National Air and Space Intelligence Center

So You Think You Have It Tough?

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This Briefing is
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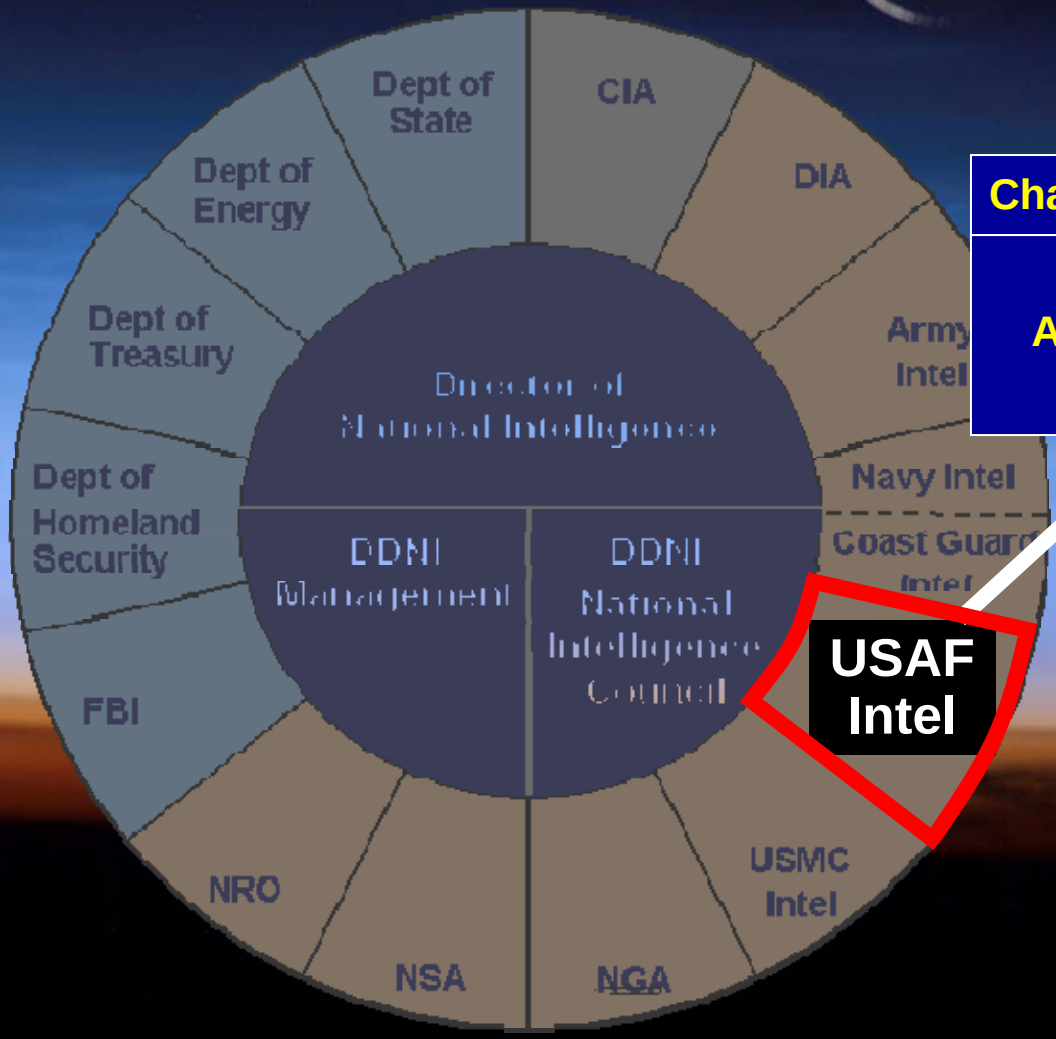
Purpose

To provide an overview of NASIC's technology warning responsibility, and how tough it can be to assess foreign technology maturity

Who is NASIC ?



Chain of Command
USAF/A2
AF ISR Agency
NASIC

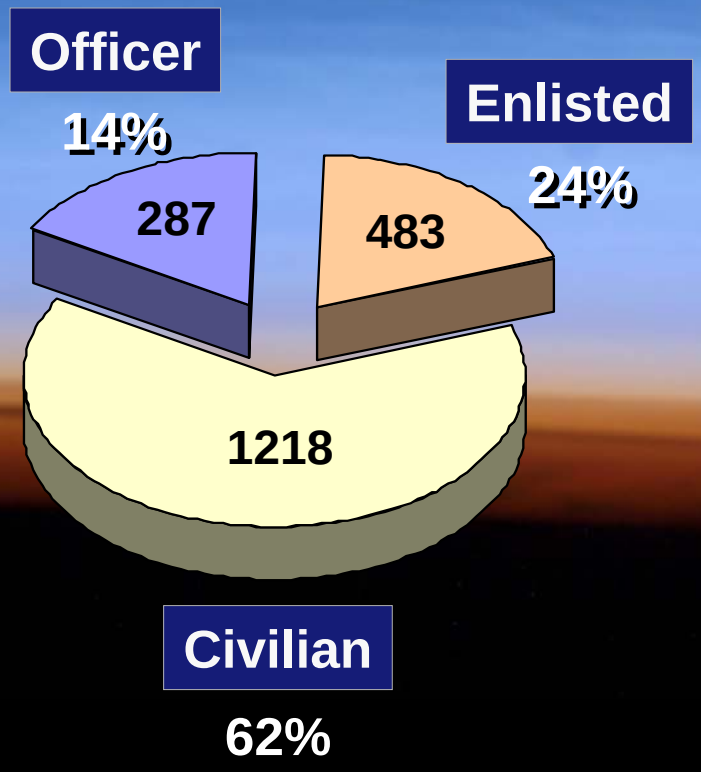
NASIC Mission

Produce Integrated, Predictive Air & Space Intelligence

… to Secure Our Nation's Future

Programmed FY07 Resources

Manpower
1988 Billets



Total Force on Site

~ 2600

Contractors
NGA
DIA
JRIC

Technology Division Mission

Mission: Conduct all-source analysis of emerging foreign aerospace research, development and acquisition (RD&A) programs. Provides strategic warning of disruptive technologies, technology transfer, air modernization developments and proliferation of aerospace systems.

Breakthroughs in technology with a 20 year outlook

Foreign Technology Transfer and acquisition networks

Air RDA with emphasis on R&D processes, programs and resources

Focus: conception to acquisition of new technologies/force capabilities

Technologies Tracked
(TRLs 1-9)

Advanced Computing

Advanced Electronics

Information Technology

Technology Integration

Biotechnologies

Anti-Materials

Advanced Sensors

Signature Modification

Power Technology

Weather Modification

Directed Energy

Nanotechnologies

Energetic Materials

Hypersonics

Materials Science

Denotes STIC Subcommittee Chair

Focus on air and space applications of disruptive technologies

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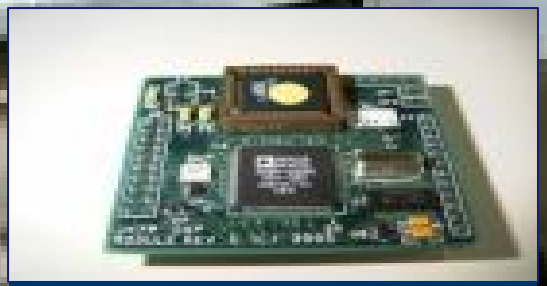
Air/Space Superiority

Examples of Warning Concern

AAM system development and proliferation

Biosensor enabled UAV swarms



Influence of COTS (e.g. radar DSPs)

RDA timelines for foreign UCAV developments

The ability to control what moves through air and space…ensures freedom of action

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Rapid Global Mobility

Examples of Warning Concern

Radio Controlled
Micro Air Vehicles

Biotechnology -
Anti-material agents

ISR UAV
proliferation

EW radar
developments

The ability to rapidly position forces anywhere in the world…ensures unprecedented responsiveness.

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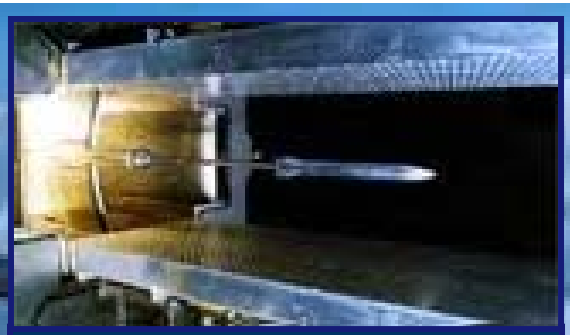
Global Attack
Examples of Warning Concern



Tri-sonic/hypersonic aerodynamic test facilities

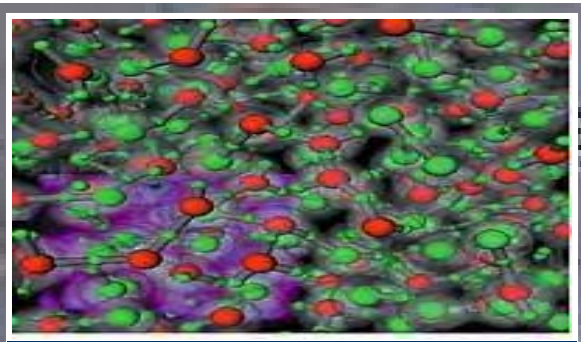
Counterspace system developments

Ballistic missile system proliferation

Satellite launch facility modifications

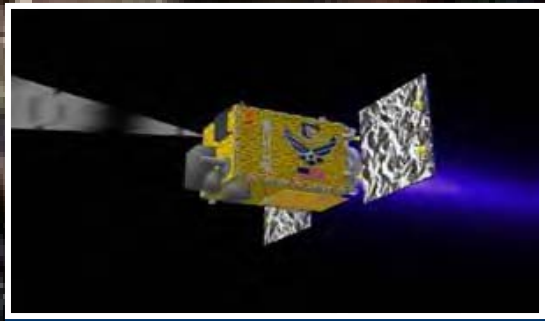
The ability to engage targets anywhere, anytime…holds any adversary at risk.

Information Superiority
Examples of Warning Concern



Quantum computing technology

Computer Network Attack



Microsatellite capability

C4 system developments

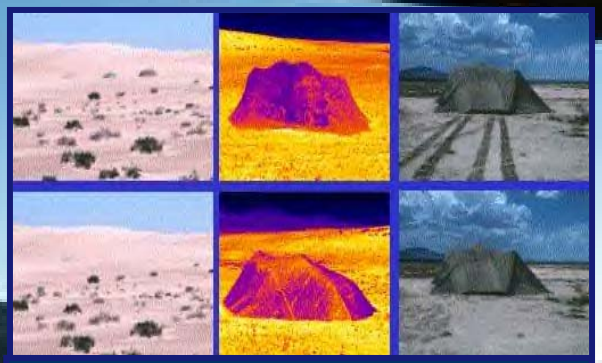
The ability to control and exploit information to our nation's advantage…ensures decision dominance.

Precision Engagement

Examples of Warning Concern

Directed Energy - RF Weapons Technology

Integrated Air Defense Modifications



Denial & Deception Test Activity

GPS Jammer Proliferation

The ability to deliver desired effects with minimal risk and collateral damage…denies the enemy sanctuary

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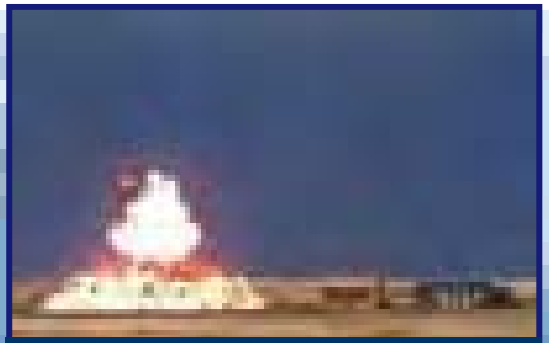
Agile Combat Support

Examples of Warning Concern

Lethal UAV Proliferation



Energetic Materials Technology

Weather Modification

LACM Developments

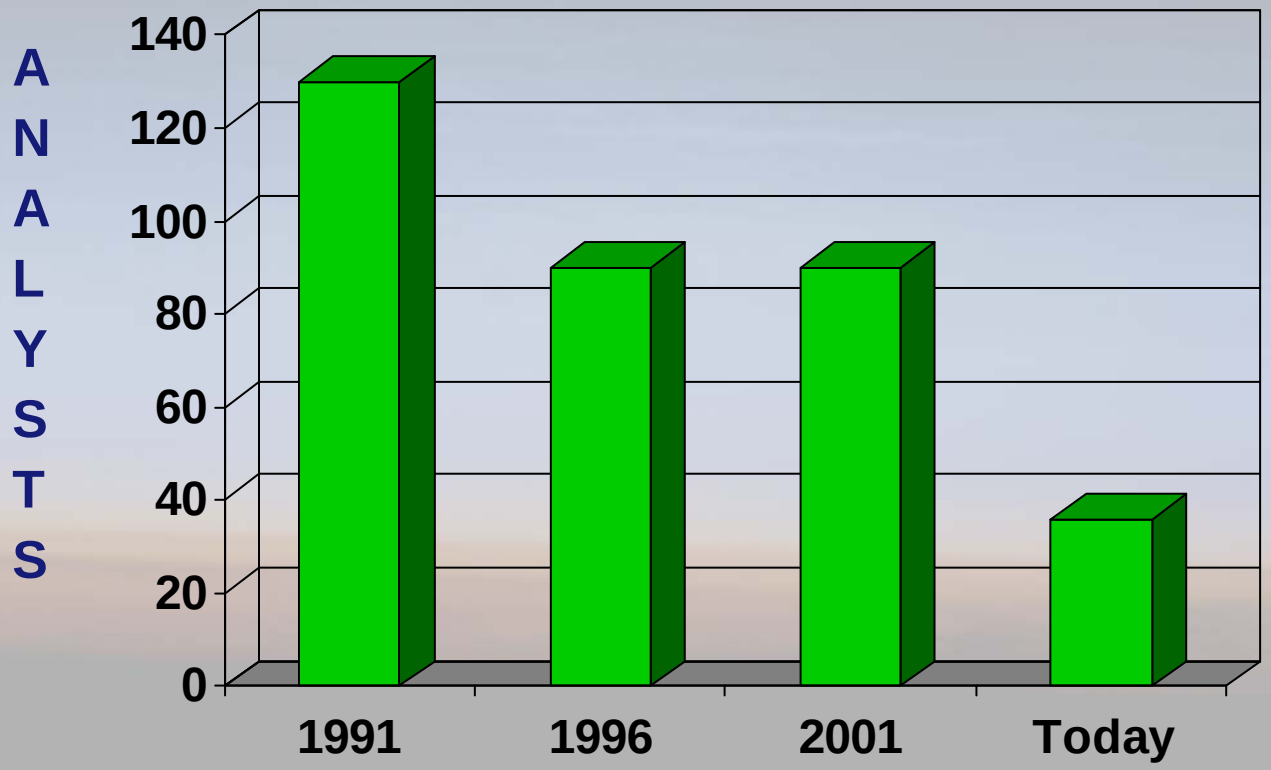
The ability to sustain flexible and efficient combat operations…is the foundation of success

How Tough Is It?

- Must understand the technology
  - Foreign countries may take alternative approaches
  - 70% of the world's R&D conducted outside the U.S.
- Discover the R&D programs
  - Main Players, Facilities, Funding, TRL
- Identify intent
  - Threat Application, Military Sponsorship
- Predict IOC
  - How many (types and numbers)
- Assess how the threat will be employed
  - Unit Subordination, Tactics and Doctrine
- Determine the impact (i.e., how significant is the threat)
- Track technology proliferation (buyers, sellers, and copiers)

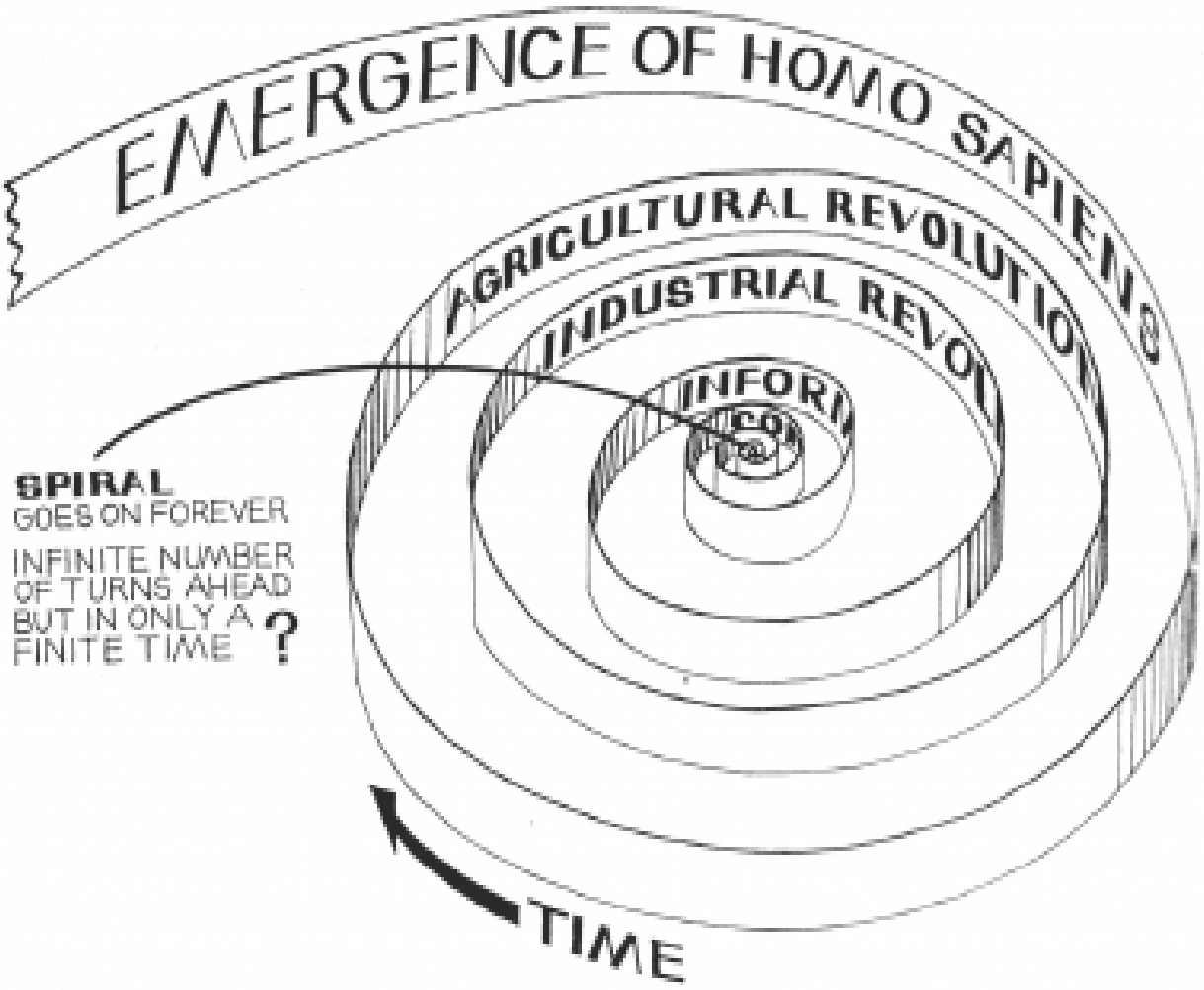
How Tough Is It?

NASIC's Technology Division



Total within DoD Intel is ~ 100!
NASIC is the largest!!

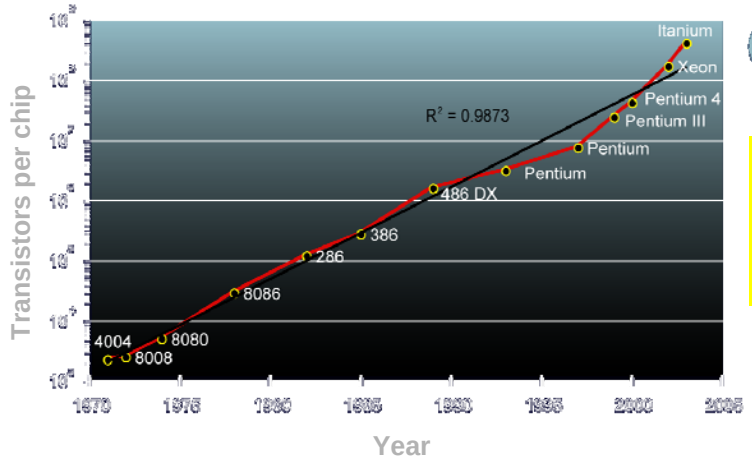
How Tough Is It?



We live in exponentially accelerating times!

How Tough Is It?
Accelerating Trends

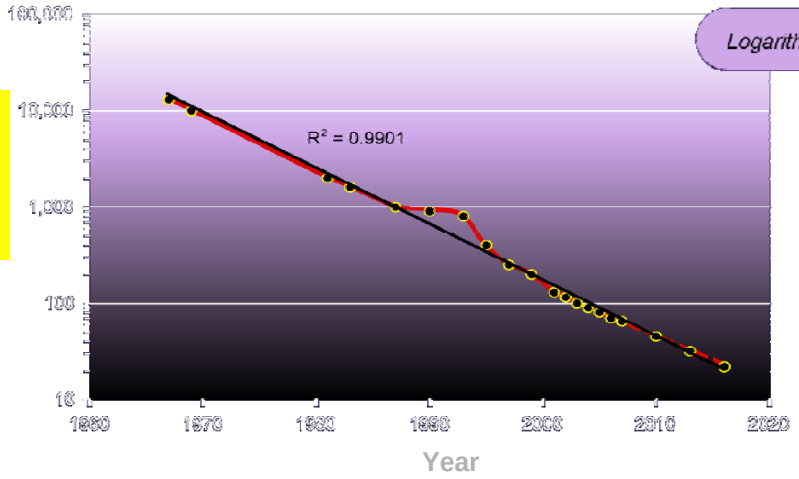
Transistors (Intel processors)



Logarithmic Plot

 # per chip doubles every 2 yrs

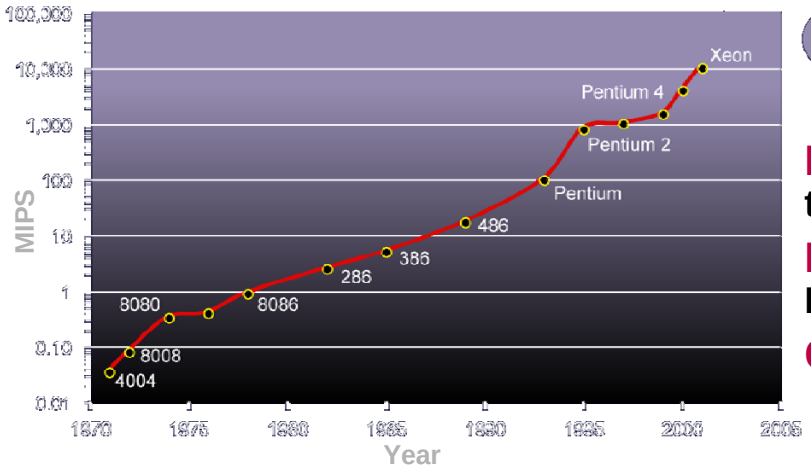
Dynamic RAM Memory "Half Pitch" Feature Size



Logarithmic Plot

Half size reduction every 5.4 yrs

Processor Performance (MIPS)



Logarithmic Plot

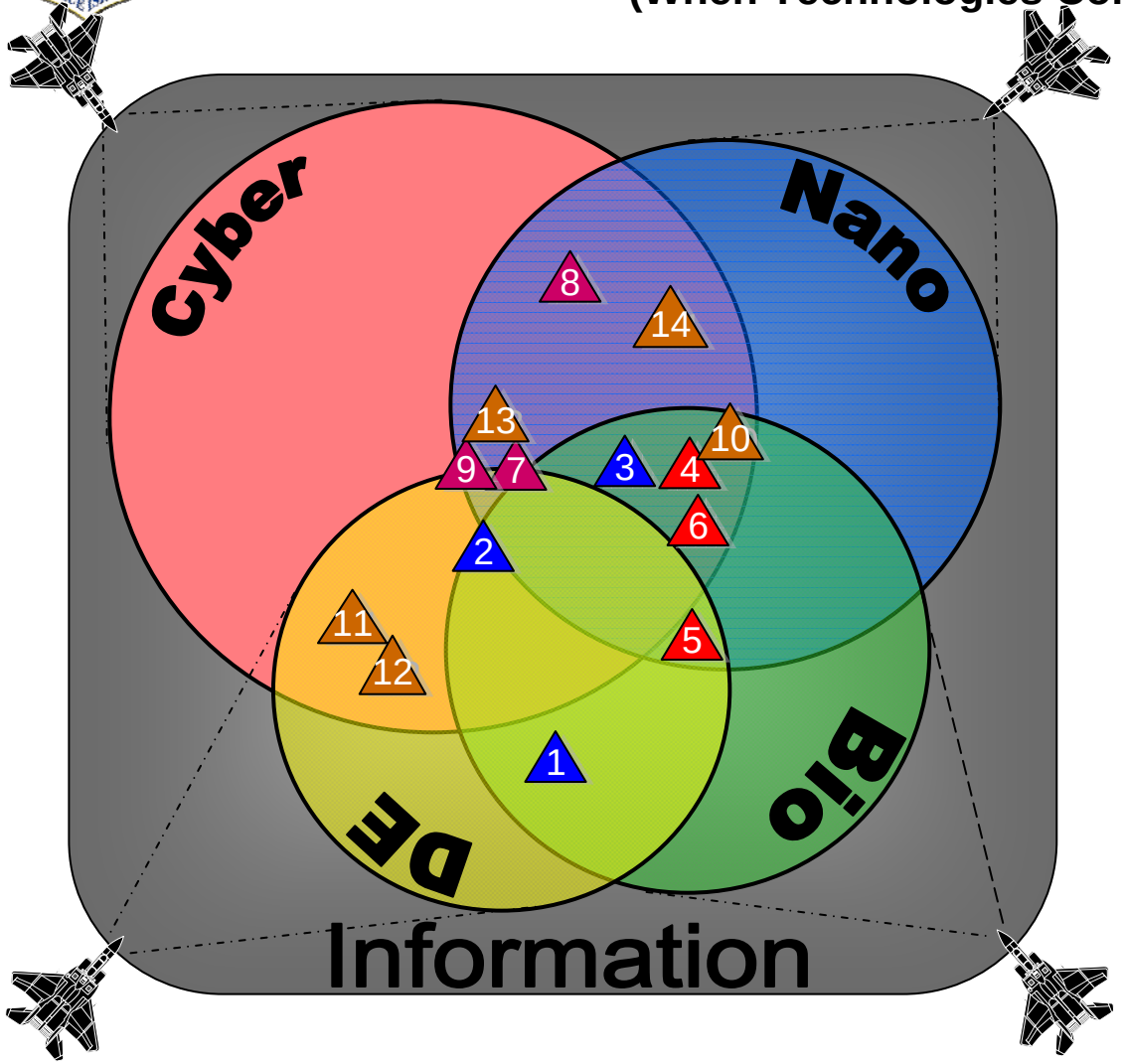
Doubles every 1.8 yrs

Metcalf's Law – Economic value of a network increases as the square of the number of connections

Moore's Law - Miniaturization Processing, storage, Price/Performance 2X every 12-18 months

Gilder's Law - Bandwidth increases 3X every 36 months

How Tough Is It?
Synergistic Effects
(When Technologies Collide)



2010
- 1 Non-lethal HPM weapons
- 2 Ladar imaging systems
- 3 Covert Tag/Track/Target

2015
- 4 Soldier suit
- 5 Nano-delivered medical
- 6 Fast vaccine development

2020
- 7 Satellite augmentation
- 8 Intelligent nano AAA
- 9 Swarming ISR

2025
- 10 Human augmentation
- 11 Air/space-based lasers
- 12 Air/Space relay mirrors
- 13 Quantum computing
- 14 Self-healing/smart skins

How Tough Is It?
The Globalization of S&T

"In 2001, India graduated almost a million more students from college than the United States did. China graduates twice as many students with bachelor's degrees as the U.S., and they have six times as many graduates majoring in engineering. In the international competition to have the biggest and best supply of knowledge workers, America is falling behind."

--"The World is Flat", Friedman, 2005

China had 15 companies on Forbes Global 500 list in 2004, up by 4 from the 2003 rankings.

India had only 1 company on the Global 500 in 2003. In 2004, there are 4 Indian companies.

IBM Global Services India unveiled its global delivery centre in Hyderabad on June 14, 2005, the fifth IBM center in India.

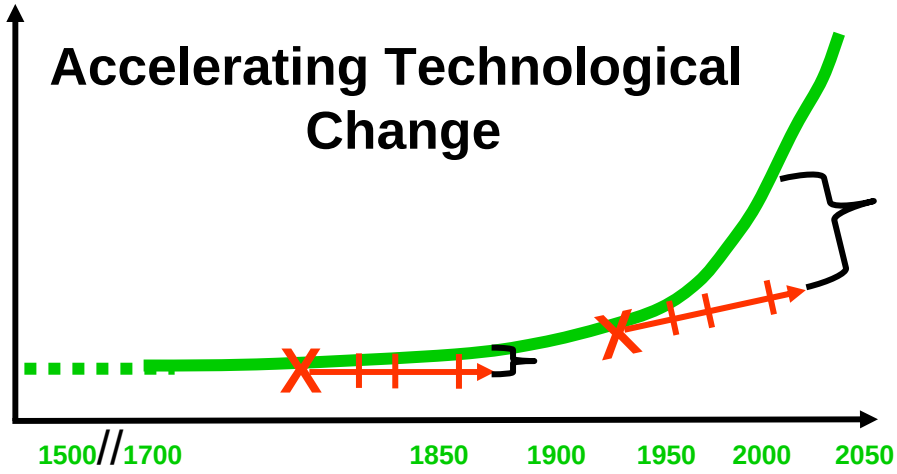
China's Gross Domestic Product is now 2nd in the world to the U.S.

" The last 25 years in technology have just been "the warm-up act." Now we are going into the main event, and by the main event, I mean an era in which technology will truly transform every aspect of business, of government, of society, of life."
Carly Fiorina, Hewlett-Packard CEO 2004

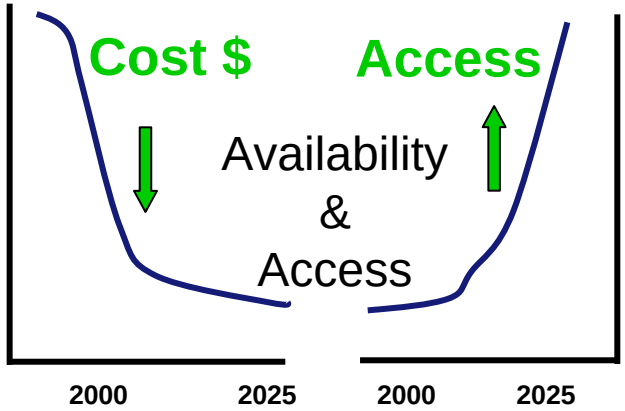
For the first time ever, all members of China's Politburo Standing Committee, the highest tier within the Communist Party, are card-carrying engineers.

How Tough Is It?

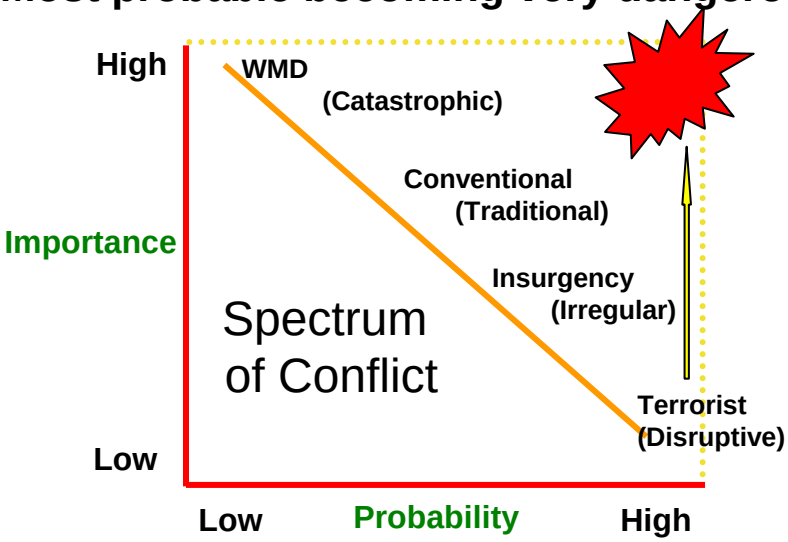
The Curve and Curveball



What belonged to few now available to many



Most probable becoming very dangerous



Bottom Line

Strategic environment for S&T changing rapidly:

- **-- Globalization levels playing field**
- **-- USG no longer the major driver**
- **-- Reduced cost of access**
- **-- Empowered non-traditional actors**
- **-- Reduced reaction times**

How Tough Is It?

Rising Above the Gathering Storm

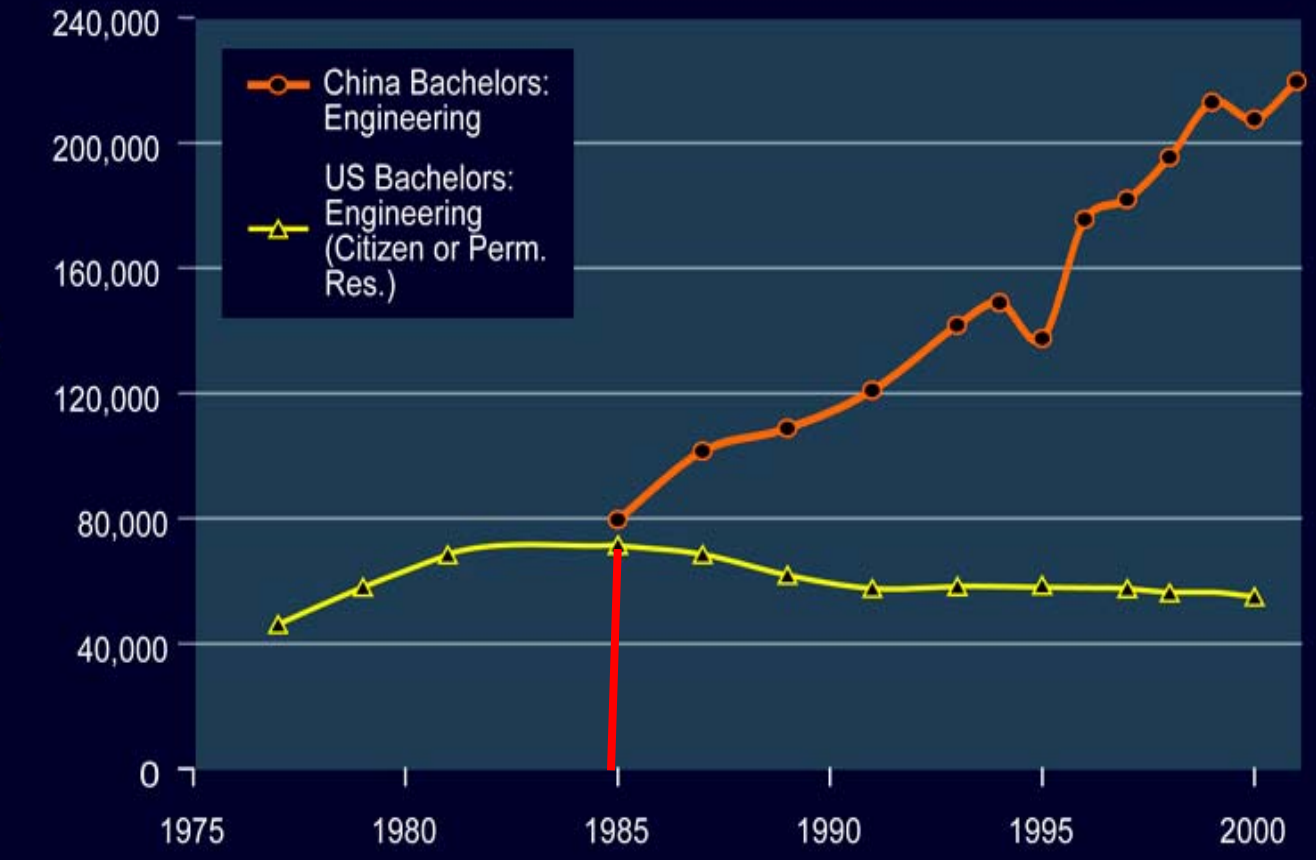
Norman R Augustine 2005 testimony before Committee on Science US House of Representatives

- **For the cost of one engineer in the US, a company can hire 11 in India**
- **In 1997, China had fewer than 50 research centers managed by multinational corporations, by 2004 there were over 600**
- **About two-thirds of students studying chemistry & physics in US high schools are taught by teachers with no major or certificate in the subject**
  - ***44% of eighth-graders in Singapore scored at the most advanced level in math, as did 38% in Taiwan – U.S. only 7%***
- **In 2003, foreign students earned 59% of the engineering doctorates awarded in the US**

In China today, Bill Gates is Britney Spears. In America today, Britney Spears is Britney Spears – and that is our problem

How Tough Is It?

Bachelors Degrees in Engineering, US (citizens and permanent residents) and China



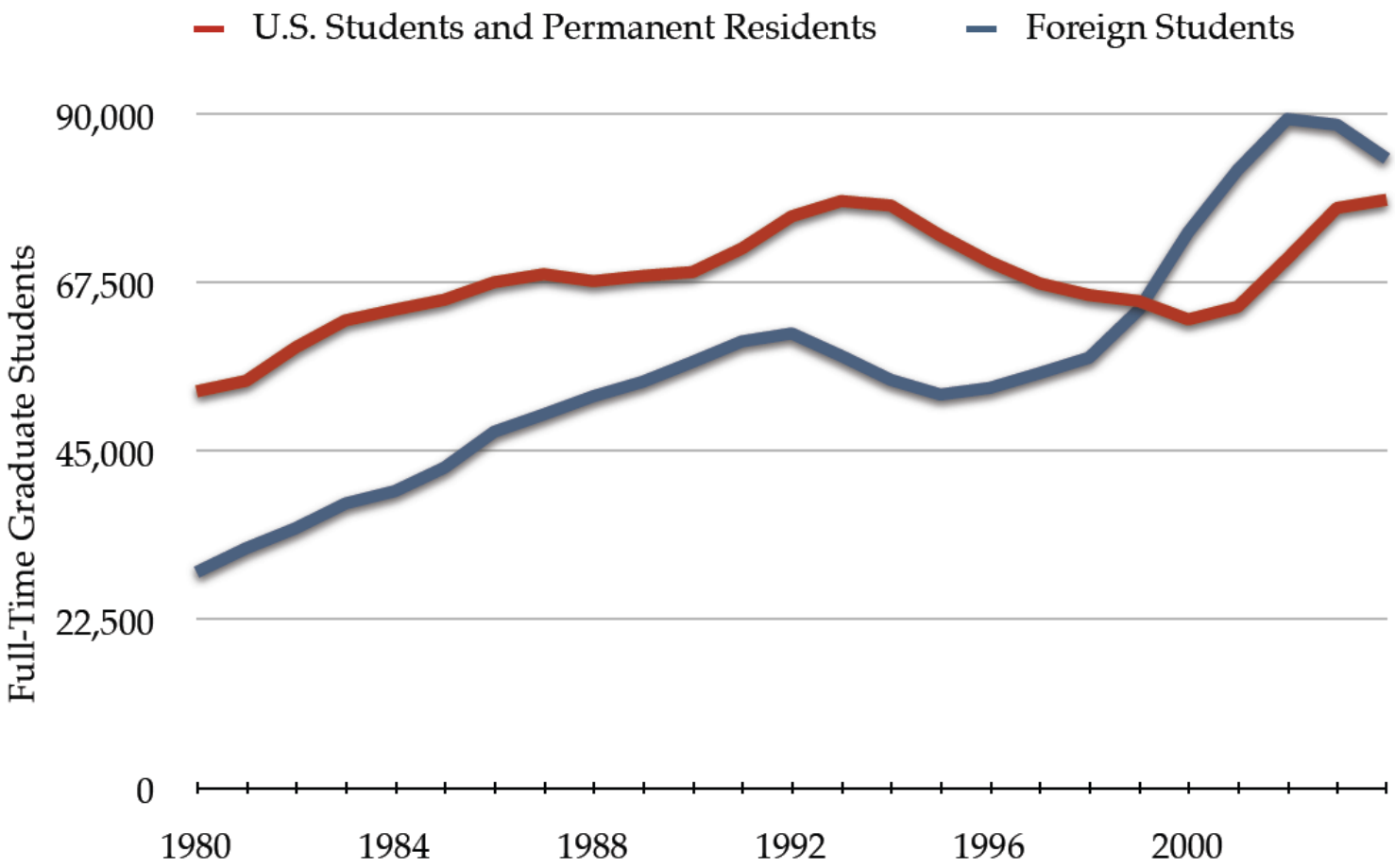
Linear Plot

3.6:1

Source: Ray Kurzweil, KurzweilAI.net

How Tough Is It?

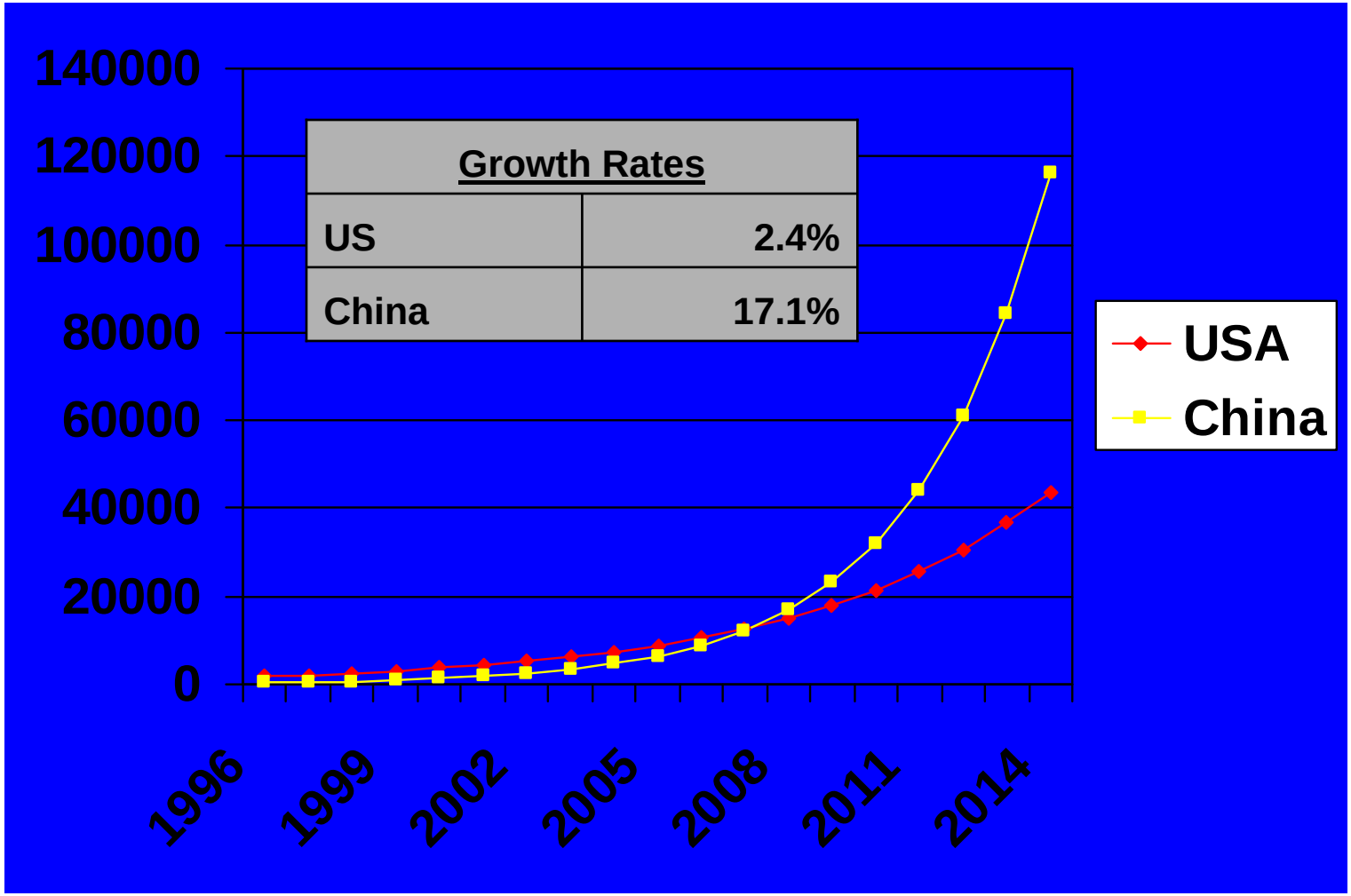
U.S. Graduate Institutions: Foreign Students Outnumber U.S. Students in Physical Science* and Engineering



* Mathematical and Computer Science included.

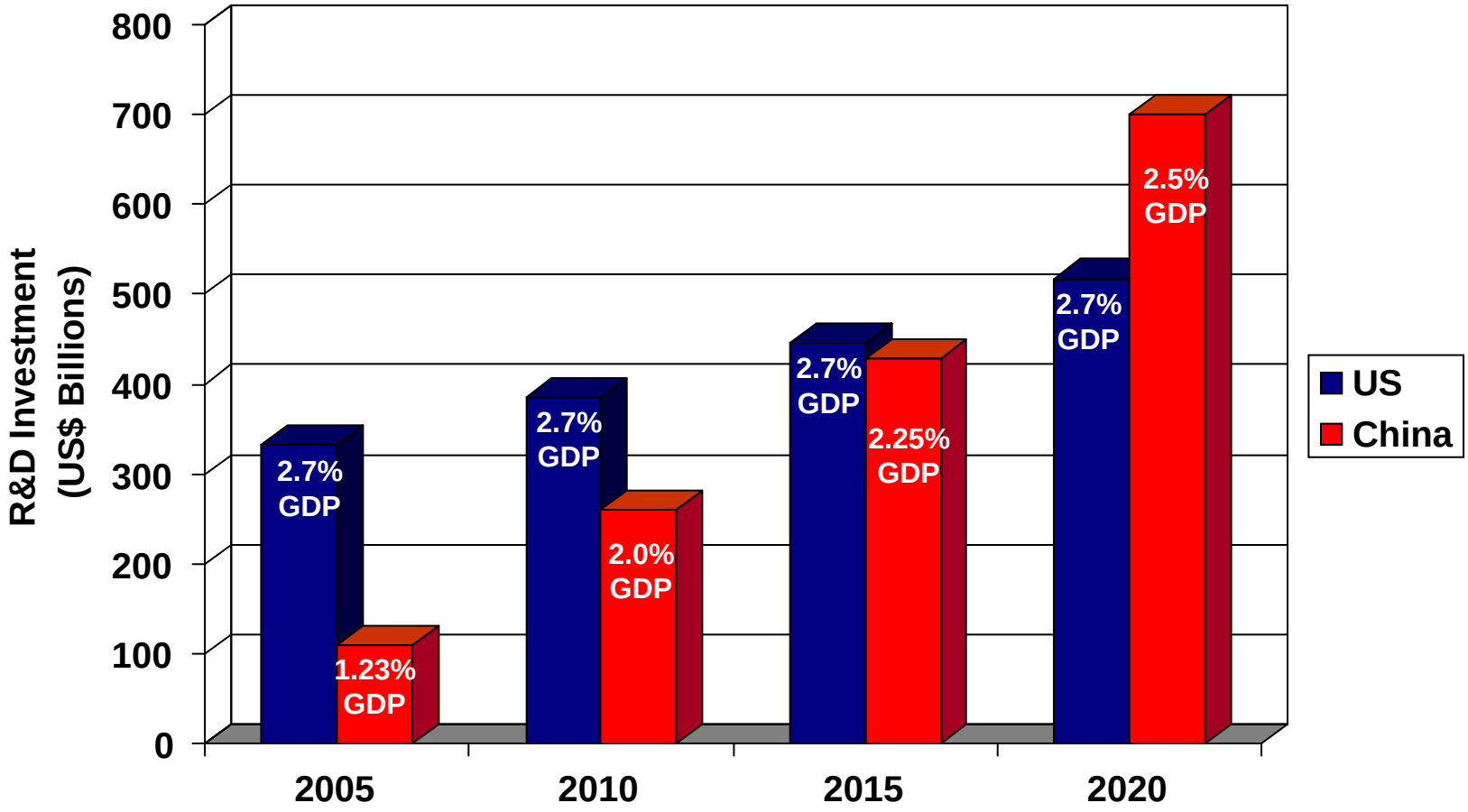
Source: National Science Foundation Division of Science Resources Statistics: Graduate Students and Postdoctorates in Science and Engineering, Fall 2002, Fall 2003, and Fall 2004. Compiled by the APS Physics Washington Office.

S&T Publication Trends



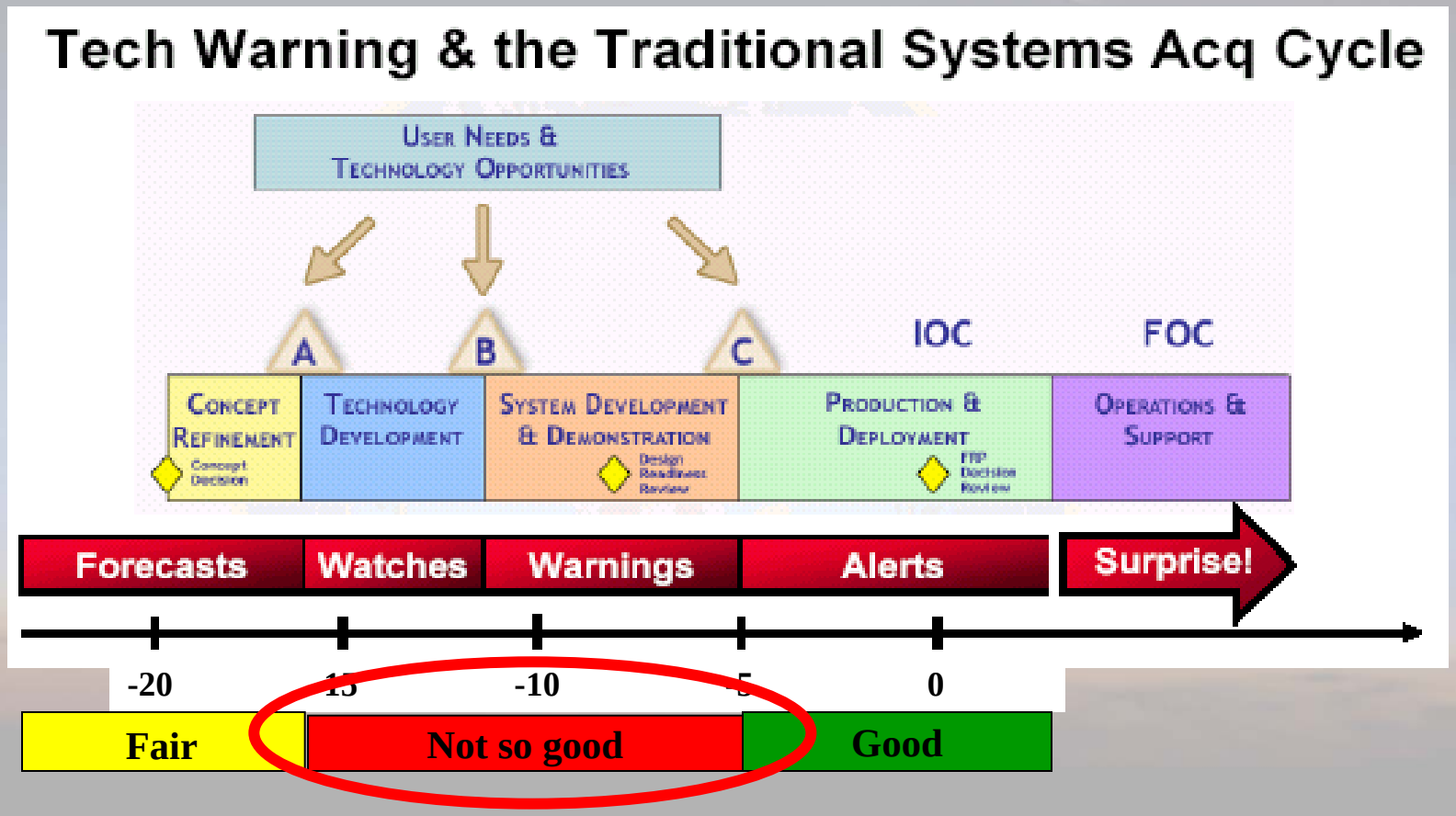
Losing the lead – not an option

R&D Investment at PPP Rates



How Are We Doing?

Technology Warning Assessments



Technological Surprise is inevitable!

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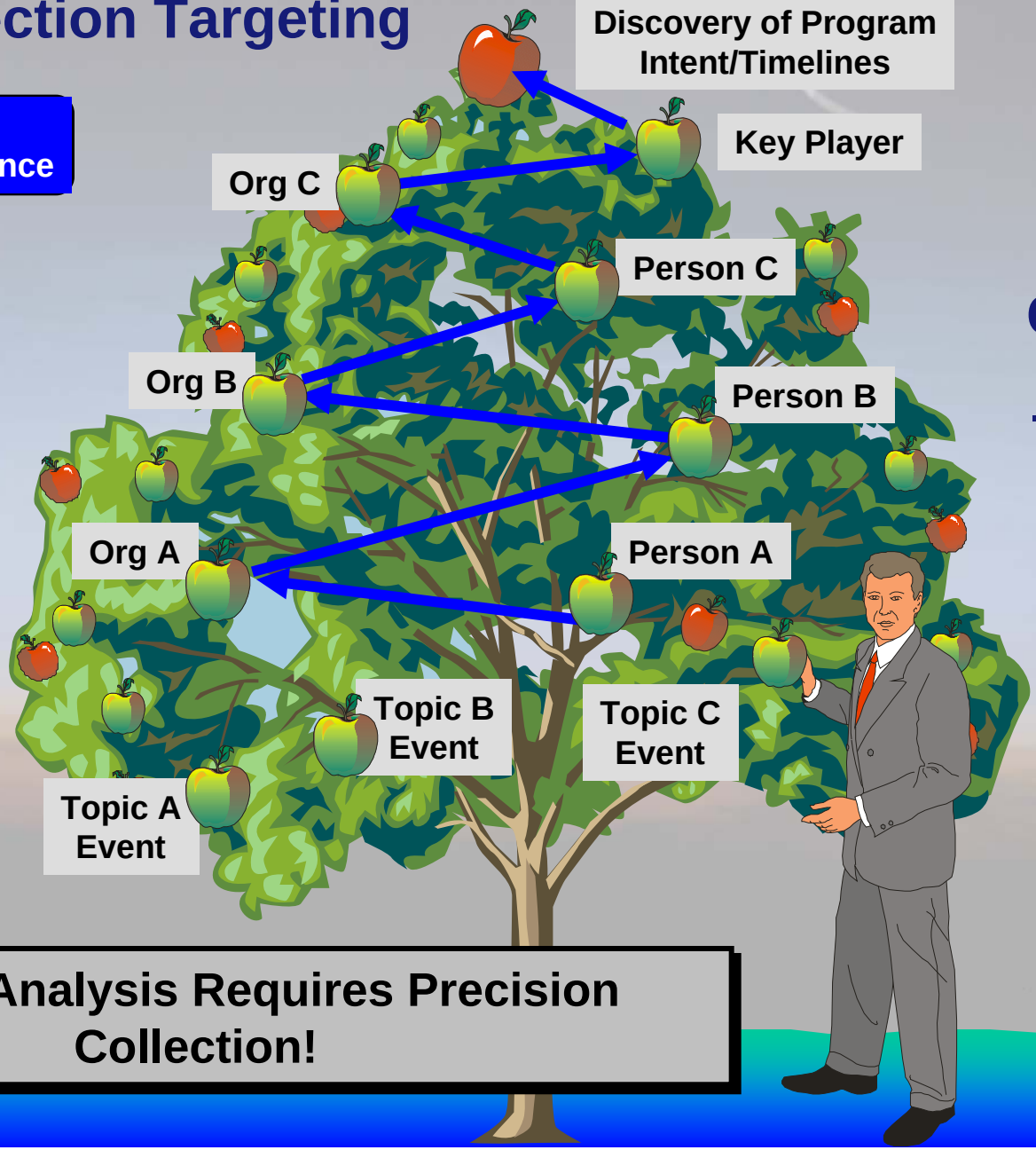
How Are We Doing?

Collection Targeting

Field of Vision/ Predictive Intelligence

High

Low



Collection Priorities

Operations

GWOT

WMD

Complex Analysis Requires Precision Collection!

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How Are We Doing?

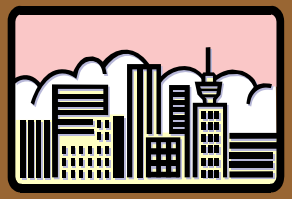
Client Requirements

Foundational RDA analysis elements

Manpower

Equipment

Materials



Facilities

Processes

Tendency to lose focus on foundational elements!

What Do You Say?

OSD/DDR&E Recommendations

1. **Less conservative, more speculative analysis of foreign research and development programs**

2. **Balance between near term (GWOT) needs and far term forecasting**
   1. **Enables DoD acquisition programs to be responsive**

3. **Expand/strengthen technical analysis capability within U.S. intelligence community**

4. **Establish consistent, community-wide standards of "technology warning"**

What Are We Doing?

Initiating Change

- **Encourage alternative analysis**
- **Adopted NASA TRLs in assessments**
- **Employed warning terminology in titles of products**
  - **Alert: Technology IOC**
  - **Warning: Technology IOC within 5 yrs**
  - **Watch: Technology IOC within 10 yrs**
  - **Forecast: Technology IOC beyond 10 yrs**
- **Implemented DNI Analytic Standards for reporting**
  - **Sourcing, Confidence Levels, Alternative Analysis**
- **Stood-up AF S&TI collection program**
- **Standardized Intellipedia**

Technology Insertion Into Programs

	Threat Concept Identified		Threat Emerging		Threat Program		Threat Operational
	Forecast		**Watch**		**Warning**		**Alert**
TRL	**1 2**	**3**	**4 5**		**6 7 8**		**9**

Focus on Gov't/Military Funding

So You Think You Have It Tough?

- One deep in doing technology maturity analysis
  - Several technologies not followed
  - Training not developed
- Often key intelligence data is lacking
  - Trend data difficult to assess
- Peers & Customers require convincing
  - To establish “INTENT” you are at TRL 7 and warning time is shortened
- Classification hurdles persist
  - Connecting databases is problematic
- Retention
  - Analysts and their Knowledge

Summary

- NASIC supports a broad analytic mission
  - Worldwide mission
    - Mission shortfalls - several
- Globalization/COTS calls for new approach
- Need to expand beyond technology control
  - Who's watching the COTS store?
  - Who's tracking component technology?
  - Who's tracking commercial industry takeovers?
  - Who's tracking venture capital?

Our best hope remains our determination & talent

Prevent Technological Surprise

Enable Global Engagement