIEW OF
ENGINEERING AND RELATED PROGRAMS OF THE
UNIVERSITY OF NEBRASKA

October, 1993

The University of Nebraska should provide for the effective delivery of appropriate quality engineering, engineering technology, and other engineering-related programs to meet the needs of the state. Constrained only by limitation of resources and regard for high standards of quality, the University's goal is to provide for the development, organization and most effective delivery of programs to ensure the best possible education for our students; to provide outreach services to communities, businesses, and government agencies throughout the State of Nebraska; and to provide Nebraska, the region and the nation with quality engineering research.

Questions have been raised recently by some Omaha faculty and business leaders as to whether the engineering and engineering-related educational needs of the Omaha area are being met. This is a very important question, and one that must be addressed by the Board of Regents. But this question must be viewed in the larger context of the educational, outreach and research needs of the entire state, and in the context of the resources available to meet these needs with quality programs. The Board seeks the advice of experts in higher education, engineering education, and engineering practice to help identify critical factors, to assess needs, and to assess how best to match the University's and the State's resources to these needs.

The main questions to be addressed are simply stated; the factors which affect the response to each are complicated and will require careful study and analysis. The questions presented and some illustrative factors for each are set forth below:

1. What are the instructional, outreach and research needs of the State of Nebraska, and particularly Omaha, in engineering, engineering technology, and other engineering-related programs? What are the future needs?
 - current and especially future needs
 - undergraduate, masters and doctoral programs
 - continuing education for Nebraska and, in particular, Omaha-based industry

2. To what extent is the University meeting current needs? Is the University positioned to meet future needs?
 - instruction, research, outreach and continuing education
 - undergraduate, masters, doctoral
 - appropriate means of delivery of instruction (including telecommunications)
 - economic development needs
 - is a sufficient level of total resources devoted to engineering instruction, research and outreach

3. If there are unmet needs, what programmatic changes or additions would be required to meet these needs?
- breadth and depth of programs
 - faculty required (FTE by program area)
 - costs associated with recommended programmatic changes
 - impact of recommended changes on existing programs within the current College of Engineering and Technology
 - undergraduate, masters, and doctoral programs
 - should engineering courses be taught over distance using telecommunications technology; what is the relative quality of such offerings compared to on-site instruction
 - implications for facilities
 - implications related to program quality and accreditation
 - impact of engineering programmatic changes on other programs (non-engineering or engineering-related programs) on the Lincoln and Omaha campuses
 - are changes in role and mission of the respective campuses required to effect any recommended programmatic changes
4. Do you recommend changes in the University's current administrative structure for instructional, outreach and continuing educational, and research programs in engineering, engineering technology, and other engineering-related fields?
- is there a relationship between the administrative structure and: the quality of education students receive; the quantity and quality of research conducted; the service to the community and the state
 - are cooperation and collaborative efforts among engineering faculty important; if so, how are these affected by any proposed administrative structure
 - are there economic development aspects to the decision on administrative structure
 - impact of administrative structure on other programs on Lincoln and Omaha campuses
 - implications related to program quality and accreditation
 - are changes in campus role and mission required to change administrative structure
 - all costs and benefits of such changes (details including estimated annual budgetary impact)
 - impact of recommended structural changes, if any, on existing and resulting academic units
 - implications for facilities needs