Introducing Gordon Gekko to Stephen Hawking

Two choices – Two consequences

- In 1492, Columbus received funding from Spain to sail West to Asia
- The Ming dynasty stopped treasure ship explorations that had reached the coast of Africa, because they were two expensive
- Consequences
  - European world domination and the Industrial Revolution
  - A century of humiliation for China

The lesson

- Economic growth requires massive investments in science and technology, but those investments are becoming too expensive for governments.
- The WWW came from the CERN collider. The semiconductor and internet came from Apollo
- Creative funding solutions from private industry are essential to build these projects.

The difference

- Immediate profit - Columbus was not motivated solely by prestige or curiosity. He wanted to make money selling spices.
- Competition - If Spain funded Columbus only after he was rejected by Portugal and England. Once Spain pushed into the New World, the other European powers had to follow.

The lesson

- For the next generation of science mega-projects, we need two things:
  - Competition
  - Immediate profits
    - Tens of billions of dollars is a lot of money for a non-profit venture. It's a small, even trivial, amount of money for a for-profit company.

Physicists need these colliders

- http://iasprogram.ust.hk/201501fhep/conf.html
- Quote from conference - The scientific issues at stake are the most difficult and profound ones we have faced since the 1930's
- Fundamental understanding of the universe
  - What is the universe made of?
  - How was the universe created?
  - What is the fate of universe?

Particle colliders

- Next generation of colliders currently in design stage
  - CERN
  - China
  - United States (?)
- Massive engineering projects
  - 50 to 100 km tunnels
  - Magnets

Constructive competition

- Either we have two or three projects or we have none of them.
- We can take people's competitive urges and focus it into doing better science rather than through destruction
- Business people are used to this

Scientific justification

- The scale of our vision and ambition must be commensurate with what the science demands – BE MORE AND NOT LESS AGGRESSIVE IN PURSUING IT
- We must seek revolutionary new ideas not only in the physics, but also in finance and politics. The limits that we face are not in the science, but in finance and politics, and there is where we need bold, creative, and ambitious thinking.

The vision thing

- Whether we can do this will determine if we remain on this planet or whether we can move to the stars
- Start with principles
  - Constructive competition
  - Immediate profits

Constructive competition

- Competition between the United States and the Soviet Union got us to the moon, but then the space race ended. We need to restart the space race. We need a Mars race, a Jupiter race, and a race to build the next particle collider
- Destructive competition is bad. No competition is also bad
- Constructive competition requires a lot of cooperation

Four projects

- Europe – FCC – Future circular collider
- China – CEPC / SPPC
- Japan - ILC
- United States - ?

- Cost: Billions and Billions

Europe

- Next generation of collider after LHC
- To be build on the CERN site
- Political goals: Deepen European integration and remain number one in particle physics
- Currently in pre-CDR stage – Estimate about 10 years of design to go

China

- CEPC – SPPC
- Site in China to be determined I
- Pre-CDR finished moving to CDR in 2015
- Construction – Phase I in 2021 if funding approved. Phase I begins operations in 2027

Japan

- International Linear Collider
- Likely to be sited in Japan
- Technical Design Review complete
- Awaiting go ahead for construction

United States

- No current projects sited in the United States
- If Europe, China, and Japan go ahead, then the United States will have to ask itself whether it still wants to be a superpower.
- This decision will be made around 2025.
- I believe that the United States will rise to the occasion. There will be a Sputnik moment.

Immediate profits

- These projects will be difficult to justify without some immediate or near term profits
- Some element of non-profit government funding will be necessary, but private for-profit funding would be helpful.
- Good for the scientists – Multiple streams of funding, give the scientists the ability to direct the project in a way that will maximize science.

How do you make money from a particle accelerator?

- You tell us
- Bankers, real estate developers, urban planners, advertising and marketing experts are needed to come up with ideas
- Projects are in the planning stages and the physicists are open to ideas

Possible ideas

- Shopping malls and residential complexes?
- Clean energy development – geothermal?
- Theme parks? Science tourism?
- Biotech? Medical tourism?
- Robotics?
- High technology manufacturing centers?
- Educational technology?
- Long term space studies? How do you build a hotel on Mars?

More than a particle physics laboratory

- The next generation of physics megaprojects, will not just be a laboratory in physics, but also civil engineering, and business and finance
- We need not only the world's brightest physicists to make this work, but also the world's brightest financiers and real estate development

The economic future of humanity is at stake

- If we can't figure out how to make this work, we are doomed to economic stagnation.
- If this works, then we can start thinking about spreading out into the solar system and the cosmos.

Getting involved

- China is in the concept design review stage. CERN is in the pre-CDR stage.
  - CERN
    - http://indico.cern.ch/category/5259/
    - http://tlep.web.cern.ch/contribute-to-the-design-study
  - China CDR
    - http://beijingcenterfuturecollider.wikispaces.com/
    - http://cepcdoc.ihep.ac.cn:7080/cepc/precdr/reg.htm

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