CAPT “Dino” Ferrari
Naval Research Laboratory

The Navy and Marine Corps Corporate Laboratory

"GOVERNMENT SHOULD MAINTAIN A GREAT RESEARCH LABORATORY TO DEVELOP GUNS, NEW EXPLOSIVES AND ALL THE TECHNIQUE OF MILITARY AND NAVAL PROGRESSION WITHOUT ANY VAST EXPENSE."

THOMAS A. EDISON

THE NEW YORK TIMES MAGAZINE
SUNDAY, MAY 30, 1915

A WORLD-CLASS LABORATORY

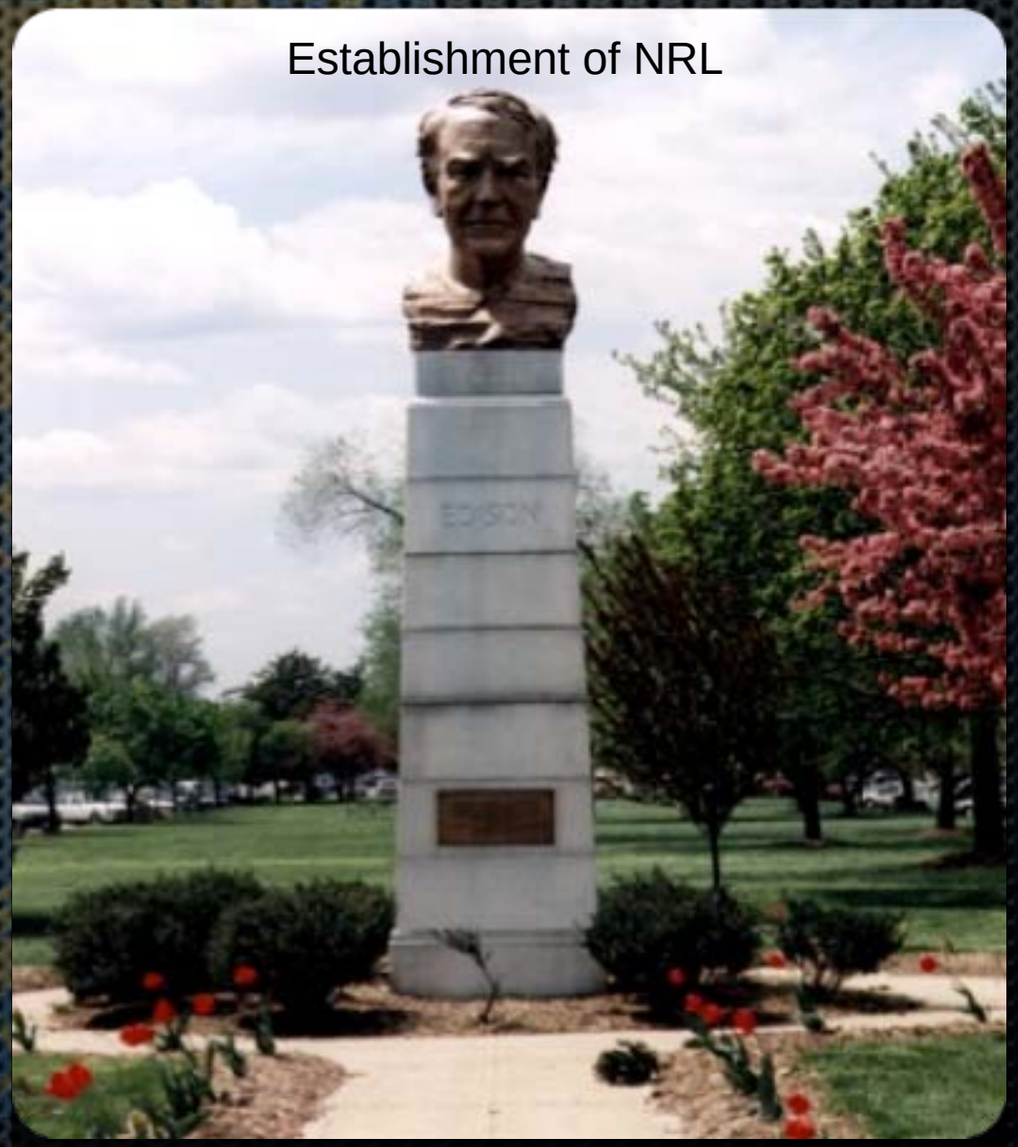
- The sinking of the British ocean liner Lusitania, May 7, 1915 (128 US fatalities)

- SECNAV Daniels established Naval Consulting Board with Edison Chair, meeting October 7, 1915

  " For utilizing the natural inventive genius of Americans to meet the new conditions of warfare as shown abroad …"

- August 29, 1916 Congress appropriates funds to establish the Lab

- Delayed by WW-I, Assistant Secretary of the Navy, Theodore Roosevelt, Jr. Commissions the Lab at Bellevue site on July 2, 1923



The Navy and Marine Corps Corporate Laboratory

The Navy and Marine Corps Corporate Laboratory

NRL Mission

- To conduct a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, systems and ocean, atmospheric, and space sciences and related technologies.
- Primary in-house research for the physical, engineering, space, and environmental sciences
- Broadly based applied research and advanced technology development program in response to identified and anticipated Navy and Marine Corps needs
- Broad multidisciplinary support to the Naval Warfare Centers
- Space & space systems technology development & support
- Designated as the Navy's corporate laboratory by SECNAV 1991

From the bottom of the ocean floor to the far reaches of space …

The Navy and Marine Corps Corporate Laboratory

Lines of Business

- Sensors, Electronics and Electronic Warfare
- Materials/Processes
- Battlespace Environments
- Air / Surface / Undersea Warfare
- Information Systems Technology
- Space Platforms
- Technology Transfer

The Navy and Marine Corps Corporate Laboratory

The Navy and Marine Corps Corporate Laboratory

Naval Research Laboratory

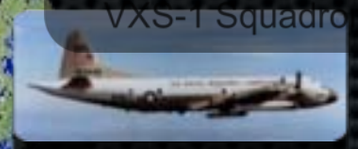
Acreage	880
Buildings	200

Lab Buildings	$1.9B
Special Facilities	$1.6B
Equipment	$0.5B
Replacement Value	$4B

Unique and in some cases, one-of-a kind Lab Facilities

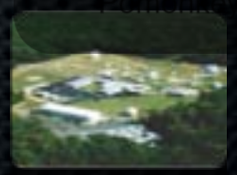
MONTEREY, CA

PATUXENT RIVER
VXS-1 Squadron



NRL D.C

Chesapeake Bay Div
Tilghman Is.
Midway Res Ctr
Blossom Point
Pomonkey



* Additional sites based on sponsor research

BAY ST. LOUIS, MS
John C. Stennis Space Center

MOBILE, AL
Ex-USS Shadwell

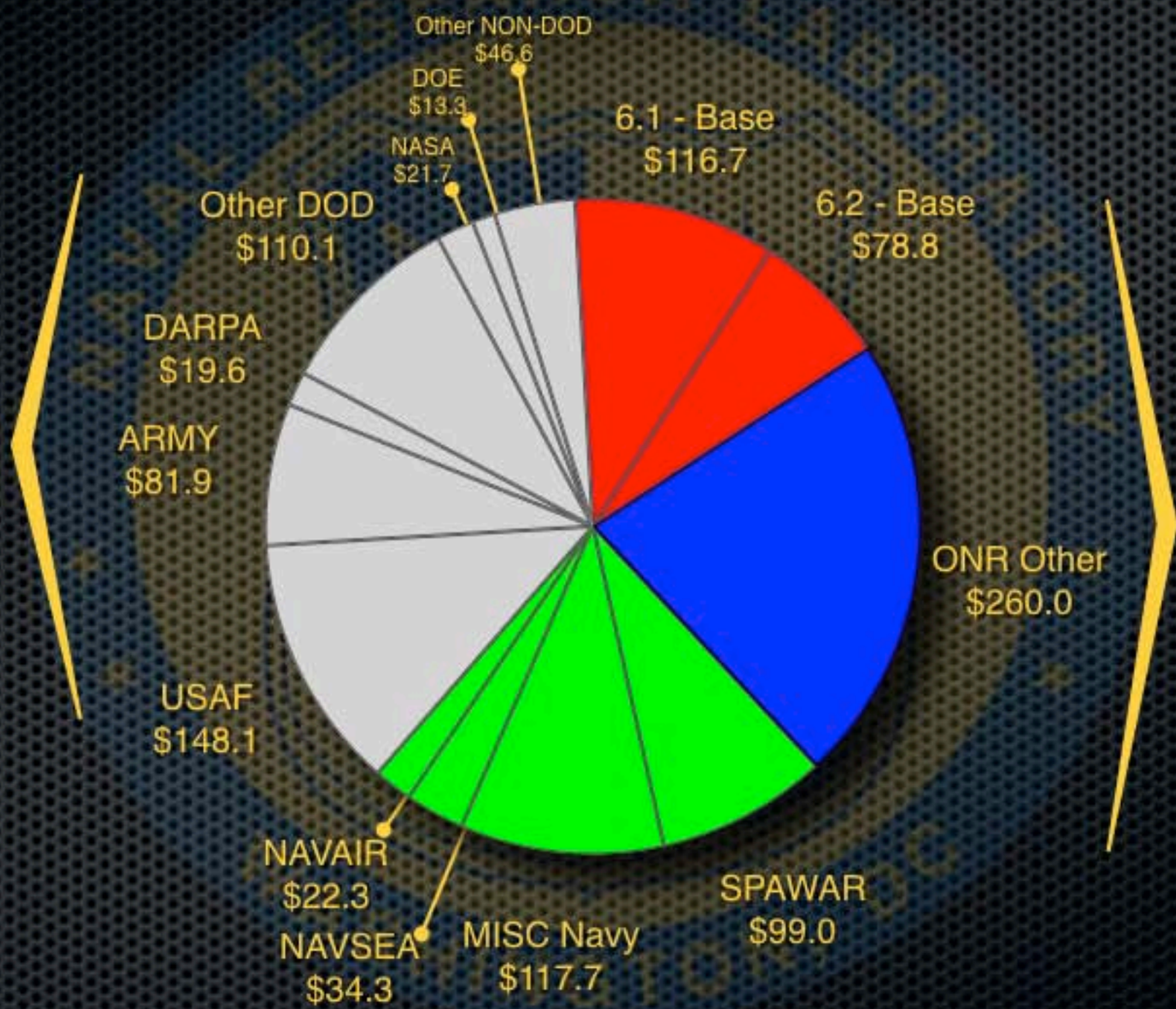
KEY WEST
Marine Corrosion Facility

The Navy and Marine Corps Corporate Laboratory

SPONSORS

FY11 Costs

$1,170.2 Million



Leveraging Joint funding for Navy needs

Navy Funding for Navy needs

The Navy and Marine Corps Corporate Laboratory

Battlespace Environments (16%)

Environmental processes and phenomena of the ocean, sediment near shore and marine atmosphere

Barny and Long Ranger ADPCs

NRL S&T Base Program

$116.7M 6.1, $78.8M 6.2 in FY11

- In-house Basic and Applied Research for the Physical, Engineering, Space, and Environmental Sciences
- Results to advance Naval Systems and Capabilities

Electronics (18%)

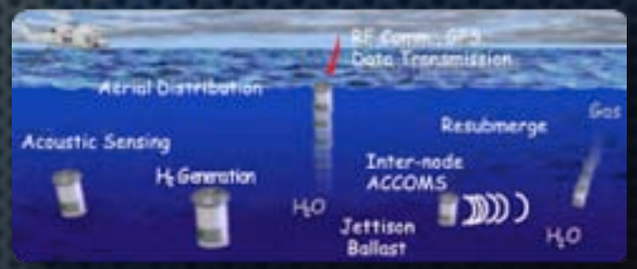
Research leadership on new electronic and electro-optic phenomena, materials, theory and techniques for future Naval forces and avoid technological surprise

Space Res. & Space Tech (8%)

Understand the space environment and its effects on Naval Systems. Conduct unique experiments in space, specific to future DON needs

Undersea Warfare (13%)

Research and advanced technologies for undersea sensors for ASW/MW



Undersea Distributed Surveillance

Electromagnetic Warfare (13%)

Develops technologies for total electromagnetic battlespace awareness/dominance

Information Technology (4%)

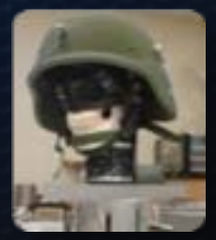
Science and technology for communications, information security, decision support, and autonomous systems.

Mobile Networks / Personal Secure Phone

Materials & Chemistry (25%)

Development of advanced functional and structural materials

NRL "GelMan" developed and implemented to determine internal brain dynamic responses under blast conditions



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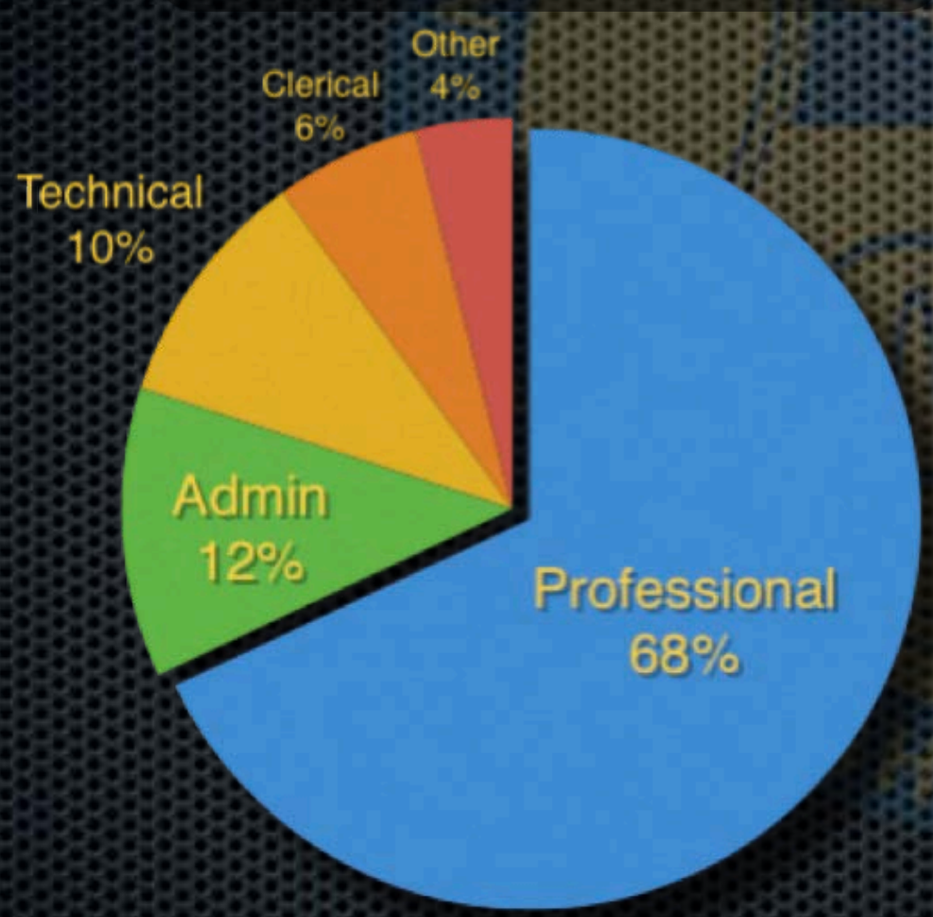
NRL Personnel FY 11 (Full Time Personnel)

Bachelor	540
Masters	353
Doctorate	817
Total (including WG)	2321



Physicists	375
Electrical Engineers	393
Computer Scientists	133
Other Engineers	111
Chemists	99
Mechanical Engineers	73
Aerospace Engineers	67
Oceanographers	58
Meteorologists	55
General Physical Scientists	43
Astronomers	35
Mathematicians	26
Biological Scientists	28
Metallurgists	9
*Other	33
Scientists/Engineers:	1538

* other includes: Geologists, Operations Research Analysts, Health Physicists

A diversity of expertise, co-located, with the ability to mix and match talents to solve new and difficult problems

The Navy and Marine Corps Corporate Laboratory

Institutional Programs In Support of NRL Research

- Post doctoral Program (~120-200 Postdoctoral Fellows)
  - A comprehensive process managed by the National Research Council & the American Society For Engineering Education (ASEE)
- Summer Faculty Program (~ 40 University Faculty)
  - Summer appointment (10 weeks)
  - Managed by ASEE
- Summer Student Program (200-400 students)
  - High School / undergraduate /graduate students
  - Naval Research Enterprise Intern Program
  - Student Career Experience Program
  - Student Temporary Employment Program
  - Student Volunteer Program
  - DoD S&E Apprentice Program (High School juniors)

NRL Partnerships

- Partnerships with Industry
  - Cooperative Research and Development Agreements (CRADA)
  - Sale to Third Parties (non-Federal Government)
  - Licensing/Sublicensing
- Partnerships with Universities
  - @1000 collaborations with 250 institutions in 50 states
  - 198 collaborations in 34 foreign countries
- International Agreements/Committees
  - Involvement with 44 nations
- Joint Programs
  - MOA/MOUs

Measures of S&T Excellence

Great Science, Right Science, Payoff for the Navy

World Class Science

- Papers, patents, citations, royalties
- Nat'l Academy members, society fellows
- Percent of staff with PhD/advanced degrees
- Prestigious scientific and engineering awards

High Value for DoN

- Transitions & quick responses
- BRAC military value rankings
- Studies by DSB, NDU, NRAC, NAS, etc
- Outside customers

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World Class Science

(Linkage between U.S. Scientific Research & Patents)

Top Ten (of 430) U.S. Institutions in Rank Order

(an NSF Study Research Policy)

Physics Papers	Engineering & Technical Papers
1. AT&T Bell Labs	1. AT&T Bell Labs
2. IBM Corporation	2. IBM Corporation
3. Stanford University	3. University of CA Berkeley
4. Bellcore	4. MIT
5. Naval Research Laboratory	5. Stanford University
6. Lincoln Labs	6. General Electric Company
7. MIT	7. Texas Instruments
8. University of Illinois	8. Naval Research Laboratory
9. UC Santa Barbara	9. UC Santa Barbara
10. Cornell University	10. Bellcore

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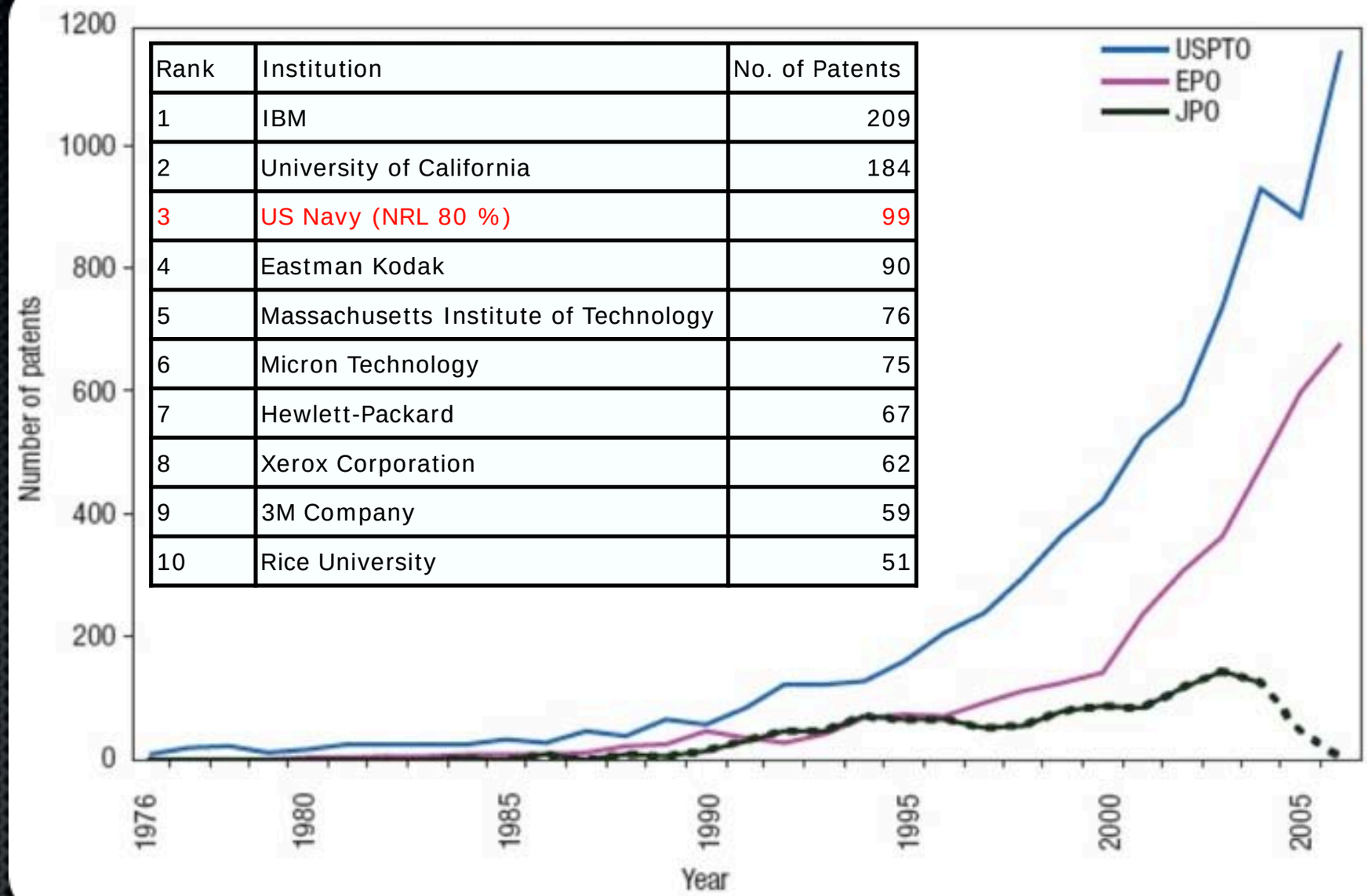
Rank	Institution	No. of Patents
1	IBM	209
2	University of California	184
3	US Navy (NRL 80 %)	99
4	Eastman Kodak	90
5	Massachusetts Institute of Technology	76
6	Micron Technology	75
7	Hewlett-Packard	67
8	Xerox Corporation	62
9	3M Company	59
10	Rice University	51



Top Ten Institutions for US Patents in Nanotechnology (1976-2006)
Nature Nanotechnology, Vol. 3, March 2008

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Cover Highlights in S&T Journals

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National Academy Membership, 2009

	ANL	BNL	JPL	LANL	LLNL	IBM	NIST	NRL
NAE	3	2	6	4	3	17	10	6
NAS	3	9	0	5	0	11	5	3

<u>Advisors to the Nation …</u>

Distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the public good.

NRL Commissioned
1923

First radar installed on USS New York
1939

Principles of modern fracture mechanics
1947

Vanguard I launched
1958

First U.S. intelligence satellite
1960

Sound Navigation and Ranging (SONAR)

Plan-Position Indicator

Liquid Thermal Diffusion Process

Synthetic lubricants

Improved Aircraft Canopy

Deep Ocean Search

1920 | 1930 | 1940 | 1950 | 1960

Gamma-Ray Radiography

First U.S. radar patents

Submarine, airborne & OTH radars & IFF

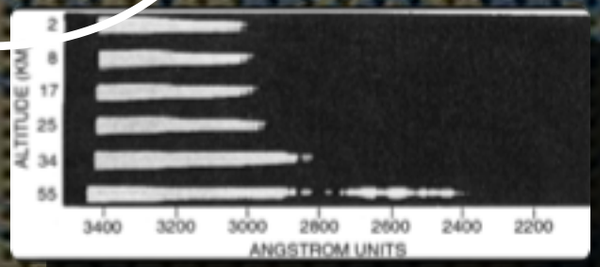
First Detection of X-Rays from the Sun

submarine life support

Over the Horizon Radar

Skip distance effect
1925-1926

First concept & proposal for nuclear sub
1939



First experiment in space
1946

Purple K Powder
1959

Aqueous Film Forming Foam
1966

The Navy and Marine Corps Corporate Laboratory

Significant and consistent contributions to the evolution of technological landscapes in both military and civilian venues

The Navy and Marine Corps Corporate Laboratory

Through Knowledge, Sea Power

22 Initial members from 11 National science and Engineering societies, to illustrate what can happen when a critical mass of diverse expertise and equipment is assembled in close proximity…

Facilities + Expertise + Structure to yield …

A diversity of expertise, co-located with the ability to mix and match talents to solve new and difficult problems

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Establishment of NRL

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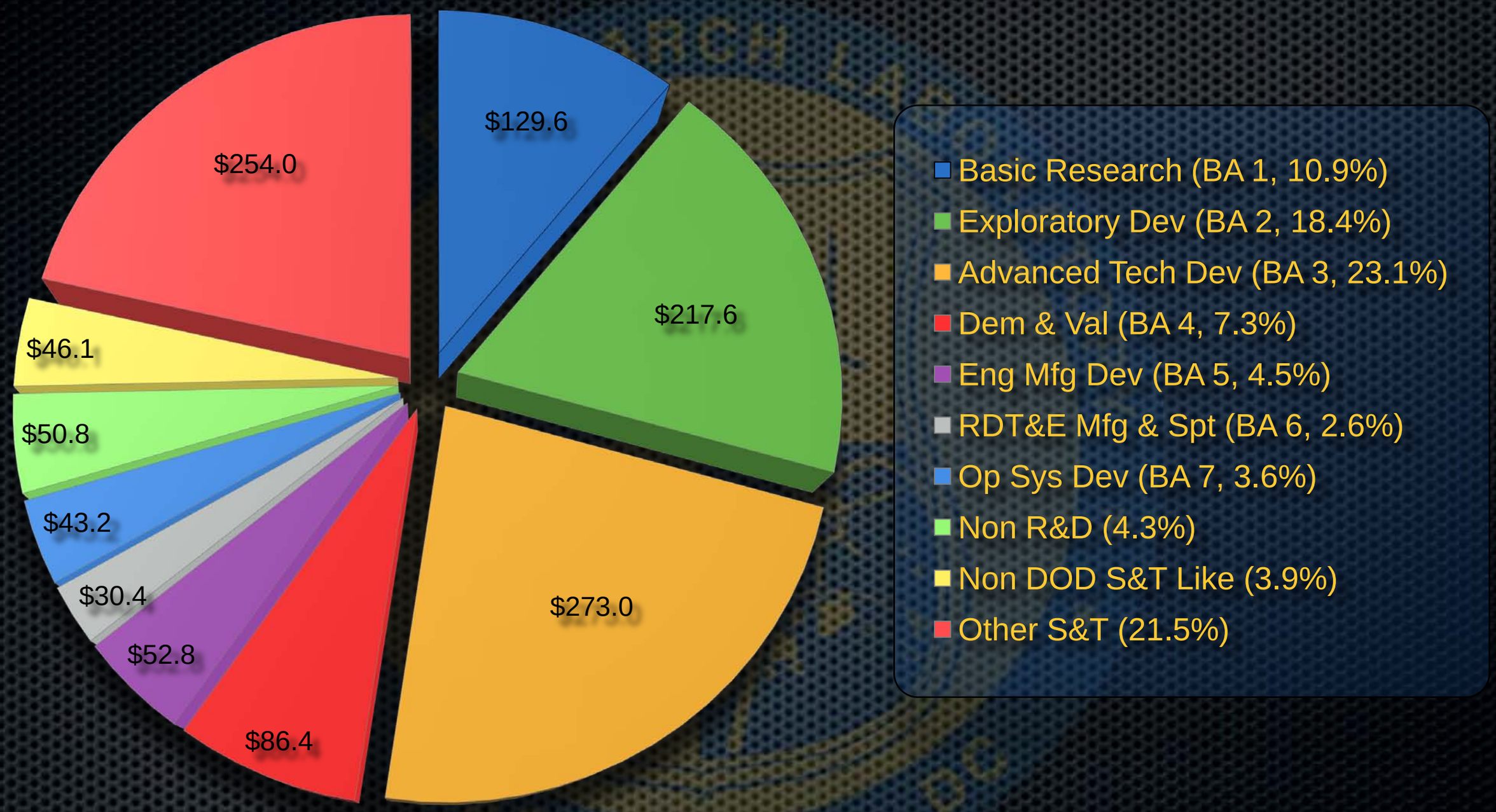
R&D Categories



Research Modified NP-3D	2
AEW Rotodome NP-3D	1
Research Modified RC-12	2
MZ-3A Airship	1
Total Aircraft	**6**

Scientific Development Squadron ONE (VXS-1**)**

Provides airborne research capability to NRL-Sensor and system test bed, airborne surrogate-Worldwide deployable

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