“Changing the Game”
Emerging Technologies and Public Policy

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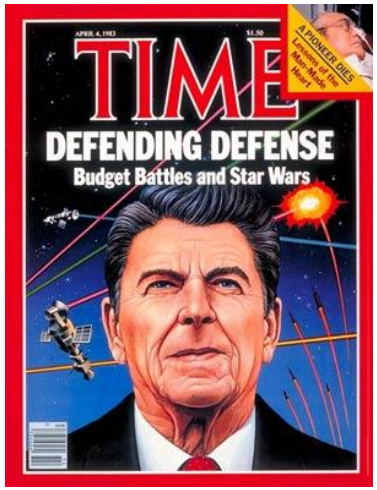
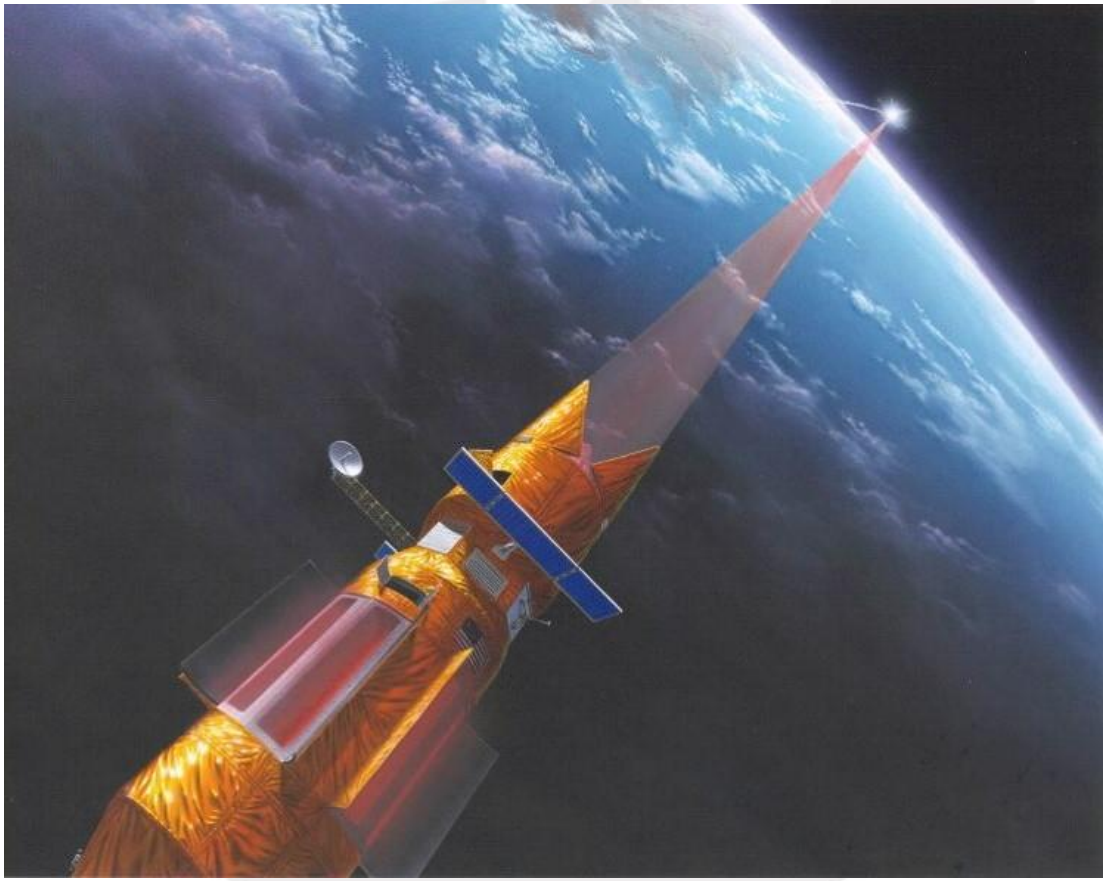
President Emeritus, Directed Energy Professional Society
Founder, AIAA Directed Energy Systems Program Committee
March 11, 2021

Introduction – Dr. Jim Horkovich

Warfighter, Educator, Star Warrior, Engineer

“Star Warrior” - 1984 - 1990





“Star Wars” Space Based Laser

Agenda

- Introduction
- Statement of the Problem
- White House S&T Policy
- Aerospace Industry Corporate R&D
- Acquisition “Valley of Death”
- Public Policy Issues

Did You Know?

- 30% of US youth did not finish high school in the 2001 – 2010 decade[1]
- 65% of young Hispanic and Black males did not finish high school[1]
- 60% of high school graduates applying for union trade schools could not pass the trade school entry math tests[2]
- US Students scored in the bottom 5 among the 30 industrialized nations of the world in science and math[3]
- A majority of young Black and Hispanic students chose “professional athlete” or “Entertainer” as their career goal in 2007[4]
- India had more high school students that test at the genius level than the USA had students in 2011[5]
- China has opened 7 major new technical universities between 2001 & 2011[6]
- Asia graduated 636,000 new engineers in 2002, compared to 68,600 in the USA[7]
- IN 2006 the USA was 17th in graduating science and engineering majors[7]
- Only two of the top ten engineering and sciences schools in the world are in the USA (it was 8 of 10 a decade ago)[8]

Questions

- How many Heisman Trophy winners will it take to solve global warming?
- How many Oscar winners will it take to find a cure for breast cancer?
- How many Super Bowl champions will it take to develop clean energy?
- How many PGA Tour winners will it take to find a cure for Alzheimer's?
- How many Grammy winners will it take to find a cure for autism?
- How many college football coaches are paid more than a $1 million a year? How many science, engineering, and math professors?
- How many school teachers will earn in their entire careers what Charlie Sheen is paid for one acting episode?
- How many major news stories were there during the most recent "National Engineers Week?"

How can we successfully impact our education system and ensure that our culture puts a value on the things that matter to producing advanced technology?

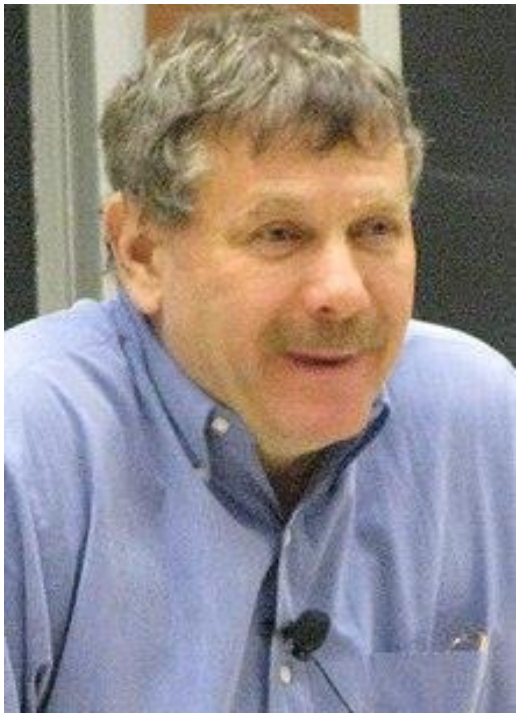
Initial Thoughts

- Why are we engineers?
- Because we are driven to solve problems!
- Our profession has largely been focused on **HOW** to solve problems.
- As engineers, we know that solution to any given problem requires that Necessary and Sufficient Conditions be met.
- Technical correctness and innovation is a necessary condition, but it is not SUFFICIENT.
- **WHY** we are solving the problem has become perhaps more important than **HOW**

How Do We "Change the Game?"

- Sufficiency comes from Need and Public Policy
- Where does Public Policy Come From?

Public Policy Starts at the Top – The President and Congress



New OSTP Director Dr. Eric Lander.

President Biden has elevated the White House Office of Science and technology Policy to Cabinet Level.

OSTP Policy Guidance for 2020:
Five overarching "budgetary priorities," spanning defense and civilian research, as well as five "high-priority crosscutting actions," which include developing the future STEM workforce and better leveraging federal datasets

- R&D must underpin "Industries of the Future," such as artificial intelligence and quantum information science
- Favor "early-stage" energy research over later-stage technology development, and adds a new emphasis on nuclear energy R&D, including work on advanced reactor technologies
- Several entirely new priorities are included, such as research relating to "Earth system predictability," ocean exploration, critical minerals, high-risk high-reward research, and research integrity.

S&T Priorities for FY20 Budget (OSTP)

- **Basic Research**
- **US Competitiveness**
- **Advanced Manufacturing**
- **Energy**
- **Medical Research**
- **Expanding Private Sector Investment**
- **21st Century Infrastructure in Wireless and Energy Grid**

2013 Federal R&D Request of $140.8B ($142.2B with facilities)

2020 Federal R&D Request of $134.1B

Source: Congressional Research Service: **Federal Research and Development (R&D) Funding: FY2020** Updated August 13, 2019

Practical Challenges for S&T in FY2020 Budget

- Applying S&T strategies to drive economic recovery, job creation, and economic growth;
- Promoting **innovative energy technologies** to reduce dependence on energy imports and support new businesses;
- Applying biomedical science and information technology to help Americans live longer, healthier lives while reducing health care costs; and
- Assuring we have the technologies needed to **protect our troops**, citizens, and national interests, including those needed to verify arms control and nonproliferation agreements essential to our security.

National Academy of Sciences: “National Photonics Initiative”

Addressing S&T Policy Challenges Requires:

- **Increasing productivity** of our research universities and major public and private labs and research centers;
- **Strengthening STEM education at every level**, from pre-college to post-graduate to lifelong learning;
- Improving and protecting our information, communication, and transportation infrastructure;
- Enhancing our capabilities in space, essential for communications, geopositioning, intelligence gathering, Earth observation, and **national defense**, as well for increasing our understanding of the universe and our place in it.

National Academy of Sciences: “National Photonics Initiative”

Development of Outcome Oriented Goals for S&T

- Explain how agencies are strengthening their capacity to rigorously evaluate success of their programs.
- **Open innovation model, in which the whole chain from research to application does not have to take place within a single lab, agency or firm,**
- **Support for long-term, visionary thinkers proposing high-risk, high-payoff research**.
- Explain how S&T investments contribute to increased economic productivity and progress - make these data open to the public in accessible, useful formats.
- Develop “science of science policy” tools that can improve management.

National Academy of Sciences: “National Photonics Initiative”

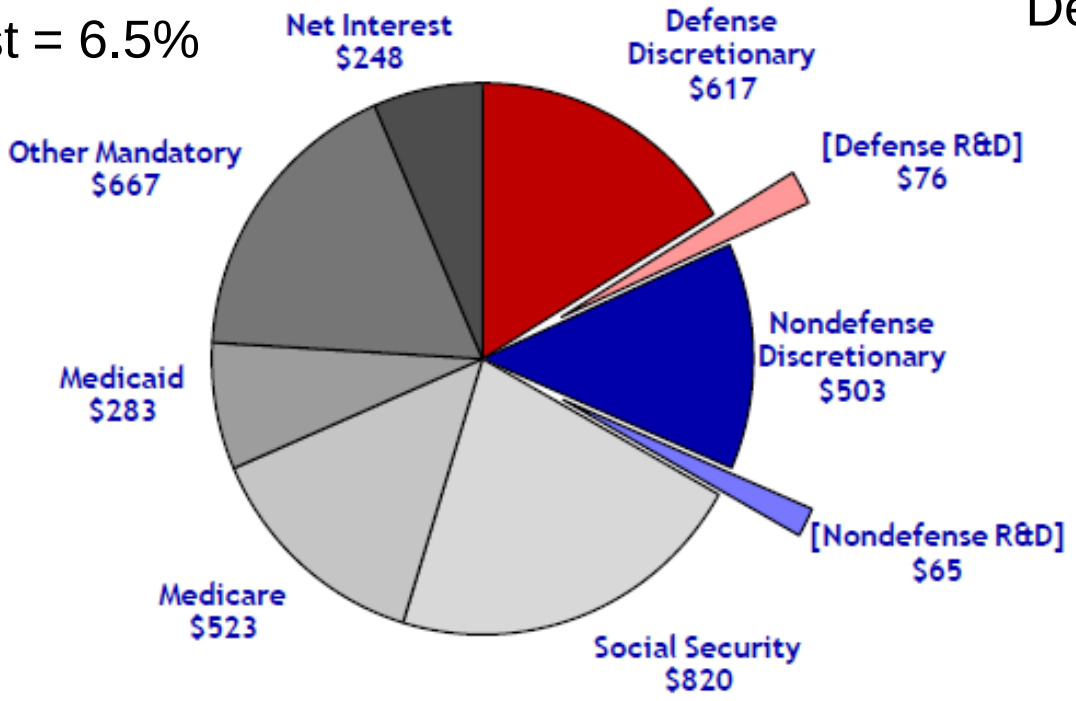
Federal Budget Overview - 2013

Composition of the Proposed FY 2013 Budget
Total Outlays = $3.8 trillion

outlays in billions of dollars

Debt Interest = 6.5%

Defense = 18.2%

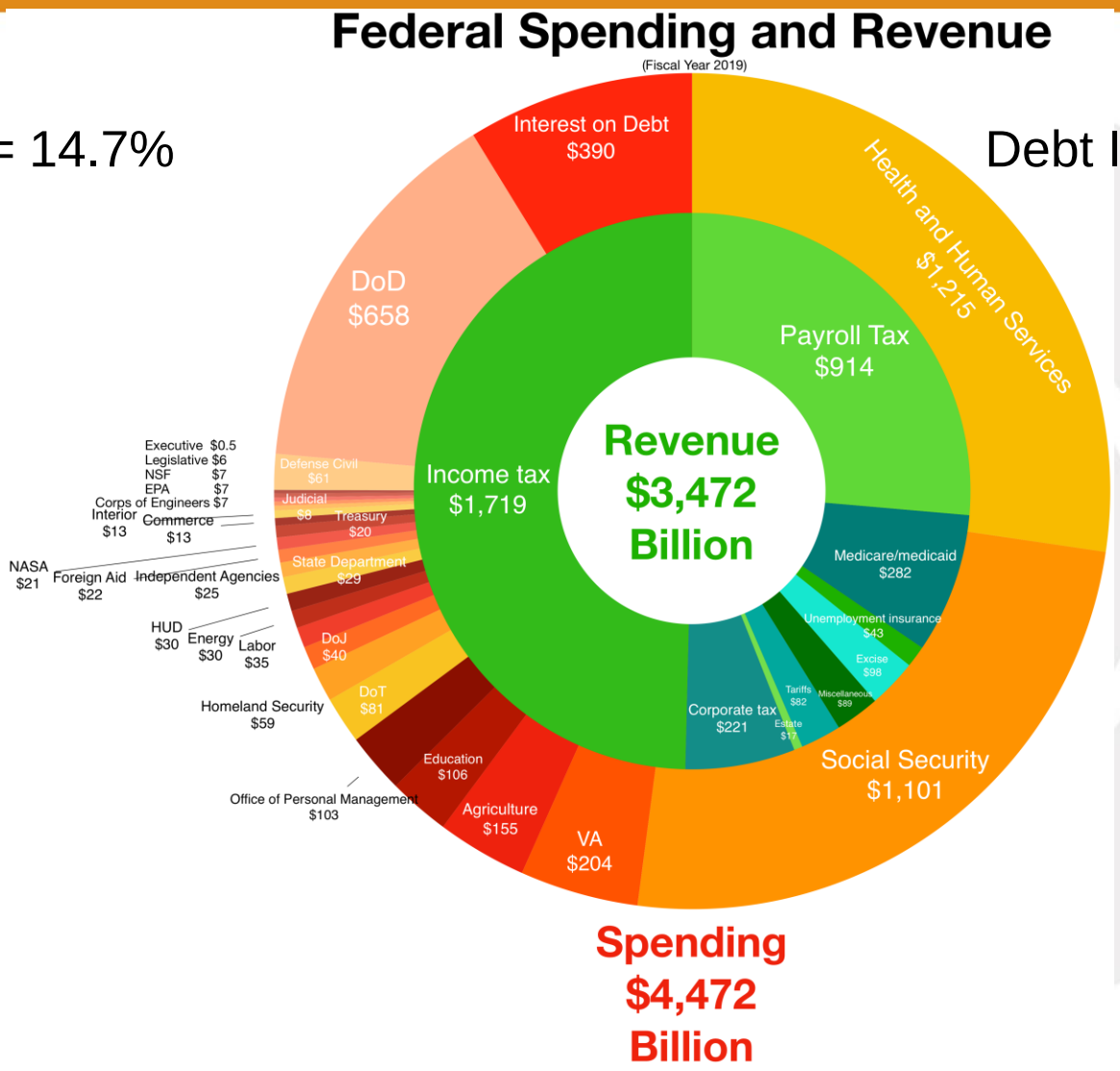


Source: *Budget of the United States Government FY 2013.*
Projected unified deficit is $901 billion.

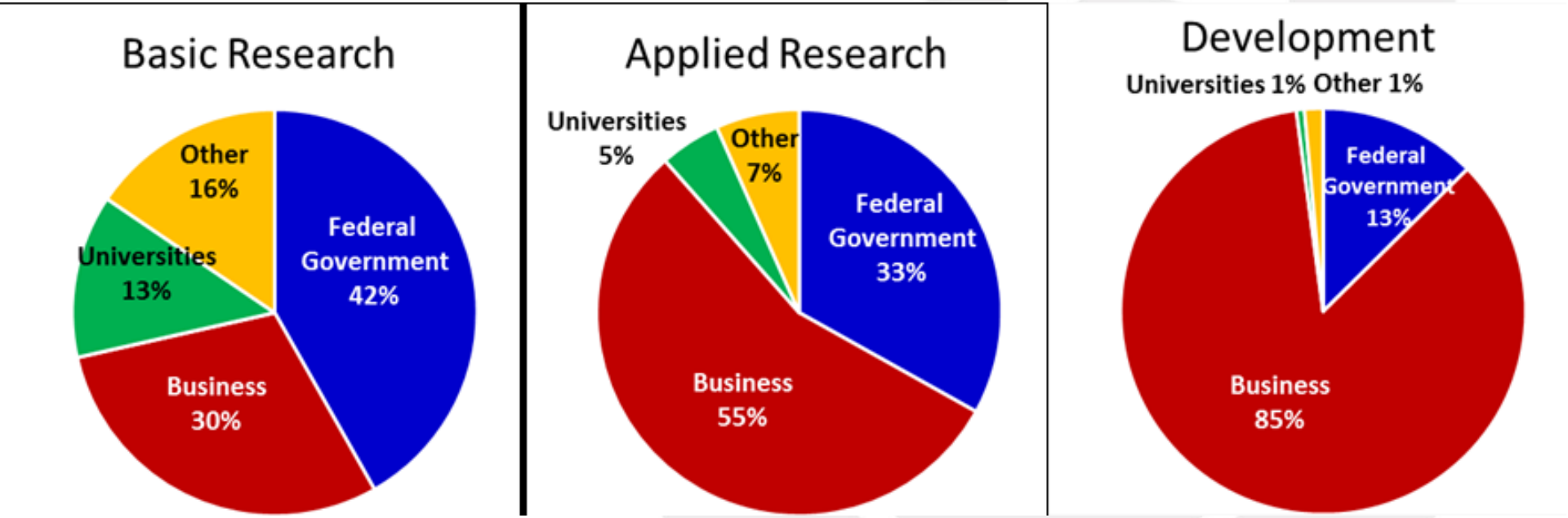
Federal Budget Overview - 2020

Defense = 14.7%

Debt Interest = 8.7%



Composition of U.S. Basic Research, Applied Research, and Development by Funding Sector, 2017

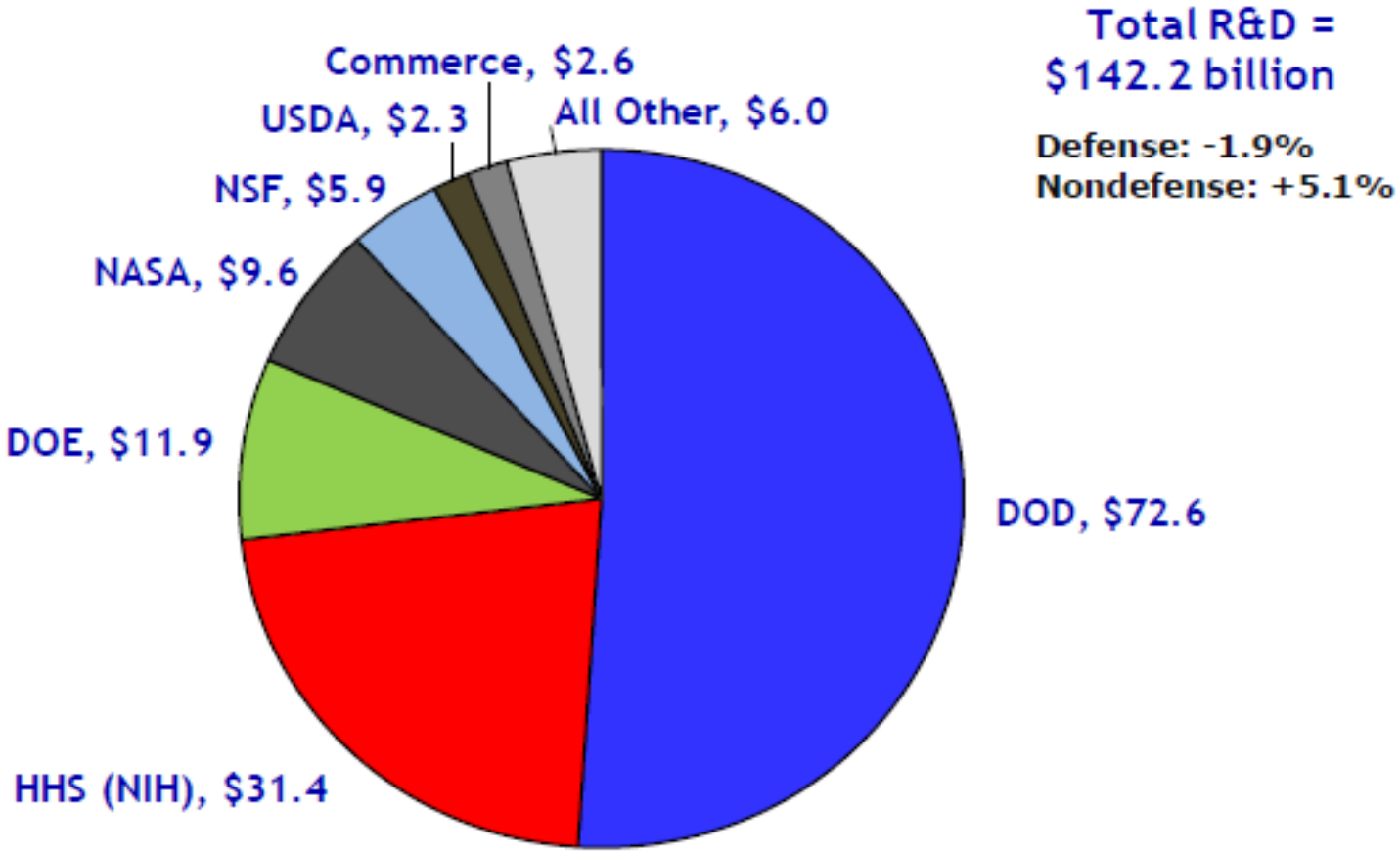


Source: Congressional Research Service: **Federal Research and Development (R&D) Funding: FY2020**

Federal R & D Budget Overview - 2020

Basic Research	FY18	FY20		
Health and Human Services	18,278	16,785	-1,493	-8.2%
Energy	5,005	4,647	-358	-7.2%
National Science Foundation	5,066	4,568	-498	-9.8%
Applied Research				
Health and Human Services	18,414	16,624	-1,790	-9.7%
Energy	7,998	6,410	-1,588	-19.9%
Defense	5,690	5,440	-250	-4.4%
Experimental Development				
Defense	44,363	51,686	7,323	16.5%
NASA	5,872	3,791	-2,081	-35.4%
Energy	2,549	1,952	-597	-23.4%
Facilities and Equipment				
Energy	1,930	1,709	-221	-11.5%
Commerce	633	566	-67	-10.6%
National Science Foundation	503	505	2	0.4%

Total Federal R&D By Agency ($B) - 2012



Source: OMB R&D data, agency budget justifications, and other agency documents.
R&D includes conduct of R&D and R&D facilities.

Secretary of Defense S&T Policy Statement

STATEMENT BY DR. MIKE GRIFFIN
UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING
BEFORE THE
HOUSE ARMED SERVICES COMMITTEE
ON
PROMOTING DOD'S CULTURE OF INNOVATION
SECOND SESSION, 116TH CONGRESS
APRIL 17, 2018

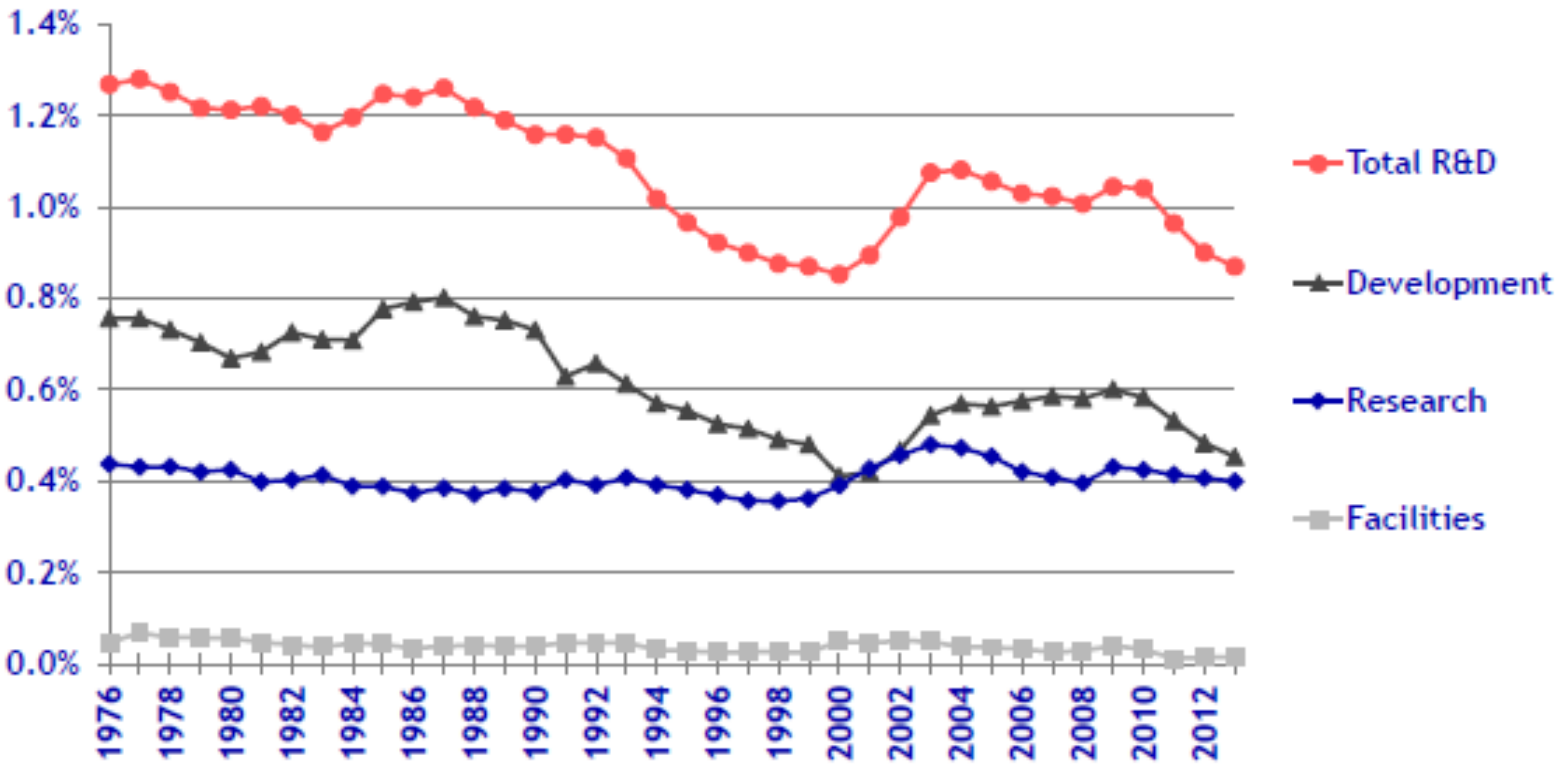
Excerpts

- The Department must pay much more attention to **future readiness** and regaining our Joint Force conventional overmatch. We must be willing and able to tap into commercial research, recognize its military potential, and leverage it to develop new capabilities, while also accounting for the operational and organizational constructs to employ them faster than our competitors.
- The department has realized rapid technological developments in **advanced computing, big data analytics, artificial intelligence, autonomy, robotics, miniaturization, additive manufacturing, meta-materials, directed energy, and hypersonics**. These are the very technologies that ensure we will be able to fight and decisively win the wars of the future.
- **Our mission-focused modernization efforts are Fully Networked Command, Control & Communications, Space Offense and Defense, Missile Defense – Evolved Midcourse and Airborne BPI, Cybersecurity – Offense and Defense, and Nuclear Modernization. Our technology-focused modernization efforts are Hypersonics (both Offense and Defense), Directed Energy, Machine Learning (Artificial Intelligence), Quantum Science (Including Encryption and Computing), and Microelectronics.**

Key FY 2020 S & T Investment Areas

- Networking and Information Technology Research and Development
- U.S. Global Change Research Program (USGCRP)
- National Nanotechnology Initiative (NNI)
- American Artificial Intelligence Initiative
- National Quantum Initiative
- R&D aimed at advances in manufacturing and the integration of those advances into the domestic supply chain to reduce U.S. reliance on foreign sources of critical products.
  - Budget priorities include intelligent manufacturing systems, materials and processing technologies, advances in semiconductor design and fabrication, and innovations in food and agricultural manufacturing
- Cancer Moonshot
- Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative,
- Precision Medicine Initiative (PMI),
- Materials Genome Initiative (MGI)

Trends in Federal R&D (as % of GDP)



Source: Up to 1994 - National Science Foundation / National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development; 1995 to Present - *AAAS Report: Research and Development* series; GDP figures are from *Budget of the U.S. Government FY 2013.*
FY 2012 and FY 2013 figures are latest estimates.

Aerospace and Defense Industry Issues

- Last Global Recession took a heavy toll on many industries
  - Waves of layoffs, retirements, lost revenue, bankruptcies, and a general sense of uncertainly about future.
- In comparison, the aerospace and defense (A&D) industry as a whole continues to buck the trend — finished 2019 with record results.

- The picture isn't entirely positive, however
  - Many defense programs have been terminated, and defense budgets are scheduled for major cuts in future years.
  - Companies face more pressure than ever to improve productivity; increase transparency; and respond to increasingly complex government regulations, tighter schedules, and generally higher expectations.
- Aerospace and Defense Industry and Technology plays an essential role in the global economy.
  - A&D industry has performed more consistently through disciplined management
  - Most notable factor affecting results was better program performance

Aerospace is a Major Engine of our Economy

Source: PWC Aerospace & Defense 2010 year in review and 2011 forecast

Statement of the Problem

- Innovative Emerging Technologies face increasing difficulty transitioning from “promising concept” to employed product or system
- This ***“Acquisition Valley of Death”*** occurs across all technologies and agencies (DoD, DoE, Homeland Security, NASA)
- Who funds prototype development?
- Government Executive pronouncements that “we can’t afford the 98% solution” not reflected in agency acquisition decisions
- “Better is the Enemy of Good Enough” stymies many paradigm shifting emerging technologies and keeps them in the research “sandbox.”
- As a result, industry investment in innovation is declining.
- Directed Energy (DE), “Green” Energy, Hyperspectral Imaging, Biometric technologies key example areas

Decline in Aerospace Corporate R&D

- Funded and Corporate R&D declining - putting future leadership in innovation at risk
- Average Industry R&D Investment declined from 2.86% of revenues in 2006 to 2.67% in 2008 and continues to decline.
- Small apparent percentage represents a large amount of dollars.

Infamous Business & Technology Predictions (1)

- *"Heavier-than-air flying machines are impossible,“*
  - Lord Kelvin, president, Royal Society, 1895.
- *“This 'telephone‘ has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us.”*
  - Western Union internal memo, 1876.
- *"There is no likelihood man can ever tap the power of the atom.“*
  - Robert Millikan, Nobel Prize in Physics, 1923
- *The wireless music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?“*
  - David Sarnoff's associates in response to his urgings for investment in the radio in the 1920s. "
- *"Man will never reach the moon regardless of all future scientific advances.“*
  - Dr. Lee DeForest, "Father of Radio & Grandfather of Television.“
- *“Goddard is a lunatic; it is a well known scientific fact that such a rocket cannot work in the vacuum of space.”*
  - New York Times Editorial, April 1926

Infamous Business & Technology Predictions (2)

- *"I think there is a world market for maybe five computers."*
  - Thomas Watson, chairman of IBM, 1943
- *"Computers in the future may weigh no more than 1.5 tons."*
  - Popular Mechanics, forecasting the relentless march of science, 1949
- *"I have traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year."*
  - The editor in charge of business books for Prentice Hall, 1957
- *"640K ought to be enough for anybody."*
  - Bill Gates, 1981
- ***"You'll Never Hit a Bullet with a Bullet, or Build a Powerful Enough Laser"***
  - Union of Concerned Scientists, 1984

The “High Frontier”

- Shortly after election as President, Ronald Reagan tapped USAF Lt. General Daniel Graham to review options for strategic ballistic missile defense.
- Reagan, while Governor of California, had been briefed by Dr. Edward Teller on Livermore’s “X-Ray Laser” concept.
- "The “High Frontier” pulled in advanced developments from DoD and DARPA programs across the spectrum of requirements for missile defense
  - Space Based and Ground Systems
  - Lasers and Kinetic Kill Vehicles
  - Ground and Space Based Radars, and Space Based IR Sensor Systems

A long time ago
In the Milky Way Galaxy
On a planet dear to our hearts named “Earth”
A conflict of fundamentally opposed political philosophies
Led to a stalemate known as the “Cold War”
Where fear of mutual annihaliation using nuclear weapons
Was the basis of national defense strategy
Called Mutually Assured Destruction or “MAD”
We lived in a “Mad, Mad, Mad” world
Until a technological fantasy dubbed “Star Wars”
Played a role in changing the geopolitical landscape

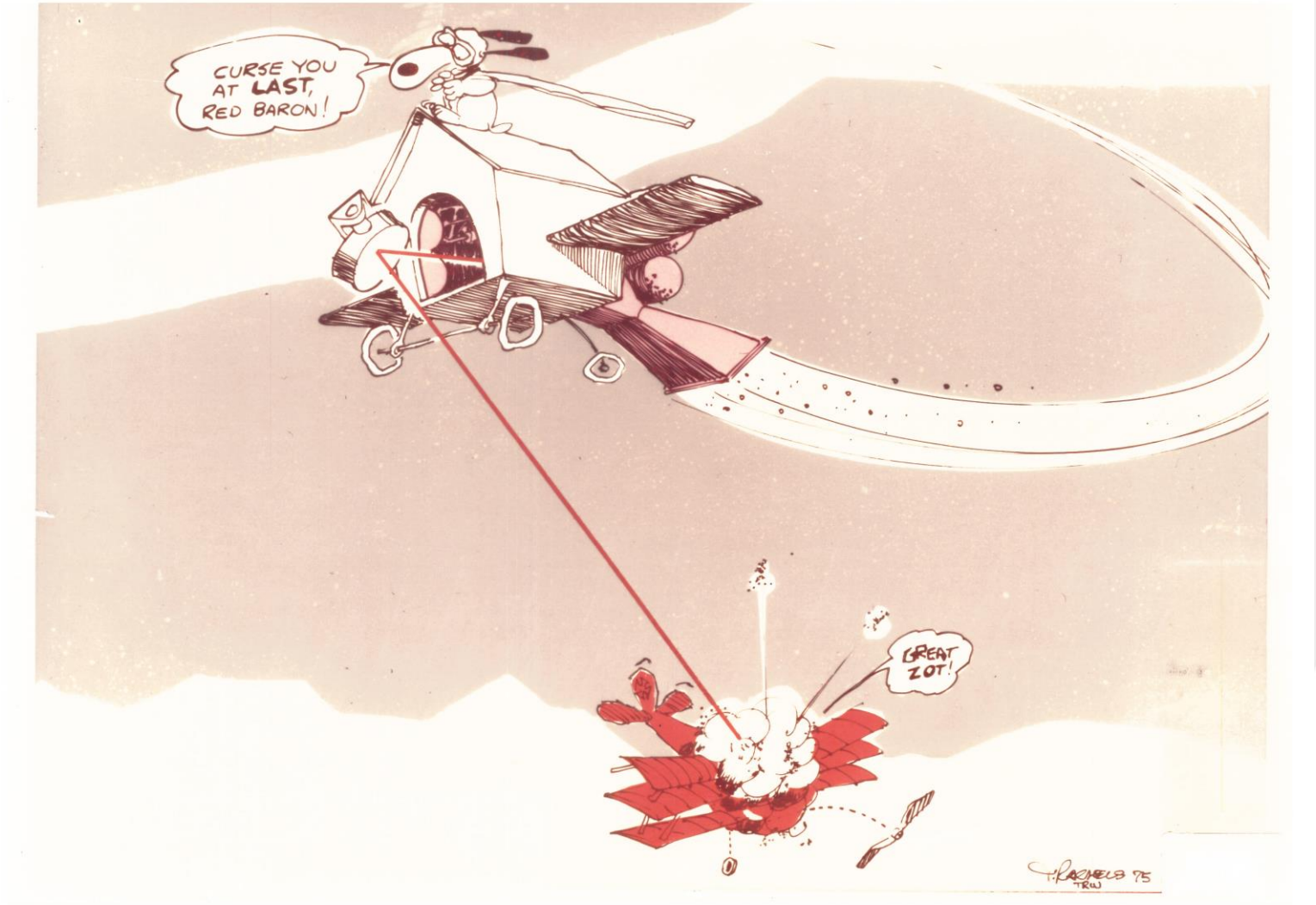
‘Star Wars’ and Missile Defense

“Tonight, consistent with our obligations under the ABM Treaty and recognizing the need for closer consultation with our allies, I am taking an important first step. I am directing a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles. This could pave the way for arms control measures to eliminate the weapons themselves. We seek neither military superiority nor political advantage. Our only purpose - one all people share - is to search for ways to reduce the danger of nuclear war.”

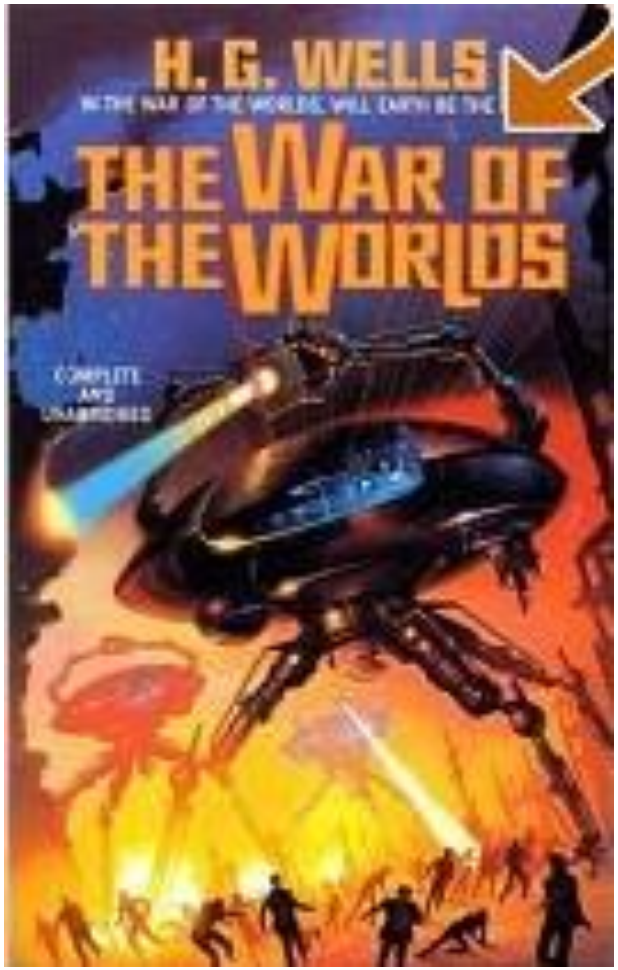
President Ronald Reagan, March 23, 1983

AIAA
The World's Forum for Aerospace Leadership

The Result was Immediately Dubbed "Technological Fantasy"



DEW is Not a New Idea



"It is still a matter of wonder how the Martians are able…..to generate intense heat….which they project in a parallel beam against any object they choose by means of a parabolic polished mirror…..Heat, and invisible instead of visible light. Whatever is combustible flashes into flame at its touch. Lead runs like water; it softens iron, cracks and melts glass…."
H. G. Wells, ***The War of the Worlds***, 1898[i]

[i] Wells, H.G. "War of the Worlds," 1898; Random House Reprint (2005), ISBN 0679910476 ■

Ray “Blast Gun” 1940

Star Trek “Photon Torpedoes”

These Concepts Go Back to Ancient History

Ancient Greek and Roman historians recorded that during the siege of Syracuse in 212 BC, Archimedes (a notably smart person) constructed a burning glass to set the Roman warships, anchored within bow and arrow range, afire.

http://web.mit.edu/2.009/www/lectures/10_ArchimedesResult.html

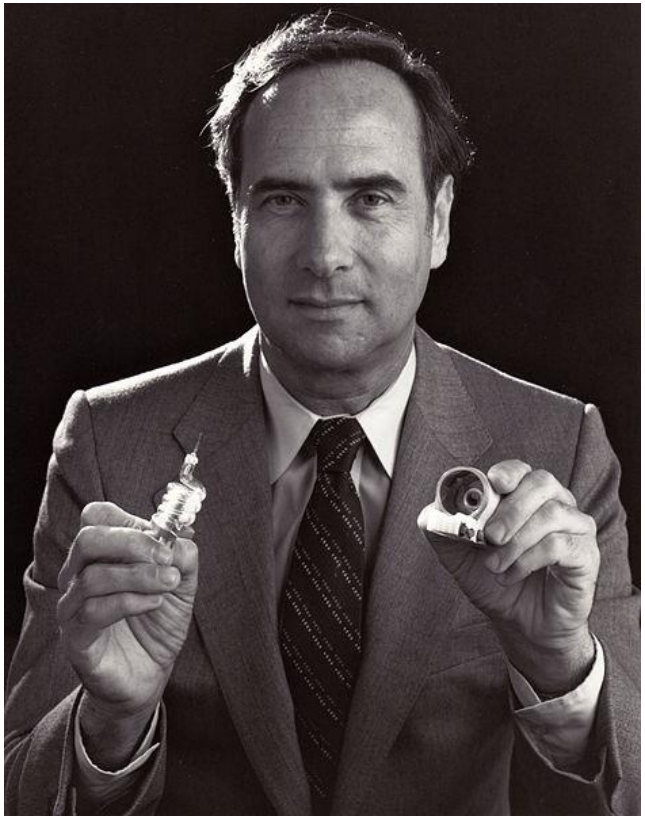
Could it Have Been True?

Intrigued by the idea and an intuitive belief that it could work, MIT's 2.009ers decided to apply the early product development process to the problem. 129, 1 foot square mirrors were “phased” on a mock-up Roman ship target. Open, sustaining flame occurred less than 10 minutes after the sun was in a clear patch of sky! The volatiles liberated from the wood ignited at roughly 1100 F.

http://web.mit.edu/2.009/www/lectures/10_ArchimedesResult.html

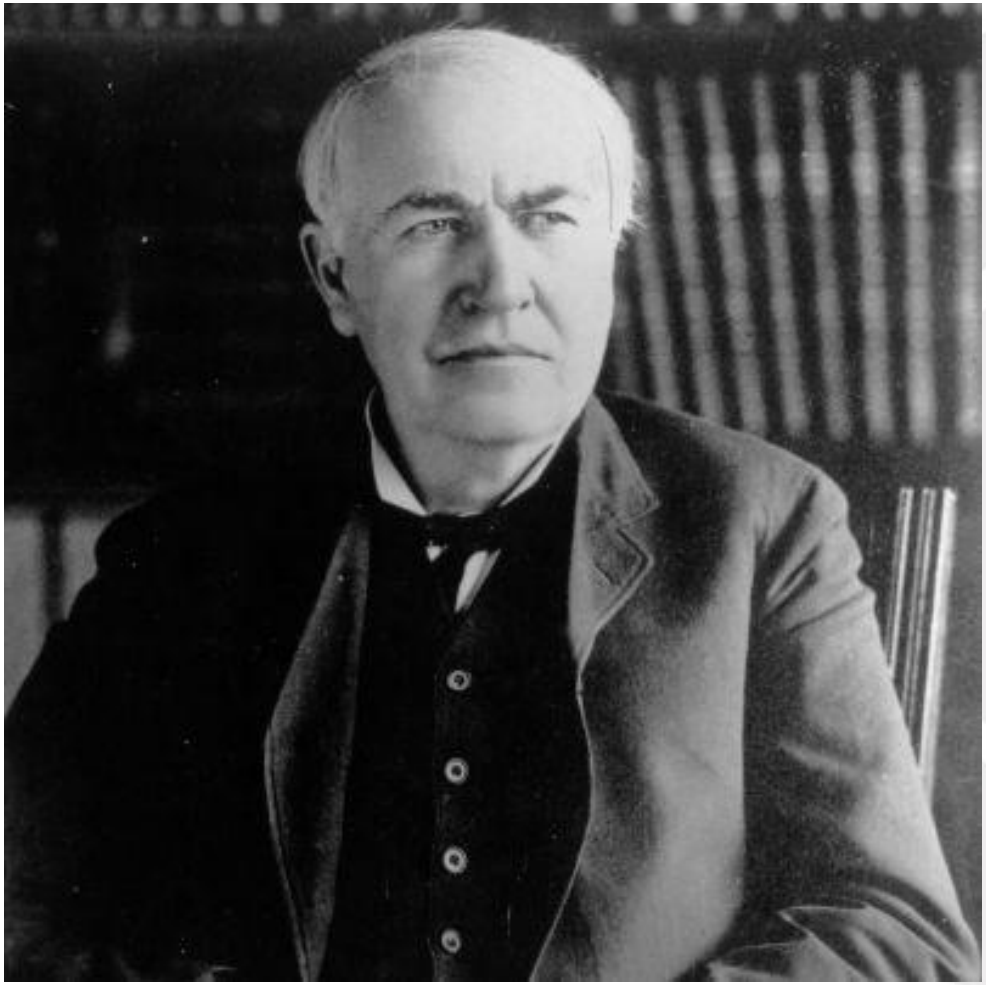
Fast Forward 2,000 Years - First Laser Operated in May 1960

Dr. Theodore H. Maiman
Hughes Research Labs
1927 - 2007



Theodore Maiman looking at a ruby cylinder, the heart of his first laser experiments. A publicity shot by Hughes Aircraft Co., July 1960.

So - Thank You TOM!

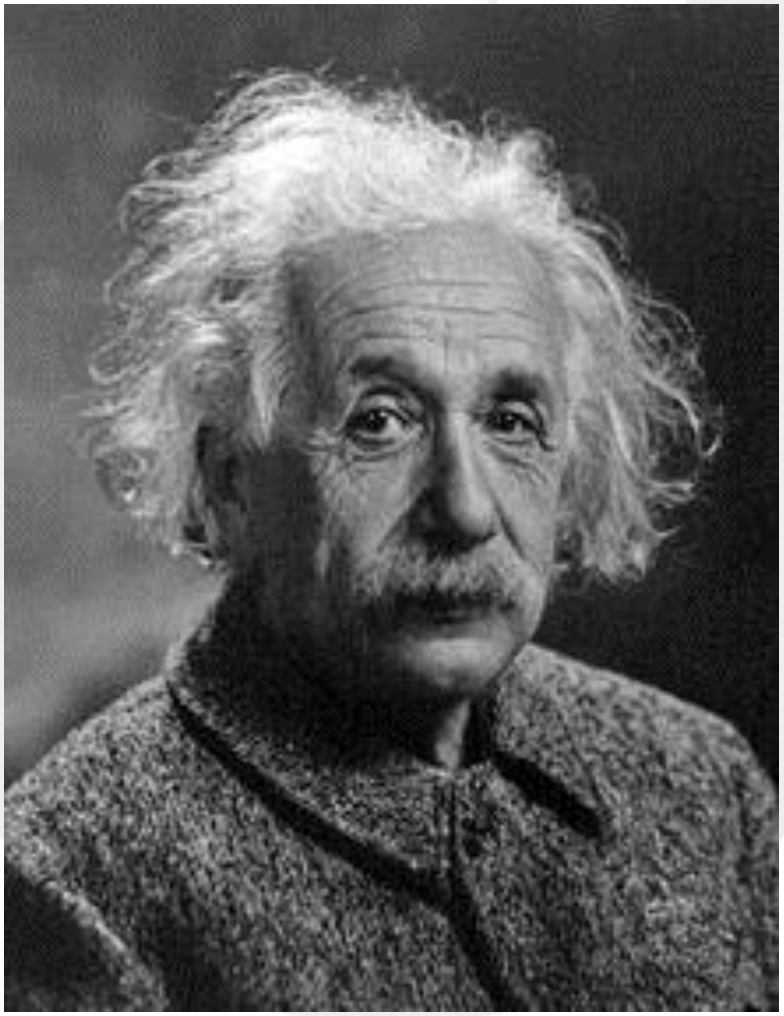


Thomas A. Edison
1847 - 1931

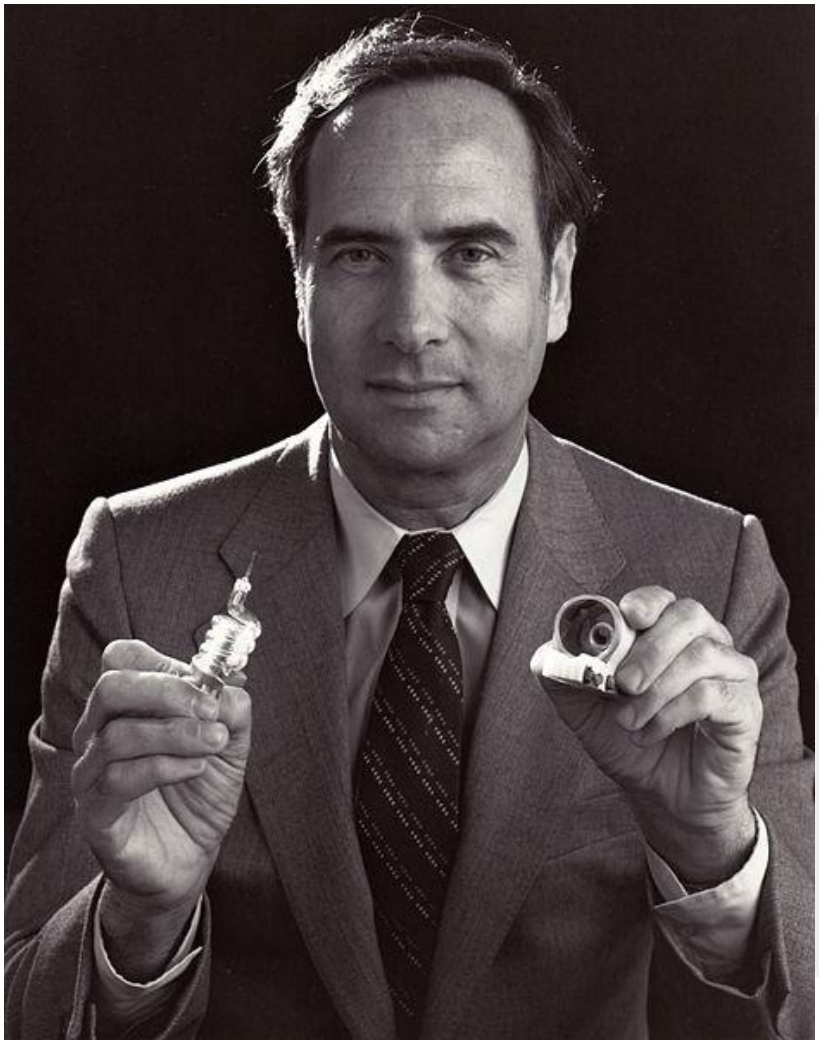
And - Thank You ALBERT!

Albert Einstein
1879 - 1955

"Of course we don't know the answer; that's why we call it RESEARCH!"



And Especially - Thank You TED!



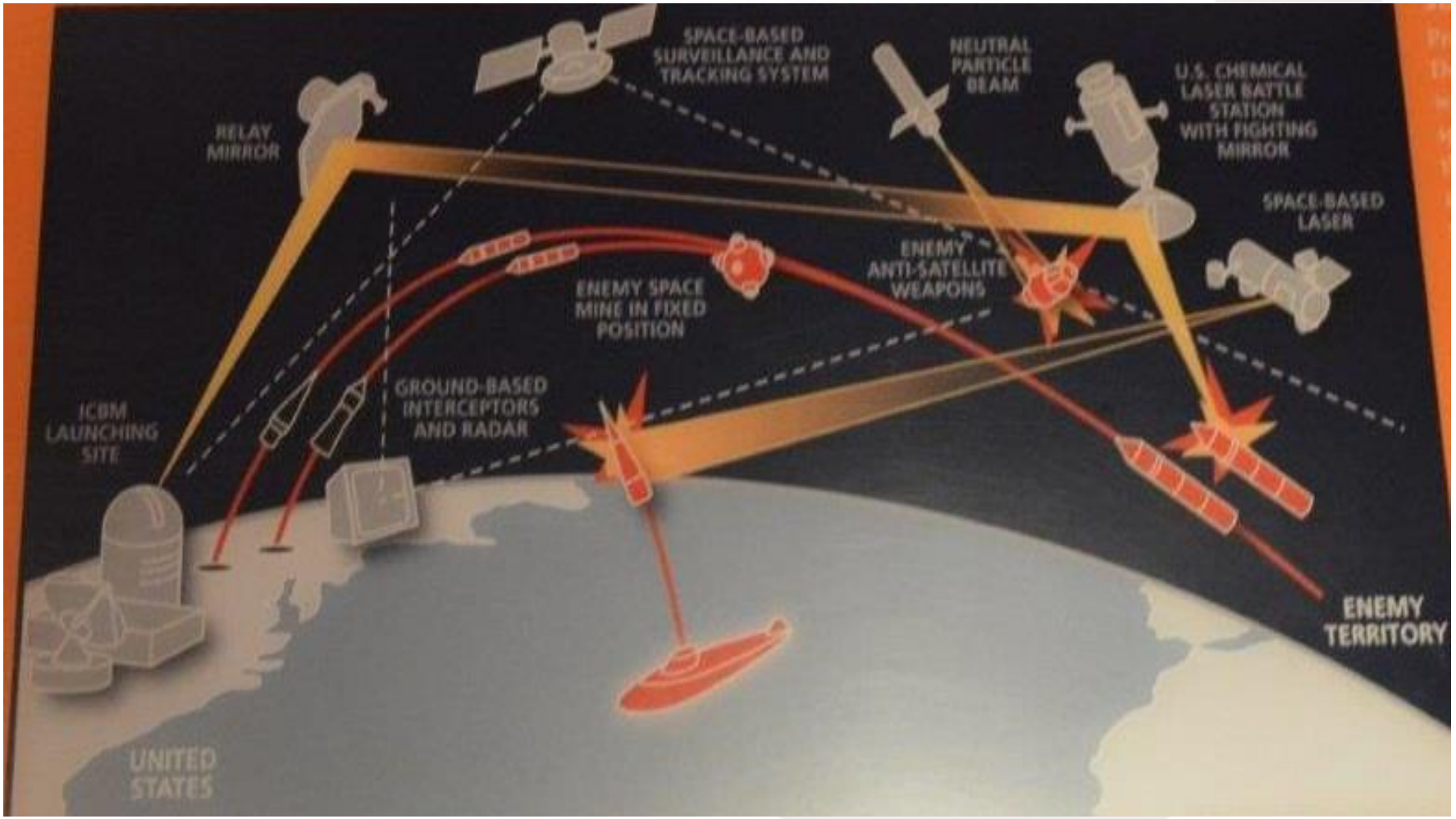
Theodore H. Maiman
1927 – 2007

Hughes Research Laboratory Inventor of the solid state laser (1960)

- ***For showing us that you cannot create the Future……***

- ***While clinging to the Past!***

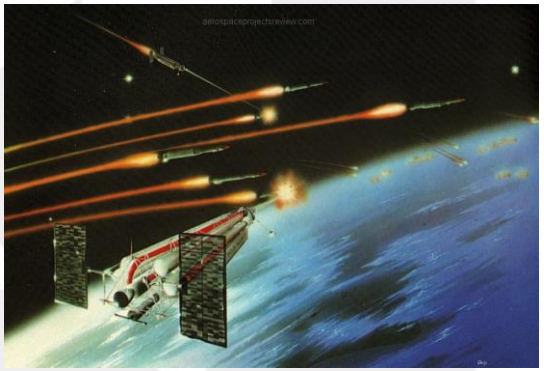
“Star Wars Architecture”



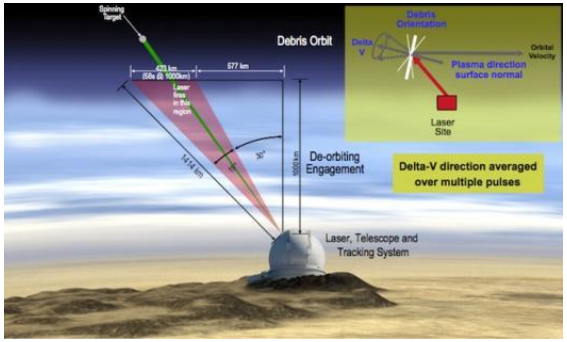
SDI Incorporated Space & Ground Based Lasers, Kill Vehicles, and Radars

LLNL X-Ray Laser

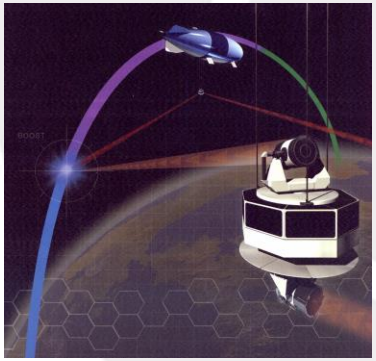
DARPA Space Based Laser



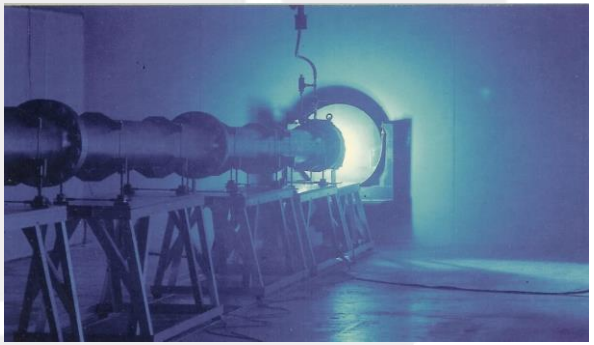
Neutral Particle Beam



Ground Based FEL

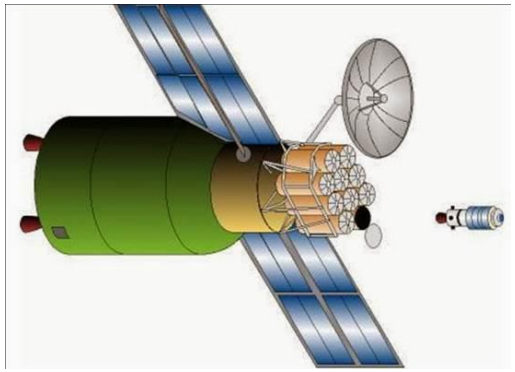


Space Based Relay Mirrors



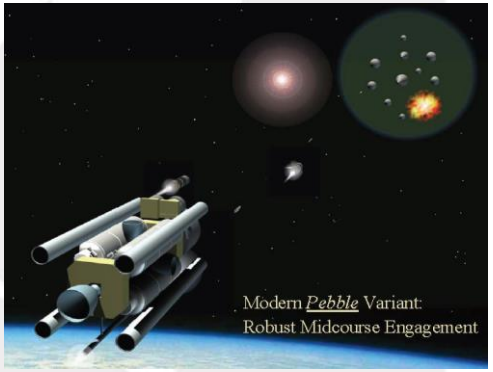
Textron Excimer GBL

SDI Incorporated Space & Ground Based Lasers, Kill Vehicles, and Radars (2)

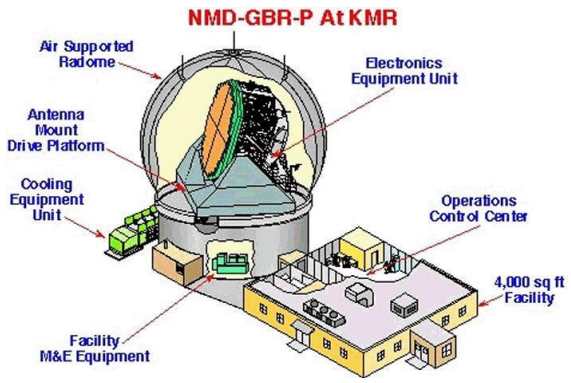


Space KKV Garage

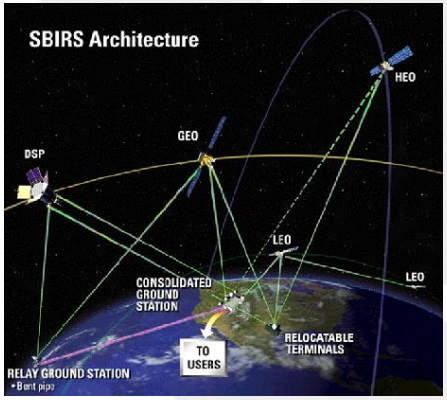
Kinetic Kill Vehicle



Brilliant Pebbles



Ground Based Radar



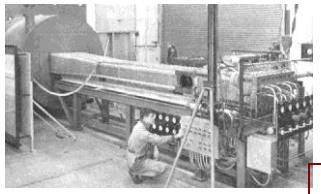
Space Based IR System

Sea Based Radar

A Brief History of US High Power Laser DEW

1960 1970 1980 1990 2000 2010

GDL



Avco Gasdynamic Laser

USAF KC-135 - ALL

BDL, NACL, MADS (DF)

TRW BDL Module

ALL (CO2)

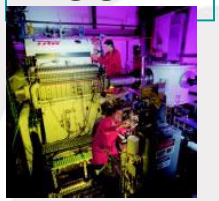
MIRACL (DF)

Sigma(DF)

Alpha SBL (HF)

TRW Alpha Module

High Power COIL



Nautilus (DF)

ALI

ITEK/LMSC/TRW LAMP Mirror

THEL (DF)

TRW

SBL/IFX (HF)

Boeing/TRW/ LMSC

ABL (COIL)

ATL (COIL)

Boeing

‘Star Wars” Evolved After 1990

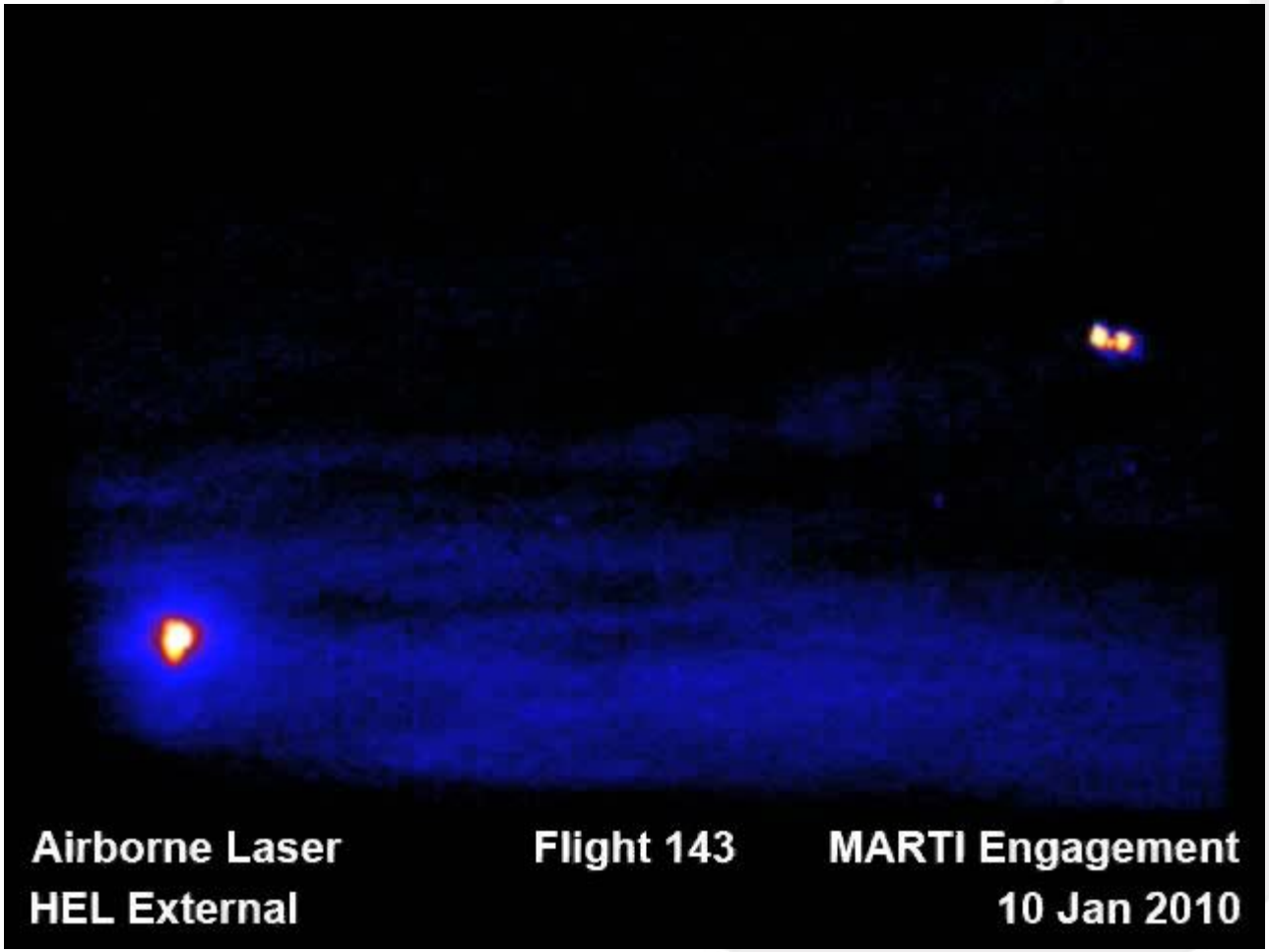
- Changing Perceptions of International Conflict
- NMD – National Missile Defense
- TMD – Theater Missile Defense
- Population Defense from Short Range Tactical Weapons
- Air, Fleet, and Point Defense
- Force Projection, Protection

USAF ABL - Airborne Laser

ABL Successful in 2010

- Successful against thrusting ballistic missiles in 2010
- Retired in 2012

ABL Successful Missile Shoot Down



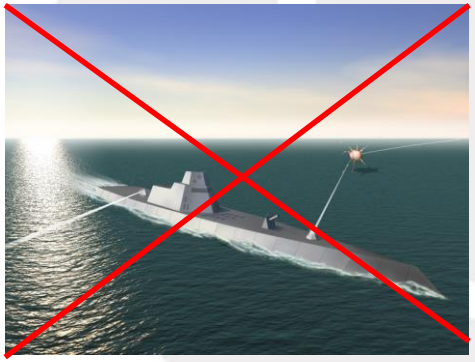
An Example: DoD DEW Programs

USAF ABL

SDI Space Based Laser

USAF Airborne Tactical Laser

US Navy LaWS



USN Free Electron Laser

US Army HELMD

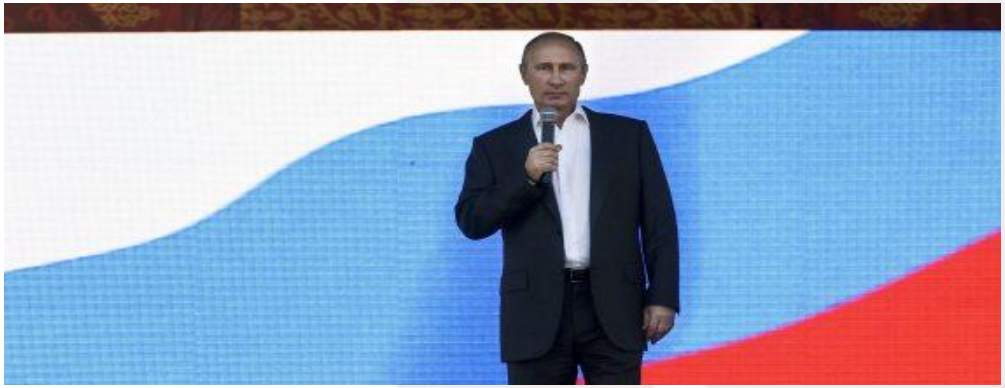
What Do These Programs Have in Common?

- Successful and expensive demonstrations followed by program termination or reduction back into research for the “next best solution.”
- Technology leaps forward perhaps too hard, too big a problem

Never get from R&D to prototype

Is There an Ongoing Threat and Need?

- Russia Tests New Nuclear Missile
  - MOSCOW, Sept 10 (Reuters) - Russia carried out a successful test of its new Bulava intercontinental nuclear missile on Wednesday and will perform two more test launches in October and November, the head of its naval forces said. The 12-meter long Bulava, or mace, has undergone numerous tests, some of which have failed, causing setbacks for the project that aims to be the cornerstone of Russia's nuclear arsenal over the next decade.

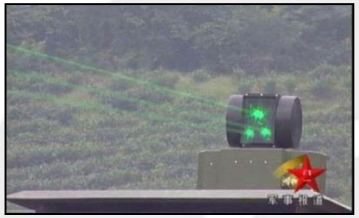


"Remember you are dealing with one of the major nuclear armed international powers!"
Vladimir Putin to European leaders in response to Ukraine economic sanctions in August 2014.

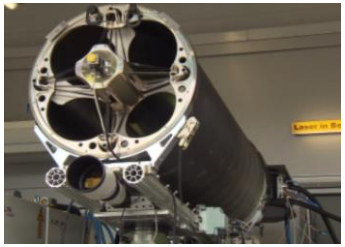
International Community Aggressively Pursuing HEL Weapons

"Israel To Deploy 'Iron Beam,' World's First Laser-Based Air Defense System"

"China unveils anti-drone laser weapons"



"MBDA Germany Targets Mini-UAVs With Laser"



"Germany showcases High Energy Laser"

- "The Kremlin hints at reviving Cold War laser tanks"
- "Japan to Equip Two Ships With Laser Weapons"
- "UK to build and test laser weapon demonstrator"
- "Turkish Indigenous Laser Weapon Advances"
- "Japan Successfully Fired The World's Most Powerful Laser"
- "Russia keeps up with US Laser Weapons"

Manufacturing

It is no longer the US or nobody – HEL Weapons Are Being Fielded

Real Advances in Interceptor Technology

NMD X-Band GBR

Exoatmosheric Kill Vehicle - EKV

Lockheed-Martin GBI

NMD X-Band SBR

Raytheon SM-3

So, What Does ‘Star Wars’ Do Next?

US Navy LaWS

USAF SHiELD

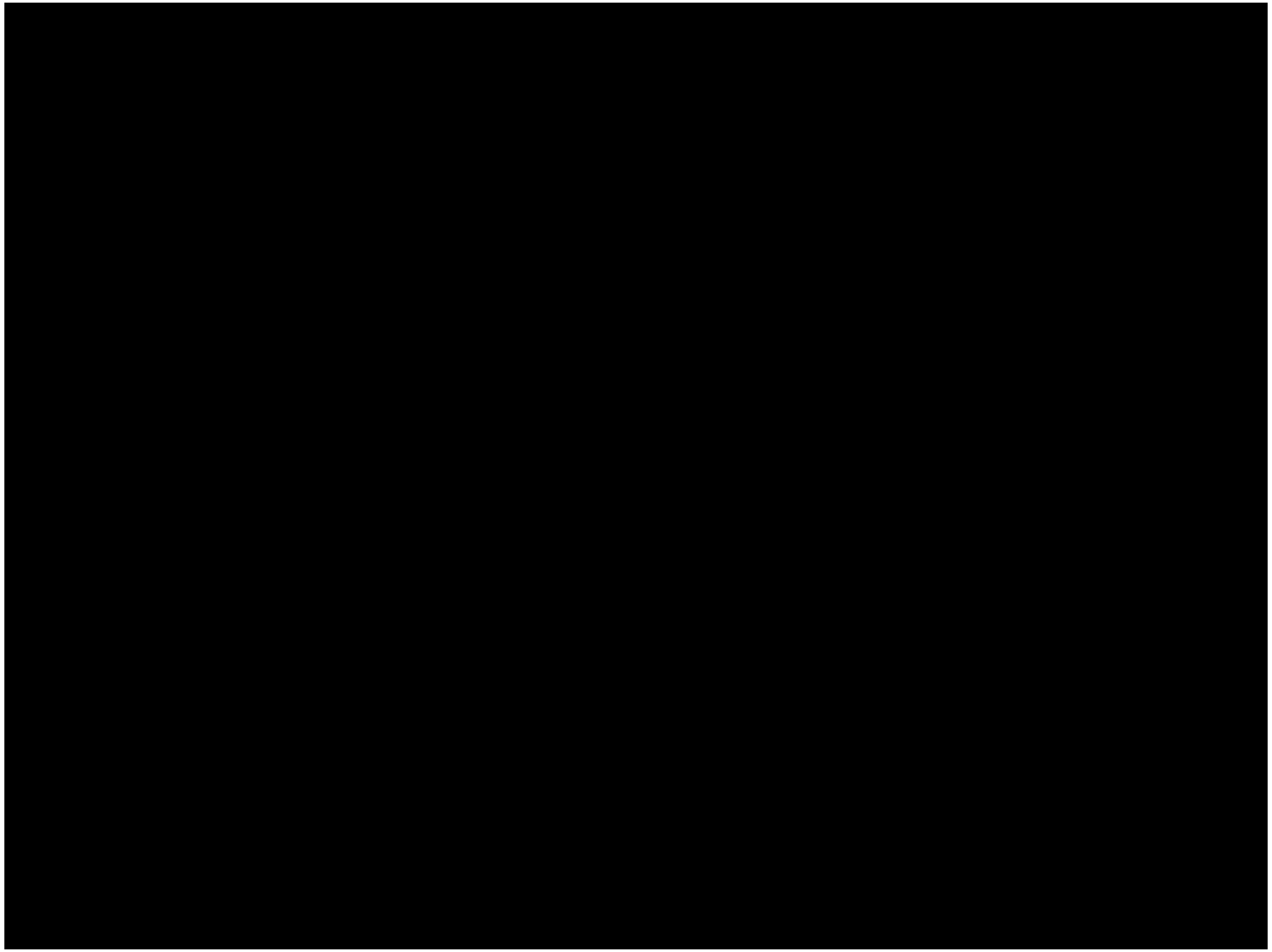
US Army HELTVD

USS Ponce Deployment

DARPA/MDA UAV

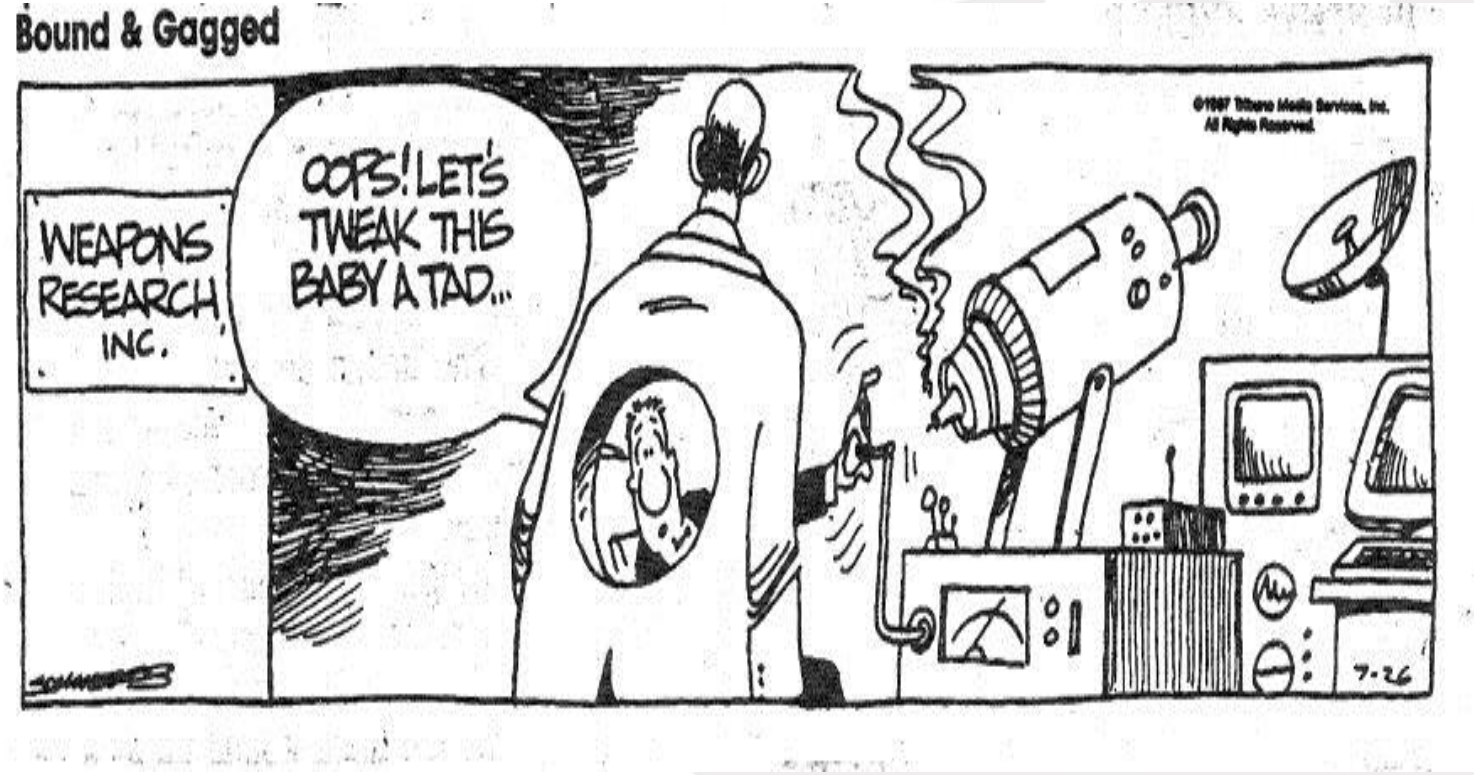
USMC GBAD

USN LaWS Program



Lockheed “ADAM” Demonstration

BUT!



But There is No Time to "Tweak" in Combat!

Historical Reminder – the Birth of Aviation

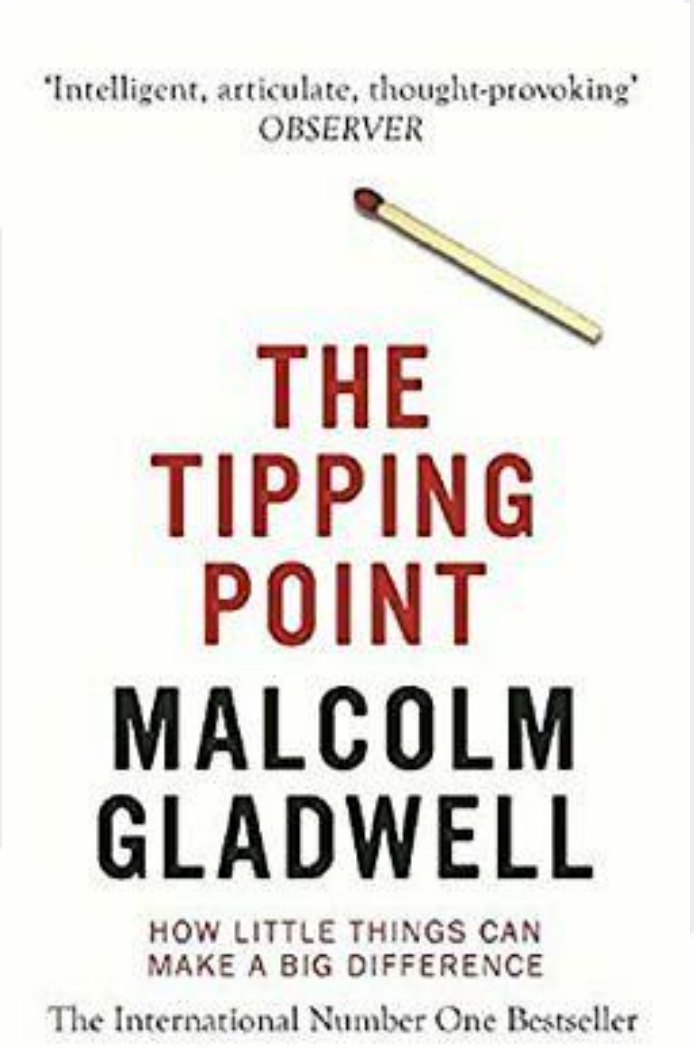
- 1898 – Dept. of War Grant to Dr. Samuel Langley (Director of the Smithsonian Institution) to "invent" the aeroplane.
  - 1 year PoP.
- Dec. 5, 1903 Langley's plane crashed into the Potomac River.
  - 5 years late and hundreds of thousands of dollars over budget.
- Dec. 10, 1903; New York Times Editorial – "Man Will Never Fly."
- Dec. 17, 1903, Wright Brothers fly at Kittyhawk.
- Then……aviation leadership went to Europe.
  - **US Flew European built airplanes in WWI**

Technological Advantage, Once Lost, is Difficult to Regain

So How Can We "Change the Game?"

Three Key Elements:

- Expertise (Mavens)
- Connections
- Communications



AIAA Congressional Visits Day

- Annual Event every March
- Home constituents visit their elected representatives
- Purpose is to educate government decision makers
- Encourage investment in Emerging Technologies to sustain US technological leadership
- “August is for Aerospace” when Congress is Home

Changing Public Policy is Up to Us!

AIAA Public Policy Issues 2019 - 1

1. FUNDING STABILITY AND COMPETITIVENESS

› Permanently eliminate the arbitrary budget caps and the sequestration process imposed on defense and non-defense discretionary spending.

› Provide sustained investment for basic scientific research in federal labs at levels consistent with maximizing economic growth and technological leadership.

› Provide the DOD with stable and predictable funding that supports efficient and effective multi-year acquisitions and operations.

› Streamline the defense acquisition process by tailoring oversight requirements to risk.

› Provide long-term authorizations and appropriations with top-line increases in the out years to properly fund all NASA missions in a balanced and predictable manner to meet short- and long-term program and mission requirements.

› Reauthorize the Export-Import Bank of the United States, and either confirm all open board appointments or allow the bank's single board member to approve transactions of more than $10 million.

AIAA Public Policy Issues 2019 - 2

2. R&D AND INNOVATION

› Invest in computational and experimental capabilities to advance military and commercial R&D.

› Ensure sufficient and stable funding for federal programs specifically toward helping industry accelerate innovation and developing products in critical areas.

› Create programs that enable greater interaction and cooperative arrangements between federal labs and research centers, academia, and industry to develop technologies needed for innovation and growth.

› Support robust, long-term federal civil aeronautics and space research and technology initiatives funded at a level that will ensure U.S. leadership.

› Offer incentives for corporate research and commercialization of that research into new products and services.

› Ensure that federal agency R&D budgets provide sufficient funding so that the United States maintains long-term technical leadership and qualitative technical superiority.

AIAA Public Policy Issues 2019 - 3

3. WORKFORCE DEVELOPMENT AND ENHANCEMENT

› Pass legislation that enhances the pipeline of STEM-competent workers into the U.S. economy, including initiatives aimed at underrepresented demographics.

› Promote educational and training programs for both the existing workforce and new entrants, as well as encourage K-12 teacher recruitment and professional development, through federal incentives and/or grants.

› Support programs that specifically focus on technical jobs, improve the pipeline from high schools, and provide grants to carry out these activities.

› Incentivize industry and the military to be more directly engaged with evaluating and hiring military personnel transitioning to the civilian workforce, such as creating a standard to process and categorize military skill sets.

› Pass visa legislation that welcomes and retains highly-educated international professionals who earn advanced STEM degrees from U.S. colleges and universities.

› Reform the security review process to streamline investigations, increase oversight, prioritize mission critical investigations, and promote reciprocity among agencies, while protecting sensitive information and utilizing advanced technology to appropriately manage risk.

AIAA Congressional Visits Day -2009

Directed Energy Delegation with Congressman Martin Heinrich (Albuquerque; NM-1)

AIAA Congressional Visits Day - 2010

Arizona “8” Group with Congresswoman Gabrielle Giffords

AIAA Congressional Visits Day -2011

"DE Cabal" with Congressman Doug Lamborn (Colorado)

Directed Energy Caucus

- The Directed Energy Caucus was formed in Congress in 2011 in recognition of the importance of this game changing technology. The Caucus watches over DE issues on Capitol Hill and has served as the Capitol host for DE2DC.
  - Doug Lamborn (co-founder), R-Colo.
  - James Langevin (co-chair), D-R.I.
  - Mo Brooks, R-Ala.
  - Mike Conaway, R-Texas
  - John Garamendi, D-Calif.
  - Michelle Lujan Grisham, D-N.M.
  - Susan Davis, D-CA
  - Mike Rogers, R-Ala.
  - David Schweikert, R-Ariz.
  - Trent Franks, R-AZ
  - Joe Wilson, R-S.C.
  - Robert Wittman, R-Va.

Congressmen Doug Lamborn & James Langevin at Rayburn Exhibit

California Aerospace Day

- Initiated by the Southern California AIAA Section
- Scheduled Meetings with California State Legislators while the Legislature is in session
  - A Full Day at the State Capitol
  - Connect with appropriate Committees
    - Education
    - Technology
    - Transportation

Connect with Local Media during National Engineers' Week

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Parting Thoughts

- 'Star Wars' Laser Systems Can be Real
- Near Instantaneous Target Engagement and Kill has been Repeatedly Demonstrated (ALL, MIRACL/SLBD, Nautilus, THEL, ABL).
- Real High Power Laser Beams are **FOREVER**
- Engineering Transition from "Laboratory Demonstrators" to Fielded Systems Requires Political and Programmatic Investment and Commitment
- Tactical and Strategic Operation at the "Speed of Light" is as real as the political and programmatic will to put systems in the field.

BUT……

Public Policy Must Accompany Technological Advancements

But!

- Serious 'Skepticism on Ability to Deliver Remains
  - Failures to deliver on past programs
  - Community "eats its' young" chasing the next best technology
  - **Paper and Viewgraph Lasers ALWAYS Work Better than Real Lasers**

No Real Laser Escapes the Fundamental Limitations of the Second Law of Thermodynamics!

Or

The Requirement for Public Policy Understanding

More History – Pioneer Naval Aviator Eugene Ely

- First to take off and land on a ship
  - 1911; U.S. Pennsylvania
- Equipment:
  - Football Helmet
  - Mouthguard
  - Inner Tubes for Flotation

Original painting by Michelle Rouch
DCMA Systems Engineer at RMS

Always Understand the Real World Applications & CONOPS!

Rule Number 1 for Progress

- You always have to give up something to get something
- The 5 “WHATS”
  - WHAT is it you want (to achieve)?
  - WHAT benefit will it really provide?
  - WHAT will it really cost?
  - WHAT will you have to sacrifice or give up to achieve it?
  - WHAT measure will you use to ensure you did it?

Motivating Philosophy

"I am only one

But I am ONE!

I can't do everything

But I can do SOMETHING!

And I will not let what I cannot do

Interfere with what I CAN DO!"

Edward Everett Hale, 19th Century American Author, historian, and Unitarian Minister

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Finally

Only those who **dare** succeed in driving the world forward!

If you keep doing what you've always done, why would you expect a different result?

Thanks to Albert Einstein's definition of insanity

Affecting Public Policy Starts With YOU!

The World's Forum for Aerospace Leadership

BACKUPS

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5. USA Today Editorial, January 25, 2011
6. Sony 2009 Annual Meeting Video "Did You Know?" on U-Tube
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AIAA Public Policy Statement

Overcoming the Emerging Technology Acquisition "Valley of Death"

ISSUE: Federal budgets for acquisition of emerging, innovative, breakthrough technologies have become increasingly constrained. Proponents of innovative technologies are challenged when budgets are tight because there is always a "better" solution just around the corner and customers are inclined to wait. This impacts a broad spectrum of emerging, innovative technologies, including Directed Energy, Biometrics, bio-fuels, hyper-spectral imaging, etc. Aviation Week (Sept. 6, 2010) recently called this "Indecision at the Speed of Light" for Directed Energy Systems. The White House Executive S&T Policy pronouncement for the FY2011 directing "support for long-term, visionary, high-payoff research" is not being fully reflected in agency actions. Pronouncements that the 98% solution is unaffordable are not being implemented at the acquisition level, where "better is the enemy of good enough" often prevails as a guiding philosophy and stymies progress towards paradigm shifting technologies. SBIR technology advances and corporate IR&D often bring significant breakthroughs and innovations, but getting past the next steps, through prototyping to initial production, is often stymied because of risk aversion. Products seldom get to the marketplace without customer or user "pull;" only through experience with operational prototypes can the real use issues be solved in terms of concepts of operation and employment or use strategies. Continued funding for pursuit of R&D for emerging, innovative technologies is essential. However, bringing them to the marketplace where they will benefit the user (military and civilian) is where the real benefits are and where real job creation occurs. R&D laboratory successes alone seldom create user "pull." With continued deferment of acquisition decisions, corporate investment is declining because of frustration with the lack of "return on investment." Data indicates a 0.1% decline in aerospace corporate IR&D each year since 2006. Small percentage declines in corporate investment as a function of gross revenues is significant in total dollars, eroding U. S. competitive posture and ultimately affecting engineering hiring and career paths for our highly trained workforce.

2011 AIAA Public Policy Statement

RECOMMENDATIONS: The Congress and Administration should work together towards the formulation and implementation of a clear and concise approach to focus on developing prototypes and getting emerging, innovative technologies to market.

- Fully fund the Rapid Implementation Program in DoD.
- Clearly highlight the "Acquisition Valley of Death" and its' impact to top level Congressional and Administrative leaders.
- Establish a nationally focused prototyping effort for emerging, innovative technologies, including directed energy systems, biometric systems, and bio-fuel systems.
- Define a responsible Acquisition focal point responsible for taking innovative R&D past the research stage into prototyping so they can progress into production.
- Provide real incentives for acquisition decision makers to follow the White House S&T FY2011 Policy Statement and truly incentivize innovative technology developments by taking them past laboratory successes.
- Emphasize that taking innovative technologies past R&D and into production is one of the most effective job creation tools that supports a healthy, highly skilled workforce.

The World's Forum for Aerospace Leadership