NOTES FOR GEORGIA TECH PRESIDENT G. WAYNE CLOUGH
The Lovett Upper School Assembly, January 18, 2007

- Pleased to be here; thank Headmaster Billy Peebles for the invitation.

- Over two dozen Lovett alumni among GT undergrads
  - 4 GT freshmen who graduated from Lovett last spring.
  - Want more Lovett students – well prepared – know how to balance AP classes with extracurricular activities; think clearly on only a few hours of sleep

- Mr. Peebles asked me to speak to the role of technology in our lives, a pretty heavy duty topic. Reminds me of the time I was asked by a friend to talk to his 5th grade class about earthquakes…… So if I am getting out of some serious work, and the trade off is that you have to listen to me about technology, it probably works.

- Technology is right in front of you in the form of iPods the Facebook, digital camera, micro-computer in your car that sends your dad e-mail alert when you speed. Of course, technology is involved in your lives in deeper ways than these examples and its role is likely to grow.

- European engineer Juergen Mittelstraus reviewed the evolution of technology over history and coined the term “Leonardo World” to describe where we are today. His theory:
  - Beginning of human history: the natural world dominated human’s daily lives. Most of life consisted of working to find food and build shelter, and hoping for the best given that nature controlled your existence. Life spans were short and life itself was tenuous.
  - Over time, humans used science and technology to allow us to grow beyond the harsh aspects of a life based only on what nature gave us and to create a world where we had the opportunity to control our personal environment to our benefit.
  - Now live inside a vast labyrinth of technology, some of which has its dark side. Need to come to grips with this evolutionary process to insure our planet will survive.

Your generation is coming of age in a time of great challenge and opportunity.

- Challenges:
  - **People**: Took all of history until about 1825 for world population to reach to 1 billion. When I was born in 1941: 2.3 billion. 1960: 3 billion. 2000: 6 billion. UN projection for 2050: 9 billion.
  - **Needs of population**: How to feed, house, incorporate them into the economy?
  - **Fresh water**: Most pressing problem of 21st century. One in 5 people don’t have access to safe drinking water; one in 3 not enough water for proper hygiene. Not just a concern in the less-developed parts of the world – water is a problem even here in Atlanta.
o **Climate change**: Huge ice shelves breaking free in Arctic, Antarctica. Last week: 2006 reported as hottest year in U.S. history. Rhythms of eco-systems disrupted (polar bears losing ice habitat; bird migrations getting out of sync with insect availability) and new weather patterns are emerging. Carbon is being pumped into our atmosphere at a growing rate with the continued reliance on carbon based fuels. Carbon-based fuels not only a problem in global warming, but haze of pollution has other dramatic effects such reducing the crop yield in China by one third because sunlight is obscured.

o **Growing disparity between the haves and the have-nots**: Unfortunately, even have-nots may now have access to weapons of mass destruction. And many countries in the developing world subject to recurring wars do not have access to the basics of life, including water and sanitation.

o **Health epidemics**: Lack of clean water; encroachment on animal habitat – AIDS virus made the jump from apes to humans; bird flu from birds to humans. Modern transportation means disease spreads very quickly.

o **Quickening of the pace of change**: Many technologies that we can take for granted today, are actually quite new. When your parents were your age 25 years ago: No iPods or Blackberries; $4,000 bought a computer with no hard drive, 9-inch monochrome text-only display; clunky walkie-talkie devices instead of cell phones; no digital cameras; no Internet.

  • Looking back in history, we learn that 4,000 years elapsed between invention of wheel, first wheelbarrow; 100 years between patent of steam engine and commercial application in boats and trains. Things moved slowly.
  
  • Reason: Poor communication meant scientists, inventors worked in isolation.
  
  • Today: Internet – can know everything almost instantly. Since commercial Internet began a decade ago – 600 billion web-pages created – 100 for every living person on Earth. Means imitators quickly enter market, much more competitive.

  • Same technology that has picked up the pace of change is also connecting people all around the world into global economy. **Tom Friedman** described what the Internet is doing as “flattening the world” – leveling of global economic playing field

  o Allows emerging nations with large populations (China, India) to compete with United States in our favorite high-tech economic space.
  
  o Not long ago, China and India were known as countries with unskilled, cheap labor. Now China, India focused on developing world-class universities – educating skilled workforce, conducting research. Graduate more engineers scientists than United States.
  
  o Formula that drove U.S. economy over the past 30 years = outstanding research universities + skilled workforce + large high-tech market + leading the pace of technology change. Today others are emulating us, now seeing multinationals put R&D labs, production facilities in China, India to access the talent pool, be close to growing markets.
• On the other side of the ledger from these emerging challenges, tremendous and exciting opportunities are arising.
  o **Environmentally sustainable technology**, infrastructure
  o **Alternative sources of energy**: Biofuels, wind, solar. New forms of nuclear power. New approaches to reduce energy demand such as solid state lighting.
  o **Nanotechnology revolution**: Flexible digital display that roll up like windowshade; tiny nano-devices that can be injected into human body to diagnose and treat disease, correct genetics; building materials lighter than steel, 10 times stronger. The impact of this field is one of the reasons Georgia Tech is building one of the world’s leading edge centers for research into nanotechnology and hiring some of the brightest faculty who work in this area.
  o **Cusp of new age of medicine**: More predictive and customized to each person, less reactive and invasive. Partnership with Emory makes Georgia Tech a major player in this space.
  o **New high speed and miniaturized computing and storage tools**: Georgia Tech and IBM researchers recently developed world’s fastest chip. Headed for Library of Congress on a device the size of a sugar cube.
  o Although we face growing international competition, large markets are opening for our goods and products in the same nations that are competing with us. And it is no wonder we are interested in those markets – if the world’s population in 2025 were reduced to 100 people, 56 will live in Asia. Six will reside in the U.S.

• The question before us is how we will respond to these challenges and opportunities? History gives us insights:
  o Great Britain a century ago: Technological leader of world with telegraph; military leader with Royal Navy. Ruled one-fourth of world’s population, one-fifth of the world’s territory.
  o Arnold Toynbee, a child at the time, remembered: “It was: Well, here we are on the top of the world, and we have arrived at this peak to stay there – forever! There is, of course, a thing called history, but history is something unpleasant that happens to other people.”
  o United States has now replaced Britain; will history now happen to us?

• Future will depend on how well we orchestrate our human, financial, and natural resources. We must out-innovate others since we cannot compete on the basis of low salaries or numbers of workers.
  o Innovation is more than invention of technology. Is the intersection of invention, ideas, insight, imagination, and implementation in the real world.
  o Must not only create new technology, must also put it to new uses in positive, creative ways to solve problems, improve the quality of life, and protect our environment.

• Challenge for Lovett, Georgia Tech: Educate innovators who will succeed and thrive in a global economy where new approaches are the key to achieving success. Educate graduates who will seek solutions to improve the environment while maintaining a strong
standard of living. Help our graduates understand the impacts of their choices and encourage them to learn to choose humanely and well. For Georgia Tech, means that we need to educate engineers, scientists and business people more broadly than in the past. They need to:

- **Understand social impact of technology** – Technology and social change are a double helix – 2 strands inextricably woven together. Environmental issues: need engineers at public policy table. Current policy debate calls for someone to make a sacrifice, and no one wants to volunteer. Engineers can offer technological solutions. Can also help political leaders understand disruptions, problems that technology can cause; address them up front. That is why at Georgia Tech offers a nationally ranked program in public policy both for policy majors and for students in engineering and science.

- **Appreciate the importance of convergence.**
  - E.O Wilson: consilience = the world is a very complex ecosystem underlain by fundamental natural laws that have an impact on every discipline of knowledge and provide connections between them. Need to see relationships, not just each individual branch of knowledge in isolation.
  - E.g. Computing is not only a discipline in its own right, but also a tool with wide variety of applications that should serve to merge fields. At GT: humanities + computing = digital media; music + computing = Haile, the robotic drummer; mapping of human genome + computing = bioinformatics.

- **Be able to work in teams that cross disciplines:** Hot spots for innovation are in spaces between traditional disciplines, fields of study. Eg., systems biology, the foundation for next revolution in medicine, brings together biology, chemistry, computer science, math, physics, and medicine.

- **Have the ability to think critically, creatively:**
  - Define what the problems are rather than simply applying rules, formulae; look at things differently and see what others do not.
  - Link issues creatively – i.e., artists who can think like engineers and vice versa; GT’s Ivan Allen College of Humanities lives at intersection of the arts and humanities with technology.
  - At GT over 40% undergrads engage in open ended research: Wrestle with problems with no foregone solution in the back of the book.
  - Participate in music programs: Did you know GT now has a major in music technology? In any given year, upwards of 2,500 of our students take music courses.

- **Learn to be citizens of the world:**
  - Appreciate history, origins of culture. Understand dynamics of global economy; comfortable with cultural diversity
  - GT: 1/3 undergrads study abroad; have our own campuses in Metz, Singapore; international dual degree agreements with universities in Great Britain, Germany, Mexico, China; international internships; degree programs with international flavor: modern languages + global economics;
modern languages + international affairs; global economics + international affairs.

- Faculty and students undertake projects that assist needy parts of world – helping Angola and Liberia recover from civil war, addressing sanitation in Brazil, water supply in Honduras, and community development in Ecuador.

  o **Become leaders in the best sense of the word.** GT offers a leadership certificate program and have an expanding array of leadership experiences.

- To produce such students, GT must be innovative in the educational experience we offer. So we are:
  
  o **Changing the curriculum:** “Threads” tie computer science theory to practical application in broader world; “roles” envision career opportunities.
  
  o **Offering a rich mix of co-curricular opportunities:** Leadership opportunities, opportunities for creativity (music, one of nation’s most aggressive poetry programs – both sides of brain); study abroad, athletics, concerts.
  
  o **Opening wide range of opportunities for students** who study engineering, science and business. Recent survey of top professional schools (medicine, law, business): GT is one of top suppliers they look to.
  
  o **One of best compliments GT ever got:** Tom Friedman in second edition of *the World is Flat:* Georgia Tech knows how to operate in the flat world.

- Conclusion: Goal of education should be to prepare you to live as a whole person in a world shaped by technology. And guess, what – it is a whole lot more interesting and fun than the old way.

  o Understand technology as tool; know how technology shapes society and how society shapes technology; anticipate, minimize problems technology can cause. Learn how to innovate.
  
  o Be prepared to live as citizen of global economy – at home with cultural diversity, and willing to tackle tough problems that will improve the life of all creatures large and small on this planet of ours.
  
  o Go to college at a place that as Tom Friedman says, “gets it.”