



# Pacific Marine Environmental Laboratory

## Overview

**Eddie Bernard**  
*Director*



# PMEL Overview Outline

- Who are we?
- What is our approach to research?
- What have we accomplished?
- What resources do we have?
- How do we measure Quality?
- How do we measure Relevance?
- How do we measure Performance?
- Summary



# Pacific Marine Environmental Laboratory

## Who Are We?

### NOAA's Mission Line Offices

**Oceanic & Atmospheric Research**

National Marine Fisheries Service

National Weather Service

National Environmental Satellite, Data & Information Service

National Ocean Service

### Oceanic & Atmospheric Research

**Assistant Administrator for Oceanic & Atmospheric Research**

Richard W. Spinrad

**Deputy Assistant Administrator Laboratories & Coop. Institutes Director, Earth Systems Research Laboratory**

Alexander E. MacDonald

Air Resources Laboratory

Earth System Research Laboratory

Atlantic Oceanographic & Meteorological Laboratory

Great Lakes Environmental Research Laboratory

**Pacific Marine Environmental Laboratory**

National Severe Storms Laboratory

Geophysical Fluid Dynamics Laboratory

# Pacific Marine Environmental Laboratory



**Directorate**

**Administration**

**Information Technology**

**Ocean Climate**

**Engineering**

**Ocean Environment**

**El Nino**

**Ocean Acidification**

**Climate Observations**

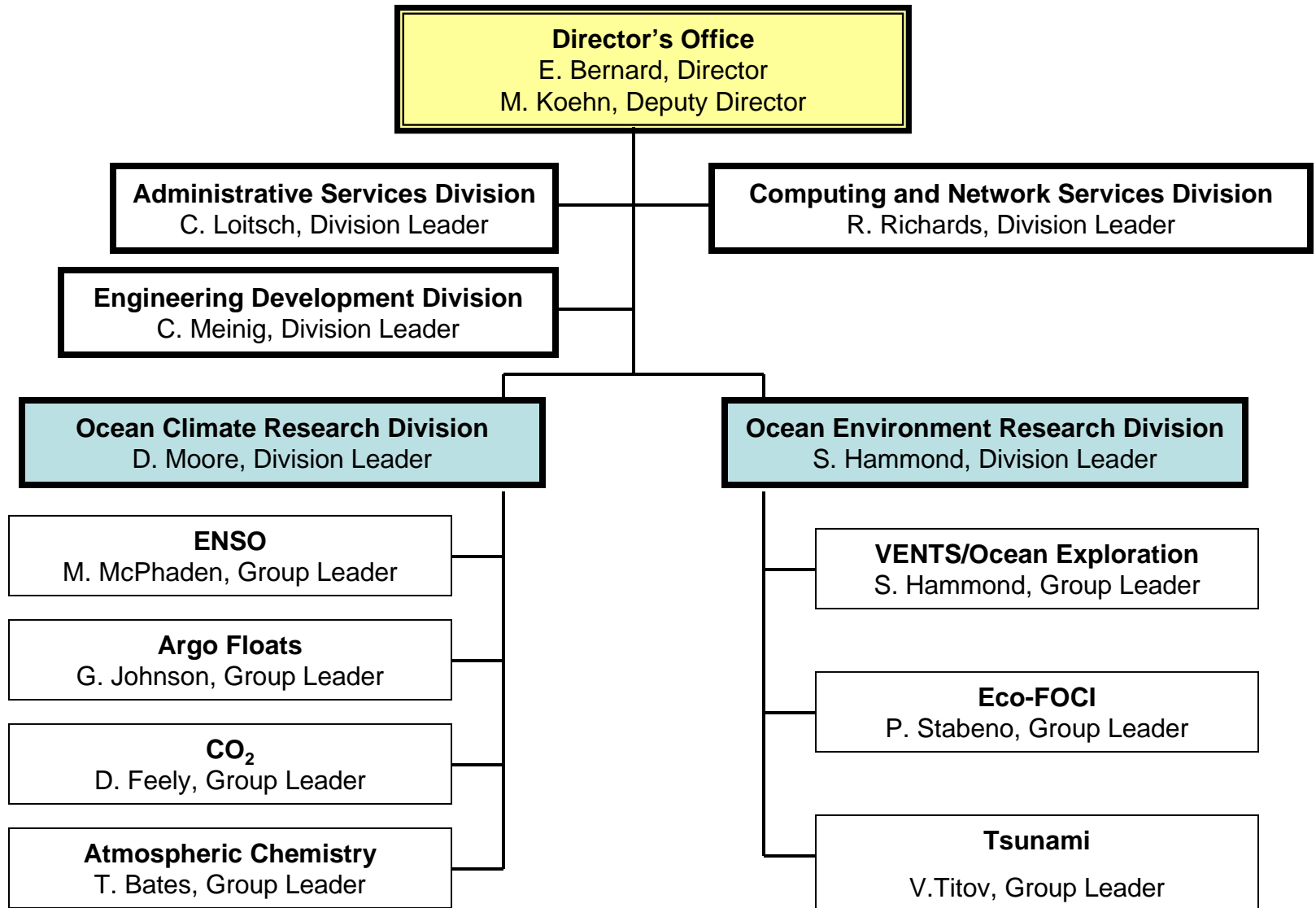
**Cooperative Institutes  
JISAO (UWashington)  
JIMAR (UHawaii)  
CIMRS (OregonSU)  
CIFAR (UALaskaF)**

**Fisheries Oceanography**

**Hydrothermal Vents**

**Tsunami**

# PMEL Organizational Structure



**M. Banks-CIMRS**



# Pacific Marine Environmental Laboratory

A Leader in Developing Ocean Observational Systems to Meet NOAA's Mission

[About us](#)

[Research](#)

[Publications](#)

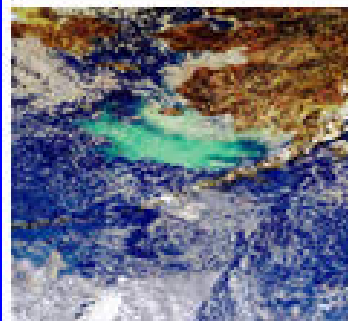
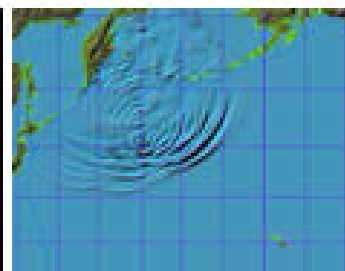
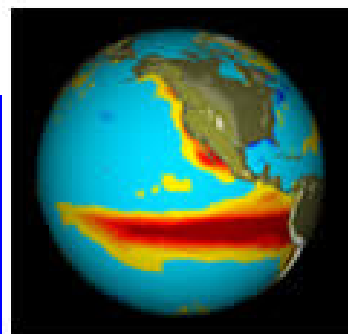
[Data](#)

[Theme pages](#)

[Infrastructure](#)

**PMEL** carries out interdisciplinary scientific investigations in oceanography and atmospheric science.

Current **PMEL** programs focus on open ocean observations in support of long-term monitoring and prediction of the ocean environment on time scales from minutes to decades.



## FEATURED:

### Climate:

- [El Niño and La Niña](#)
- [Ocean Acidification](#)
- [Argo Profiling Floats](#)

### Ecosystem:

- [EcoFOCI](#)
- [Arctic](#)
- [Underwater Hydrothermal Vents](#)

### Weather and Water:

- [Tsunami](#)

### Local Pages:

- [OAR Hot Items - Local](#)
- [PMEL Hot Items - Local](#)
- [PMEL Info - Local](#)
- [CNSD Info Desk - Local](#)

# NOAA's MISSION

To understand and **predict** changes in the Earth's environment and conserve and manage coastal and marine resources to meet the Nation's economic, social, and environmental needs.

# Oceanographic Observations

- Required to understand earth processes and develop hypotheses
- Required to calibrate, validate, and monitor satellite and new ocean sensors
- Required to validate model output
- Ultimately, **required to predict**





**Satellites can only measure surface conditions of the oceans**

We Are:

A **NOAA** Research Laboratory  
Specializing in Sub-Surface  
**Ocean Observations** to Meet  
Ever Changing Mission  
Requirements

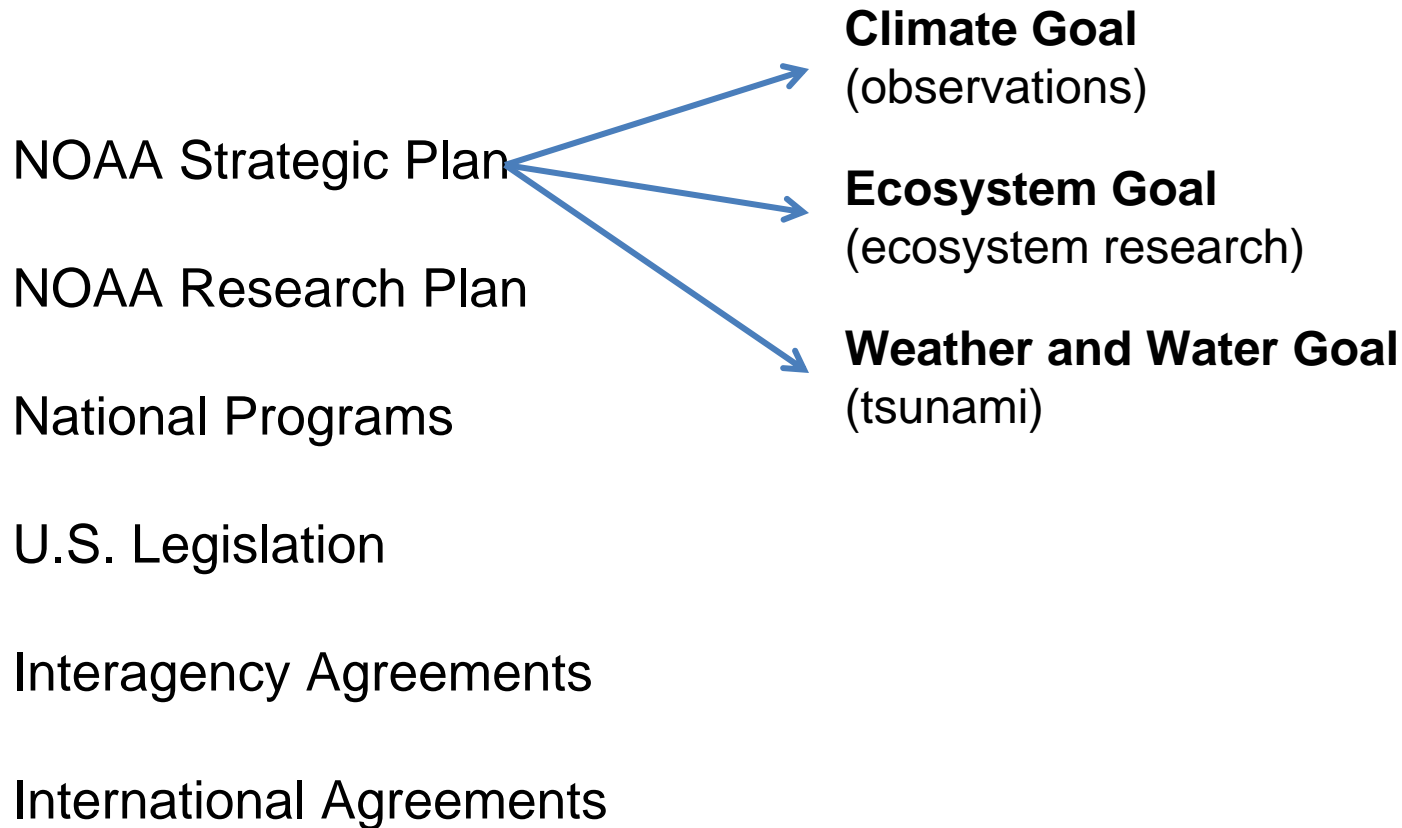
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# Pacific Marine Environmental Laboratory

## *PMEL Research – Guiding Documents*

### Major Drivers:



# Approach

- Attract talented scientists
- Nurture them into scientific leaders through a NOAA focused, supportive environment
- Encourage national and international engagement

# PMEL Science Approach

← 10 Years →

| Project                                    | Science Planning | Experiment Design | Prototype Development | Implement       | Transition to Operations/<br>Applications | Science Products | NOAA Relevance          |
|--|------------------|-------------------|-----------------------|-----------------|---|------------------|-------------------------|
| <b>ENSO/ TAO</b>                           | X                | X                 | X                     | X               | <b>Underway</b>                           | X                | Climate Obs & Analysis  |
| <b>CO2 &amp; Ocean Acidification</b>       | X                | X                 | <b>Underway</b>       | <b>Underway</b> |   | X                | Climate Obs & Analysis  |
| <b>N. Pacific/Arctic Climate/Fisheries</b> | X                | X                 | x                     | <b>Underway</b> |   | X                | Climate & Ecosystems    |
| <b>Tsunami Measurements</b>                | X                | X                 | X                     | X               | <b>X</b>                                  | X                | Weather & Water Tsunami |
| <b>Tsunami Modeling</b>                    | X                | X                 | X                     | X               | <b>Underway</b>                           | X                | Ecosystems Observations |
| <b>Seafloor Processes</b>                  | X                | X                 | X                     | <b>Underway</b> |   | X                | Ecosystem Research      |
| <b>Acoustic Monitoring</b>                 | X                | X                 | X                     | <b>Underway</b> |   | X                | Ecosystems Research     |

**Major Contributions to Climate : Argo floats, OceanSITES, PIRATA, RAMA**

**Major Planning Underway: Ocean Exploration, Tsunami, IOOS**

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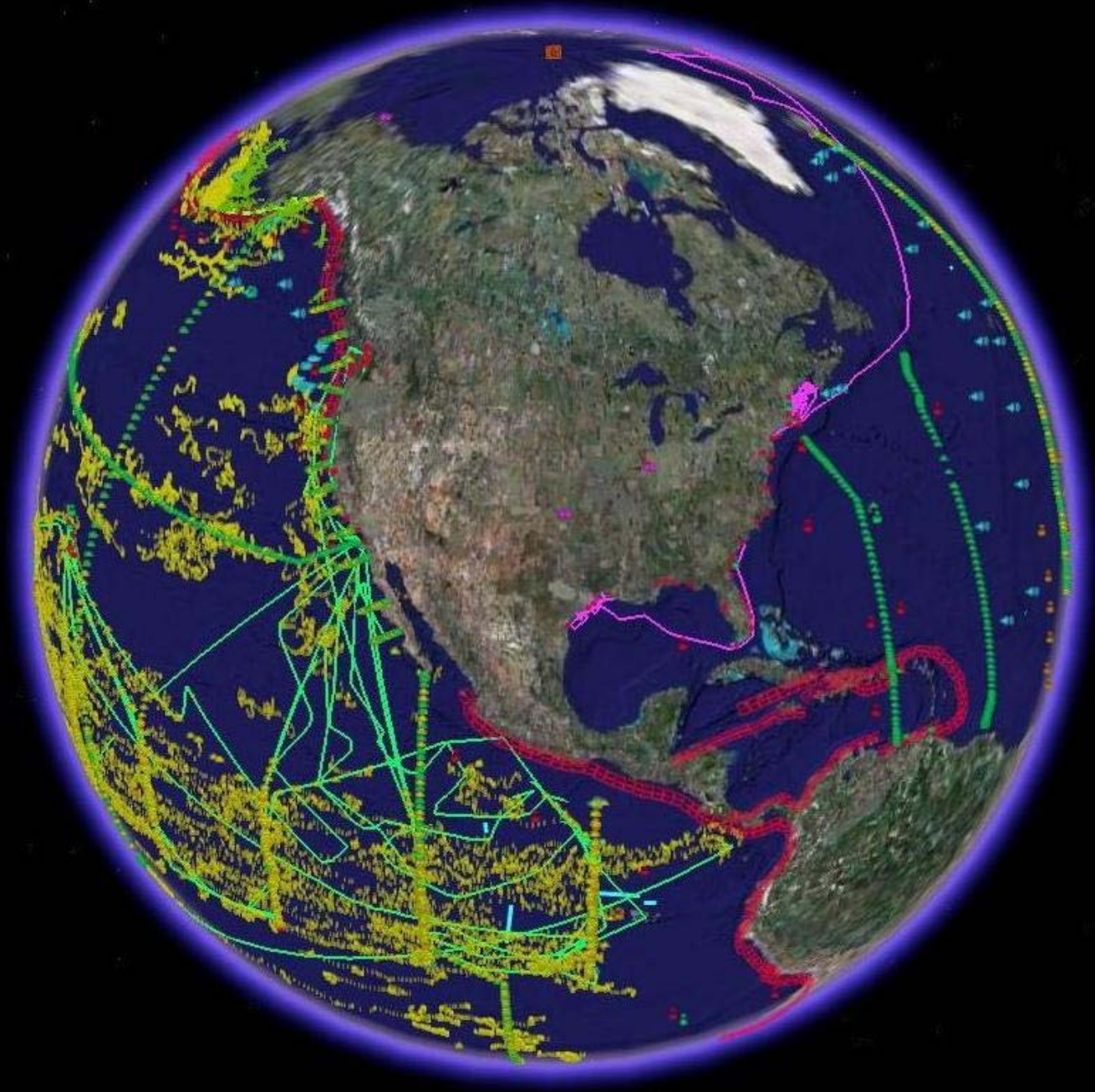
# PMEL Science Review

- **Climate Observations**
- **Ecosystems: Arctic**
- **Ecosystems: Hydrothermal Vents**
- **Tsunami**

**See Supplemental Slides for Details**



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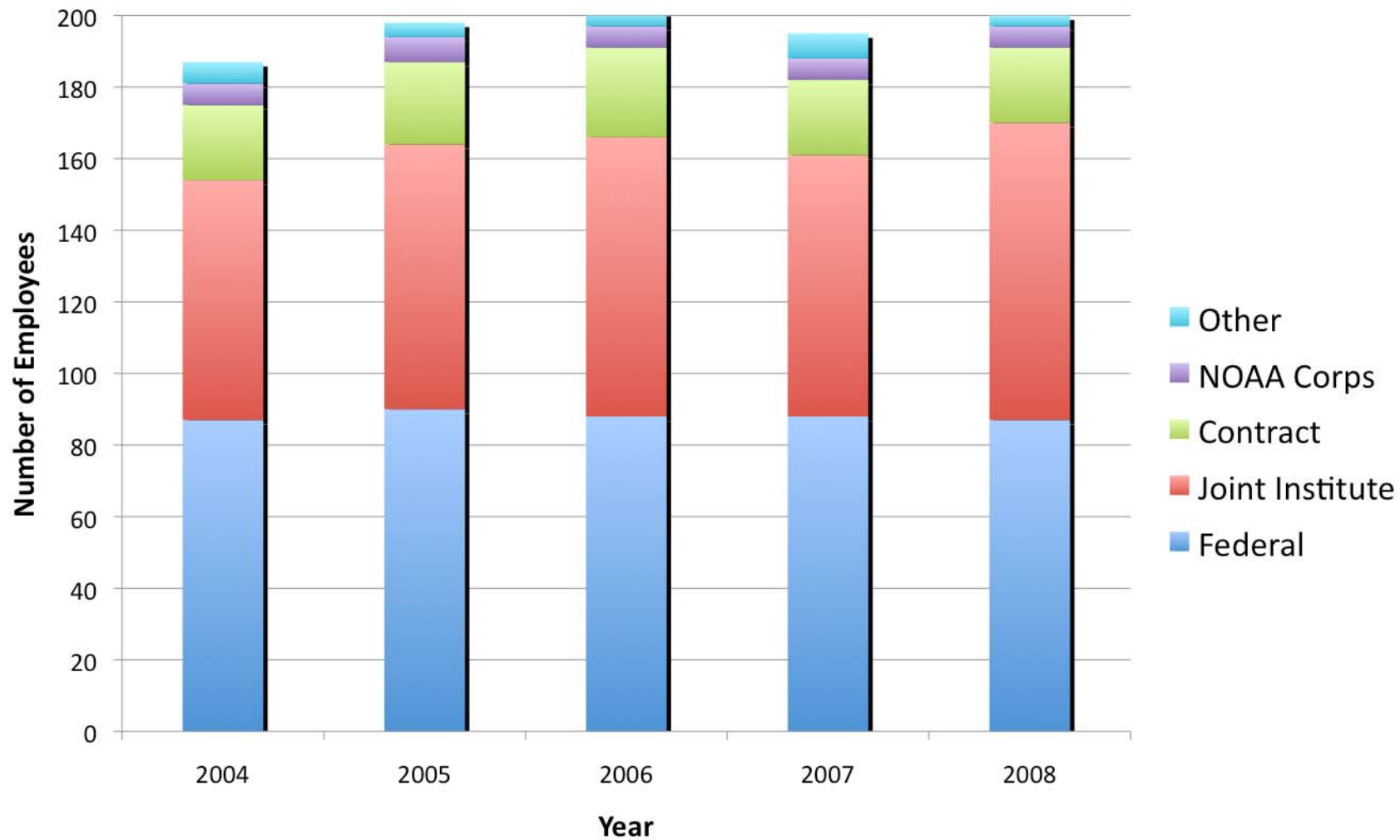


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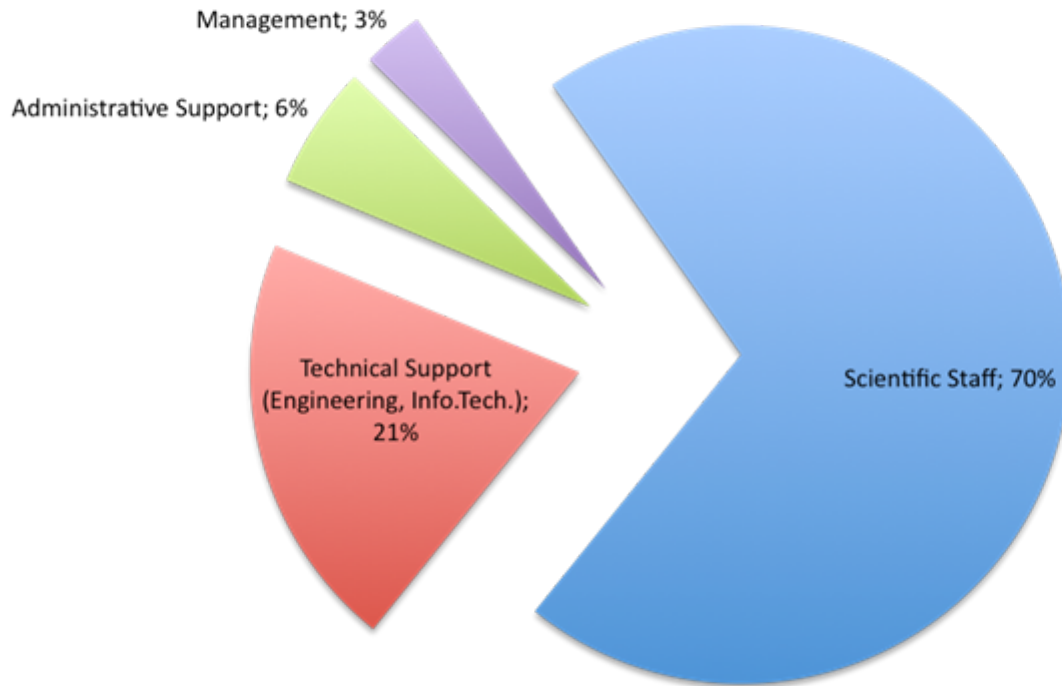
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# Pacific Marine Environmental Laboratory - Staffing

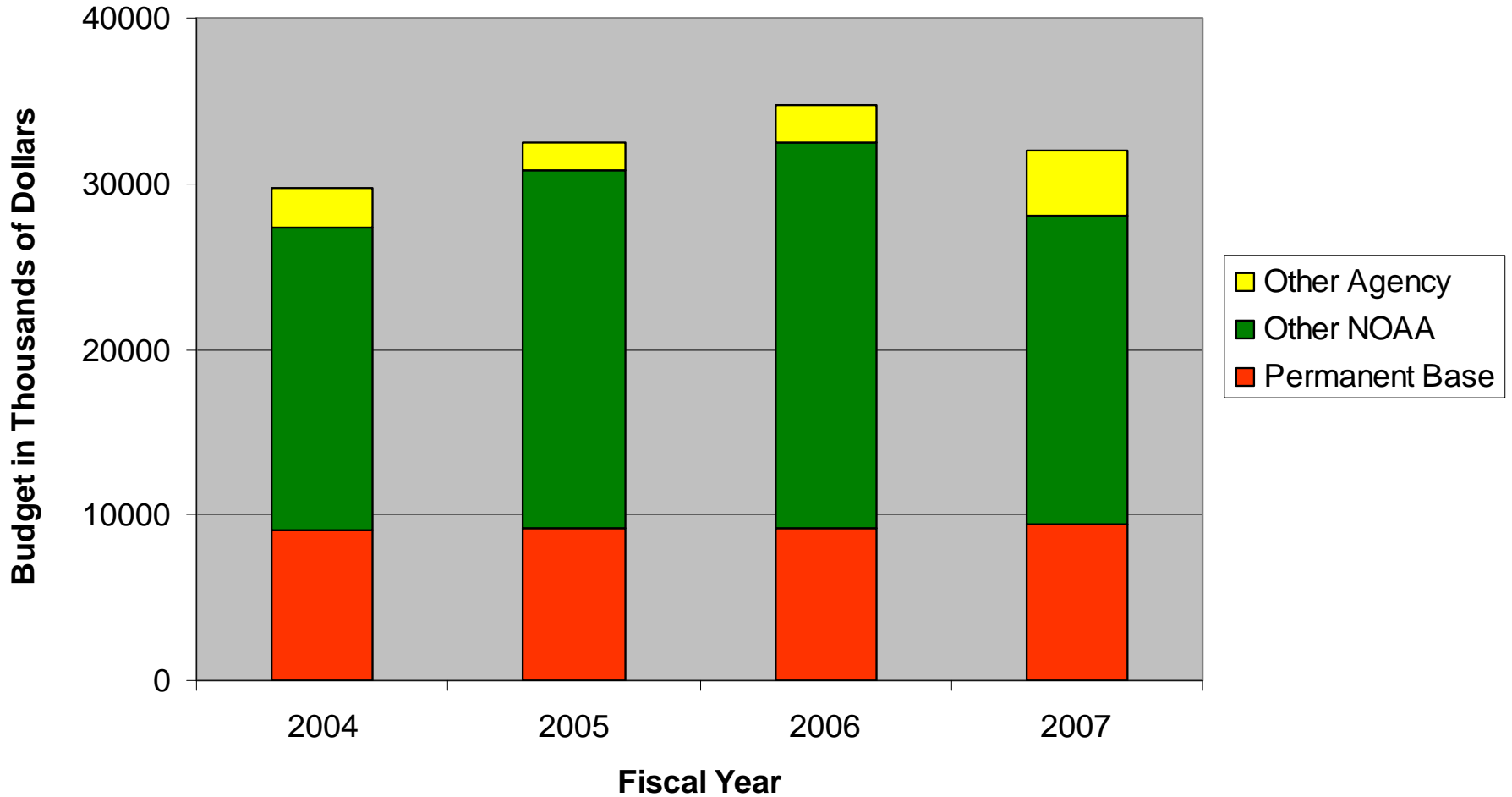


# Pacific Marine Environmental Laboratory - Workforce Distribution



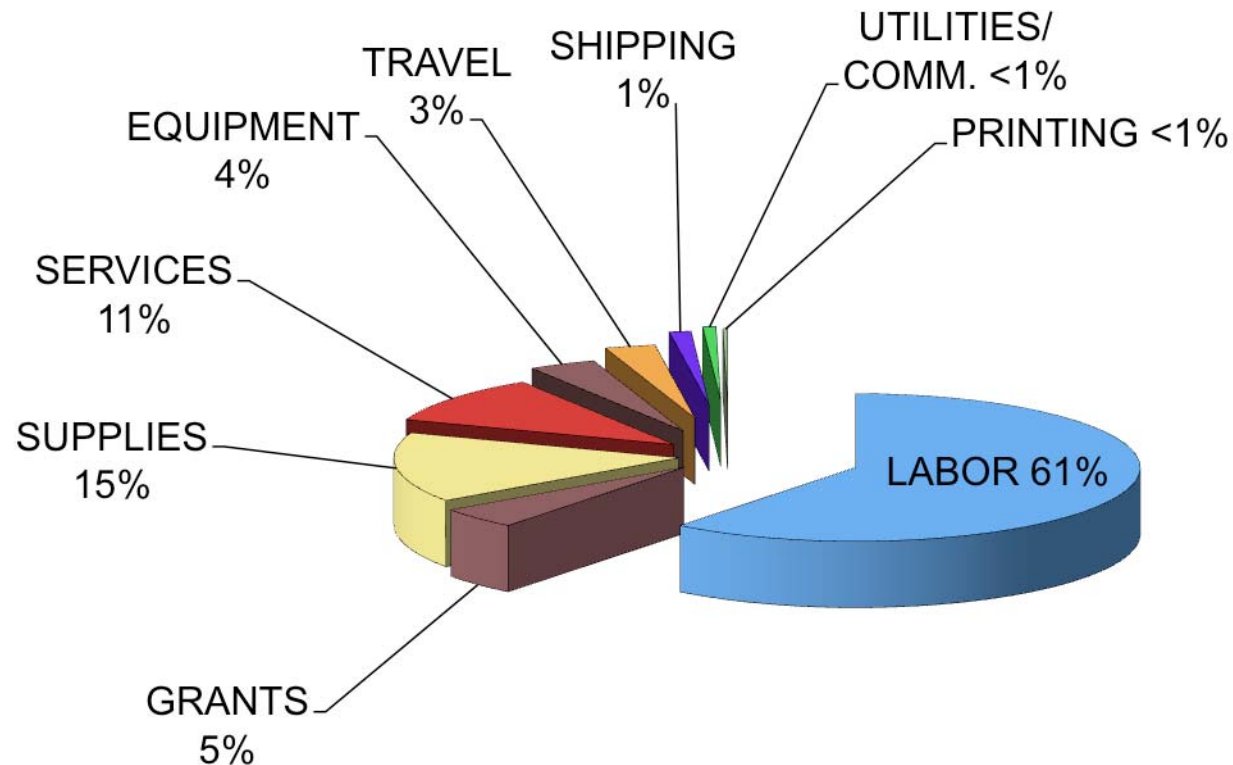
**91% Scientific/Technical**

# PMEL Funding History



**OAR Practice: At least 50% NOAA Funding**

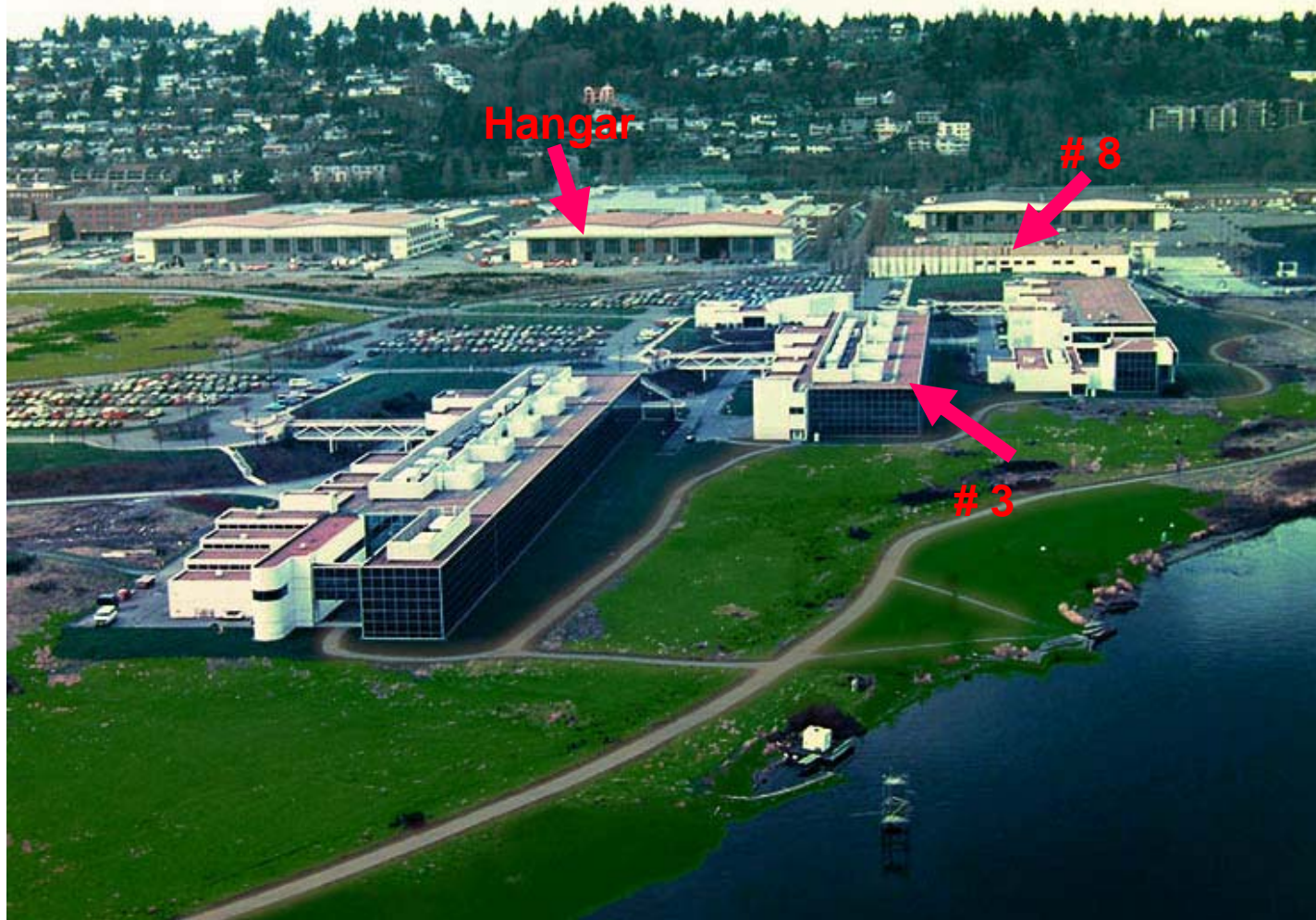
## 2007 PMEL Expenditures



**Summary: 60% Labor 40% “Doing Business”**



# Facilities overview- Seattle, Washington



- PMEL's main facility is located on the NOAA-owned Western Regional Center Campus in Seattle, Washington sharing the site with 1,000 NOAA employees representing all line offices. Approximately 180 federal, university, and contractor personnel are housed at the Seattle campus utilizing 52,000 ft<sup>2</sup> of Buildings 3 & 8 (offices, labs, shops, meeting space), 12,200 ft<sup>2</sup> in Hangar 32 and other buildings (storage, shop, lab), and a significant portion of the former airstrip tarmac area and the pier apron area for staging and storage.

# *Facilities overview- Newport, Oregon, Hatfield Marine Science Center*



**Twenty researchers and support staff utilize 6,300 ft<sup>2</sup> in the research support facility building (offices, labs, meeting space)**



# PMEL Mission Platforms

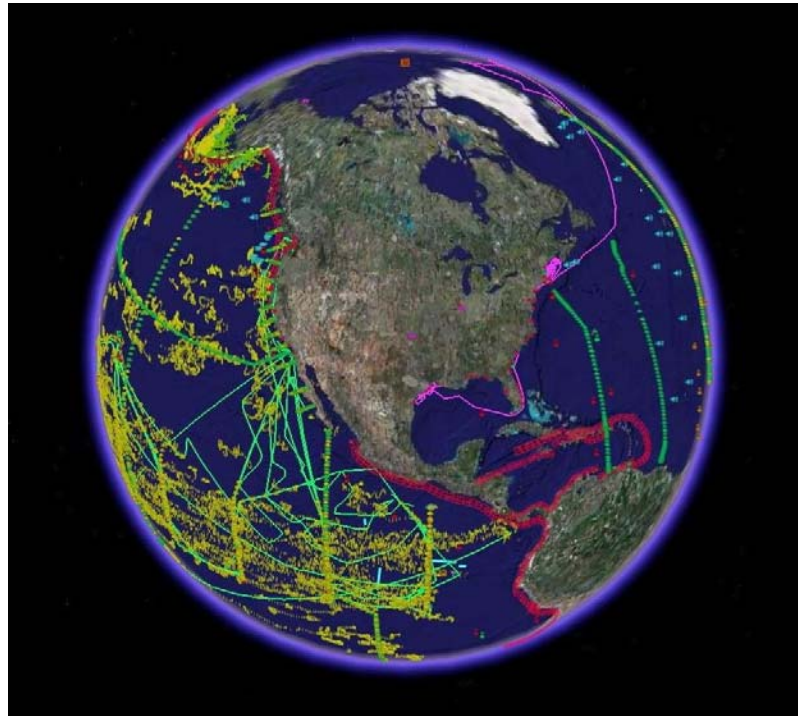
## Conventional



NOAA Fleet



Charter Vessels



## Autonomous

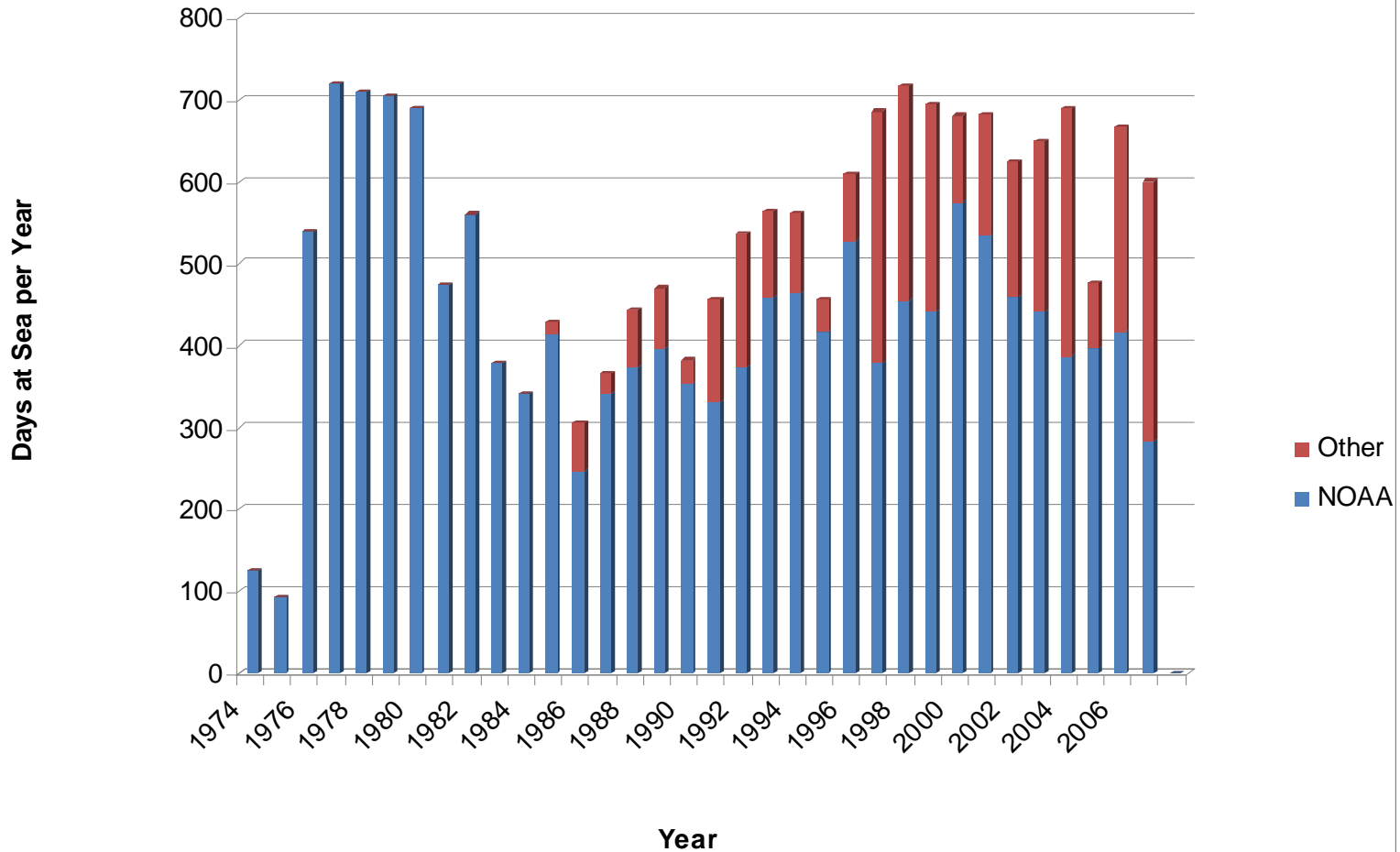


Moored Arrays



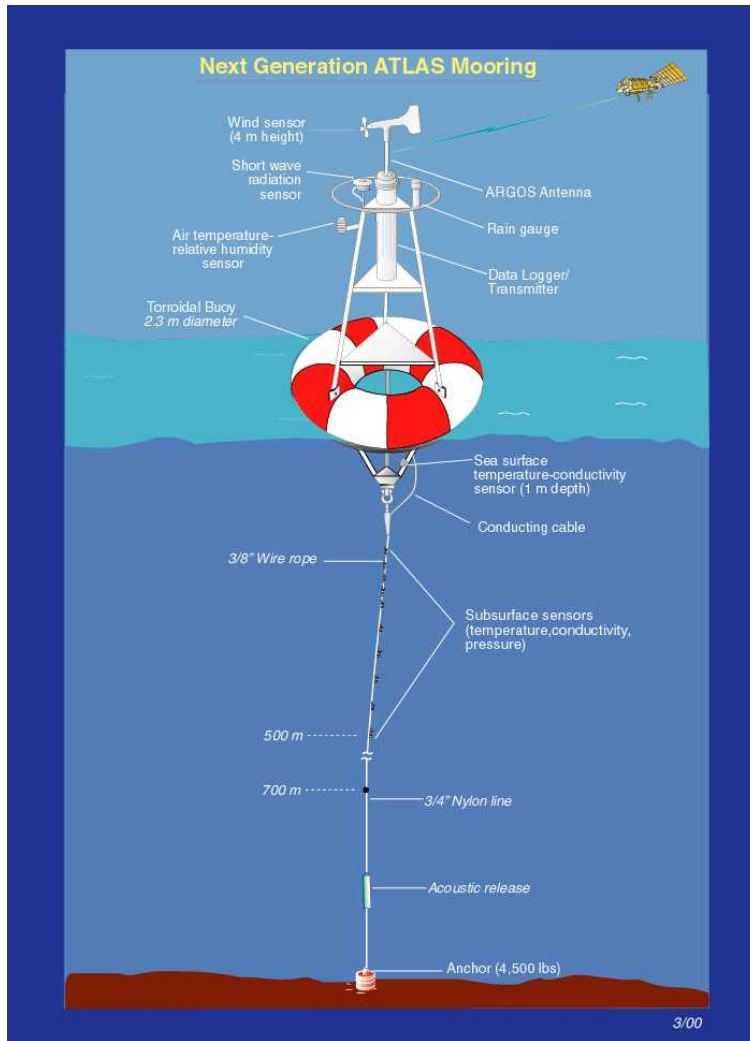
ARGO Drifters

# Pacific Marine Environmental Laboratory - Ship Time Usage

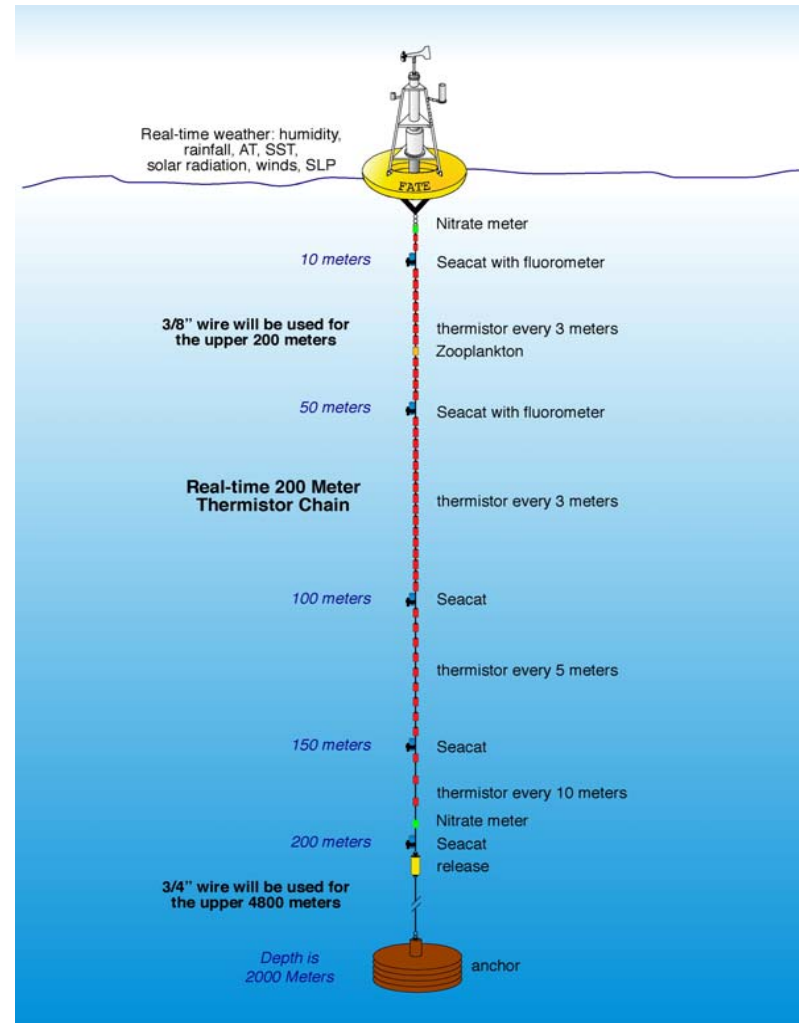


**FY07: 127 Days Contributed by Foreign Partners = \$4M**

# First Generation Buoy Development: Cable Transmitted Data

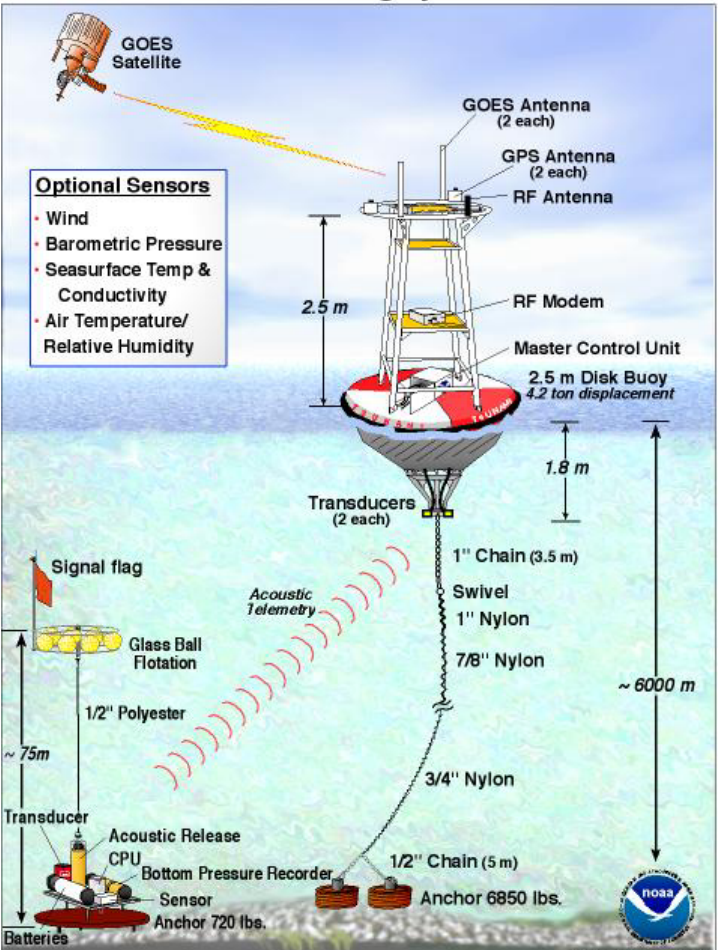


**El Nino Prediction**

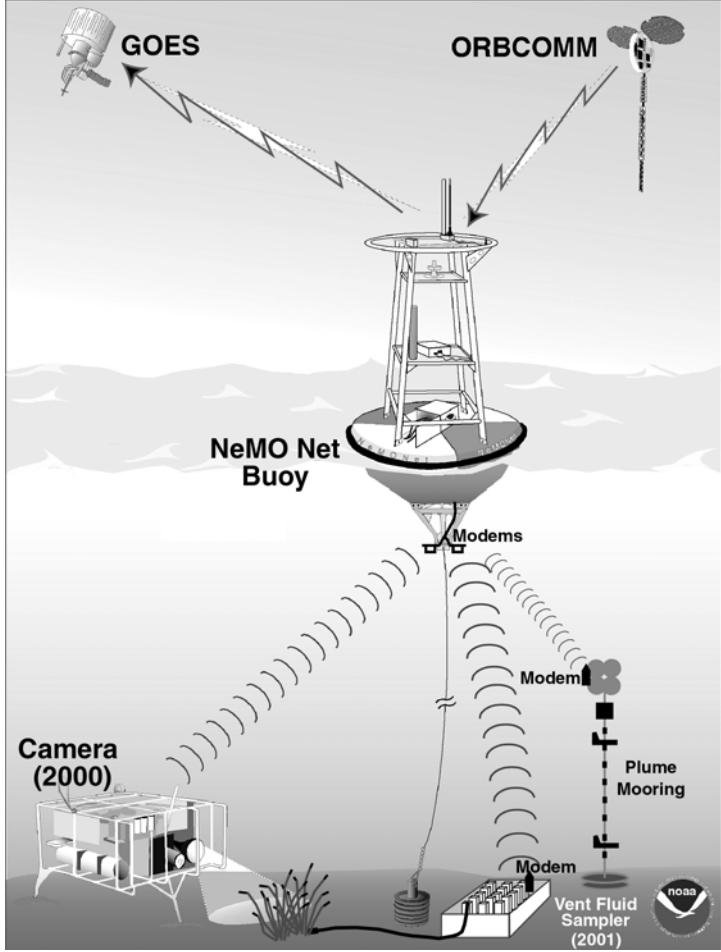


**Eco-FOCI**

# Second Generation Buoy Development: Acoustic Transmitted Data



**Tsunami**



**VENTS**

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# Indicators of Preeminence

## See Web Page

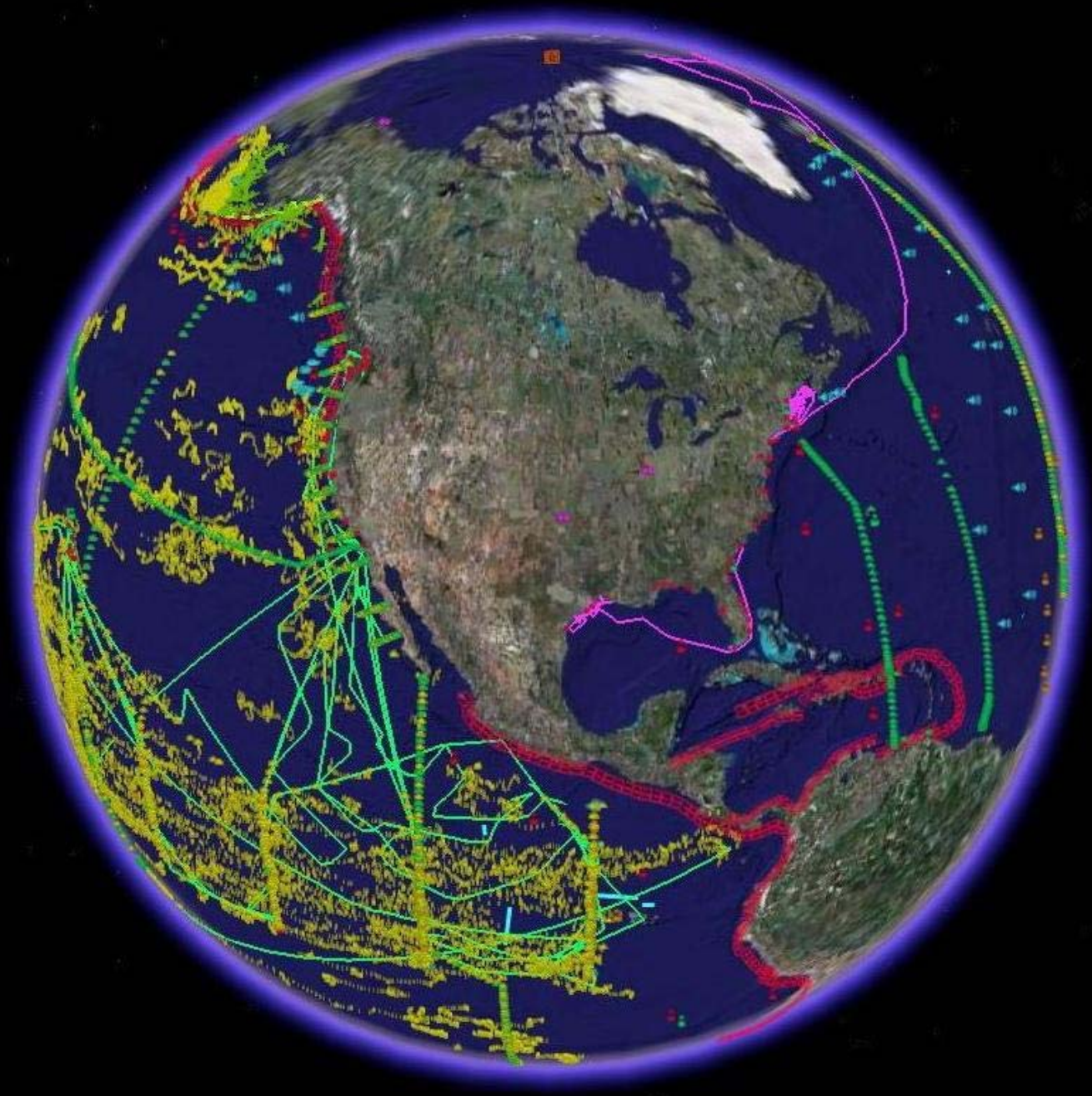
- a. A lab's total number of refereed publications per unit time and/or per scientific Full Time Equivalent staff (FTE).
- b. A list of technologies (e.g. observing systems, information technology, numerical modeling algorithms) transferred to operations/application and an assessment of their significance/impact on operations.
- c. The number of citations for a lab's scientific staff by individual or some aggregate.
- d. A list of awards won by groups and individuals for research, development, and/or application.
- e. Memberships and involvement in prestigious organizations (e.g., the National Academy of Sciences, National Academy of Engineering, or fellowship in the American Meteorological Society, American Geophysical Union or the American Association for the Advancement of Science etc.).
- f. Service of individuals in technical and scientific societies such as journal editorships, election to boards or executive level offices, service on U.S. interagency groups, service of individuals on boards and committees of international research-coordination organizations.
- g. A list of research products, information and services and an assessment of their impact by end users, including participation or leadership in national and international state-of-science assessments.
- h. Evidence of collaboration with other national and international research groups, both inside and outside of NOAA as well as reimbursable support from non-NOAA sponsors.
- i. Significance and impact of involvement with patents, Cooperative Research and Development Agreements (CRADAs) and other activities with industry.
- j. Other forms of recognition from NOAA information customers such as decision makers in government, private industry, the media, education communities, and the public.
- k. Contributions of data to national and Global Earth Observing System of Systems (GEOSS)-related data bases and programs, and involvement in international quality-control activities to ensure accuracy, precision, inter-comparability, and accessibility of global data sets.

# Quality: Preeminence in Scientific Activities

- Data Collection and Impacts
- Patents
- Transitions to Operations
- Research Products
- Publications



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# Quality: Patents and Licenses

- Tsunami- DART patent, registered trademark, license that led to a commercially available DART system
- Easy to deploy mooring technology- patent pending
- CO2 system- commercialization plan underway

# Quality: Transitions to Operations

- DART (tsunami detection) Array
  - 8 tsunamis detected, data transmitted in real-time to make experimental forecasts
- Tsunami Forecast models (underway)
  - 8 experimental forecasts show 90% accuracy ( compared with tide gauge data)
- TAO (El Nino detection) Array (underway)
  - Detected and monitored La Nina

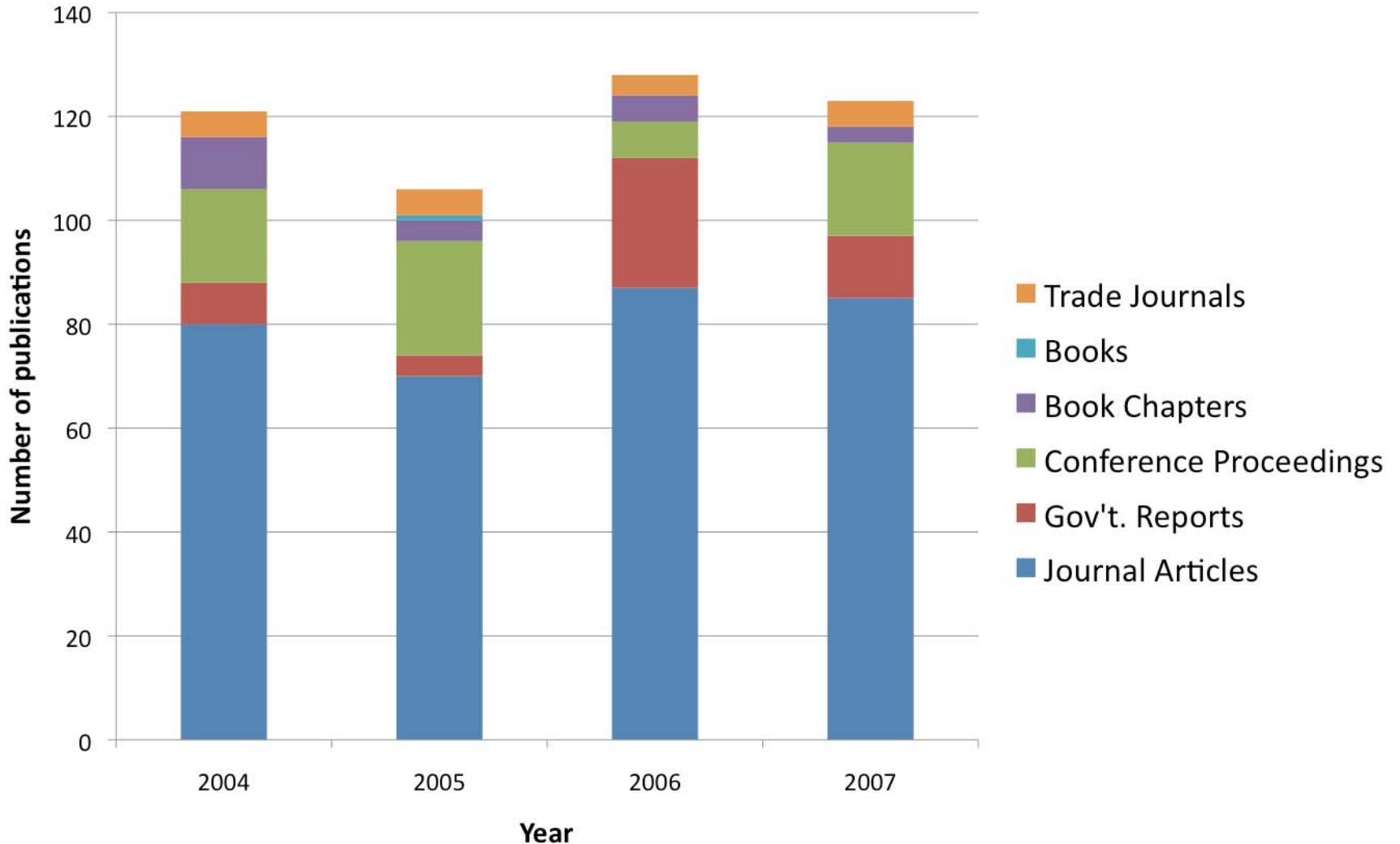
# Quality: Research Products

- Data available via internet
- Contributions to IPCC Assessment
- Forecast capability- tsunami, fisheries
- Forecast research- El Nino, CO2 inventory
- Discovery- Ocean Acidification, liquid CO2
- Development of new measurement technologies

# Quality: Publications

Journal Publications= 81/year (10 year average= 74/year) **+10%**

## PMEL Publications, 2004-2007



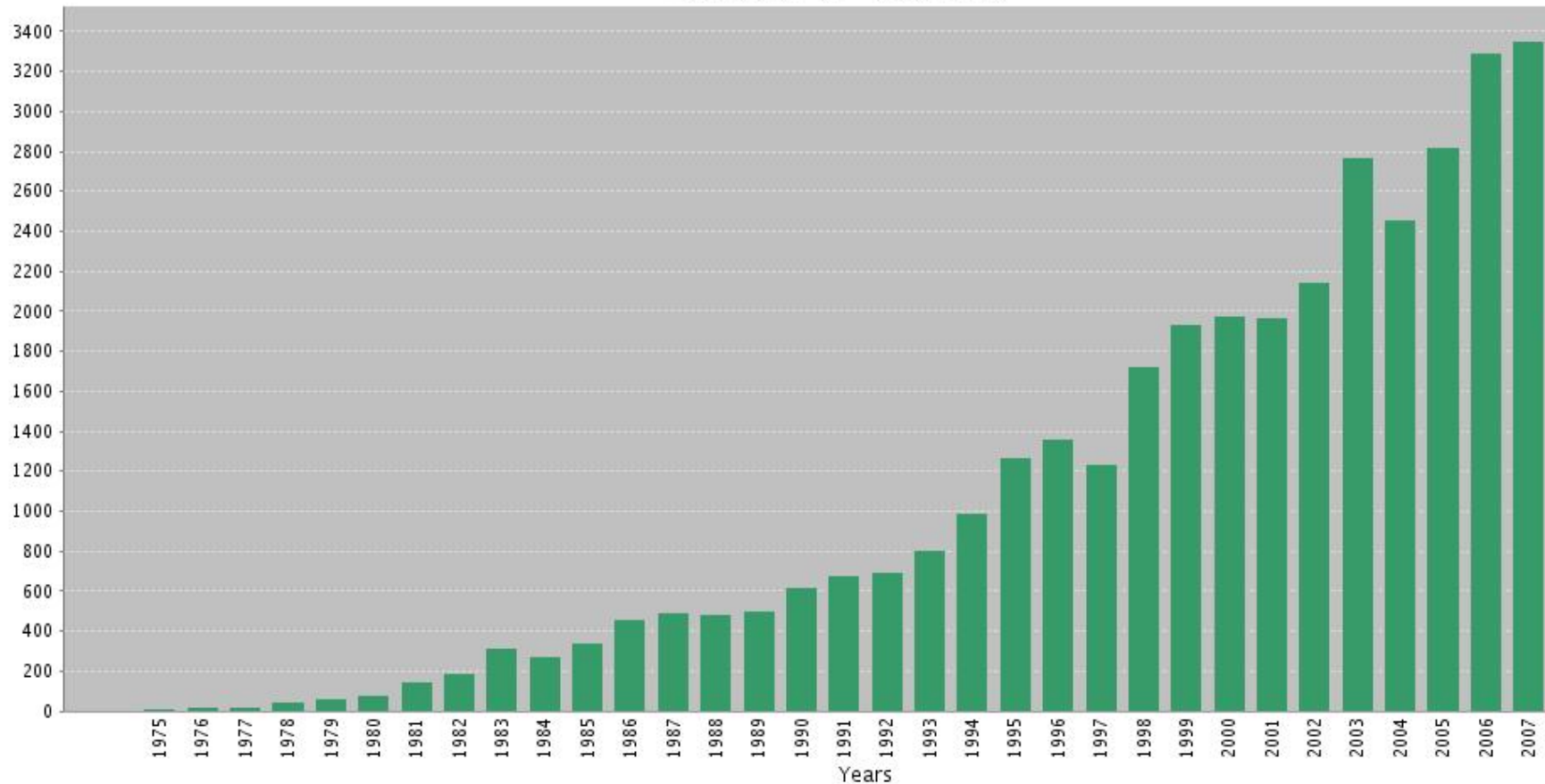
# Evidence of Preeminence

- Citations
- Awards and Recognition
- Collaborations
- Community Service/Recognition
- Other : Media, web activities, education

# Quality : Citations

**Average Citations (04-07) = 2,980/year**  
**10 Year Average = 2445/year +22%**

Citations in Each Year



# Quality: Publication Context

- Thompson ISI Highly-Cited Researchers in Geosciences (2)
- Four OAR Outstanding Paper Awards ( 21% of all outstanding awards)
- Hirsch index of top 20 publishers = 21  
Equivalent to Full Professor or  
Consideration of Fellowship in APS

# Quality: Scientific Awards/Recognition (2004-2007)

- Department of Commerce: Gold Medal (3)
- Nobel Peace Prize: IPCC Assessment (5)
- American Geophysical Union: President-elect, Fellows (2)
- American Meteorological Society: Fellows (2)
- The Oceanography Society: Fellow (1)



# Quality: Collaboration (NOAA)

- Research: Climate Program Office, Ocean Exploration, Sea Grant
- National Weather Service: Tsunami Program, Ocean Observations with NDBC
- National Marine Fisheries Service: Fisheries Oceanography (Alaska Fisheries Science Center)
- National Ocean Service: Tsunami Hazard Mapping, Tides Program
- National Environmental Satellite and Information Service: Tsunami model grid development ( National Geophysical Data Center)

# Quality: Collaborations (non-NOAA)

- Climate: NSF, NASA, International Programs in Ocean Climate Observing
- Arctic Ecosystems: North Pacific Fisheries Council, NSF, PICES
- VENTS: NSF, Academia, International
- Tsunami: FEMA, NRC, State Department, States of Washington & California, Agreements with Australia, Chile, and Indonesia

# Quality: Community Service/Recognition

- 90% of scientists belong to 105 NOAA, National, or International committees
- 83% of scientists hold Affiliate Faculty Appointments
- 83% of scientists contribute to Cooperative Institute activities

# Quality: Other Recognition

- **Media:** 580 media stories on PMEL science activities (TV- 127, Newspapers- 157, Radio- 25, Periodicals- 49, Web stories- 222) – See web site for details
- Web Hits: 620,000,000 from FY04-07  
Peak: 21,000,000 January, 2005

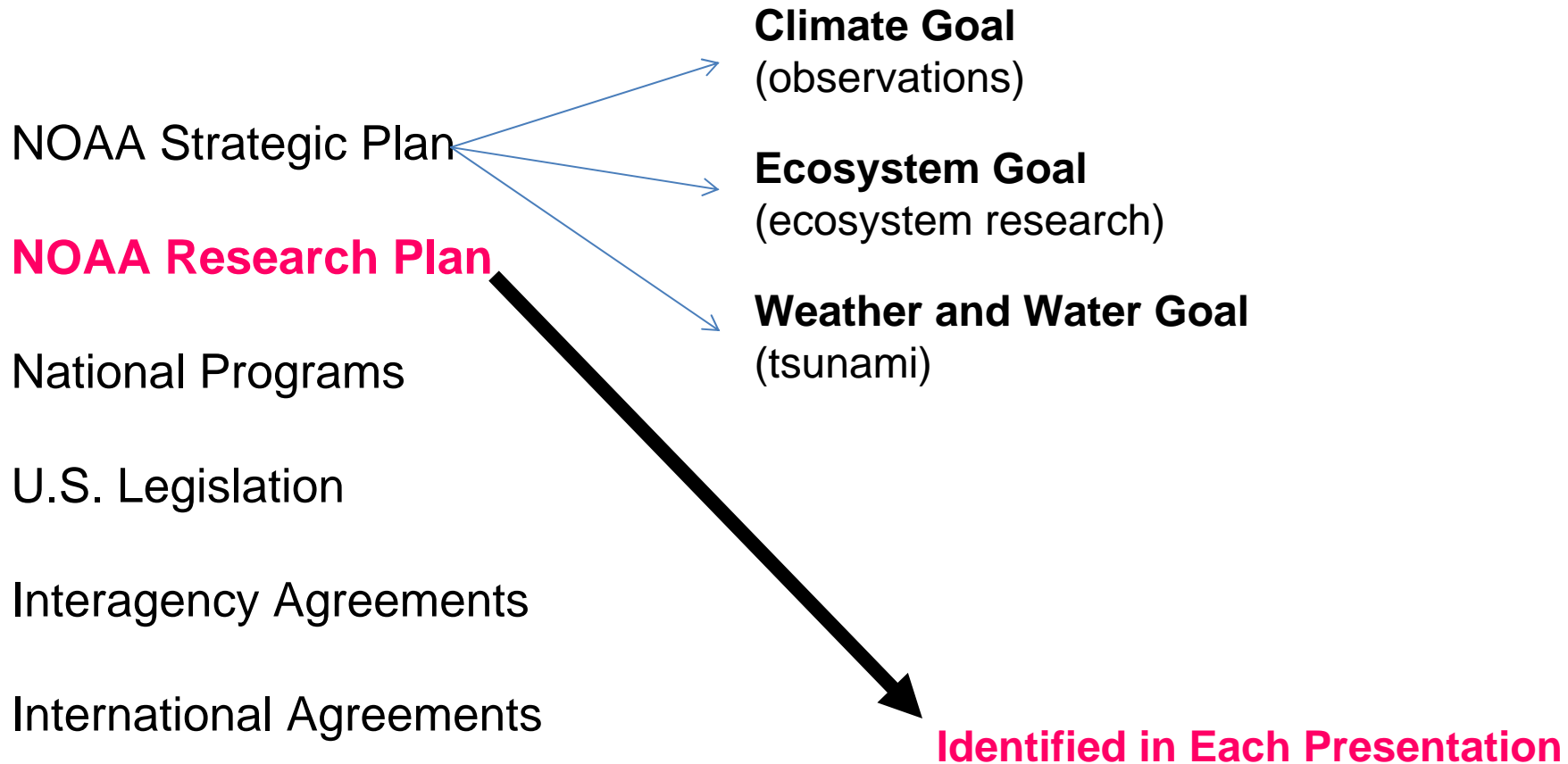
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# **Relevance:** Pacific Marine Environmental Laboratory

## *PMEL Research – Guiding Documents*

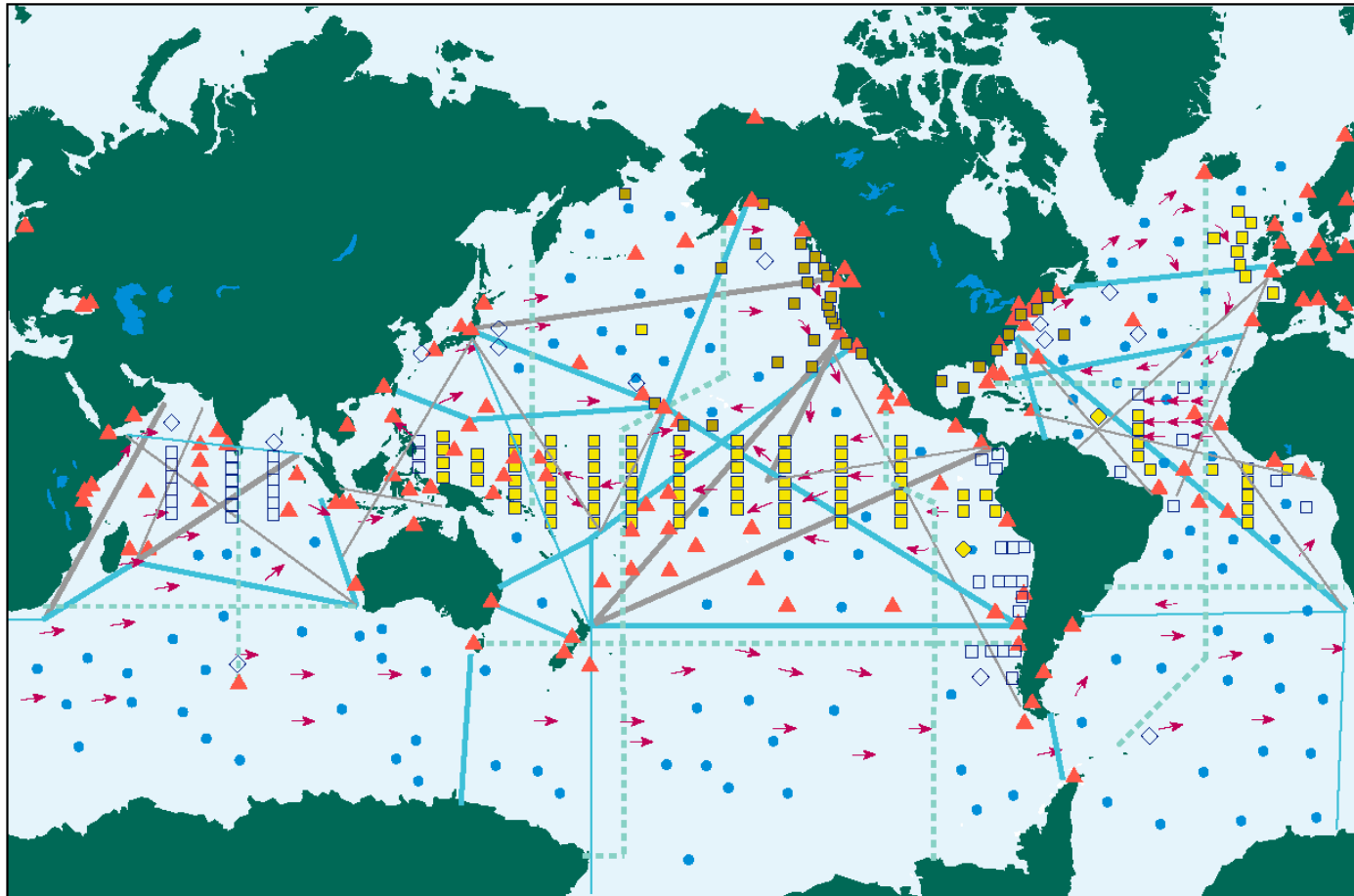
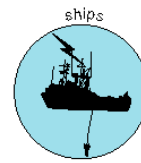
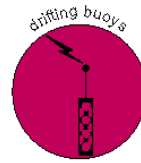
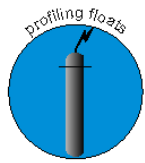
### Major Drivers:





# Relevance

## Global Ocean Observing System for Climate and Marine Services



3° x 3° ARGO ARRAY

TIDE GAUGE STATIONS

MOORED BUOYS

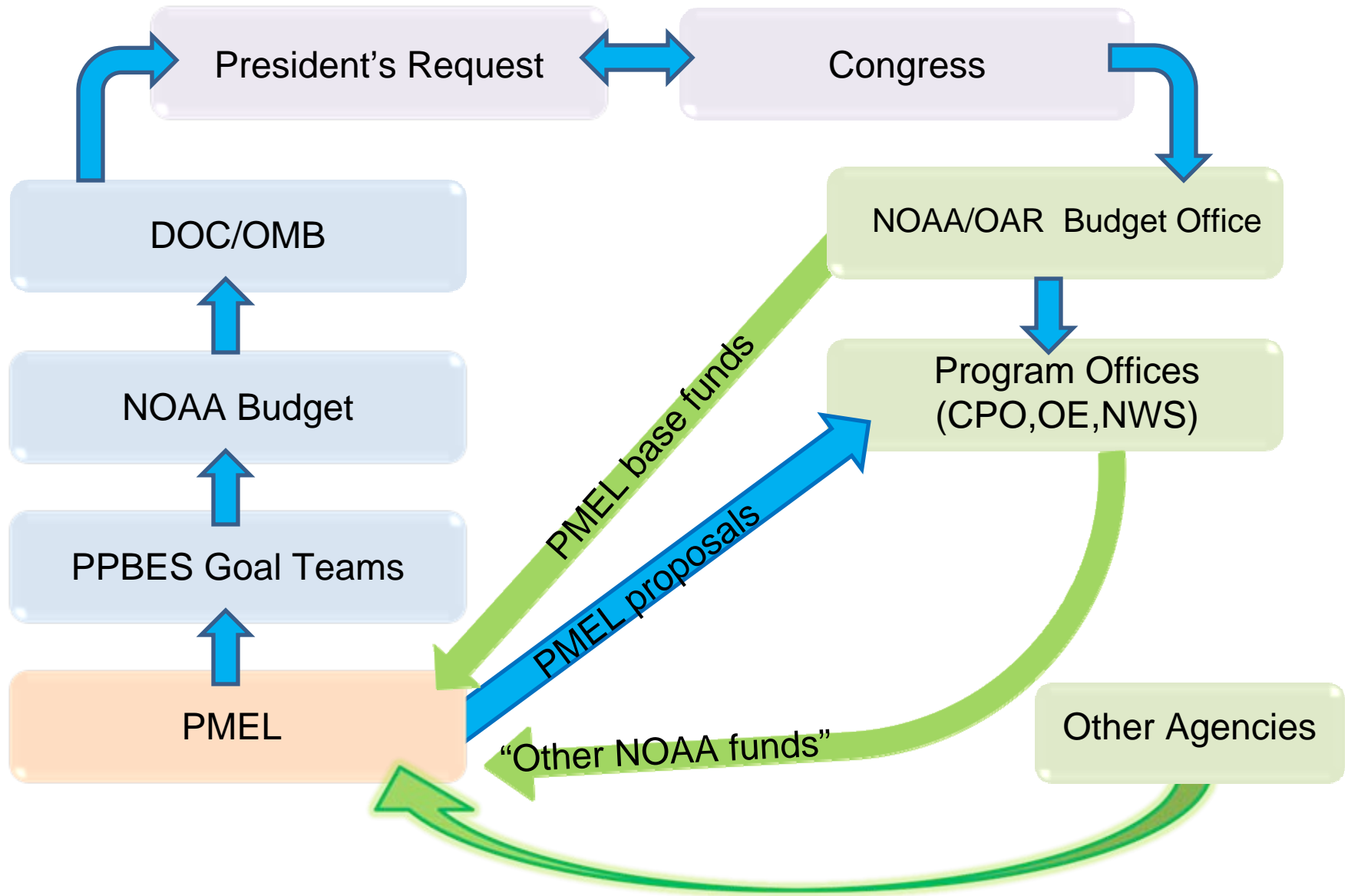
5° x 5° DRIFTER ARRAY

SHIP LINES

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# Performance: Efficiency and Effectiveness



# Performance: Efficiency and Effectiveness

## Funded Proposals

- **Quality:** Reputation, Past Performance
- **Relevance:** Other people's money
- **Performance:** Good value

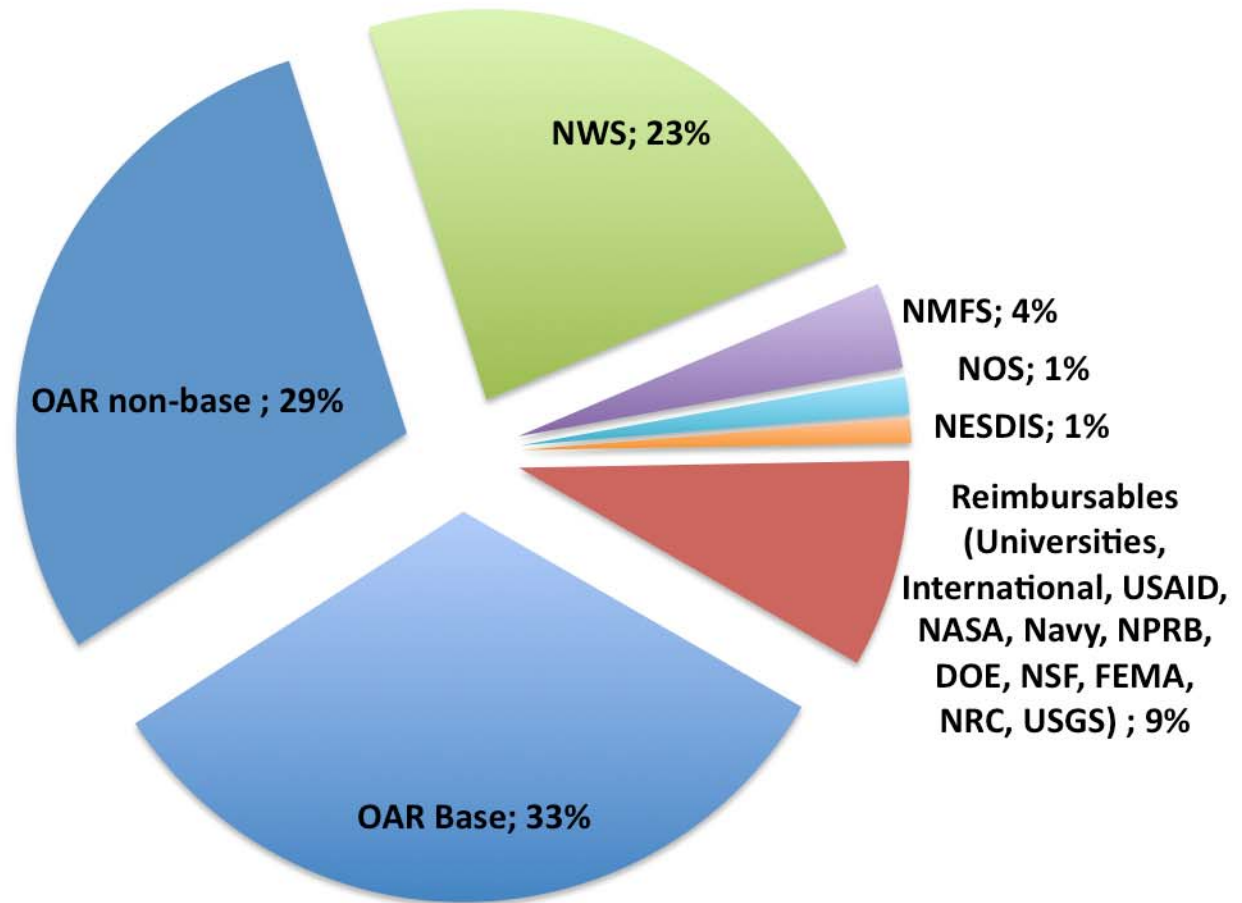
# Performance: Efficiency & Effectiveness

| FY            | # of Proposals |            | Funding (\$M) |             | % of Base  |
|---------------|----------------|------------|---------------|-------------|------------|
|               | NOAA           | Reimburse  | NOAA          | Reimburse   |            |
| <b>2004</b>   | 74             | 32         | 16.3          | 2.4         | 195        |
| <b>2005</b>   | 73             | 20         | 19.8          | 1.7         | 224        |
| <b>2006</b>   | 60             | 35         | 19.0          | 2.3         | 222        |
| <b>2007</b>   | 49             | 38         | 15.1          | 3.8         | 189        |
| <b>Totals</b> | <b>256</b>     | <b>125</b> | <b>70.2</b>   | <b>10.2</b> | <b>217</b> |

**\$1 Base = \$3.17 Research Effort**

## Performance: Efficiency & Effectiveness

### PMEL Funding Sources, 2004-2007



# Performance: Transitions

- **From Research to Applications**

Examples: Publications, Assessments (IPCC & Fisheries), Data, Community Leadership and Service, Patents, Licenses

- **From Research to NOAA Operations**

Examples: El Nino Observing Array, Tsunami Detection and Forecasting

- **From Research to Research**


Examples: Easy-to-Deploy Mooring Technology, Live Access Server (IPCC)

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# Summary

- **Quality**: Pre-eminence in scientific activities, **as evidenced by**, citations, awards (funding and recognition), professional honors, collaborations, and community recognition
- **Relevance**: Every project linked to NOAA Research Plan
- **Performance**: Publications/citations   
Funded Proposals Boost Scientific Productivity  
DART patent has license ( U.S. jobs)

# **Supplemental Slides**

# **Climate Observations Highlights**

- **El Nino/ La Nina Prediction**

Data analysis from global moored array leads to better understanding of ocean dynamics in the equatorial band

- **Ocean Acidification Discovery from Global Ocean CO2 Measurements Program**

- **Development and Use of New Observing Technologies to Expand Climate Ocean Observations**

# **Alaska Marine Ecosystem Highlights**

**Collection of long-term, biophysical time series leads to better understanding of Bering Sea ecosystem.**

**Development of physical ocean model for use in ecosystem management research**

**Completion of first fisheries ecosystem study of Aleutian Islands**

# Ecosystems- VENTS

## Highlights

- Discovery of underwater volcanic systems that are erupting from days to decades
- Discovery of high concentrations of CO<sub>2</sub> in liquid form which could serve as a natural laboratory for acidification studies
- Evaluation of new monitoring/ measurement technologies for effective use in understanding the role of underwater volcanoes in ocean ecosystems and climate

# Tsunami Highlights

- Created NOAA tsunami forecast capability using measurement and modeling technology developed at PMEL
- Patented measurement technology and approved one license which has led to a commercial product
- Established a tsunami science and preparedness educational program