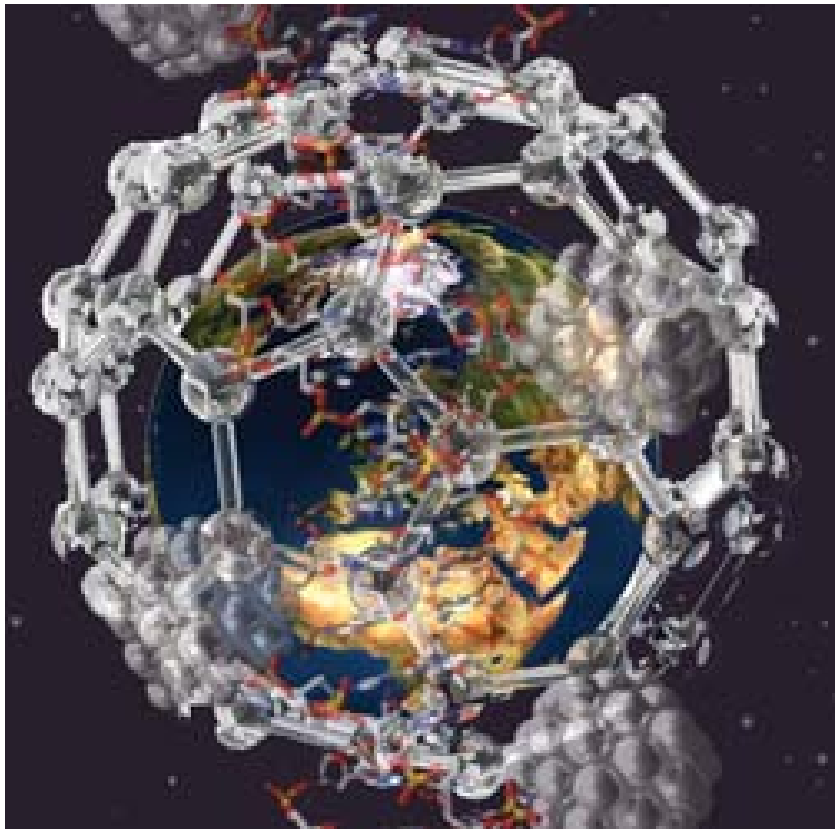
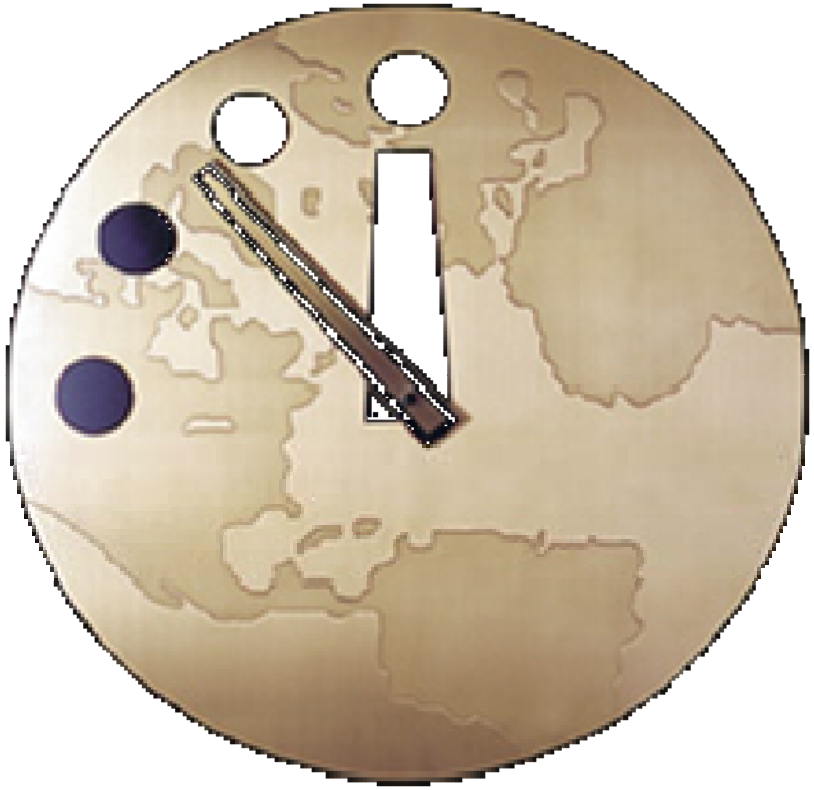
Threats to Security, Technology, & Information Society



Margaret E. Kosal, PhD
June 2010
margaret.kosal@inta.gatech.edu

“Rethinking Doomsday”

- 2010: **???**
- 2007: **Five** minutes from midnight - Nuclear proliferation/lack of disarmament & anthropogenic climate change
- 2002: **Seven** minutes - ABM withdrawal, terrorists, little disarmament
- 1953: **Two** minutes - U.S. and Soviet Union test thermonuclear devices
- 1991: **Seventeen** minutes - Strategic Arms Reduction Treaty and unilateral cuts



Doomsday Clock
Bulletin of Atomic Scientists

Rothstein, Auer & Siegel, *Bulletin of the Atomic Scientists*

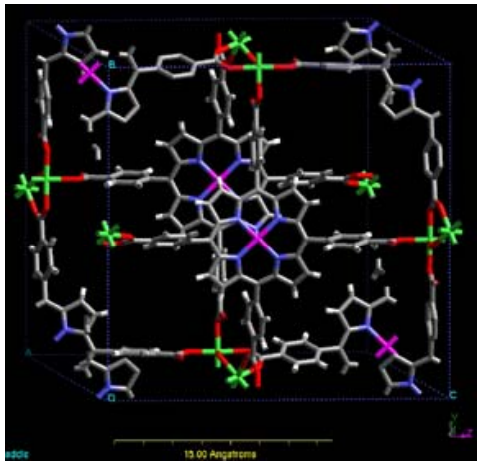
“New technologies [at risk for terrorist appropriation] include …

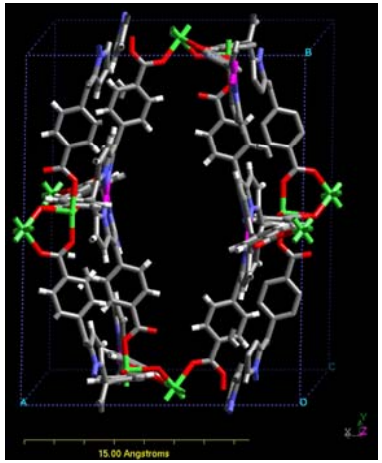
single nucleotide polymorphisms *(SNPs), and* ***Bose-Einstein condensates****.”**

* Ackerman “WMD Terrorism Research: Where to From Here?”
International Studies Review**,** March 2005, vol. 7, p. 140

From Science to International Security

- Ph.D., Chemistry
  - Bio-inorganic chemistry and nano-structured materials
- Co-founder ChemSensing Inc.
  - Explosives, biological and chemical detection
- Fellow at Stanford's Center for International Security and Cooperation (CISAC)
- Other prior affiliations:
  - Center for Nonproliferation Studies Monterey Institute of International Studies (CNS MIIS)
  - Naval Postgraduate School
  - Northwestern Medical School

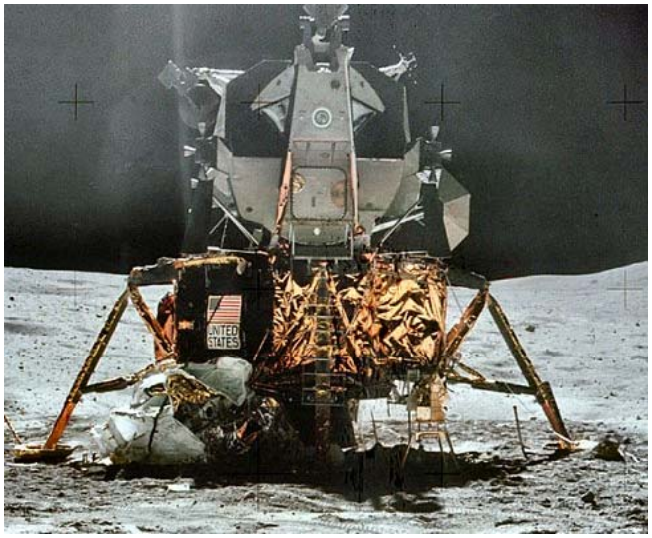




Advisor in the Defense Department

- **Chemical and Biological Defense Program (CBDP) S&T Advisor**
  - Interface with other DoD offices and interagency groups
    - Nonproliferation and Arms Control Technology Working Group (NPAC TWG)
    - National Nanotechnology Initiative (NNI)
    - Counterproliferation Review Committee (CPRC)
    - National Science Advisory Board on Biosecurity (NSABB)
    - NATO RTO Nanotechnology for Defense Group
- **Liaison to DTRA-CB**
  - Chairing the Nanotechnology for Chem-Bio Defense 2030 Study & Workshop
  - Advising the DTRA-CB SPO Nanotechnology Initiative and on the Transformational Countermeasures Technology Initiative (TCTI)
  - Coordinating CBDP basic research efforts, including the basic research strategy

What is Revolutionary?



$128.5 Billion* Apollo program makes 6 landings on the moon over a 3-year period and stimulates development of many spin-off technologies including integrated circuits and fuel cells. Journey has not been repeated in over 40 years.

* Adjusted to 2009 dollars

Automatic rifle designed by Mikhail Kalashnikov and introduced in 1947 is revered for its simplicity and reliability. Produced worldwide and used by 55 national armies, it has become a cultural icon.

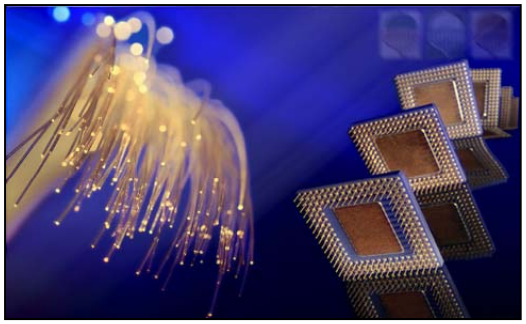
Strategic Environment

Hyper-empowered Individuals

Asymmetric Threats

Global Connectivity

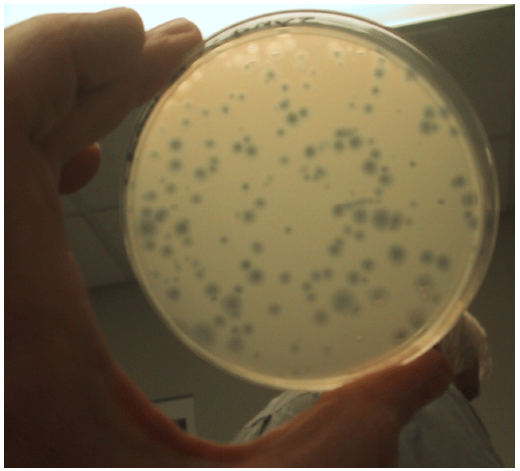
Rapid Technology Innovation

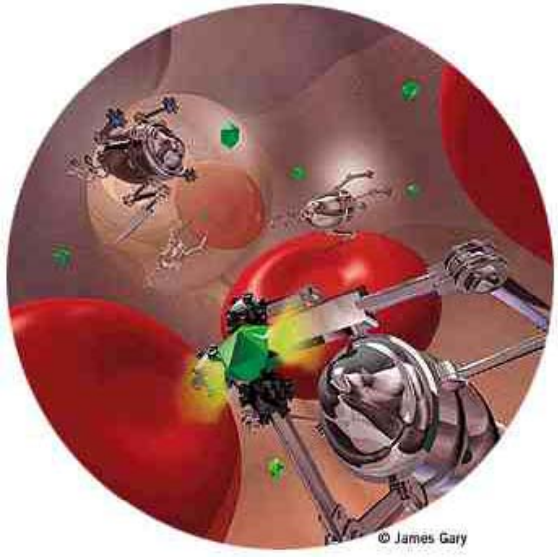


Increased Velocity of Information

Irregular Warfare

Anticipating Emerging Threats





- **Science** is a process used to
  - determine causal relationships
  - Repeatable
  - Public
  - pertains to physical and natural world
- **Technology** is a process and resulting tools (or products) by which humans modify nature (or their environment) to meet their needs and wants *(both are important)*
- **Politics** is a process by which groups of people make decisions
- **International Affairs**
  - is interactions between and among nation-states; (most formal definition)
  - systematic structures and patterns of interaction of the human species; (constructivist)
  - interactions that impact politics by nation-states (state-based actors), and non-state actors (terrorists, multi-national corporations, NGOs, transnational interest groups, mafia, organized crime)

Science: Scope by Goal and Process

The word science comes from the Latin "*scientia*," meaning knowledge.

- **1. The systematic observation of natural events and conditions in order to discover facts about them and to formulate laws and principles based on these facts. 2. the organized body of knowledge that is derived from such observations and that can be verified or tested by further investigation. 3. any specific branch of this general body of knowledge, such as biology, physics, geology, or astronomy.**

  Academic Press Dictionary of Science & Technology

- **Science is an intellectual activity carried on by humans that is designed to discover information about the natural world in which humans live and to discover the ways in which this information can be organized into meaningful patterns.**

  Dr. Sheldon Gottlieb

- **Science alone of all the subjects contains within itself the lesson of the danger of belief in the infallibility of the greatest teachers in the proceeding generation . . .As a matter of fact, I can also define science another way: Science is the belief in the ignorance of experts.**

  Prof. Richard Feynman
  in The Pleasure of Finding Things Out

Terms

- **Law**
- **Theory**
- **Hypothesis**
- **Fact**

- **Inductive**
- **Deductive**

- **Precision**
- **Accuracy**

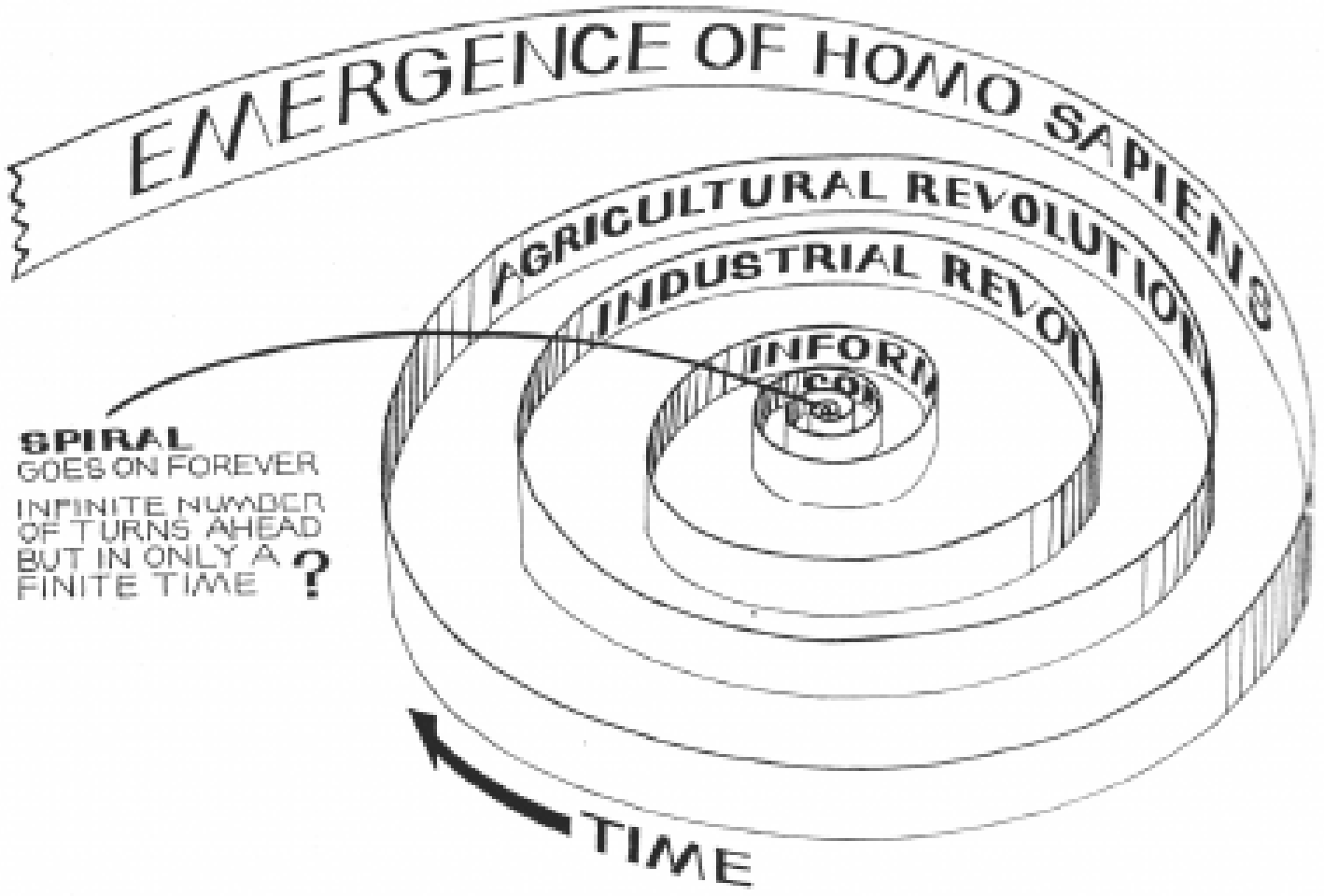
Technology Interval Time Compression

3 million years ago	***collective rock throwing;* early stone tools**
1.5 million years ago	**lever, wedge, inclined plane**
500,000 years ago	**control of fire**
50,000 years ago	**bow and arrow, fine tools**
5,000 years ago	**wheel and axle, sail, domestication of animals and plants, beer, soap**
500 years ago	**printing press with movable type, rifle, lightening rod *(really 250ya)***
50 years ago	**commercial digital computers**
10 years ago	**commercial internet**

The Technological Ages of Humankind

- Hunter/Gatherer groups
  (~1 Million - ~5K BCE)
- Agriculture (~5K BCE - ~1850 CE)
- Industrial (~1850 CE - ~1950 CE)
- Information (~1950 CE - ~2040 CE)
- Bio/Nano (~1995 - ~2040)
- Virtual (~2015 - ?)

Something Curious Is Going On



Technology

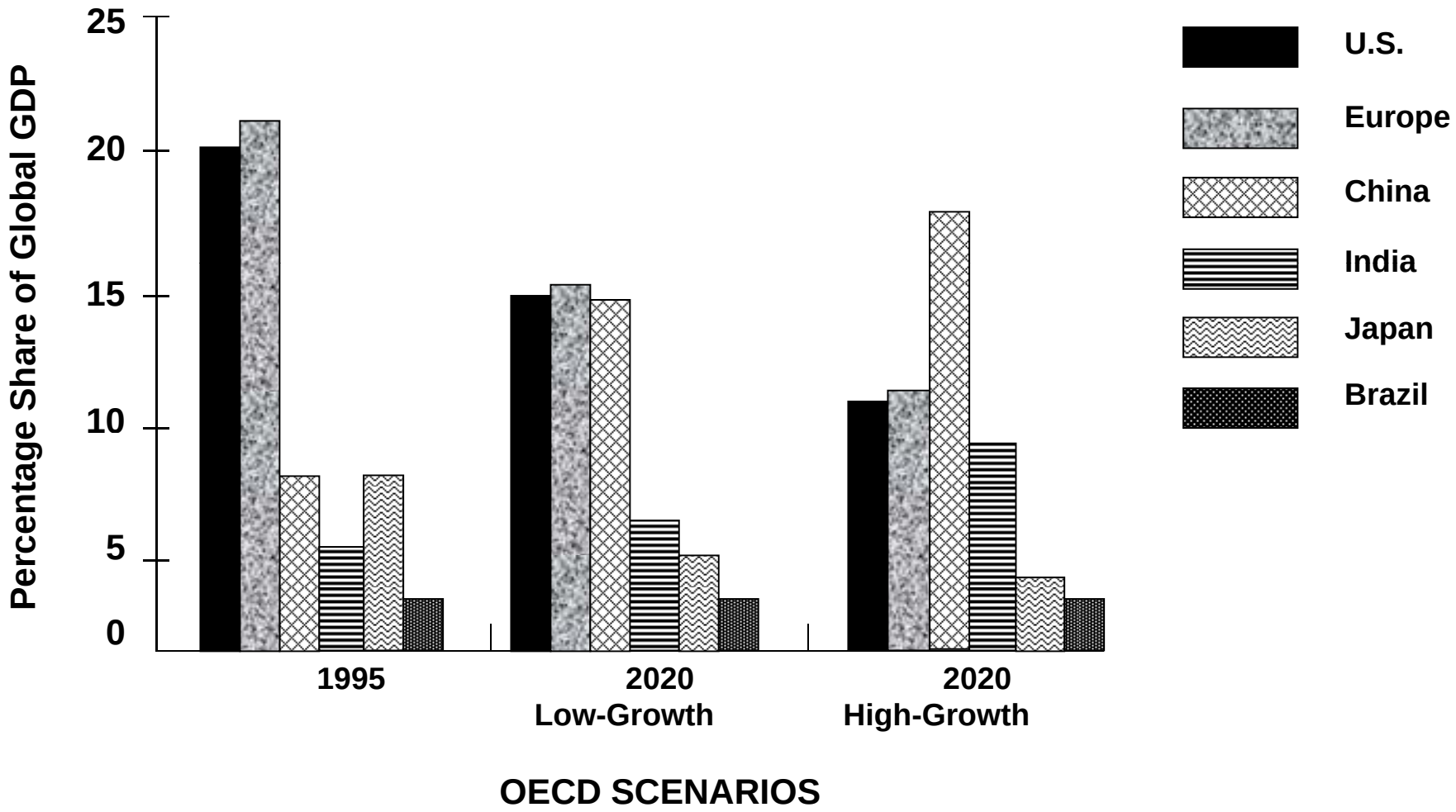
"… Advances in technology just increase our ability to do things, which may be either for the better or for the worse. All of our current problems are unintended negative consequences of our existing technology."

- Jared Diamond, Collapse, p. 505

Possible Societal Changes / Challenges

- Climate Change
  - Anthropogenic CO_2-induced, attendant arctic methane release, change in the jet stream
- Consequent “Green Energy” Requirement coupled to Simultaneous Demise of “Cheap Oil”
- Shortages of Water & Arable Land
  - Attendant increasing Food Shortage
- “Clash of Civilizations” *(a la Huntington)*
- Nuclear proliferation – weapons and energy
- (Much) Increased Life Span (Bio)
- “Solution” to Energy/Water/“Warming”
- (Far More) Global Distribution of Technology, Education, Economics, Wealth (IT)
- (Tremendous) Increases in Capability of Automatic/Robotic “Everythings” (IT/Bio/Nano)
  - Resulting in Reduced Tensions Associated with “Have/Have Nots” and Historical/Religious Issues
  - Also Resulting in (Greatly) Increased Individual destructive power (Bio, IW, etc.) and General Societal Disaffection WRT “Machines”

Emerging Multipolar Economic World

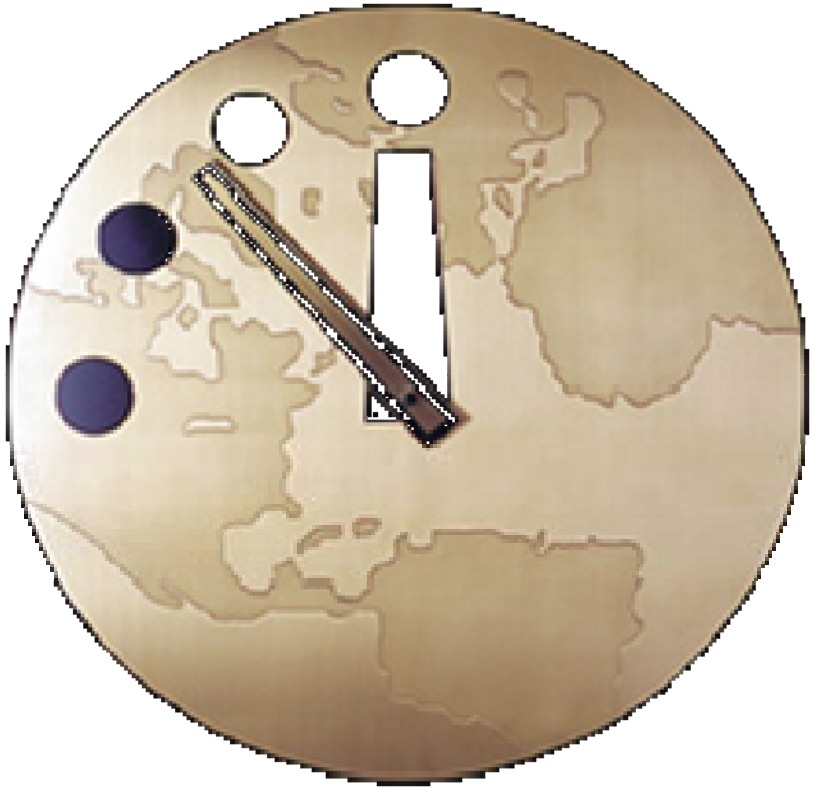


Source: OECD, The World in 2020, p. 92

Doomsday Scenarios

“Rethinking Doomsday”

- 2010: **Six** minutes …
- 2007: **Five** minutes from midnight - Nuclear proliferation/lack of disarmament & anthropogenic climate change
- 2002: **Seven** minutes - ABM withdrawal, terrorists, little disarmament
- 1953: **Two** minutes - U.S. and Soviet Union test thermonuclear devices
- 1991: **Seventeen** minutes - Strategic Arms Reduction Treaty and unilateral cuts



Doomsday Clock
Bulletin of Atomic Scientists

Rothstein, Auer & Siegel, *Bulletin of the Atomic Scientists*

Risk & Threat

Risk = Probability x Consequence

Probability = F [threat, likelihood]

Threat = F [capability, vulnerability, motivation]