

Disruptive Technologies

Col (Ret'd) Howie Marsh
14 April 2003, Ottawa

Disruptive

Technologies

Definition of

- Minor

- Significant

- Large

Predictions based on:

Mathematical Precursors

R&D Investment

Human Behaviour

Mathematical Precursors

Mathematics

D. Bernoulli: 1740

Mathematical physics

Fourier: 1800

Fourier series
and transforms

Gauss: 1840

Differential geometry

Riemann: 1860

tensor

Science

Hydrodynamics

Gas laws

Signal analysis

Flux, magnetism

General
Relativity

Technology

1850-1900

Pumps, flight

1900-1950

Analog-digital

1900-1950

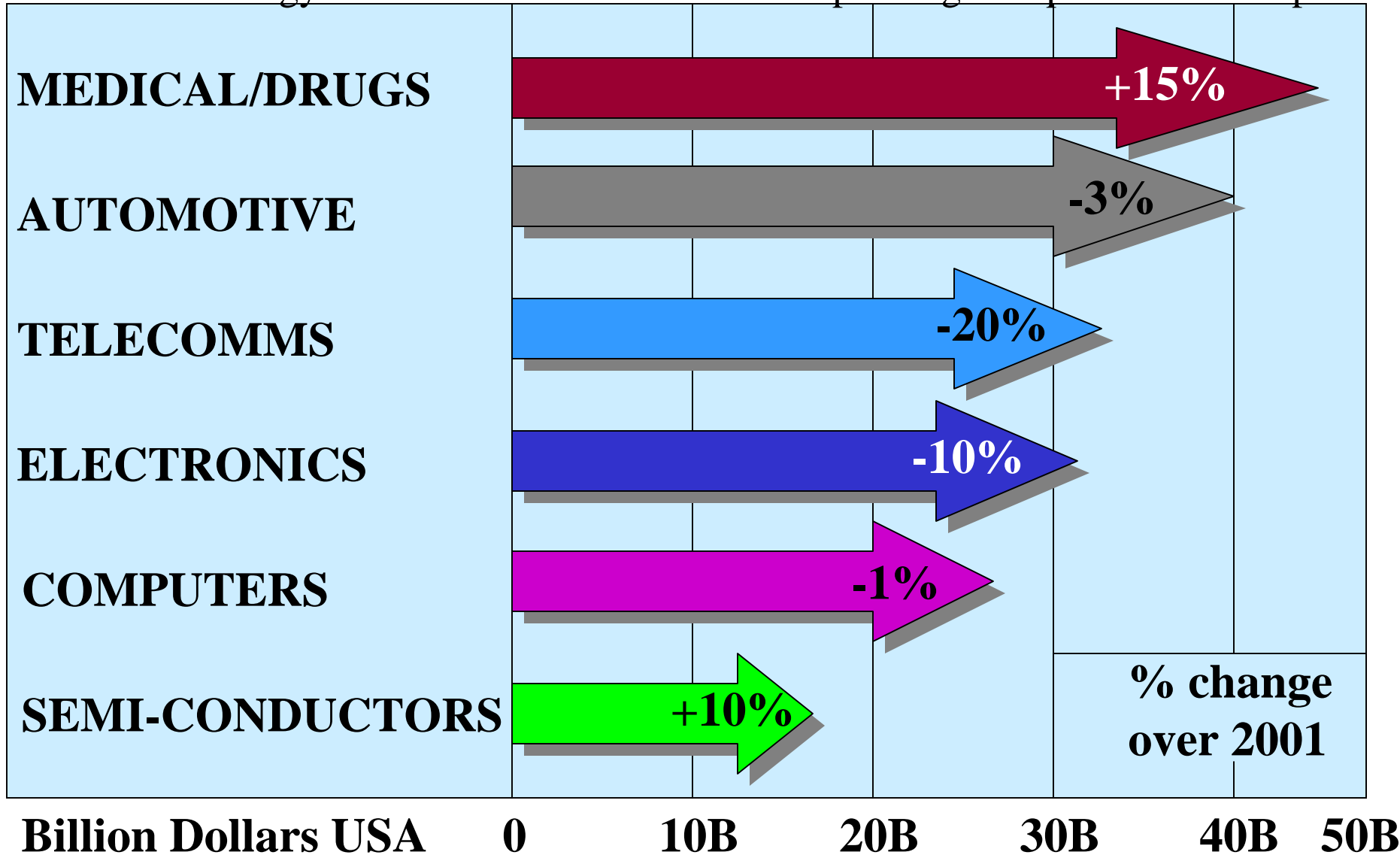
Solenoids, motors

1980+

GPS

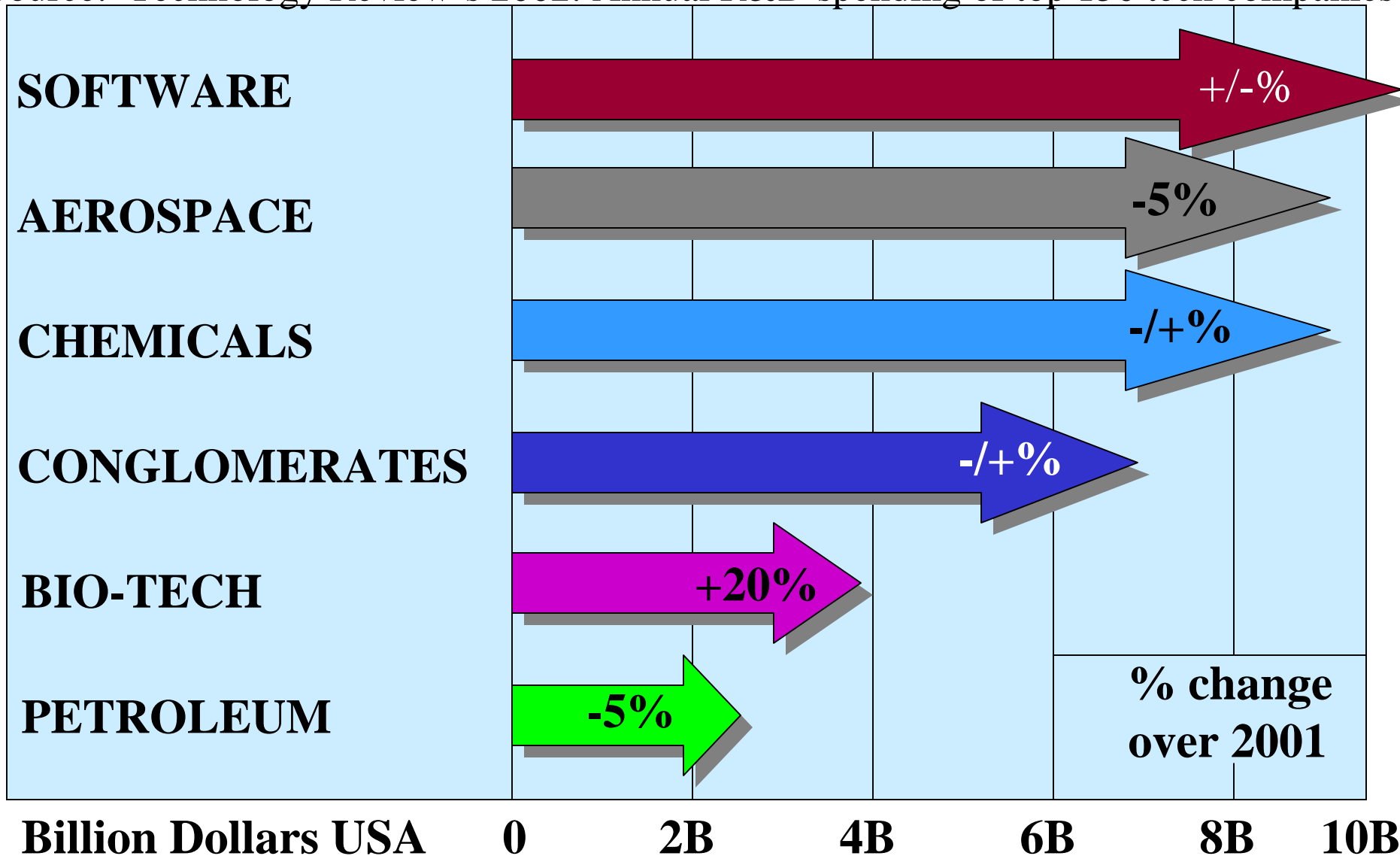
CORPORATE R&D SCORECARD 2002

Source: Technology Review's 2002: Annual R&D spending of top 150 tech companies



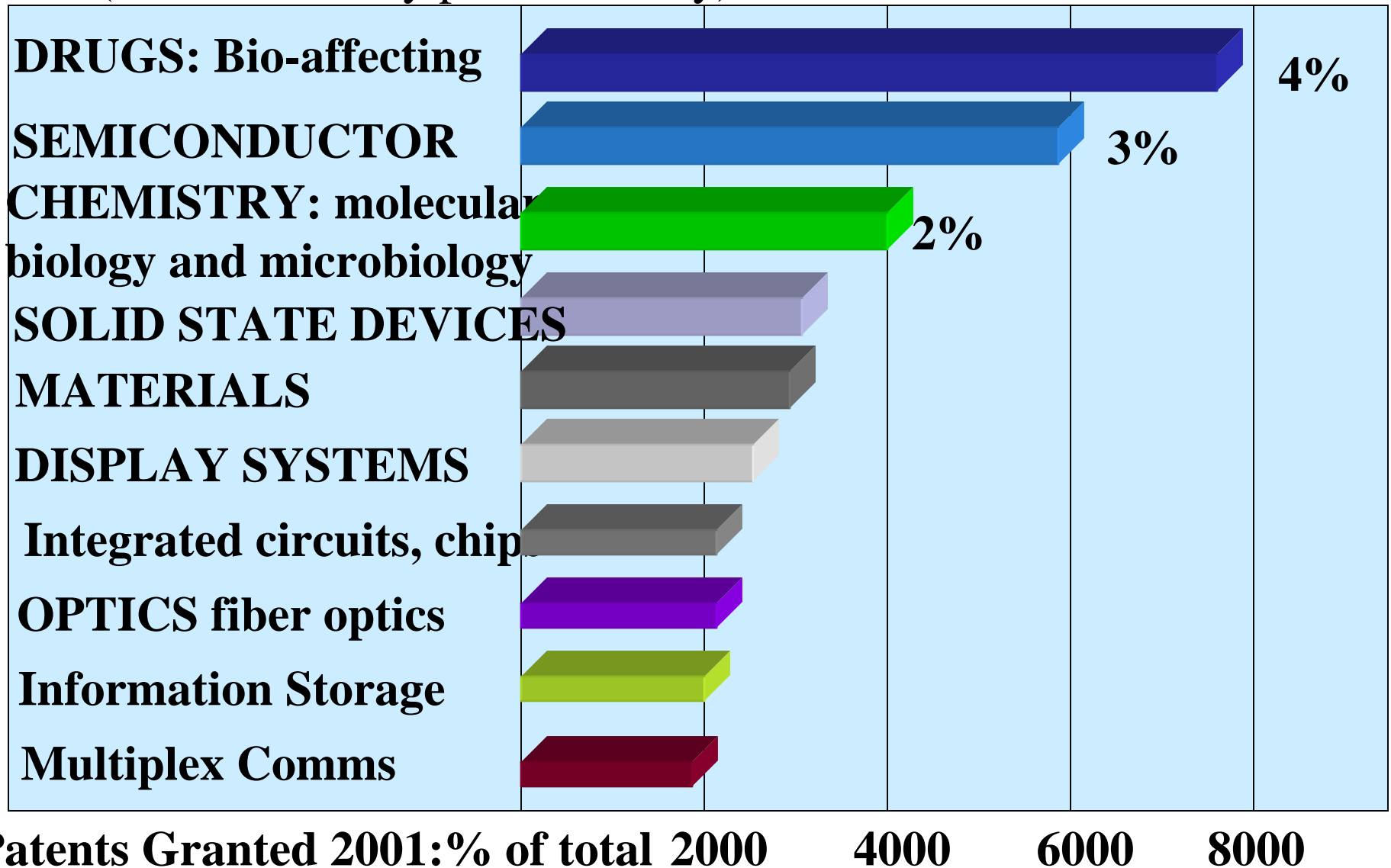
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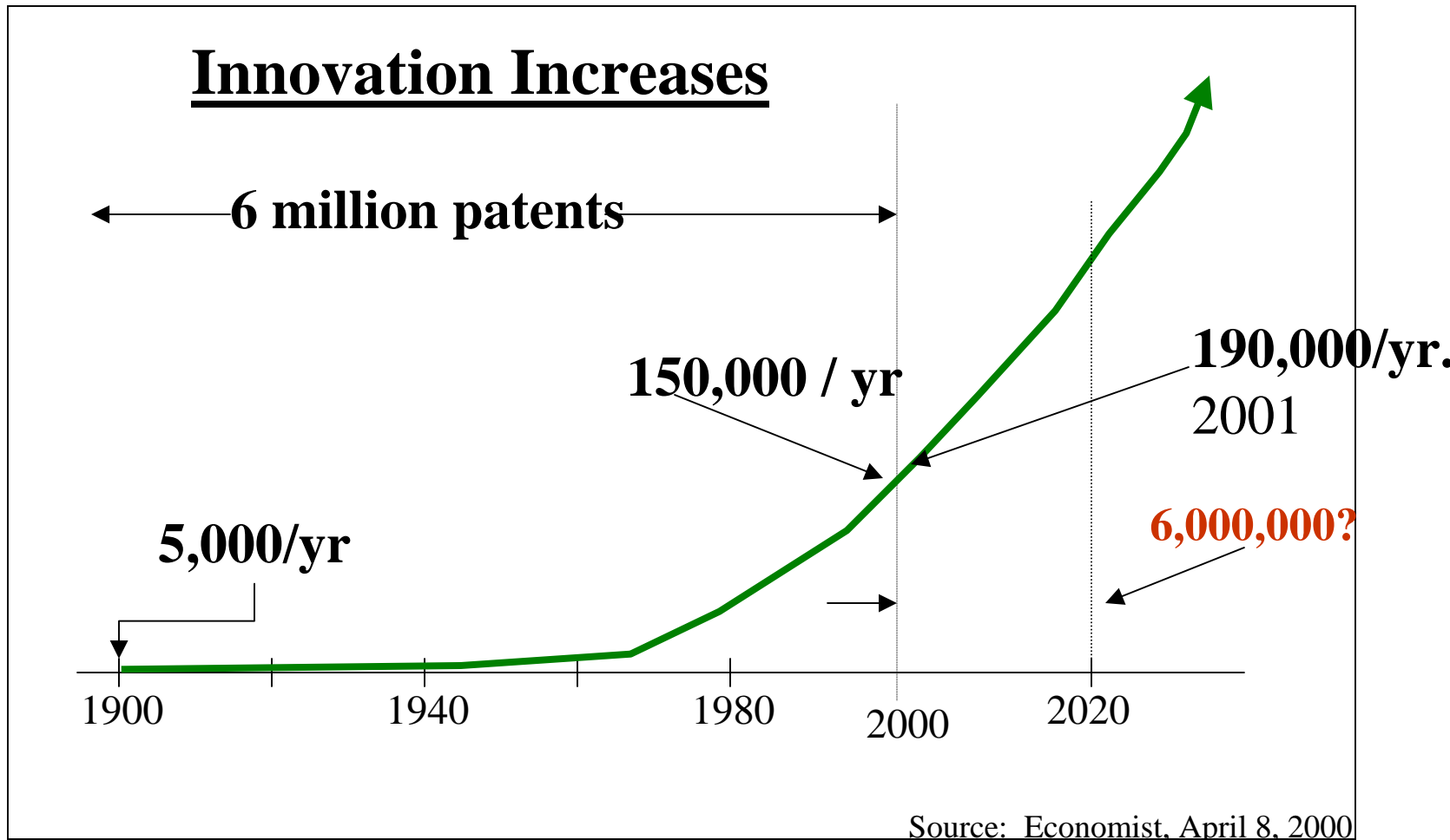


TEN TREND SETTING TECHNOLOGIES

(As measured by patent activity) TECHNOLOGY REVIEW October 2002

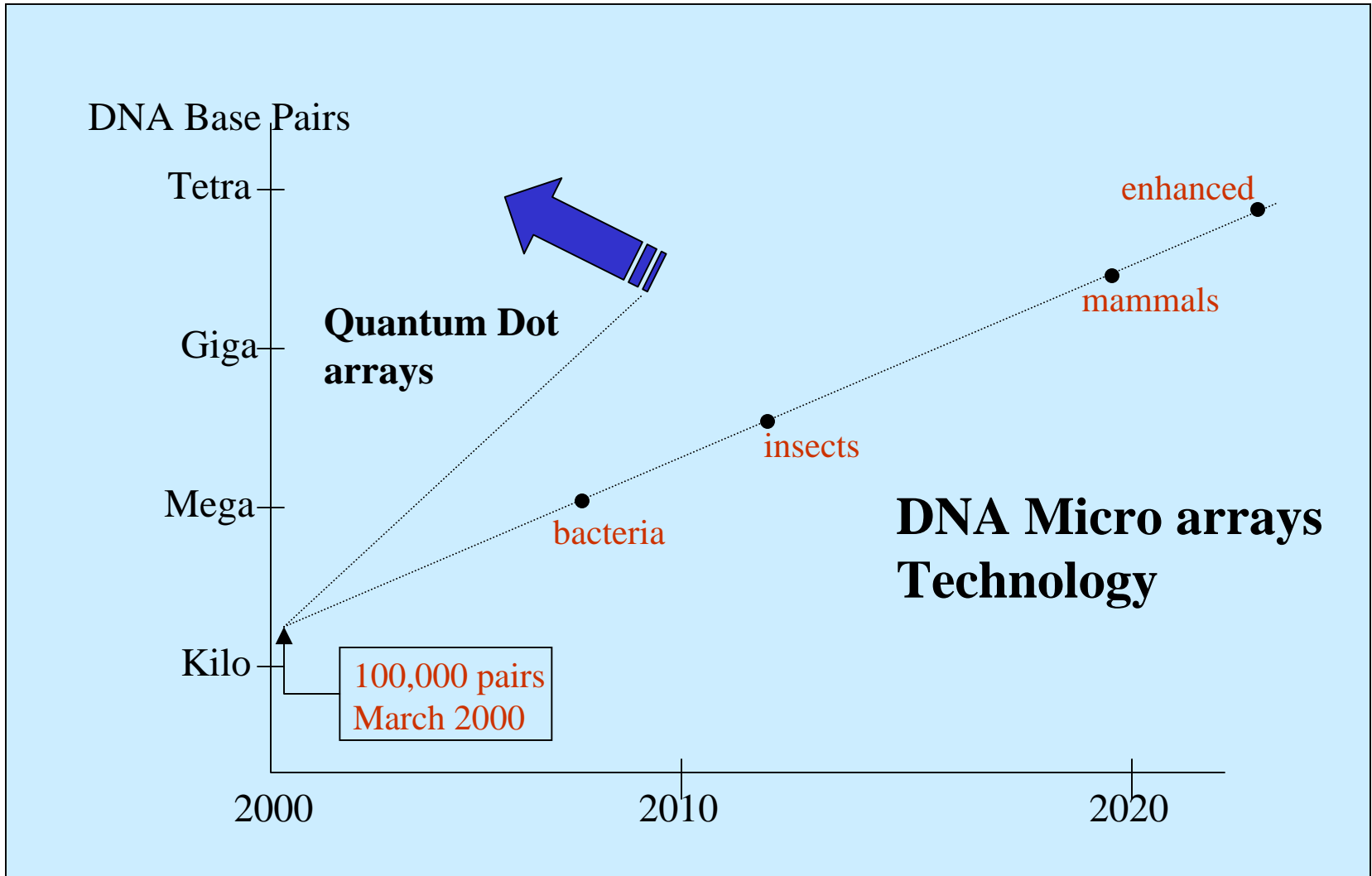


Time Ain't What it Used to Be !



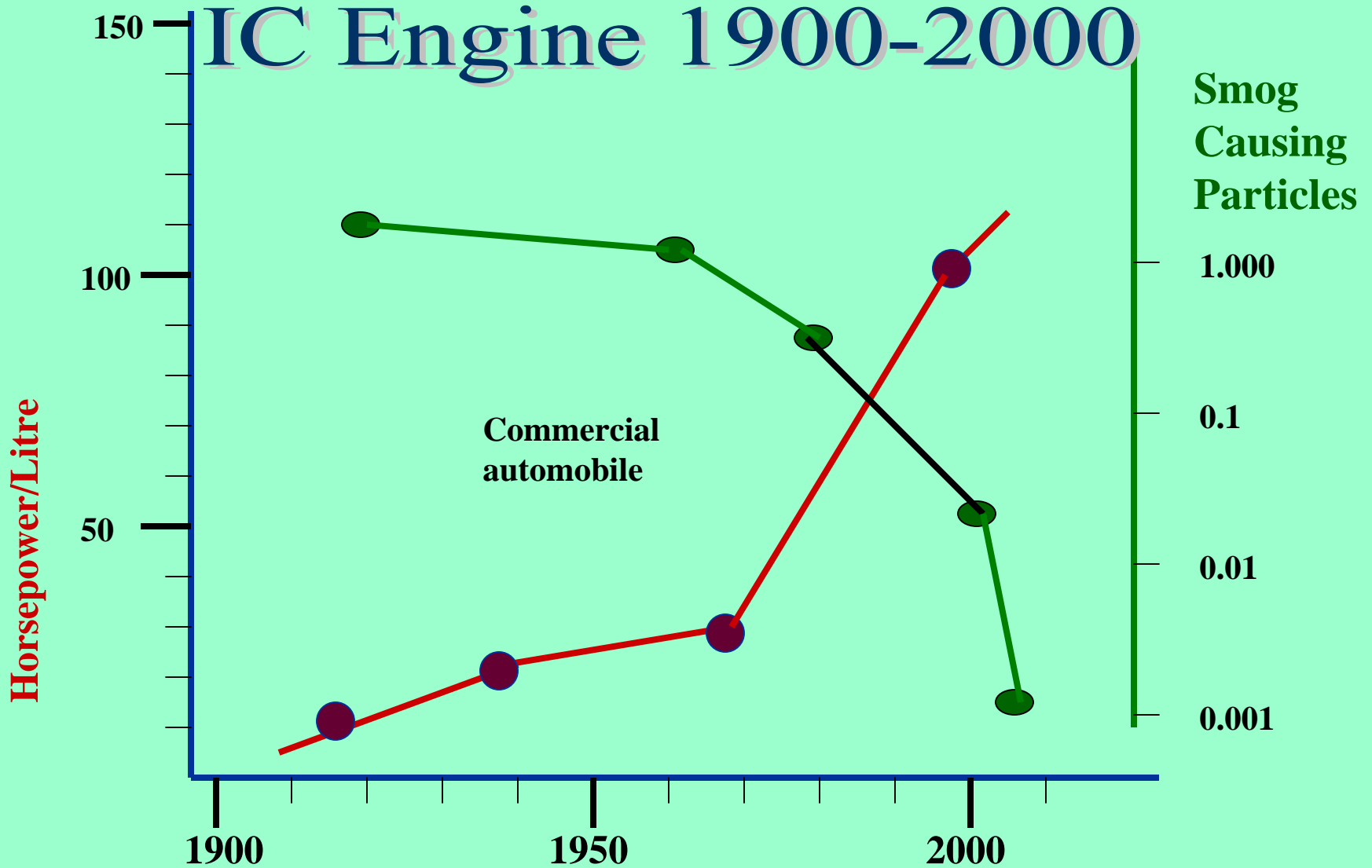
Note: Despite 2001 economic downturn, the world's top 100 R&D spenders increased R&D expenditure by an average of 5.25 percent in 2001..IEEE Sept 2002

Synthetic Life: Likely Evolution



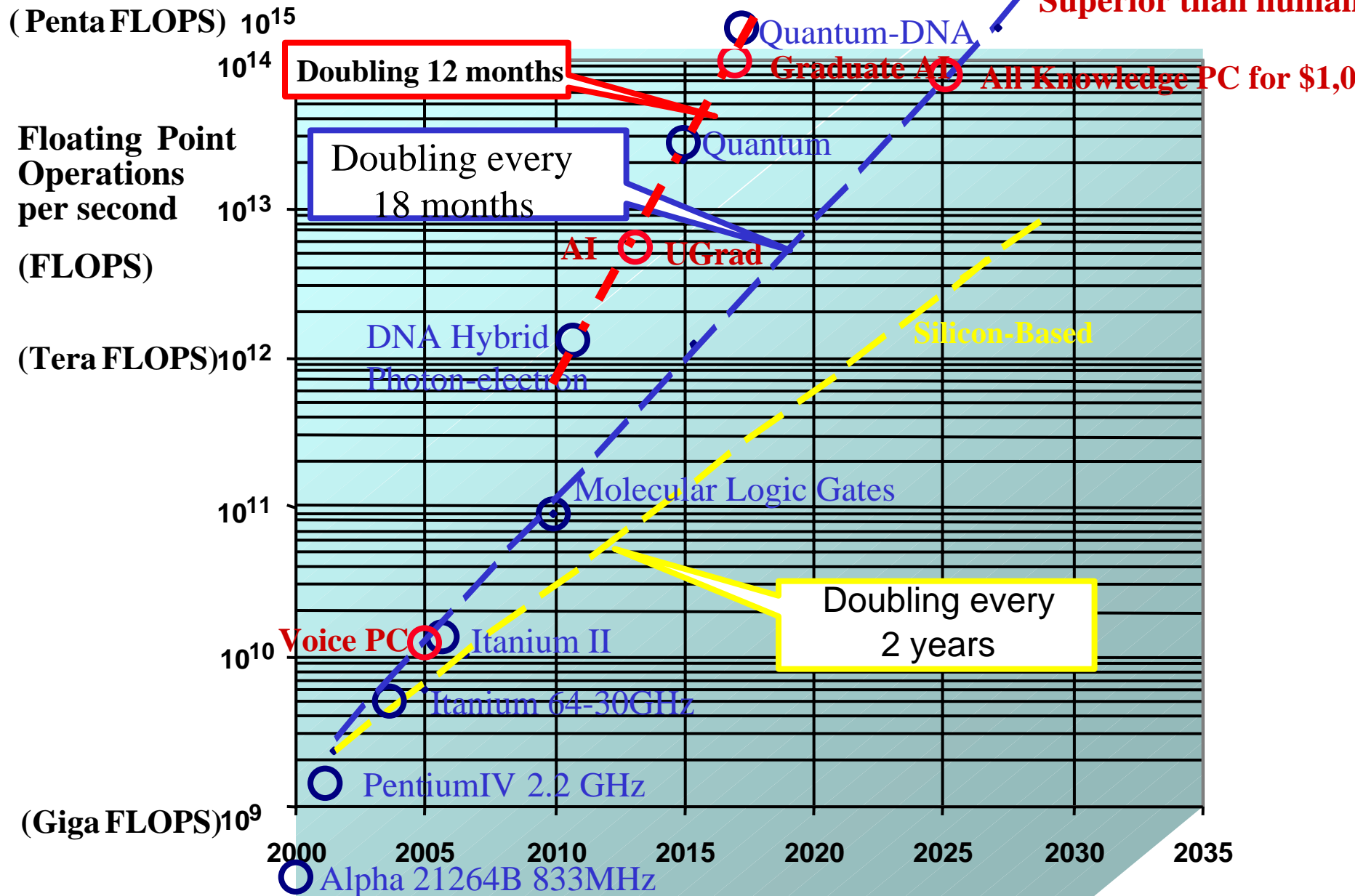
Power and Pollution

IC Engine 1900-2000



Processing Power 2000-2030

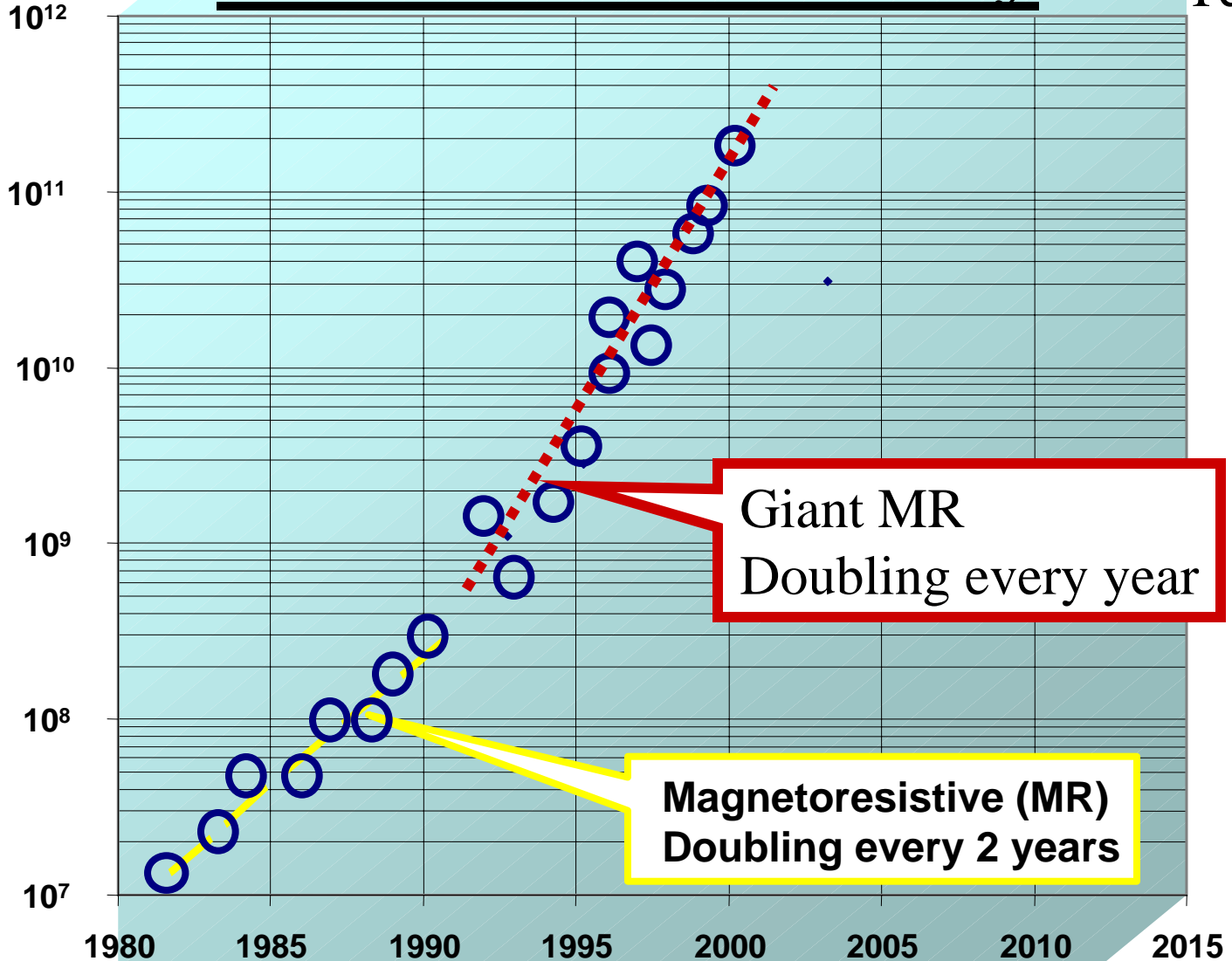
Compilation of US and UK projections*



Growth in Data Density

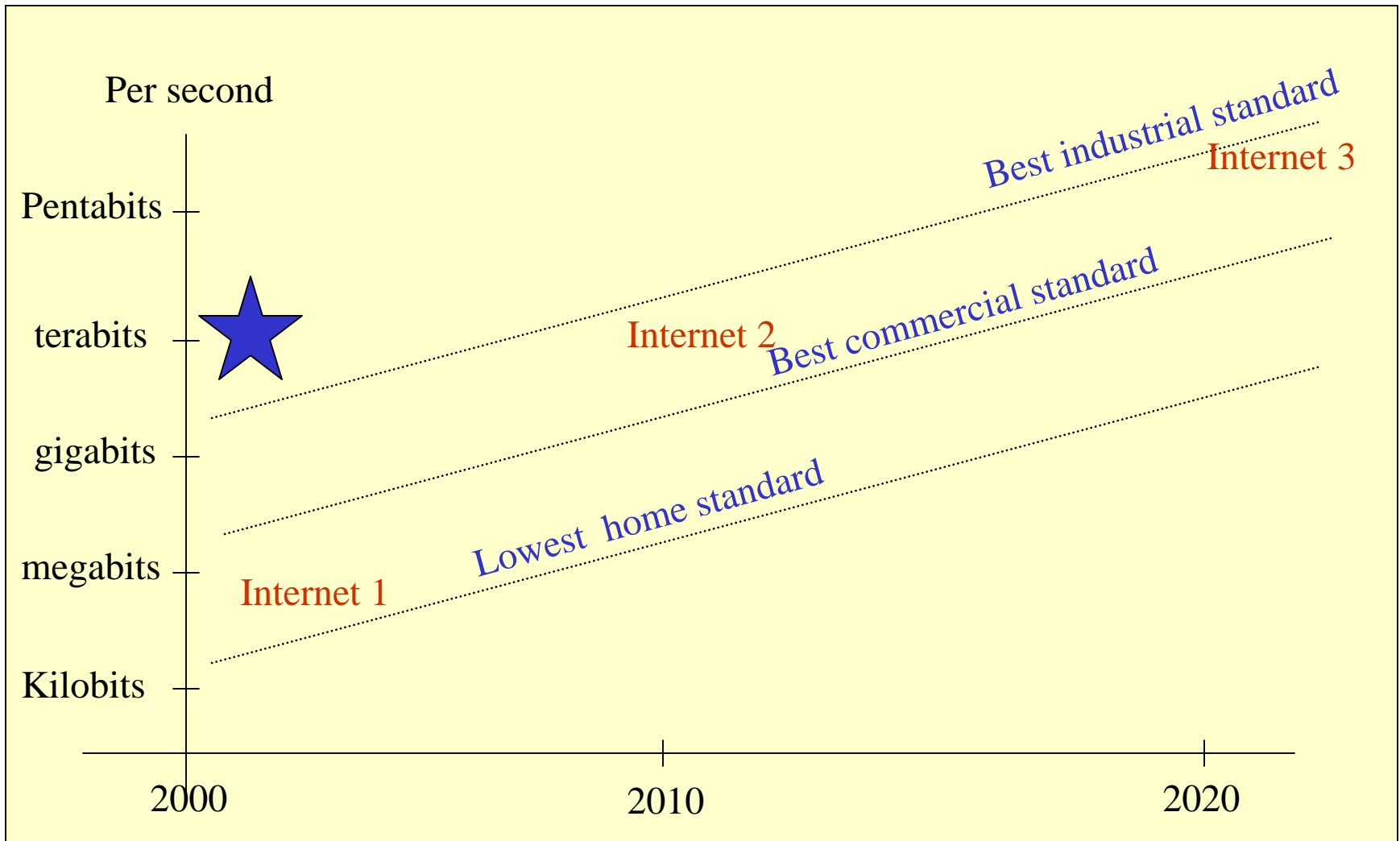
Terabyte
Territory

Density (bits) per square inch



Data transposed: source IBM Almaden Research Center

Likely Telecommunication Rates



FOR ALL OF US

DEVOLUTION OF EXPENSIVE CAPABILITIES

Computer

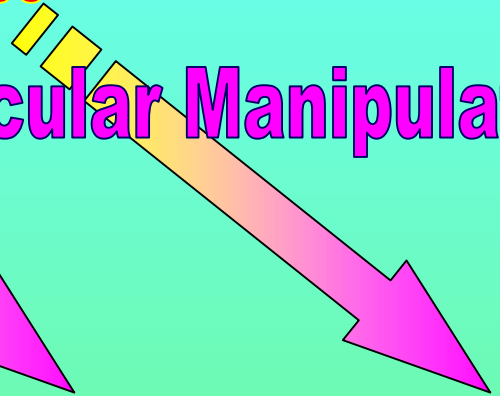
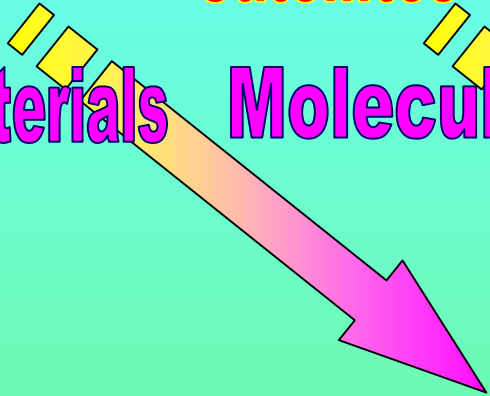
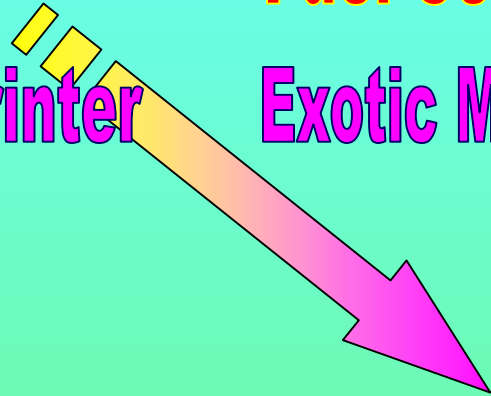
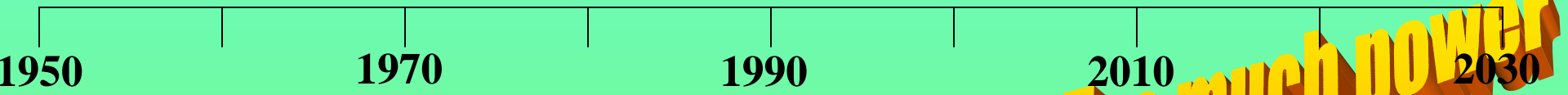
Electric Printer

Fuel Cell

Exotic Materials

Satellites

Molecular Manipulation



**Too much power
to the people**

Short-Term Trends 2000-2020

2000

2010

2020

Post-Industrial Age

Steel and oil → Carbon and Hydrogen

Nanotechnology

Silicon and electron → Molecular Reformulation and photons

MEMS

Bio-MEMS

Bio-Nano Hybrids

Bio-
Everything

Biotechnology

Nature and Light → DNA base-pairs

Long-Trend Drivers 1850-2050

1900

1950

2000

Internal Combustion engine

Steel and oil

Car hacking

Microchip

Silicon and electron

Computer Hacking

Micro Biology

Nature and Light

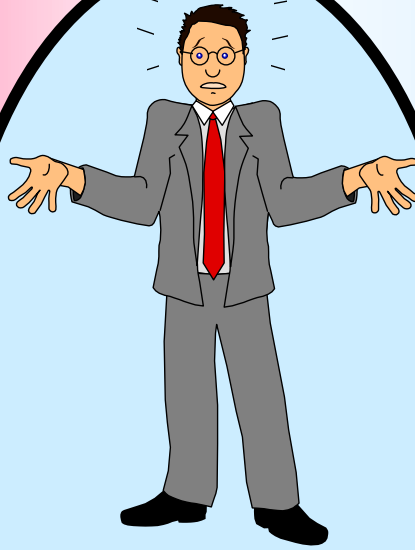
DNA

Hacking

A Paradigm

**Natural
Order
(Cosmos)**

**Beyond
Natural**



**Human
Systems**

**Science &
Technology**

**Theology
Philosophy**

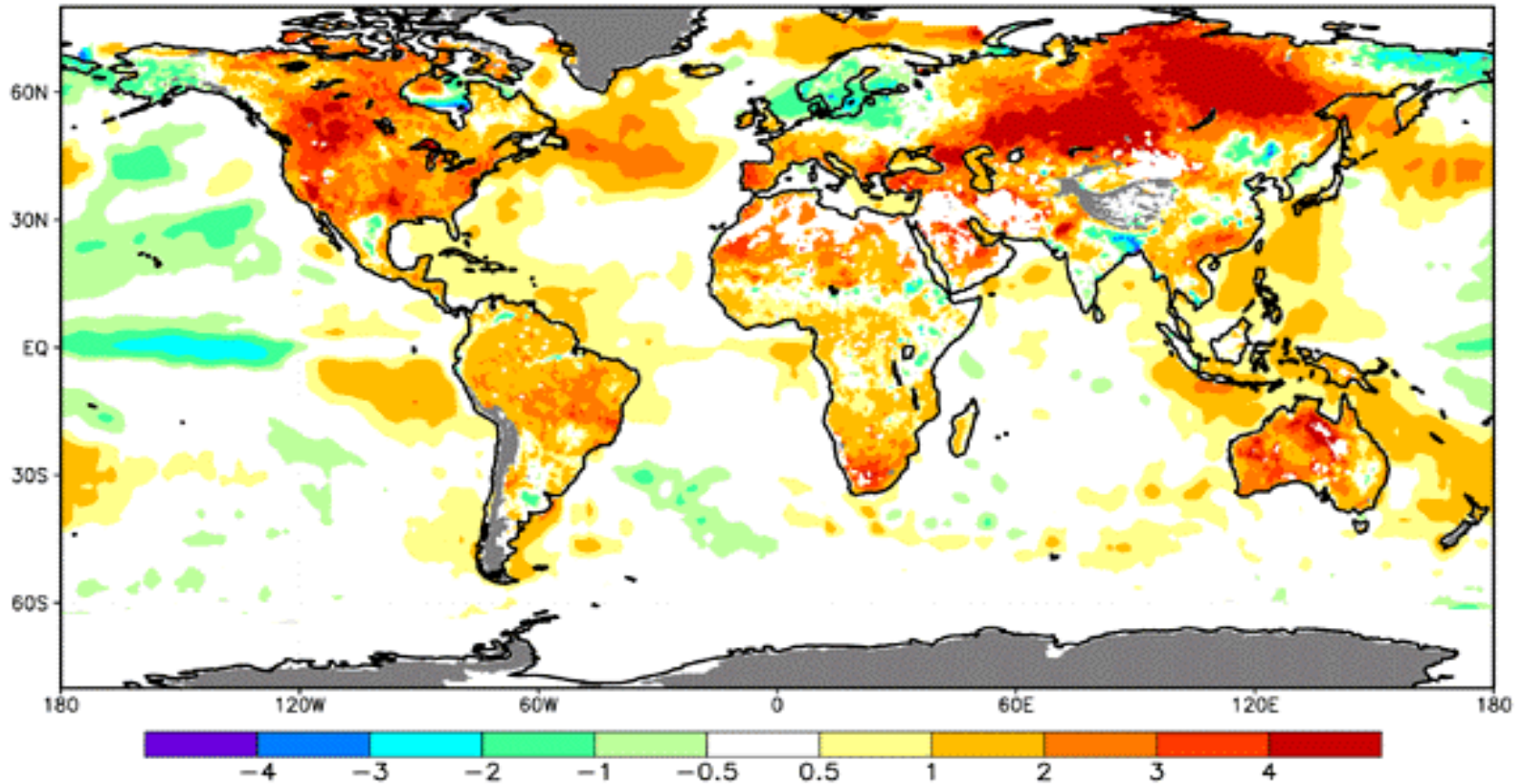
Physical

Metaphysical

Downside of technology: World is hotter



MONTHLY MEAN TEMPERATURE ANOMALY IN CELSIUS AUG. 1998
SSMI DERIVED SNOW COVER SURFACES ARE IN GREY
CLIMATOLOGICAL BASE PERIOD IS 1992 - 1998
SST DATA COURTESY OF R. REYNOLDS NCEP/NWS/NOAA



Minor

Rapid turnover of most innovations

Significant

Energy

Food

Do-It-Yourself

Middle Management

Education

Health Care

Governance

Large

**Redefinition of Cosmos and
Existence - Reformation II ?**

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Rapid turnover of most innovations

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**Redefinition of Cosmos and
Existence - Reformation II ?**

Navy

All electric
Highly Automated
Arsenal platforms
Sea Stealth
Continuous Laminar Flow
Trans-oceanic, trans-sonic “torpedo”



ARMY

Technologies

Low-observable (invisible?)

Neural Holographic

Heterogeneous structure

(Human, inorganic, organic)

Biological Command

Synchronous AI

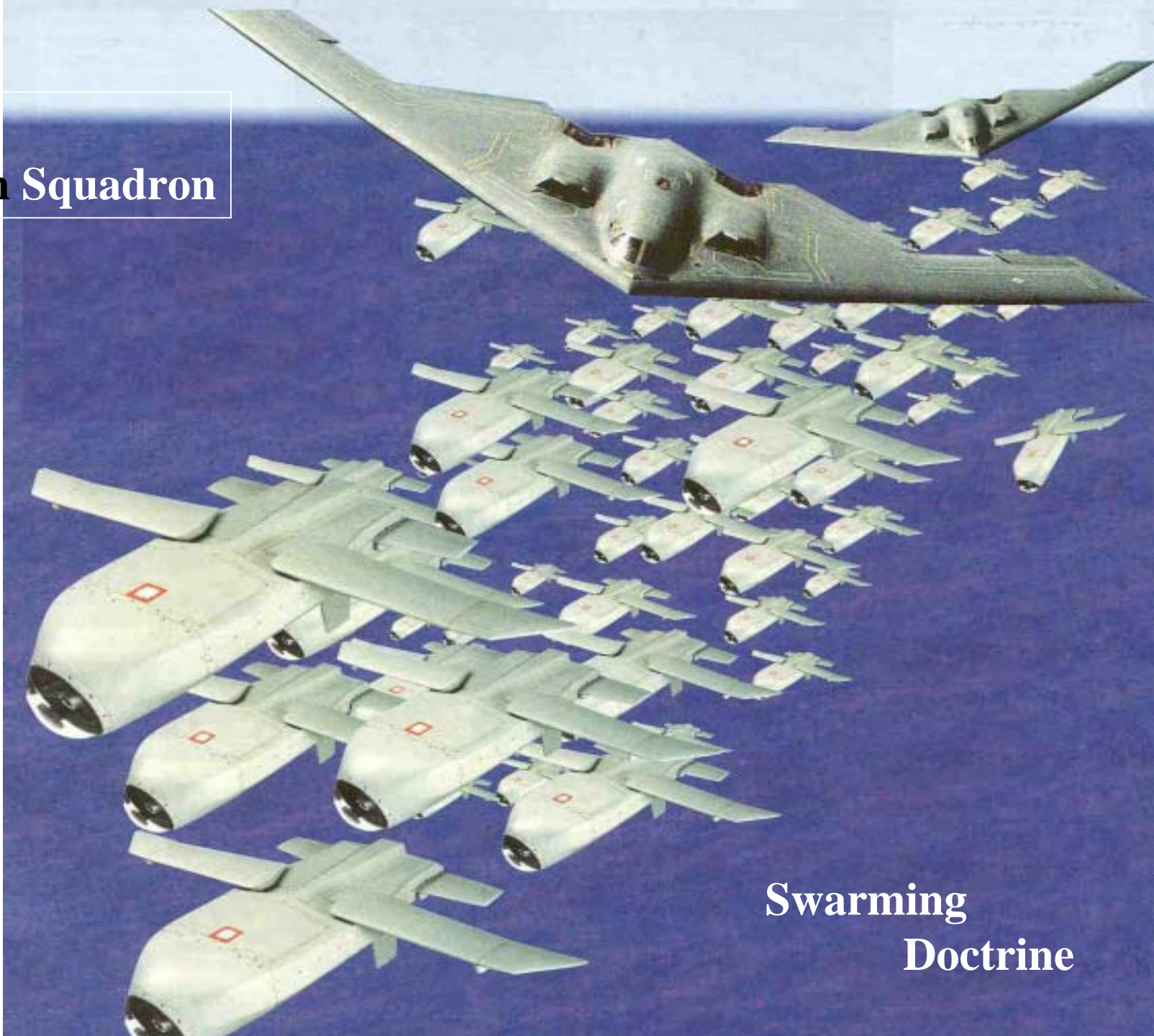


SOF

Surveillance and Arsenal Platforms

Physical and Moral Plane C4ISTAR

**1st USAF
Automaton Squadron**



**Swarming
Doctrine**

Air Force



Electro-optics

MEMS

Neural Holographic computing

Plasma boundary mechanics

Fighters: really fast, smaller, unmanned

Strategic Lift: much greater lift [flying boat]

Reconnaissance: Everyone has their own.



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