REMARKS BY DR. G. WAYNE CLOUGH
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It is an honor for me to welcome you to Georgia and our capital city of Atlanta. Many of you came a day early for EAC and TAC meetings about accreditation issues in engineering and technology, and we hope that was helpful. This morning we open the ABET annual meeting for the year 2000, and we are very pleased to be your hosts here in Atlanta. I hope you have a chance to take in some of the sights of the city while you are here, and we welcome any or all of you to visit our campus, which is right in the heart of the city along I-75/I-85 a few miles south of here.

I grew up in the small town of Douglas in rural South Georgia. Neither of my parents were able to go to college, but they understood the value of an education and were determined to send their children to college. And so I headed for Georgia Tech after high school with the goal of getting a bachelor's degree. It was my professors at Georgia Tech who felt I had potential and encouraged me to continue on to graduate school.

Looking back, I as fortunate to have been taught engineering, first at Georgia Tech then at U.C. Berkeley, by many faculty who were committed to the learning process while at the same time engaged in high-level research. The opportunity for a student to learn from a professor who is engaged in research and the creation of knowledge and who brings the excitement of this venture into the classroom, is one of the bedrock values of engineering and technological education that deserves preservation in the face of the turmoil of our rapidly changing world.

As an engineer, I am concerned about my profession. As an engineering educator of some 30 years, I have a vested interest in ensuring that the opportunities I experienced are available to other generations. As the president of a university that graduates the large number of engineers in the nation, I feel a heavy responsibility for the more than 2,000 engineering graduates that leave Georgia Tech each year and the growing number of engineers who return to us to renew their knowledge and skills. And I believe we are at a critical moment in the life of engineering and technology education.

Everyone in this room today is concerned about accreditation issues, and that is important. But we have to be careful not to view engineering and technology education simply as the sum of their curricular parts. We require students to study the essential math and sciences that form the knowledge base for engineering and technology. They also take the humanities and social sciences courses that comprise the core of any higher education curriculum. Then we teach theory, design, and hopefully some elements of practice, in engineering and technology.

Our discussions tend to focus on how to squeeze an adequate amount of each of these ingredients into the four-year time framework of a conventional bachelor's degree program. The goal of the discussion is usually to negotiate a compromise relative to hours of credit among the champions of these various parts of the curriculum.

But when you step back and look at the larger picture, the perspective changes dramatically. The real question confronting engineering and technology education today goes beyond how to juggle credit hours. It is a question of how to do teaching and learning in the midst of an era of revolutionary new technology and how to fulfill the new demands that a

fast-paced economy is making of us. The concept of the educational ivory tower is no longer a nostalgic ideal, it is a relict of a past we will not see again. To be relevant, engineering education has to think in terms of life-long learning, its role in economic development, and how to work with other disciplines to address the problems and opportunities society faces.

That larger picture is reflected in the theme of this annual meeting: "The Knowledge Triangle: Partnerships in Education." And the year 2000 is a good time to stop and consider the relationship between higher education, private industry, and government. Our well-being as a society in the coming century depends on strengthening the partnerships in the knowledge triangle. But at the same time, life has changed for the three partners that make up the triangle and for their relationships with each other.

During the course of my career I have had the opportunity to live and work in Silicon Valley, the Research Triangle Park, and Seattle. All of these locations have vibrant high-tech economies, and while there are some differences in why they are successful, the common factor in each case is the presence of strong research universities that reach out to the community. Such institutions are the source of research, of talented graduates and

knowledge workers, and of innovation, which today are the drivers of our economy.

As we enter the 21st century, the nature of the economic development process has changed dramatically. During the 20th century, research universities fattened their calves on federal research, and where some luck prevailed, spun out a few research ideas that were developed into products for our economy. But too many research universities still stood apart from society and did not participate in the development of economic strategy. Even today, the average research university does less than 10% of their research volume with private industry.

Too many states also blissfully ignored their research universities assuming that research was something that was the responsibility of the federal government. Economic development, particularly here in the South, followed a simple formula that did not include research universities. They sought to attract companies from other states or countries by offering simple, bottom-line inducements – tax breaks, freeports, subsidies, and site-specific incentives like water and sewer lines, access road and rail sidings. The goal

of this policy was to attract "big industry," and while it had its merits, it was based on a premise whose time is now past.

Economic development now requires that we pay as much attention to **growing** companies as to **attracting** them. And this is a continuous process, not stop and start. This calls for a robust sources of innovation and idea creation, talent, and cability to move ideas from the laboratory to the market place.

After all, Silicon Valley did not attract Hewlett Packard or Cisco with government-funded inducements. It home-grew the ideas, moved them to the market and peopled the talent needs for them. Seattle did not bring Microsoft in from some other location or just find the people needed for this remarkable success story. The company developed and grew there. To compete successfully in the economic world of this new century, a region must be capable of growing a company like HP, Cisco, or Microsoft.

Economic development by this definition is much more complicated, and the old style of economic development, support for research and relationships with research universities are not adequate anymore. What now drives the

best of industry is innovation, talent, and economic alliances between federal government, state government, universities and private industry. We are surrounded by a knowledge-based economy that rewards quality education – for individuals, for businesses, and for communities. The place with the best ideas, the largest supply of talent, and the conditions that produce alignment between government, universities and industry, have the key ingredients to grow or attract any business, large or small.

But we have a long way to go just in terms of the need for a skilled technological workforce. The National Council on Competitiveness says that the United States now ranks 10th in the world in its percentage of 24-year-olds who hold science or engineering degrees. During the 90s, the percentage of growth-company CEOs who report the lack of skilled workers as their top barrier to growth has increased from one-third to two-thirds.

Beyond talent, another key to innovation is funding for research and development, and once again the landscape has changed. Following World War II, the federal government began to invest seriously in R&D, and it was the principal source of funding until the early 1990s. In the heyday of defense research, the federal government was providing 70 percent of

national R&D funding. Today the federal government supplies just over 30 percent. Today, federal funding for R&D has fallen below 1 percent of the Gross National Product, its lowest level since the 1950s.

Much of the slowing of federal support for R&D can be attributed to the end of the Cold War. Without an enemy to motivate us, only health problems are a sure thing, and the National Institute of Health has tripled its research budget over the past decade. At the same time, the budget for the NSF held about constant and research funds for the Department of Defense declined. This approach will not work in the long run, since NIH research is dependent on that of basic science and engineering.

The decrease in federal funding for research comes at a time when industry's demand for research is increasing. And to industry's credit they are putting more into research, but much of the funding is directed to short term issues such as increasing productivity or moving a particular product to market, rather that developing the next product for the market.

Large and dangerous gaps have developed in our research and development infrastructure, both in terms of the amount of funding for engineering

research and the balance in where it is being applied. Blame for the present circumstances can be spread liberally and our universities have their share to accept. We have not done what we should have to justify the relevance of our research, or shaped our work to benefit our local stakeholders.

A powerful antidote to reverse the trends I have noted is by building coalitions with state government, industry, universities and the federal government. To this list I would add another element I believe is worthy of consideration, and that is local chambers of commerce and technological associations. This latter component helps bring the outcomes of the work done to the local level and generates support from those closest to the university.

We have been working on building those alliances in Georgia, and I want to tell you about a few of them this morning. The largest and oldest is the state-based Georgia Research Alliance, which was created a decade ago. This three-way partnership brings together key elements of the Knowledge Triangle. It includes Georgia's six research universities, both public and private, state government, and three high-tech industries – advanced communications, biotechnology, and environmental science and technology.

These industries were targeted at the outset because of their tremendous potential for future growth and because Georgia already had a foundation of university expertise and private industry to build on.

The goal of the Georgia Research Alliance is high-end and strategic economic development – funding, promoting, and coordinating university research and innovation that helps generate start-up companies as well as attract high-tech companies. To date the Research Alliance represents an investment of about a billion dollars. About $300 million has come from state government, which was used as seed money to attract federal and corporate investment. The state puts up the first half of the money needed to create endowments for research chairs at the six universities, providing leverage to raise matching private funds. This allows recruitment internationally known scholars to hold the chairs, and they help us capture research funding, attract top-quality graduate students, lure high-tech companies and spin off new start-up companies. Beyond endowed chairs, the state investment also provides equipment and even labs and buildings, which are important assets in attracting well-known scholars.

A recent development in the evolution of the Georgia Research Alliance was the creation of a focused initiative within its telecommunications mission to propel Georgia into the forefront of the creation of new broadband technologies. Named the Yamacraw Initiative, this effort involves the hiring ninety new faculty in eight of the University System of Georgia universities in computer science, computer engineering, and electrical engineering to help produce the manpower needed. It also provides targeted support for continuing education, research funding and venture capital in broadband technologies, while funding marketing efforts to grow and attract new businesses in this area. To date, about forty five faculty have been hired, and ten companies have made commitments to that will create upwards of 1700 new jobs.

The Research Alliance and its universities work closely with Georgia's Department in Industry, Trade and Tourism in helping attract companies to Georgia that match up with the focus areas of the Alliance. This often leads to direct support by the Governor, creating a working network where all parties are teaming to a common end, and building bonds for the future.

Beyond attracting companies, we also grow companies, something that is the job of the Advanced Technology Development Center, or ATDC, which was created 20 years ago as the nation's first university-based technology business incubator, and it was recently cited as the best in the nation. The Advanced Technology Development Center operates three high-tech incubators in Atlanta, one in central Georgia, and we will soon have one in Savannah on the coast.

The ATDC helps researchers harden their ideas into marketable products, assists with management and marketing, and incubates start-up companies in its facilities.

ATDC also helps "landing parties," which come from larger corporations that are spinning off a new, high-tech subsidiary. When corporations are looking for locations for these new spin-offs, the services of ATDC make Georgia a very attractive place to put them.

Since its creation in 1980, ATDC has incubated more than 110 companies and graduated more than 70. Last spring a record 19 new

graduates were recognized. Together these 19 young companies attracted more than $300 million in investment from venture capital, mergers and acquisitions.

The newest ATDC incubator is at a facility that represents another partnership. EmTech Bio is a commercial research and development center for biotechnology formed and administered jointly by Georgia Tech and Emory University, and is just one piece of the close working partnership that exists between the two universities. It is partnership that allows Georgia Tech, which has an engineering college but no medical school, and Emory University, which has a medical school but no engineering program, to be leaders in the emerging field of biomedical engineering and biotechnology.

In addition to incubating start-up biotech companies, Georgia Tech and Emory also conduct joint research and participate in a joint alliance in running the National Center of Excellence for the Engineering of Living Tissues, funded by the National Science Foundation. And we educate students in a joint academic

department of bioengineering, which is a rare occurrence between a public and a private university, but an example of an alliance that works for both parties as well as the state of Georgia.

Our efforts at economic development in the Atlanta area have also found a vigorous ally in the form of the Metro Atlanta Chamber of Commerce. Three years ago, under the leadership of President Sam Williams, the Metro Chamber undertook a strategic planning process in which they included a number of university presidents. The result was a new approach to economic development that focused on quality of life issues and quality growth. The quality growth effort was termed the Industries of the Mind initiative, and it focused on attracting industries in areas that had strong parallels to those of the Georgia Research Alliance. After two years of preparation, this initiative is in the implementation phase. It has targeted over 200 high tech companies that would be likely to located part or all of their operations in Atlanta. It also is unique it that it relys on the universities to help inform the companies about hiring their graduates and of research opportunities. The IOM initiative further

is using a sophisticated information campaign to attract talented engineers and scientists from other areas to Atlanta, recognizing that companies will come to the place where the talent lies. To date, the IOM effort has attracted 30 companies and about 6000 jobs, and the implementation phase has just begun.

road alignments

The partnerships that have been developed in Atlanta and Georgia with the research universities are having a profound effect on the economic development of the city and the state. Twenty years ago, wages in Georgia were well below the national average, but today they are equal to it, and in Atlanta, well above it. This past year Atlanta had a job growth rate of 106,000 jobs, the highest in the nation, and it is predicted that Atlanta will continue to be a national leader in job production for the coming decade. Already this year, $1.2 billion in venture capital has been invested in new companies, more than that invested all of last year. Not surprisingly, Atlanta is now listed as a top five city for high tech jobs and companies, and this recognition has come only in the last decade.

So it is no accident we believe in the power of alliances. They work where they are based on a platform for research innovation that will drive leading-edge technology, and a skilled workforce. ~~Universities are the source of both of these tools~~. In such alliances it is important ~~to~~ respect ~~the~~ nuances of the relationships between the partners. Rigid planning or too strong a position for any one partner can upset the dynamics needed for success.

~~But~~ beyond the power of ~~the~~ alliances in economic development, are tangential benefits for the university in good will that develops with the local stakeholders. Added to this is the wonderful opportunity provided to ~~our~~ faculty and students to get involved with the entrepreneurial business world and to become more practice-oriented. And if we step forward to fully engage in these opportunities, the value of our universities to the world and the importance of our contribution will be restored and renewed.