"Creative Disruption"
2005 State of the Institute Address
Georgia Tech President G. Wayne Clough
October 11, 2005

I'm pleased to have this opportunity to report to you on the state of the Institute, and I want to thank you for providing an occasion for us to reflect on Georgia Tech's progress and think ahead to the opportunities and challenges that lie before us in the coming year and beyond. I hope that all of you have received a copy of this brochure, and that you will take a few minutes to read it. It provides a much fuller accounting of the accomplishments of the past year than I will have time for in this talk.

In what is a sign of our times, a few weeks ago the technology company, Sony Corporation, announced plans to cut 10,000 jobs and restructure the company in response to an expected loss of $90 million this year. It will be Sony's first annual loss in more than a decade. Sony's difficulties are an expression of a phenomenon that was described in the early part of the 20th century by the Austrian economist Joseph Schumpeter as "creative destruction." Schumpeter said that creative destruction occurs when a new generation of technology moves into the mainstream, competes with, and eventually overshadows and replaces its predecessor technology.

More recently some have modified Schumpeter's term from "creative destruction" to "creative disruption." The change better fits today's economy because it recognizes that the scrapping of old technologies for new ones is no longer an occasional event, but has become a constant. It is my choice for the title of this year's State of the Institute address because it is a force to be reckoned with, particularly in the technology space. Despite having disruptive side effects, creativity and innovation have become the driving economic forces of the 21st century. Without question as we pursue our goal to define the university of the 21st century, we must be an innovator and drive change. But we also must recognize and manage the disruption side and even turn it to our advantage – so that we are not engaged just in destruction, but rather in building a better world and educating our students for it.

Technology is born to be disrupted, and the process of creative disruption is as old as technology itself. Electric lights displaced gas lights. The telephone displaced the telegraph. Diesel engines displaced steam boats and locomotives. But the process used to be slow with long periods of equilibrium in between. It took 100 years from the time the steam engine was patented in 1698 until it came into commercial use to power trains and ships. Another century elapsed before the diesel engine was invented and 60 years passed before it came into commercial use. Workers could begin and end their careers without seeing any significant changes in the technology they used or made.

In the case of Sony, the new generation of technology is Apple's iPod, which in very short order eclipsed Sony's Walkman and Discman as the portable music source of choice. The first iPod was introduced in 2001, just 22 years after the first Sony Walkman went on sale in 1979. And today, just four years later, Apple has added the nano iPod to compete with the iPod imitators that are flooding the market.

Fifty years ago, Sony was the upstart with a portable transistor radio that drove out of business the traditional American technology companies who relied too long on vacuum tubes as a source of revenue. Sony capitalized on a series of innovations to rise to the top, but it is now in the position of struggling to avoid being eclipsed by new technology from elsewhere.

SLIDE: FORTUNE QUOTE
If we look more broadly at the world today through the lens of creative disruption, the question that comes into focus is whether the United States – which has been the established innovation leader in the world through the 20th century – is about to find itself in the same position as Sony – challenged by ambitious nations who are entering the innovation space with plans to knock off those at the top.

The article from the July 25, 2005 issue of *Fortune* magazine that is quoted on the slide, joined a chorus of growing concern noting that a few years back China and India began to exceed the United States in graduating engineers, and that they are now accelerating past us as our numbers remain largely stagnant. In an increasingly technological world this should be a cause for concern, and is in fact only one of a large number of warning signs pointing to the need for our nation to re-invigorate its ability to compete.

SLIDE: CAN WE COMPETE + CISCO QUOTE
Although we are feeling the heat of creative disruption in this country as we see jobs previously thought a staple disappear due to competitive pressures, automation, and offshoring, the opposite side of the equation is creation of jobs through new business start ups. This is something the United States has done better than any other nation for a long time. Here at Georgia Tech our new approaches to commercialization are accelerating our ability to create new start ups and in the last two years our research and incubator programs helped spawn a remarkable 24 new companies. Each of these has the potential to grow into the next technology giant. The question is, can our nation replicate this type of success into the future? Does it have the right pieces in place to keep its innovation enterprise in high gear? Do we have a strategy to moderate the disruptive side of all of the innovation to help stabilize the societal impacts?

The National Innovation Initiative of the U.S. Council on Competitiveness has as its goal to address these issues and to develop and implement a plan that will allow us to be successful. Last year we held a national summit and issued a widely read report, and we have now kicked off a three year implementation effort. Georgia Tech has been leader in this initiative, and on October 31, we will host the first of a series of regional Innovation Summits focusing on how local economies can adapt to the forces of globalization.

Georgia Tech itself is not immune from the forces that challenge our nation, and we are increasingly competing on a global stage. With technology progressively driving the world, our role becomes ever more important, but this does not automatically guarantee our leadership. Only if we are willing to adapt to the new circumstances and educate our students to compete in a global context within the forces of creative disruption will we fulfill our potential. We need to become a university that not only drives innovation, but is innovative in itself. I know some will say that combining "innovative" with "university" is an oxymoron. But I believe this is not pre-ordained to be the case and would argue that Georgia Tech is on the road to proving the counter point. If you look around Georgia Tech at our transportation systems, our energy systems, our business operations, the new buildings we are constructing, our commitment to sustainability, and our global partnerships, you will see signs in all instances of innovation. I do not have time in these remarks to cover all of the work going on here to create an innovative university, but I would like to speak to a few examples that illustrate our intentions and to comment on what all of this means.

SLIDE: EDUCATING INNOVATORS
Education is at the heart of our mission, and the obvious place to begin is with the educational experience we offer our students. How can we prepare our graduates not only to thrive in the innovation economy, but also to be sensitive to the human and environmental impacts of innovation and to manage the disruption it causes? How can we prepare them to be lifelong learners, comfortable with the notion that their careers will likely change course several times along the way? How can we prepare them to be citizens of the world who understand the global dynamics of our economy?

SLIDE: RIGHT STUDENTS
It begins with the right students. When I think about the best engineers I know, they are not necessarily the ones who were 4.0 students in college, but they are individuals who are comfortable with change and can assimilate information and ideas across disciplines while communicating them well. What it comes down to is that there are different wellsprings for creativity and some don't directly correlate to SAT scores. Recognizing this, about six years ago we broadened our admissions criteria be more inclusive of what it takes to be successful in the world ahead.

Building on this idea, we have sought to enrich the undergraduate educational experience to encourage intellectual growth and provide alternative options for learning. We began with the fiber-optic computer networks installed for the 1996 Olympics, which enabled us to launch a new computer initiative. Today virtually every course Georgia Tech offers is web enhanced.

In 2000, we launched Georgia Tech's Undergraduate Initiative, a multi-faceted effort to improve our students' chances of success and to help them grow as individuals. Our faculty responded with the concept of mid-term grades and follow-up advising to help those students who are having problems. The innovative Library West Commons project, designed with the help of our students, offered a new approach to team-based learning, and students responded by more than doubling visits to the Library. A more strategic approach was taken to GT 1000 which helps

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prepare new freshmen for success at Tech, and the Colleges of Computing and Sciences, and the Ivan Allen College have overhauled the core courses all of our students take.

Working with our students, we also created more opportunities for undergraduate research and study abroad to help them to better understand the world in which they will live and work, and to become more personally engaged with the faculty outside the classroom. Students responded to the opportunities, and participation in these options quadrupled. Impressive progress, yes, but there is more to come as these programs are refined, new options like those to study leadership are added, and a much enhanced summer school program is unveiled.

SLIDE: INTERDISCIPLINARY MAJORS
Change is also bubbling up from within as our faculty develop interesting academic offerings that combine knowledge and skills across the disciplines. We now offer more than a dozen interdisciplinary degrees and programs, most of them arriving during the past few years. The last four on the list are the most recent and deserve comment.

SLIDE: GLOBAL TEAM EMBA
This fall the College of Management expanded Georgia Tech's list of professional degrees by enrolling its first class of students in the new Global Team Executive MBA. This unique program is a partnership between Georgia Tech and universities in Nancy, France, and Buenos Aires, Argentina. Students in the program are based at Georgia Tech's College of Management, and over the course of the program they have a two-week residency at each of the other two campuses where, in addition to classes, they visit companies, attend cultural events, and work together with international MBA students.

SLIDE: NANO
In addition to new majors, Georgia Tech certificate programs offer exciting cutting edge opportunities that are available to all students. Students from any major can take a 12-credit-hour Nanoscience and Nanotechnology Certificate Program, strengthening and broadening their science background and becoming knowledgeable in this emerging field which will eventually touch virtually every aspect of human life.

SLIDE: UNDERGRADUATE RESEARCH
As I mentioned a moment ago, we have deliberately worked over the past several years to deepen the undergraduate experience and we estimate that about 40 percent of today's student body will have engaged in research by the time they graduate. This year we moved to the next level with the Undergraduate Research Option, which began this semester. This is an intensive program that students carry out over the course of their academic career and results in a special designation on their academic transcript.

SLIDE: INTERNATIONAL PLAN
With 882 students studying abroad last year, we have now reached the point where a third of our undergraduates have had an international educational experience by the time they graduate, a stunning rate particularly given our technological nature. This year we began the International Plan, which takes the concept of study abroad to the next level. With this program in place, we

are hoping to achieve our long-term goal of 50 percent of our undergraduates participating in some form of study abroad.

SLIDE: HUMAN NEEDS

As our study abroad programs have become more mature, the range and impact of the experiences have deepened. In Angola students joined faculty to survey and discuss the immense infrastructure and environmental problems caused by thirty years of war. In Honduras, students walked the streets of a rural community, determining the best path for a new water line. In an Ecuadorian canton where population is expected to triple over the next three decades, students and faculty in urban design are helping to plan for orderly growth and the provision of services.

SLIDE: ALUMNI

It is apparent from the academic enrichment initiatives I have described that we are in the midst of an innovation cycle that is bringing new educational opportunities to our students, but are there clear impacts that we can point to? One answer to this question came when we recently surveyed alumni who had graduated between 1998 and 2001. Of this cadre of graduates, almost a quarter had participated in structured research as undergraduates, and one in five had participated in study abroad. Importantly, many explicitly gave credit to these experiences for their ability to do well in their careers, to adapt to the changes they experienced, and to prepare for the next stage in their lives.

SLIDE: SCHOLARSHIPS

Further proof of the impact of these improvements to the undergraduate experience is seen in rising retention and graduation rates. Our first-year retention rate, which had been hovering around 85 percent throughout the 1990s, is now up to 92 percent. Our six-year graduation rate, which was hovering in the mid-60s a decade ago, is now at 76 percent and headed upwards.

And whereas our students were once locked out of prestigious scholarship competitions, this is no longer the case. We have some of the nation's most exceptional young people on our campus and our educational opportunities open the doors for them to compete with anyone.

SLIDE: ATHLETICS

Speaking of competing, some of our exceptional students find an outlet for their talents on the playing fields of athletics and their level of skills is also among the best in the nation. Many of us vicariously experience the thrill of victory and the agony of defeat as fans, but regardless of the outcome, we take pride in the performance of our student athletes. We also expect our student-athletes to succeed academically, and it is notable that six Tech teams achieved perfect scores in the first ever NCAA Academic Progress Rate Report.

SLIDE: STUDENT LIFE

Sports are only one aspect of providing a well-rounded college life. Another critical lesson for our students to learn is the value of their participation in community service. More will come from our efforts as we are mobilizing our technological resources to help in the rebuilding of New Orleans and environs.

SLIDE: DRIVING INNOVATION

It is a given that a great research university is a place where faculty will create new knowledge, and this is true of Georgia Tech. We are renowned for our work in traditional disciplines and fundamental research, and this is as it should be. But a growing trademark is our ability to conduct cutting-edge interdisciplinary research and teaching. We know this is true because new faculty often cite this as a reason they were attracted to our campus. We attempt to enable interdisciplinary research by developing a leading view on what will be the strategic research thrusts of the future.

How does this happen? Although it might seem odd on some campuses, here at Georgia Tech we ask our faculty. After all, they are among the smartest people around. Our Provost, Dr. Chameau, and his partner in crime, Dr. Liotta, have found the best way to stir things up is to bring together our best minds from a divergent set of fields for "blue sky" sessions to discuss emerging issues. These discussions between experts of different fields often spark ideas that we in the administration use as a basis to set a strategy for future investment and to bring together the talent required for an initiative.

But this is not only way new ideas for interdisciplinary research pop up. In other cases, a target of opportunity arises that fits so well within our innovative "wheelhouse" that it is too good to pass up. Georgia Tech is unique in having both a traditional academic research capability and the Georgia Tech Research Institute, which in combination give us a unique ability to tackle both long term and short term research in a way not available to other universities. Let's consider a few examples of these approaches.

SLIDE: EXCEPTIONAL FACULTY

But first, I mentioned our exceptional faculty, and Georgia Tech is blessed in this regard. I would like to say congratulations to those recognized this past year. The saying that "good things come in threes" certainly held for Georgia Tech last year as faculty received an unprecedented three PECASE Awards, three Sloan Awards, and three Fulbrights.

SLIDE: CAREER AWARDS

Five faculty also received NSF CAREER Awards, including one in public policy in the Ivan Allen College, which is very unusual because these awards mostly go to science and engineering faculty. Former Georgia Senator Sam Nunn, who is a member of the Ivan Allen College faculty, received the Benjamin Franklin Medal for Distinguished Public Service, which is given only occasionally – not necessarily every year, but when the American Philosophical Society decides it has a worthy recipient. He joins such luminaries as retiring Supreme Court Justice Sandra Day O'Connor and Nelson Mandela.

And of course we are very proud to see Georgia Tech's women faculty being recognized for their role in inventing the products of the future. It is faculty like these who make our campus an exciting place to be.

SLIDE: NANOMEDICINE

Not long ago, our faculty informed us of the growing importance of a new area, nanoscience and nanotechnology. We agreed, and followed up with investments in people and facilities. Today

more than 100 faculty are involved with nanotechnology research in the materials area alone. Within this rapidly evolving landscape, our unique partnership with Emory University has allowed us to move to the forefront in the application of nanoscience and nanotechnology to medicine. Emory and Georgia Tech faculty have pioneered the development of nanoparticles that can identify cells that are cancerous, or cells that will produce plaque that can lead to heart disease. Advanced versions of these nanoparticles can even carry with them chemical and biologic payloads to kill cancer cells or restrain the development of heart disease, a concept with enormous implications for disease prevention and cure.

After receiving three major grants in this area, last week a team led by Jonathan Simons and Shuming Nie was awarded a $19 million National Center of Cancer Nanotechnology Excellence by the National Cancer Institute. Only seven such awards were made nationally, and this represents a major step in national recognition of the remarkable progress that has been made by our research programs in nanomedicine.

SLIDE: HEALTH SYSTEMS
Advances in molecular medicine will call for a new generation of health information systems, and Georgia Tech is one of only a handful of universities that has chosen to move quickly to fill the need for new technology in this space. More than just to enable use of molecular medicine, our researchers see new health information systems as an engine that will integrate critical information about patients, improve efficiency, reduce costs, and provide improved service to patients. Anyone who has had an encounter with health care in the United States, and that includes virtually all of us, realizes the importance of this effort. From the daunting prospect of an outbreak of contagious disease to the lack of information sharing among multiple doctors seeing the same patient – if ever there was a system in need of engineering, it is health care. This is an emerging field which will receive increasing emphasis and prominence in Georgia Tech's future.

SLIDE: HIGH PERFORMANCE COMPUTING
Another new research thrust for Georgia Tech is high performance computing – one we missed the first time around. Fortunately, there are second acts in life. High performance computing is making a comeback, but in a different way than before. And this time, given the opportunities posed within areas like nanotechnology, molecular medicine, advanced combustion, and climate change, we are going to be present and accounted for. Earlier this year, the College of Computing unveiled three new supercomputer clusters which can be joined into a single 448-node supercomputer than ranks among the world's 100 fastest computers.

The supercomputer clusters will also serve the College of Computing's new Computational Science and Engineering Division, which has a major emphasis on computational biology. Georgia Tech has added several exceptional new faculty in this strategically important area.

SLIDE: MANAGING DISRUPTION
The activities mentioned to this point represent initiatives that required an infusion of new assets and a shift in directions. But our world also faces major disruptions that present themselves as targets of opportunity for our existing strengths. Not surprisingly, these often are well matched to

the power created by combining the resources found in our academic faculty and those of the Georgia Tech Research Institute.

SLIDE: ENERGY
Energy is a "new-old" topic that is growing so important it is beginning to dictate our national economic and strategic policy. It represents an opportunity that fits the strengths of both our academic side and GTRI. The urgency of the issues and their importance to our nation, convinced us it was time to form a Strategic Energy Initiative that will focus on alternative energy sources. We will explore the possibilities to be found in solar cells made of organic materials, micro-generators for small electronics, fuel cells based on new developments in nanotechnology, and even wind energy farms off the coast of Savannah. The initiative has already attracted significant attention from the Department of Energy and from major utilities.

SLIDE: ULTRA AP
Sometimes timing is the thing itself. The devastating losses created by roadside bombs in the Iraq War demonstrated with numbing effectiveness the vulnerability of traditional military vehicles like humvees and Bradleys. A little over one year ago the Marine Corps recognized the futility of trying to adapt the present vehicles to meet the challenge and asked GTRI to develop an entirely new approach to personal troop transport vehicles. GTRI took the innovative high road and partnered with Ford Motor Company and NASCAR, yes, NASCAR, to develop the ULTRA-AP – AP meaning armored patrol – a remarkable new vehicle concept. It provides better protection from blast ballistics, and from roll-overs using NASCAR driver protection concepts. And it uses on-board computers to integrate steering, suspension, and brakes, providing a higher level of mobility and safety. ULTRA is now under testing and interest is being expressed in it by the Army as well.

SLIDE: BUILDING GLOBAL PARTNERSHIPS
So we have seen innovation at work at Georgia Tech through our academic and research programs, but what we can do by ourselves is not enough to make us a leader. We have historically recognized that partnerships can build strength and leverage our capabilities. Thus, we have our long standing dual degree programs with Morehouse and Spelman Colleges, which have conferred engineering degrees to more than 1,000 students. Working with Emory University we have created a partnership between public and private universities that is second to none in terms of its potency. But today I would like to speak to the global dimensions of our partnerships, since it is here that the potential impact of creative disruption are today the largest.

A few months ago, I had a chance to talk with alumnus Craig Mundie, senior vice president at Microsoft. And he said he doesn't think of Microsoft as a "multi-national" company anymore, but rather a "global" company. What is the difference? A multi-national corporation has a home base in one country and does not adjust its business model or products to fit local conditions. By contrast, in India Microsoft markets programs in 15 different dialects of Hindi, and Microsoft's fastest growing R&D facility is not in Seattle but in Beijing, China.

We are used to thinking of multi-national corporations as big American companies with foreign branches or subsidiaries. But the "global" companies that increasingly characterize the world economy today are more likely to be based on partnerships and alliances. And we are building on

that model at Georgia Tech with the intent of becoming one of the world's truly global universities.

SLIDE: INTERNATIONAL PARTNERS
We established Georgia Tech Lorraine in Metz, France, in 1990 in conjunction with the local government there. Over the past 15 years, this program has grown, and developed its own partnerships with other European universities and businesses. It has been cited in numerous European publications as a model for others to emulate. Next came the creation of The Logistics Institute–Asia in Singapore – a partnership with the National University of Singapore. We now offer joint master's degrees in international logistics with the National University of Singapore, and are in the process of expanding this research and education platform.

More recently, we have developed dual degree partnerships with the Technical University of Munich and with the Technical Institute of Monterrey in Mexico. We continue to add to this list, and in December of this year I will travel to China with a Georgia Tech delegation to sign a dual degree agreement with Shanghai Jiao Tong University. We are also exploring dual degrees with Peking University in Beijing, China.

These international academic partnerships are more difficult to manage than the ones right next door in Atlanta because of the distance and the cultural, legal, and language difficulties that must be negotiated. But they play a critical role in helping to make us a truly international university.

SLIDE: RESEARCH PARTNERS
Many of our more substantial international partnerships begin with the work of individual Georgia Tech faculty who collaborate with colleagues around the globe on research projects. The ones you see on this slide are just a tiny sampling from an expanding world-wide web of relationships and research contracts that have been awarded to collaborative partnerships involving Georgia Tech faculty and faculty at other universities near and far. To facilitate their work, Georgia Tech became a founding partner National Lambda Rail Inc., a powerful computer network devoted to research.

SLIDE: CORPORATE PARTNERS
Being a global university is a two-way street. It means that we reach out to others and develop partnerships that span the globe. But it also means that others from around the world reach out to us and come here to Atlanta to develop partnerships with us.

Technology Square and Technology Enterprise Park, which will soon be under construction along North Avenue close to our North Avenue Research Area, allow us to provide opportunities to international partners who want to locate close to our campus. Recently Samsung, which is a South Korean company, and Pirelli, which is an Italian company, announced that they are locating R&D units in our expanding space at Technology Square. Samsung has cut the ribbon on its new radio frequency integrated circuit design center, and Pirelli will move their North American broadband headquarters here.

These two companies are just the leading edge of a growing number of first-class corporate research and development operations with a global reach that want to move here to be close to Georgia Tech.

SLIDE: CREATING INNOVATIVE SPACES
So far I have illustrated Georgia Tech's innovative nature as it relates to our work, but I would like to leave you with one more idea. There is a Chinese proverb that says, "Talent counts 30 percent; appearance counts 70." So it is that we seek to use our appearance to demonstrate our intentions. While the new generation of buildings we are completing is the central component of this effort, there is more to it, and it is this "more" that will serve to complete the case I am making about our ability to thrive in a time of creative disruption and become a leading university defined by innovation.

SLIDE: IMPROVED SPACES
Beyond the buildings and structures, a campus is shaped by the land and space that give it form. For many a year, concern for the land and open space on the Georgia Tech campus was a lost concept, but it is necessary to embrace it if we are to harmonize our intent to be at the cutting edge of things in our work, with our respect for the environment and the need to demonstrate our aspirations to lead in sustainability. Our objective is to shape our outdoor spaces so that their calm beauty provides a counter-balance to the creative intensities in our labs and classrooms. It is our hope that these spaces will create informal meeting areas where creative minds can meet and exchange views.

As seen on our website, our updated Master Plan presents the concept we are pursuing in detail. The plan is subtle and will take years to develop in full, but it is important to appreciate the steps taken along the way.

SLIDE: 5TH ST BRIDGE
On your way to the Global Learning and Conference Center, you probably noticed that work is progressing on the new Fifth Street Bridge and Park. On the screen is the view you will see on your way back across the bridge. We have made streetscape improvements to this emerging gateway to campus, including the first phases of undergrounding all of the wires on campus. And, of course, rising in the distance is the impressive form of the new Klaus Advanced Computing Building.

SLIDE: KLAUS
The Klaus Building is the site of a new, carefully designed open area that not only will be beautiful to look at, but will also capture the rain that falls so it can be reused on the site. The asphalt parking lot that was once there will soon be a long lost memory.

SLIDE: BIOTECH COMPLEX
The new quadrangle in the Biotechnology Complex will take shape shortly as the Molecular Sciences and Engineering Building is completed. A two story dining area and coffee house will be housed in the new building with a view of Midtown, and people will be drawn to this special place on campus.

Finally, think even farther ahead with me to our most ambitious ground plane project – the Eco-Commons. The Eco-Commons will be built around what used to be natural bodies of west-to-east trending water and waterways before the expansion of our campus paved them over many years ago. The Eco-Commons will restore these waterways, but this time they will be carefully engineered as a tool to help us manage our run-off storm water for use in irrigating the campus.

This year Georgia Tech celebrated the 120th anniversary of its founding in 1885. By that measure, we are certainly an old, established institution. According to Schumpeter's model, we ought to have been replaced by the next generation university by now. In fact, business guru Peter Drucker predicted the demise of the traditional university about five or six years ago when online courses were attracting a lot of attention.

But education is not merely about transmitting information, which the Internet does very well. Education is about learning to think, reason, collaborate, create, question, and solve. Research universities are the motherlode of the talent, the discoveries, and the inventions that drive the innovation that is essential to economic success in this rapidly changing world of ours. And we want Georgia Tech to be innovative as well as to drive innovation. Together we are steadily creating the academic programs, research thrusts, and strategic alliances, and designing a new campus that will enable us to address the issues caused by the disruptions of our time. Our goal is to flourish as one of the world's truly global universities, and I want to thank all of you for being part of this endeavor and for joining in our efforts to make it happen.