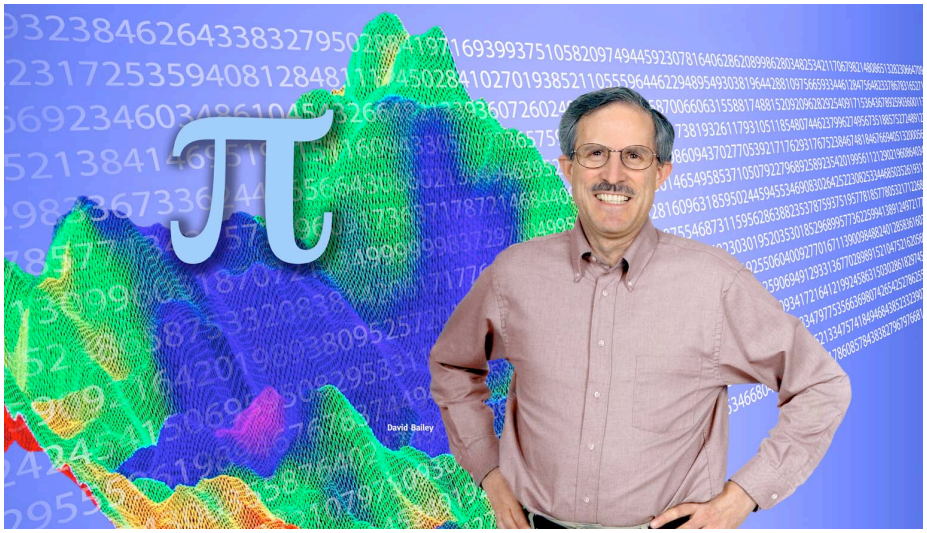
Welcome to the 21st Century: The Uncharted Future Ahead

David H Bailey

Lawrence Berkeley National Laboratory

http://www.dhbailey.com/papers/



Science and Progress

It is not unusual to hear, especially in academic circles, people questioning where mankind is truly progressing. Examples:

- Philosopher Thomas Kuhn (and numerous others) questioned whether science has progressed towards fundamental truth.
- In their "Lessons of History," historians Will and Ariel Durant asked "Is progress real?"
- With the recent economic decline, many feel "the end is near".
- In general, many regard the world as decadent and declining.

But to most scientists and engineers (and certainly to me!), such talk is nonsense – real and substantial progress has been made and continues to be made.

LDS scientists and engineers are generally even more positive about progress, and potential for the future.

A Brief History of the Past 50 Years

- Far more people than in previous decades or centuries have had opportunities for college education.
- Radio and television has brought instant news and entertainment.
- Computers have emerged from large government laboratories, then to businesses and universities, then to homes, and now in our hands.
- The Internet sprang upon us in the last decade of the 20th century, and already a sizable fraction of the U.S. economy is tied to it.
- Advanced pharmaceuticals, vaccinations and medical technologies have banished diseases and premature death from much (although sadly not all) of the world.
- Scientific research continues its relentless advance uncovering the secrets of the natural world – subatomic physics, cosmology, DNA, etc.
- War is now unthinkable among most (but not all) nations, because the global economic system has made armed conflicts among major trading partners unthinkable.

Downsides of Modern Science and Technologies

- Our global high-tech economy has greatly increased overall wealth (GDP is up by a factor of 6.5 in the U.S. since 1950), but millions have been left behind in ignorance and poverty.
- Our high-tech economy has produced trash, pollution as prolifically as it has produced goods and services – our heavy usage of fossil fuels is now threatening our very existence on this planet.
- The Internet has created millions of new jobs, but also it has also enabled epidemics of fraud, computer viruses and pornography – 90% of all email is now "spam."
- Cell phones have facilitated a mobile society and have saved many a marriage, but have also been utilized by terrorists to detonate bombs.
- Some (mostly conservative Protestant) religions have been challenged by the findings of modern science, spawning a major backlash – e.g., recent attempts to replace conventional biology and geology with "creationism" and "intelligent design."

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What Will the Future Hold?

- The current pace of scientific and technological advancement shows no sign of abating, and may even accelerate in coming years.
- Moore's Law (the doubling of computer power every 18 months or so for the past 40 years running) continues apace, even in the current economic downtown.
- With recent developments in "nanotechnology," many experts are predicting Moore's Law will continue for at least another 20-30 years.
- Biotechnology is emerging as a major force – many promising new treatments and technologies are in the works.
- The field of artificial intelligence is making great strides, and intelligent computer systems are destined be a major force in the future.

How many of these terms do you understand?

Blog, Facebook, JPEG, MP3, GPS, 3G, Ethernet, multicore, terabyte, podcast, nanotube, stem cell, telomere.

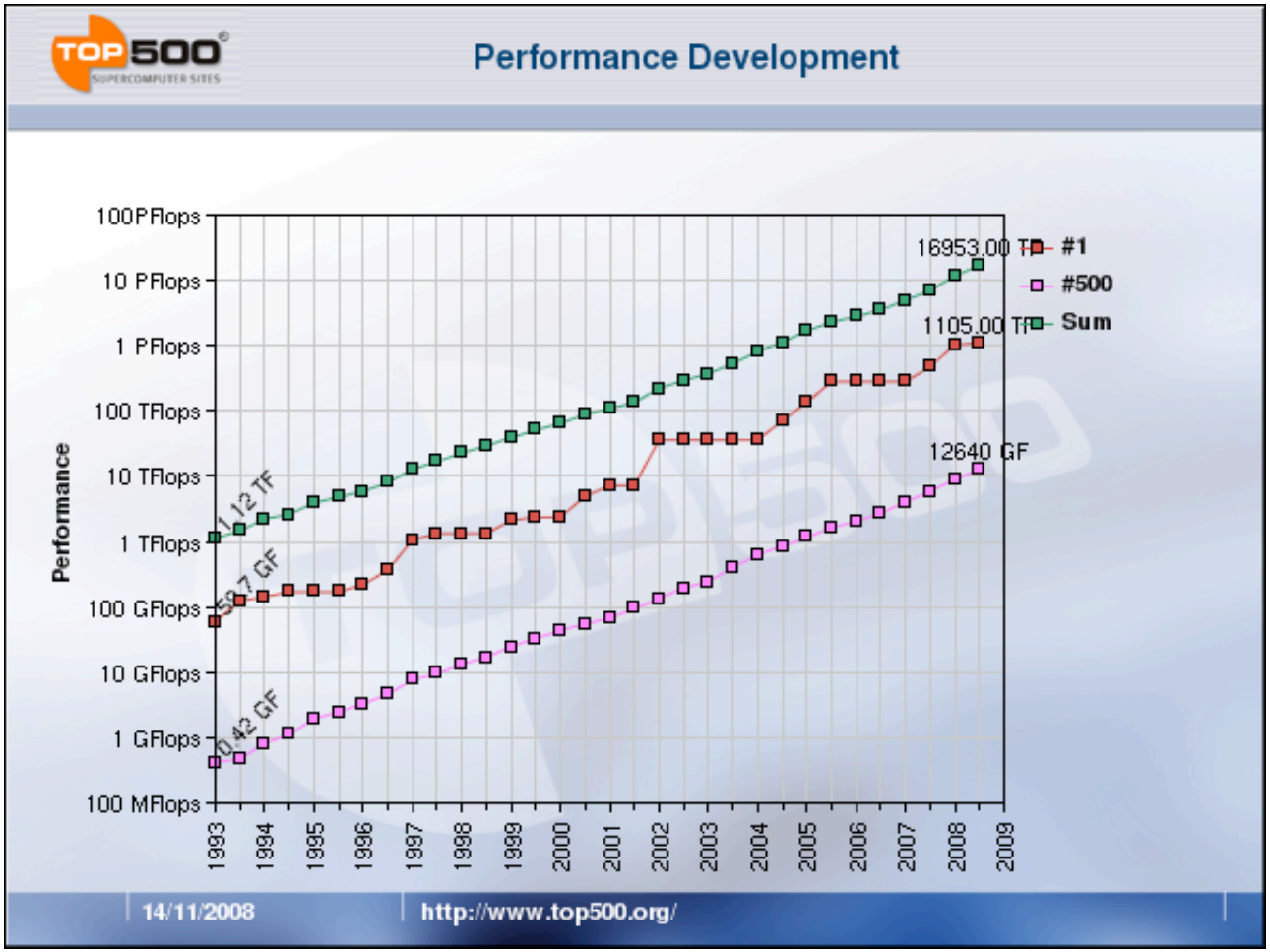
Overview of Recent Developments in Technology

- Hewlett-Packard have fabricated “nano-imprint crossbar” devices with features as small as 4 nanometers (4 billionths of meter), several times denser than any current memory or processor device.
- Scientific supercomputers, which are used to simulate physical phenomena for science and engineering, continue to advance relentlessly in power – the most advance systems perform at over 10^{15} floating-point operations per second (i.e., one million billion operations per second).
- Quantum computing, the eerie phenomenon some have likened to computing simultaneously in “multiple universes,” is becoming more real.
- In 1997, an IBM computer defeated world champion chess player Garry Kasparov.
- Automatic translation facilities, such as that provided publicly by Google, are now greatly improved over previous versions.
- Scientists now understand numerous sections of the brain, and are constructing computer models of brain activity – they should be able to simulate the entire brain in 10-15 years.

Overview of Recent Developments in Technology, Cont.

- The recent energy crisis has spurred numerous new technology developments for clean energy – solar-electric energy is particularly promising (every day we receive 10,000 times our planet's energy needs).
- Researchers developing technology for the handicapped now see a future in which physically impaired persons can regain much of their lost facility – robotic arms, artificial eyes, etc.
- Large-scale computer simulations are being developed to test drugs "in silico" – i.e. assess effectiveness and safety of drugs on a supercomputer.
- Several remarkable discoveries have been made using stem cells – regenerating organs damaged by accident or disease.
- Several remarkable cancer therapies are in development, for example drugs that inhibit creation of blood vessels in cancer tumors.
- Several promising treatments for diabetes are in development.
- Gerontologists have identified the seven major agents of aging – optimists are predicting future lifespans of 100 to 120 years or even higher.

Progress of Scientific Supercomputers: The "Top500 List"



Ethical, Moral and Social Issues

Recent discussions of future technology frighten many people, and not just anti-technology "Luddites" and Bible-thumping fundamentalists. Many prominent scientists see vast potential for trouble:

- Genetic experiments going awry.
- Nanotech "grey goo" multiplying beyond bounds.
- Robots running amok.
- Computers that are smarter than their human masters.
- Biotech experiments creating and destroying intelligent life.
- Insert your favorite sci-fi movie scenario here!

Former Sun Microsystems technologist Bill Joy warned of these dangers in his widely publicized article, "Why the Future Doesn't Need Us."

Even inventor Ray Kurzweil, one of the most optimistic of future technology observers, soberly acknowledges these dangers.

Can We Stop the March of Technology?

- How will anyone be able to convince some handicapped person that a promising new thought-controlled arm cannot be used, because a few (nonhandicapped!) persons are concerned about “ethical uses”?
- How can anyone convince poor farmers in China not to use some new high-yield, nutrient-enhanced strain of rice, because some (amply fed!) Americans and Europeans are concerned about unspecified “dangers”?

Consensus of many observers: we can’t stop the forward march of technology. We can, however, carefully manage these developments – insist on careful testing and monitor results.

At the least, let’s pick our battles judiciously – a knee-jerk opposition to all things new will be seen as old-fashioned Ludditism.

Some Examples of Ethical Issues

- How can we prevent advanced technologies from falling into the hands of those who might use them for evil purposes?
- How can we encourage constructive uses of technology, while discouraging unethical uses – e.g., “designing” a deaf child?
- How can we mitigate the “digital divide” between those who have the education and economic means to utilize technology, and those who cannot?
- How can we finance the medical and pension costs of an increasing aged population (even if the health of such persons permits them to continue to do productive work)?
- How can society avoid becoming so risk-averse that any substantive changes are not democratically possible?
- How will “intelligent computers,” “enhanced humans” and “conventional humans” peacefully and respectfully co-exist?
- How will the LDS Church (and other religious movements) adapt to these developments?

Education: A Top Priority

- Observers in this field are unanimous that education must be a top priority, not just for youth but for adults as well.
- Sadly, the U.S. educational system is mired in mediocrity:
  - 44% of eighth-graders in Singapore scored at the most advanced level in mathematics, as did 38% of eighth-graders in Taiwan, but only 7% in U.S.
- The U.S. cannot continue to rely on importing on bright students from China and India – exploding opportunities in those countries are leading many to remain (or return) to their native lands.

The LDS Church has always had a strong tradition of education, with a particularly strong showing in science and technology.

- In one study in the 1970s, Utah led all other states in the percentage of home-grown students who went on to achieve advanced degrees in science.

One Key Issue:
What Will It Mean to be "Human"

- Will we define "humanity" based on our current biology and psychology?
- If not, what aspects of our bodies, minds, emotions, art, and religion constitute being human?
- If we gain power to control, to some extent, human personality, are there some aspects that are better cast aside – e.g., predilections for violence, domination, and/or mental illness? Who will decide?
- At what point will computers and robots merit civil rights and protection?
- Should one baptize one's computer (provided it is waterproof)?

Some questions may seem amusingly futuristic at the present time, but in the not-too-distant future they may be major items of public discourse.

The Idea of Progress in LDS Thought

- Mormonism, from its founding, has been a "progressive" movement, in the sense of identifying with and promoting human progress.
- A central tenet is modern revelation, as declared in the ninth AoF:
  - "We believe in all that God has revealed, all that he does now reveal, and we believe he will yet reveal many great and important things pertaining to the Kingdom of God."
- This is strikingly similar to the definition of the idea of progress by historian Robert Nisbet:
  - "Mankind has advanced in the past, … is now advancing, and will continue to advance through the forseeable future."
- Closely connected with the "idea of progress" is the "law of eternal progression – mortal life is but an interlude between a preparatory pre-mortal existence and an eternal post-mortal existence, where we will advance in knowledge and glory without limit.

Quotes by LDS Authorities on Progress

- Brigham Young:
  - "The first great principle," the "mainspring of all action," is the "principle of improvement."
  - "We have the principle within us, and so has every being on this earth, to increase and to continue to increase, to enlarge and receive and treasure up truth, until we become perfect."
  - "When we have lived millions of years in the presence of God and angels … shall we then cease learning? No, or eternity ceases."
  - "Our religion measures, weighs and circumscribes all the wisdom of the world – all that God has ever revealed to man. God has revealed all the truth that is now in the possession of the world, whether it be scientific or religious."

Quotes by LDS Authorities on Progress

- Brigham H. Roberts:
  - "The world's best hope is the world's continued progress in knowledge of the truth."
  - "By those collateral rays of light men have been led to those great discoveries in the arts and sciences and in mechanics, which make our age so wonderful as an age of progress and enlightenment."
  - "To pay attention to and give reasonable credence to [scientific] research is to link the church of God with the highest increase of human thought and effort."
- Hugh B. Brown:
  - "We should be in the forefront of learning in all fields, for revelation does not come only through the prophet of God nor only directly from heaven in visions or dreams. Revelation may come in the laboratory, out of the test tube, out of the thinking mind and the inquiring soul, out of search and research and prayer and inspiration."

Progress and the Quest for Immortality

It is worth noting that the quest for immortality has been the foundation for great thinkers since time began. Every major religion has dealt with the question of immortality (e.g., reincarnation).

Even some recent writers have discussed this theme:

- Pierre Teilhard de Chardin (a 20th century religious philosopher):
  - To incorporate the progress of the world into our picture of the kingdom of God … would immediately and radically put an end to the internal conflict from which we are suffering."
- Marc Geddes (a present-day transhumanist):
  - The desire for immortality "is one of the deepest, most enduring dreams of humanity." … "Rational people understand that actions have consequences. A life of crime may help a person in the short term, but in the long run it may get you killed or imprisoned. … People are more likely to be moral when they understand they will have to face the consequences of their actions in the future. It follows that the future into the future one plans for, the more moral one's behavior should become."

Progress and the Quest for Immortality

- Albert Schweitzer:
  - Affirmation of life is the spiritual act by which man ceases to live unreflectively and begins to devote himself to his life with reverence in order to raise it to its true value. To affirm life is to deepen, to make more inward, and to exalt the will to live. At the same time the man who has become a thinking being feels a compulsion to give to every will-to-live the same reverence for life that he gives to his own. He experiences that other life in his own. He accepts as being good: to preserve life, to promote life, to raise to its highest value life which is capable of development; and as being evil: to destroy life, to injure life, to repress life which is capable of development. This is the absolute, fundamental principle of the moral, and it is a necessity of thought.

Conclusion

- Despite the many dangers and challenges, there are numerous reasons to be optimistic about the future.
- It is truly a remarkable opportunity for us to be living in an age of so great progress, and with such glorious possibilities before us.
- Each of us can be a part in making the future a “heaven on earth.”

Gen. 11:6: “And now nothing will be restrained from them, which they have imagined to do.”