

“The Growing Global Connectivity of Research Universities”
REMARKS BY DR. G. WAYNE CLOUGH
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It is a great pleasure to be here with you and a high honor to accept an honorary doctorate from Shanghai Jiao Tong University. It is exciting for us to have this opportunity to visit Shanghai, which is China’s gateway to the world. In addition to being China’s largest economic and transportation center, Shanghai has a worldwide reputation as China’s most cultured and cosmopolitan city. And your international status as a leading economic and cultural center has been strengthened during the past 15 years, as Shanghai has become the engine driving China’s economic progress.

With 13 million people, Shanghai is much bigger than our home, Atlanta, but we see many similarities between our two cities. About the same time that Shanghai began to develop from a small village into a port city, the city of Atlanta was taking shape at the intersection of three major rail-lines that connected the east coast of the United States to the grain and livestock region of the Midwest. So both of our cities trace our history as centers of commerce and transportation to a similar timeframe, and we are both centers of logistics in the global economy of today.

As a result, we see many of the same corporate names as we travel around Shanghai on this visit that we see back home in Atlanta. The Coca-Cola Company, GE Energy, BellSouth, and UPS have their international headquarters in Atlanta, and we see them here in Shanghai as well. We are also seeing Georgia Tech connections in the corporate community of Shanghai. Dave Dorman, the CEO of AT&T is a Georgia Tech alumnus. The CEO of WalMart’s international division is also a Georgia Tech graduate. John Portman is a Georgia Tech graduate and prominent Atlanta architect. There is an office of John Portman & Associates here in Shanghai, and we see that he has left his mark on the Shanghai skyline with the Bund Center and the Portman Ritz-Carlton.

Both Shanghai and Atlanta are strengthening their cultural life as well as their commercial activities. Here, the impressive Shanghai Museum and the striking Grand Theater are important new cultural attractions. Back in Atlanta, within the past month we opened the world’s largest aquarium as well as a major expansion of the High Museum of Art.

Our universities also have much in common. Georgia Tech was founded in 1885, just eleven years before Shanghai Jiao Tong University was founded. We are both public universities. You are under the administration of China’s Ministry of Education, while we are under the administration of the Board of Regents of the University System of Georgia. And we are both have a technological orientation. Just like SJTU, Georgia Tech began as an engineering school, and then broadened into other areas.

We are both focused on the future. We are emerging as technological leaders in the new global economy of this new century. This common goal has brought Shanghai Jiao Tong University and the Georgia Institute of Technology together as partners. You have already opened your doors to our students, and the first group of 44 Georgia Tech students arrived last summer for a term of study. Then three months ago, we began the process of developing a dual master's degree program in electrical and computer engineering. We are looking forward to getting to know you better and to working together with you. And we hope our partnership will continue to expand and grow stronger in the future.

China has a rich heritage of invention. Historically, you led the world in developing new technology that ranged from paper to the magnetic compass, from gunpowder to cast iron, from segmental arch bridges to delicate porcelain. Inventions like these not only benefited Chinese society, they also led to a web of ancient trade routes that criss-crossed China and extended into nearby nations like Korea, Vietnam, and Burma. By the end of the first century B.C., international trade had expanded across five contiguous powers that stretched from the Roman Empire in the West to the Han Dynasty in the East. Major trade routes like the Silk Road were well established by the time Marco Polo set out in the year 1271 on his historic journey from Venice, Italy, through Asia to the court of the great emperor Kubla Khan.

So, science and technology and the economic interactions they generate have been international for many centuries. But for a long time, the pace was very slow. Marco Polo took 24 years to travel from Italy through China and back to Venice. By comparison, it took me less than 24 hours to travel from Atlanta to Shanghai, and I will be back home in less than a week.

In Marco Polo's day, the spread of knowledge and ideas was even slower than the pace of travel. He wrote a book about what he had learned on his travels, and on his deathbed he said, "I have only told the half of what I saw." But his stories were so amazing to Europeans that his book was nicknamed "The Million Lies." The new technology that Marco Polo described in his book was not adopted in Europe when he returned, because only a few people actually read his book. The European printing press had not yet been invented, so copies of the book had to be made by hand. Moveable type was already in use in China at the time, but communication was so slow that no one in Europe knew about it.

Prior to the 20th century, poor communication meant that scientists and inventors worked in isolation, without the benefit of exchanging ideas with others who were working on the same ideas. When something new was invented, the news of it was slow to travel. Four thousand years went by between the time when the wheel was invented and when it was put to use in the first wheelbarrow. It took another century to get from the wheelbarrow to the four-wheeled wagon. After the Chinese began using paper, it took 1,000 years until that invention came into use in Europe. The first battery to store electrical energy was invented in 1796, but 50 years later, only a handful of scientists knew that it existed.

Today, information moves around the globe at the speed of light by satellite and fiberoptic cables, and the Internet tells us more than we ever wanted to know. This year we celebrated the 10th anniversary of the commercial Internet, which was launched on April 30, 1995, when the National Science Foundation of the United States opened up access to the computer network that

had been developed by the government together with American universities. Over the course of the past 10 years, 600 billion web-pages have been created – 100 for every living person on Earth.

As communication, transportation, and logistical technologies have grown faster and more powerful, they have been weaving all of us closer together, connecting people all around the world in new and profound ways. Of course, the United States is interested in protecting and furthering its own national interests and promoting its own economic advantage – just as China wants to further its own national interests and promote its own economic advantage. But the economy in which we now function is global, and we need to balance our national interests with our ability to collaborate in a global arena.

Trade has increased dramatically. During the second half of the 20th century, the value of world production increased six-fold, but the value of world exports increased 19-fold. And the global economy never sleeps. IBM squeezes 32 hours of writing Java software into a 24-hour day by relaying the work around the globe in tandem with the time zones, from China to the United States to Latvia to India and round to China again for the start of the next workday. The stock exchanges of nations around the world are increasingly interconnected, so that transactions that can affect all of us are underway somewhere in the world 24 hours a day.

The global economy has also emerged at a time in world history when we are facing unprecedented challenges. Six years ago, the world surpassed 6 billion people. It took all of world history until the early part of the 1800s for the population to reach 1 billion people. The second billion took nearly a century after that. The most recent billion was accomplished in about 12 years. Fortunately, the birth rate has begun to slow, and the next billion is expected to take 14 years instead of 12. But before it peaks, the world population will reach 10 billion people. That is still almost 4 billion more people than are alive today. How will we feed them all? Where will we find enough clean, fresh water? Water tables are falling in China, the United States, and India, which together produce half of the world's food. By the year 2025, 3 billion of the world's people will live in places where fresh water resources have fallen below sustainability levels.

In addition to become more populous, the world is also becoming more industrialized. As a result, we face the dual problems of increasing energy demands and increasing pollution. The United States is the number one importer of fossil fuels, and China is number two. We are both learning that it is no longer practical for any nation to be overly reliant on any one fuel source, and that we must diversify into the use of more renewable energy resources.

Even if the supply of fossil fuels could keep up with demand, the burning of such fuels contributes to air pollution and global warming. Researchers recently drilled out an ice sample from the world's deepest core in Antarctica and found that the levels of carbon dioxide in our atmosphere today are 27 percent greater than at any point in the past 650,000 years. Researchers from Georgia Tech's School of Earth and Atmospheric Sciences did a study five or six years ago in conjunction with NASA and the government of China, and they found that the haze that hangs in the air above China as a result of air pollution was cutting agricultural production by as much as a third by blocking sunlight.

As leading economic powers, China and the United States have had similar environmental experiences, although it has been faster here because of your rapid growth. Both of our countries were busy focusing on economic development. Then one day we looked up and realized that we have been creating environmental problems in the process. This year at SJTU you have created the Centre for Eco-Agriculture, and at Georgia Tech we have the Institute for Sustainable Technology and Development. So this may be another place where our two universities could collaborate in the future to help develop the environmental solutions our nations need.

Over the past several decades, we have also seen the global population grow more urban, and people around the world have migrated to marginal land that is at risk for natural hazards. In the United States, more than a fourth of our population now lives within 50 miles of the coastline, which puts them at greater risk for hurricane damage. Here in China, your population is also concentrated along the coast in the east, which faces the threat of damage from typhoons.

For the United States, the past 10 years have been the most active hurricane period in our history, and the hurricane season that just ended was the worst in recorded history in terms of both the number of storms, and the devastation they caused. Hurricane Katrina alone resulted in 1,300 deaths and caused billions of dollars worth of property damage, and that was just one of four major hurricanes to hit the United States this year.

Katrina was followed quickly by Hurricane Rita. These two storms were among the most powerful in recorded history, and studies by scientists at Georgia Tech indicate the global warming may have played a role. The oceans of the world are growing warmer, and that in turn contributes to making hurricanes and typhoons around the world more powerful. We need new technology and new approaches to flood control and construction in our coastal areas to help us protect lives and property against the powerful storms of the future, even as we work to reduce the human impact on global warming.

Wind and water do not respect political boundaries – we have air pollution in the upper atmosphere in the United States that traveled all the way across the Pacific from Asia. And Europe is looking at pollution that traveled across the Atlantic from America. So we all will have to work together around the world to meet these environmental challenges.

This new age of global communication, and these new population and environmental challenges increase the importance of research universities to shape the future. Working together we can help solve the common problems our nations face.

Universities are unique in that they are places where openness is valued and where people with differing views and from different countries can sit down and converse with each other and share ideas while working together in the pursuit of knowledge. Political leaders around the world will come and go, relationships between countries will change, philosophies about how governments should operate will shift. But intellectual partnerships between universities can be enduring and weave a fabric of friendship and common goals that focuses on making the world a better place.

Shanghai Jiao Tong University and Georgia Tech share an important common goal, which is to support the economic development goals of our respective regions. As I noted at the beginning of my talk, both Shanghai and Atlanta have a history as centers of commerce and transportation. Our regions are working hard to build on that heritage to achieve success in this new global economy of the 21st century. Our respective universities have an important role to play in those efforts, and we are beginning to collaborate in that task. For example, SJTU and Georgia Tech are the leaders of the Sino-U.S. Global Logistics Institute, which was just formed on October 20.

To stay ahead of the game in the global economy in which they both must compete, our respective regions must become more innovative. Last year I had the privilege of co-chairing the National Innovation Initiative of the U.S. Council on Competitiveness, together with the CEO of IBM, Sam Palmisano. The Council on Competitiveness defines Innovation as I⁵ – or the intersection of five I's: ideas, imagination, invention, insight, and implementation. Innovation begins with research in science and engineering to generate new discoveries and new inventions. But, unlike the scientists and inventors of bygone days who worked in isolation, innovation is a social activity that emerges from conversation and collaboration. This is what provides the ideas and insight that enables discoveries and inventions to be used to solve problems, address the needs of society, meet market demand, and even create new markets.

Research universities generate the new discoveries and new technologies that are the starting point of innovation. The next step is for research universities to encourage the conversations and collaborations that enable faculty and students to piece together their ideas, knowledge, and inventions in unique ways. These conversations and collaborations are often the most productive when they are carried out across the traditional academic disciplines and between faculty and students of different universities. The hotbeds of discovery and innovation today are in fields like nanotechnology, logistics, biotechnology, optics, and photonics, that combine traditional academic disciplines in science and engineering. And they often result from collaboration across national boundaries.

At Georgia Tech, our faculty have research partners in many other nations. Marine biology faculty from Georgia Tech are working with the University of the South Pacific to conserve the coral reefs of Fiji. Public Policy faculty from Georgia Tech are working together with faculty from the Fraunhofer Institute for Systems and Innovation Research in Germany and Sussex University in the United Kingdom to study what factors lead to innovative research. Faculty in Georgia Tech's School of Earth and Atmospheric Sciences are working with researchers from the University of Bremen to study what causes dramatic climate change.

Georgia Tech physicists are part of an international team that is studying the formation of carbon nanotubes. Researchers from Georgia Tech and the Vienna Institute of Technology in Austria developed a system that combines chemical and biological sensors. These are just a few of the many international research teams that include Georgia Tech faculty.

Shanghai Jiao Tong University is also a participant in international research. You recently hosted the 15th International Photovoltaic and Engineering Conference, the 2005 International Forum on Welding Technologies in Energy Engineering, and the 27th International Conference of the IEEE Engineering in Medicine and Biology Society. One of your electrical engineering

professors has been chosen as the first Chinese academic to serve on the editorial boards of two important international journals of the World Scientific and Engineering Academy and Society.

In addition to building international research partnerships, we also need to educate our students to be citizens of the world. They need a higher level of sensitivity to diversity and cultural differences, and a greater ability to work across cultures. They need to understand the differences in the way business is conducted around the world. And both of our universities are achieving this goal.

At Georgia Tech, one third of our students study abroad or do an international internship. As I noted earlier, some of them come here to SJTU. We just began a program this year to give special recognition to students on their diplomas if they complete an international course of study that includes language study, courses in international affairs and economics, two semesters abroad, and a special project that connects their international experiences with their major field of study. We also offer more substantial opportunities to our students. We have our own campus in France – Georgia Tech Lorraine, which serves European students as well as our own. And we have dual degree programs with the Technical University of Munich, the Technical Institute of Monterrey in Mexico, the National University of Singapore, and soon Shanghai Jiao Tong University.

Going the other direction, we welcome many international students to our Atlanta campus. This year we have almost 2,900 international students, which is 17 percent of our enrollment. Four hundred seventy-one of them come from China.

Similarly, SJTU welcomes students from around the world, and sends your students and faculty out to other countries. You were a pioneer in establishing some of China's earliest exchanges in modern times, and today you enroll more than 2,000 international students. Georgia Tech is very proud to be one of several dozen international universities with which you have partnerships.

These experiences will give our students the international perspective they need to be successful citizens of the world.

New York Times writer Thomas Friedman recently wrote a book entitled *The World is Flat: a Brief History of the Twenty-first Century*. It is a best seller in the United States. The title recalls the ancient days of earliest world trade, hundreds of years ago, when it was a common misperception that the world was flat, and anyone who sailed too far out to sea would fall off the edge. Then the 16th century launched an era of global exploration that proved not only that the Earth was round, but also documented the continents it contained. And everyone had to revise their understanding of the world.

As the title of Tom Friedman's book suggests, we are once again at a time in history when we are revising our understanding of the world. When Friedman says today's world is flat, what he is actually describing is the leveling of the global economic playing field. A vast web of information technologies now interconnects the world, and anyone with a computer and Internet access can be an instant player in the global economy. Nations like China and India are investing in research in science and technology and developing world-class research universities. The

research that drives innovation and the skilled workers who can translate it into products and services are increasingly spread around the world rather than concentrated in only a few places. Markets for leading-edge technology and the companies that make it are also increasingly spread around the world rather than concentrated in just a few places.

But I would argue that instead of being flat, the world of the 21st century will be “spiky.” The spikes will be centered in communities that have intellectual capital and world-class research universities that live at the inflection point of change – anticipating it and even driving it. Becoming one of those spikes of innovation will make a community a leader in the global economy and in making the world a better place. At its core, to be focused on innovation is to be engaged in a dynamic search for imaginative new ways to cure disease, to develop new environmentally friendly energy sources, to assure plentiful supplies of fresh water, and to improve the quality of life for all of the people and creatures that inhabit our world.

Those world-class research universities that become truly global by reaching out to each other and collaborating together to drive innovation will become an important force in the world. Georgia Tech aspires to be one of those truly global research universities that are on the leading edge of innovation, and we believe Shanghai Jiao Tong University shares that goal. By joining together in partnership with each other, together we can join those few universities that are truly global and that help to improve the world for the people of all countries.