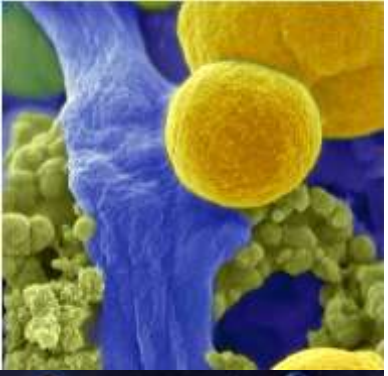
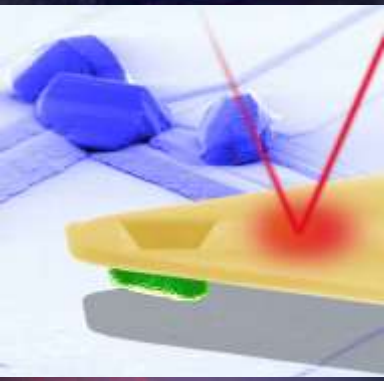





Overview of the Instrumentation & Facilities (EAR/IF) Program

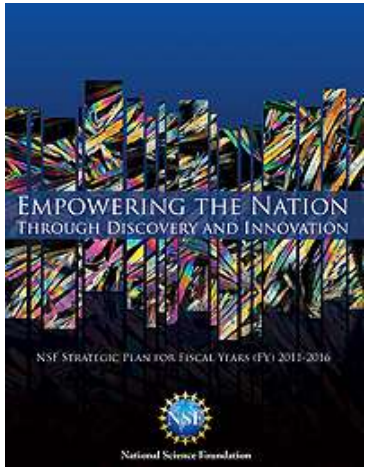
Division of Earth Sciences
Directorate for Geosciences

David Lambert, Russell Kelz & Jonathan Wynn

Jun 26, 2014

National Science Foundation

EAR/IF Mission statement



1. Ensure that the best researchers in the Earth sciences have access to the *tools* they need.

2. Support NSF aim to ensure that US research in the Earth sciences is internationally competitive.

3. Support acquisition, development & access to analytical instrumentation required to foster research and research training in the Earth sciences.

NSF Program Officers can be thought of as science *"investment managers"* for the federal government & the USA taxpayers ⇨ **95%** of NSF budget is invested.

National Science Foundation

IF Areas of Investment

FY13 Budget = ~$28.1M

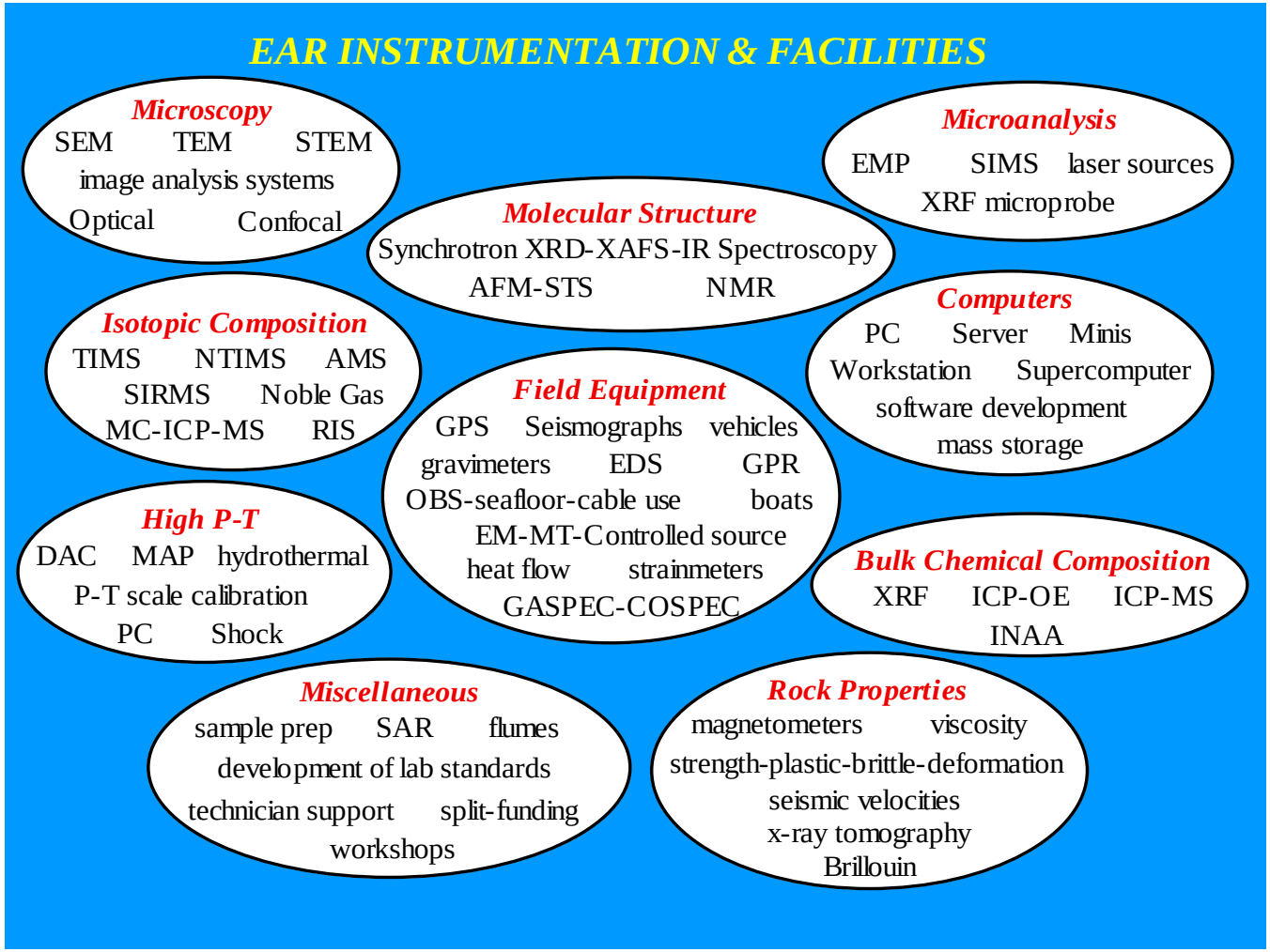
(EAR total FY14 budget = $176.7M)

- **EA** — *Equipment acquisition - **$1M** max (11%)*
- **ITD** — *Instrument & technique development (6%)*
- **FS** — *National, multi-user facility support (74%)*
- **EC** — *Early-career support (12%)*
- **O** — *Other - workshops, supplements (3%)*

Funds can be budgeted for outreach & broadening participation activities (up to $20K)

National Science Foundation

Equipment Acquisition
- EAR/IF & MRI -



National Science Foundation

Equipment Acquisition (EA): Enabling Transformative Science

Ed Young (UCLA)
Doug Rumble (CIW)
EAR-0948938, $500K

$^{13}CH_3D$

$^{12}CH_2D_2$

} 18

High-mass resolution gas source mass spectrometer

- Large geometry = high MRP (37K) & high sensitivity
- Target is to measure both rare mass-18 doubly substituted isotopologues ("clumping") of methane to high precision & accuracy
- Methane provenance & temperature of formation
- Funding consortium of NSF, DOE, Sloan, Shell, Carnegie, UCLA

National Science Foundation

Instrument & Technique Development (ITD)

Development of a Replacement for the STS-1

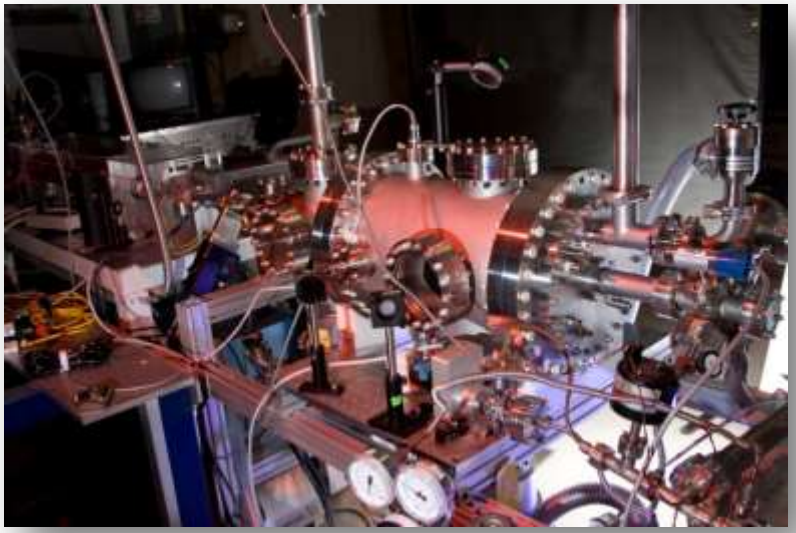
U. of California, Berkeley & Metrozet LLC

(EAR-0744021, -0744045; $780K)

Development & test of new mechanical sensors for the Streckeisen STS-1 Very Broad-Band (VBB) seismometer. The proposed program would be the second step in the team's efforts to develop a commercially-viable replacement to this aging, but state-of-the-art sensor (design-for-manufacturing).

National Science Foundation

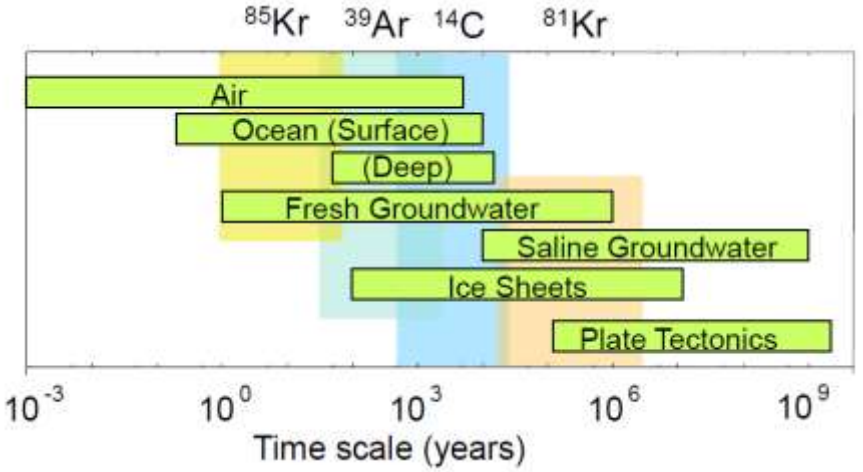
Instrument Development



Atomic Trap Trace Analyses at Argonne National Lab (DOE partnership)

Transformative Research in Geosciences:
Noble gas (radio Ar, Kr) at extremely low levels

- Dating of groundwater, ice sheets
- Ocean circulation
- CO_2 sequestration, geothermal applications



ATTA -1:Dating of 1M year old water in Nubian aquifer (Sturchio et al., 2004)
ATTA-3: Dating of 100,000 year old hydrothermal water in Yellowstone (Yokochi et al., in press)

National Science Foundation

Facility Support (FS): Alignment with NROES Science Drivers

~ $25 M/yr

Internal Dynamics	Climate-surface interactions	Early Earth	Hydro-Geo-Eco response to change
Faulting Deformation	Co-evolution life-climate		Bio-Geo and water cycles

IRIS

OpenTopography

ARIZONA LASERCHRON CENTER

UNAVCO

AMS PRIME LAB PURDUE UNIVERSITY

AAGL

COMPRES

National Ion Microprobe Facility

CTEMPs

IRM

High Resolution X-ray CT Facility

ASU SIMS

GeoSoilEnviroCARS

CMT

International Seismological Centre

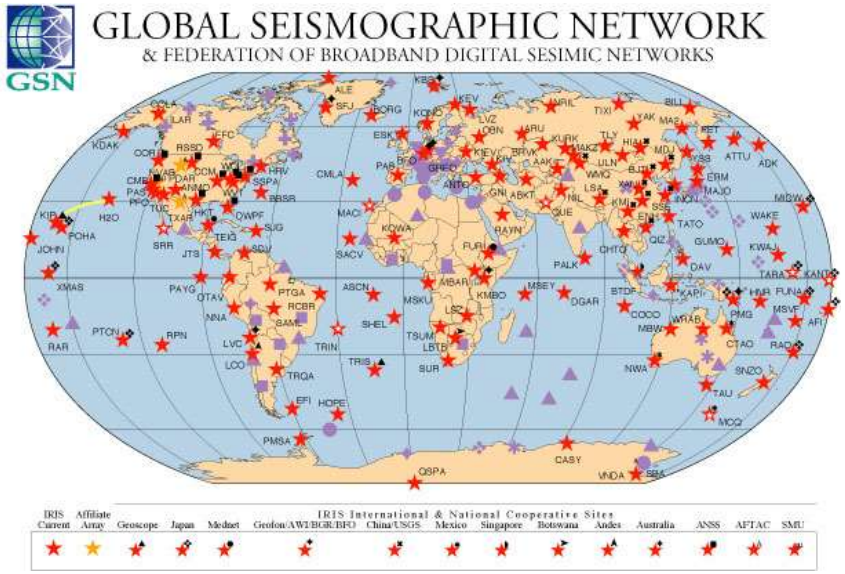
NCALM

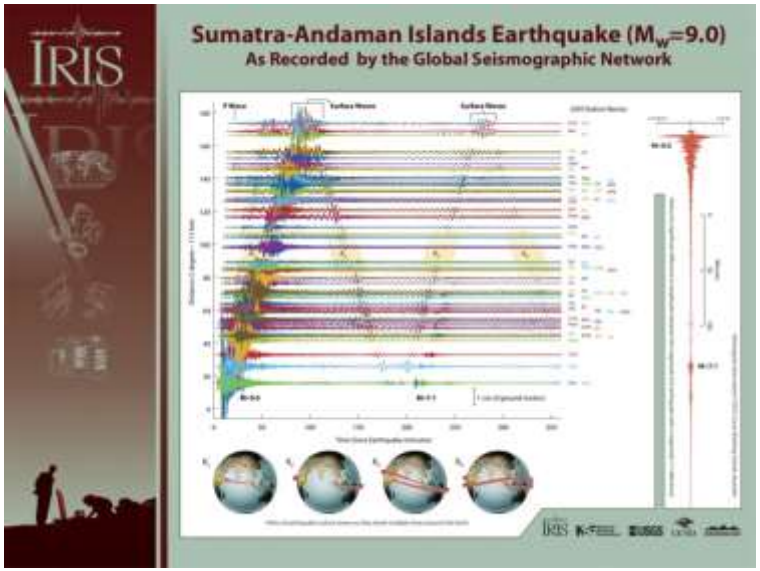
Wisc SIMS

LACCORE

National Science Foundation

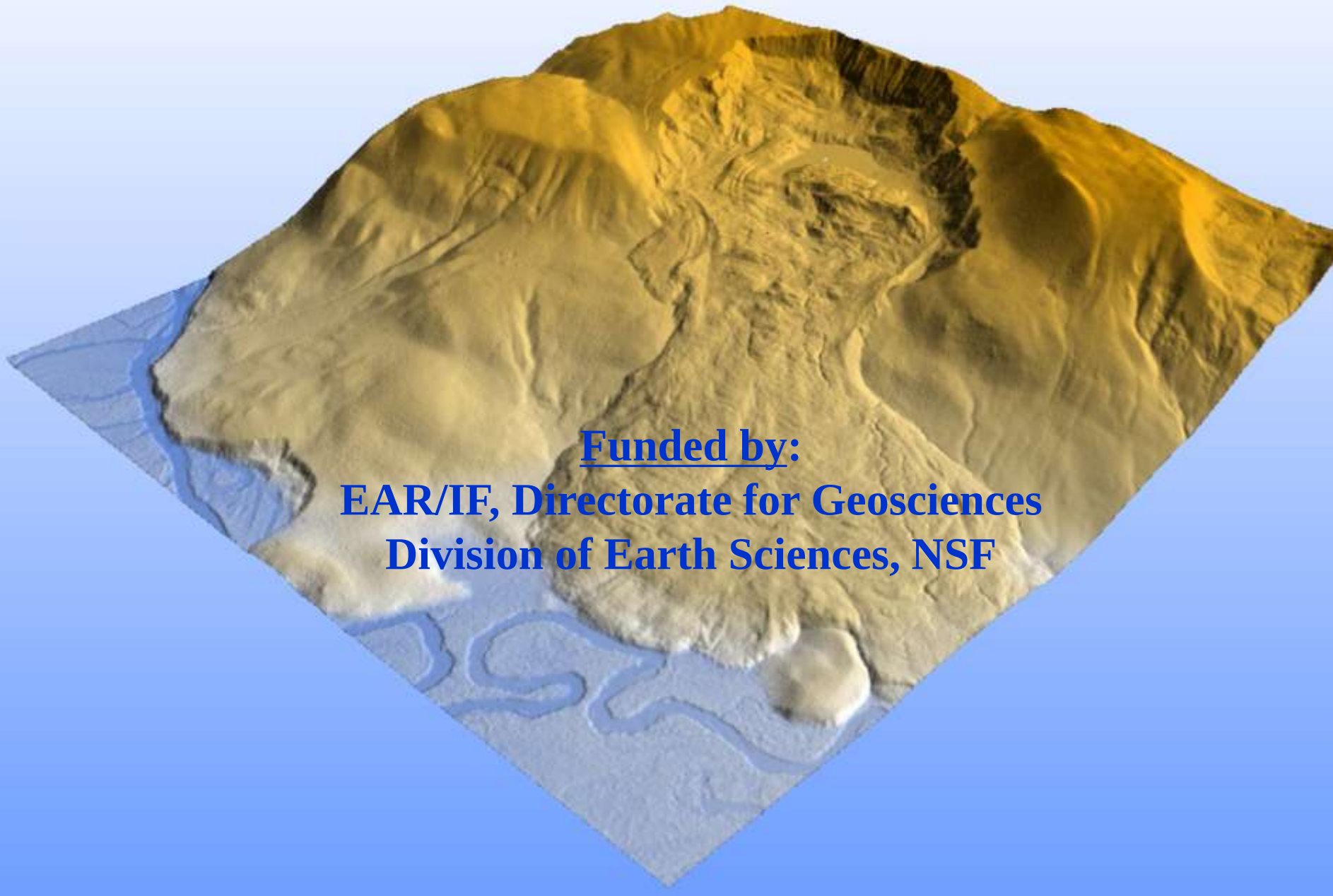
Facility Support: Long-Term Investment in Observing Systems





Real-time data from the **IRIS *Global Seismographic Network*** (GSN) allowed the early warning of the Mw = 9.3 Sumatra-Andaman earthquake by the Pacific Tsunami Warning Center (PTWC). Within 8 minutes of the initial rupture, GSN data flashed electronically via satellite & the Internet to the GSN Data Collection Center & then to the PTWC & the U.S. Geological Survey's National Earthquake Information Center: EAR-1063471

- *Currently, 140 stations – free & open access to data in near real-time*
- *$100M capitalization cost ($7M p.a. O&M cost, with USGS partner)*
- *25 year investment by U.S. federal government (NSF, DoD)*



Funded by:
EAR/IF, Directorate for Geosciences
Division of Earth Sciences, NSF

Topography and Bathymetry Mapping

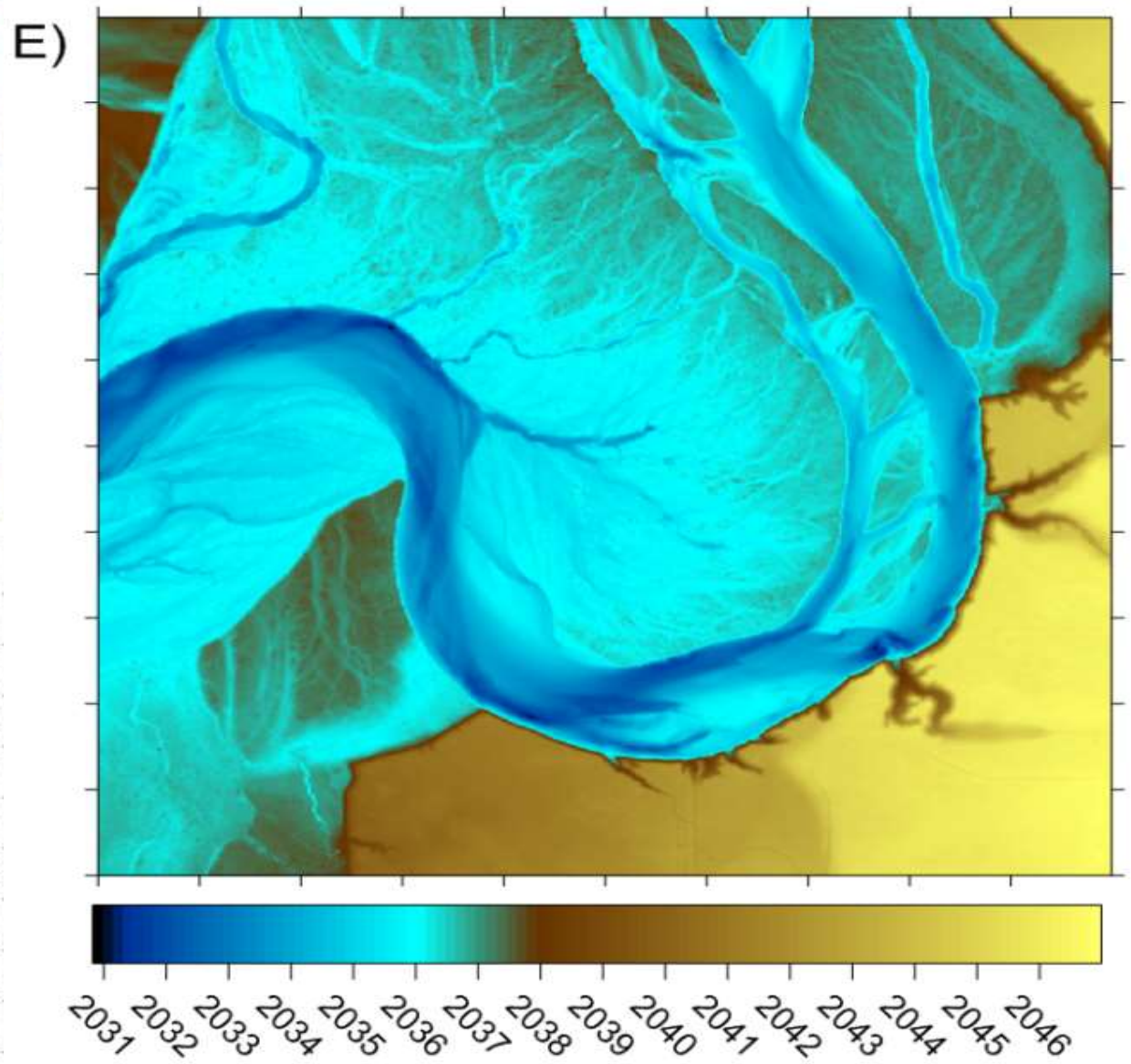
Sensors:

Near IR LiDAR (Gemini)
Green Lidar (Aquarius)

Project Location:

Snake River, Jackson, WY

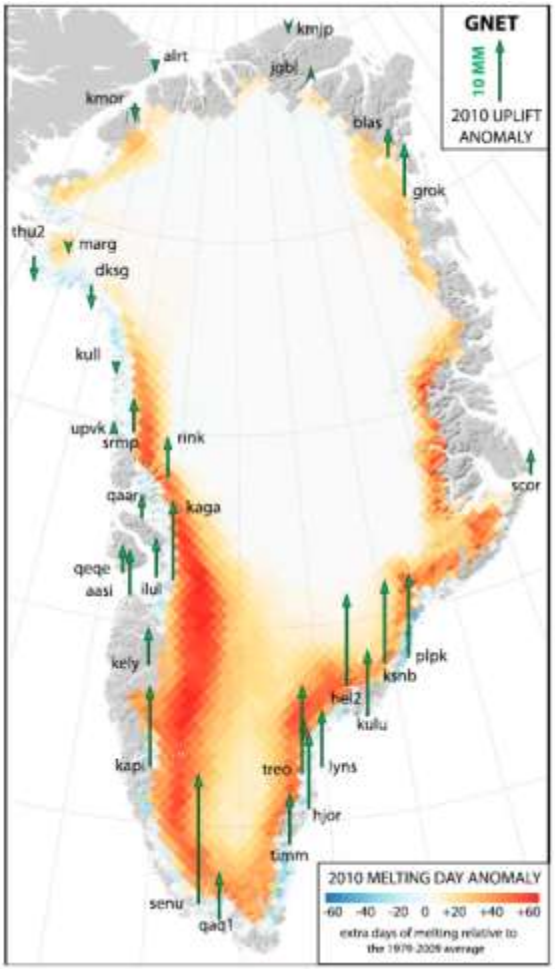
(A) Digital Photograph (DiMAC)
(B) NearIR (Gemini)
(C) Green All Return (Aquarius)
(D) Green Bare Earth (Aquarius)



National Science Foundation

Facility Support: UNAVCO… and IRIS

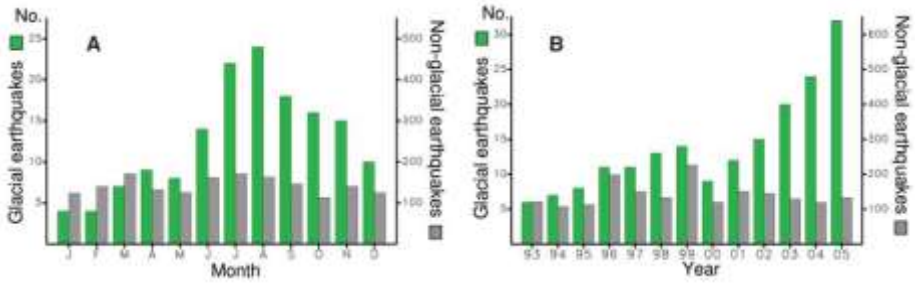
Greenland's response to present day ice mass changes.
Supported through OPP/EAR-IF partnership.
Melting day anomalies and uplift anomalies for 2010
Bevis et al., PNAS 2012



Seasonality and Increasing Frequency of Greenland Glacial Earthquakes

Göran Ekström,[1]* Meredith Nettles,[2] Victor C. Tsai[1]

Some glaciers and ice streams periodically lurch forward with sufficient force to generate emissions of elastic waves that are recorded on seismometers worldwide. Such glacial earthquakes on Greenland show a strong seasonality as well as a doubling of their rate of occurrence over the past 5 years. These temporal patterns suggest a link to the hydrological cycle and are indicative of a dynamic glacial response to changing climate conditions.



www.sciencemag.org SCIENCE VOL 311 24 MARCH 2006

National Science Foundation

Early-Career Support

- Started in FY 2004
- Response to discussions regarding early-career funding with the community & with COV's
- Recognition of the importance of both new *instrumentation* & *technical support* to the success of early-career Earth scientists
- Lab construction, instrument commissioning, O&M vs. new teaching responsibilities, manuscript prep, etc.
- Permit bundling of **EA** & **TS** into a single, integrated proposal for the establishment of a new laboratory

❖ **Award**: **Shikha Sharma, WVU**

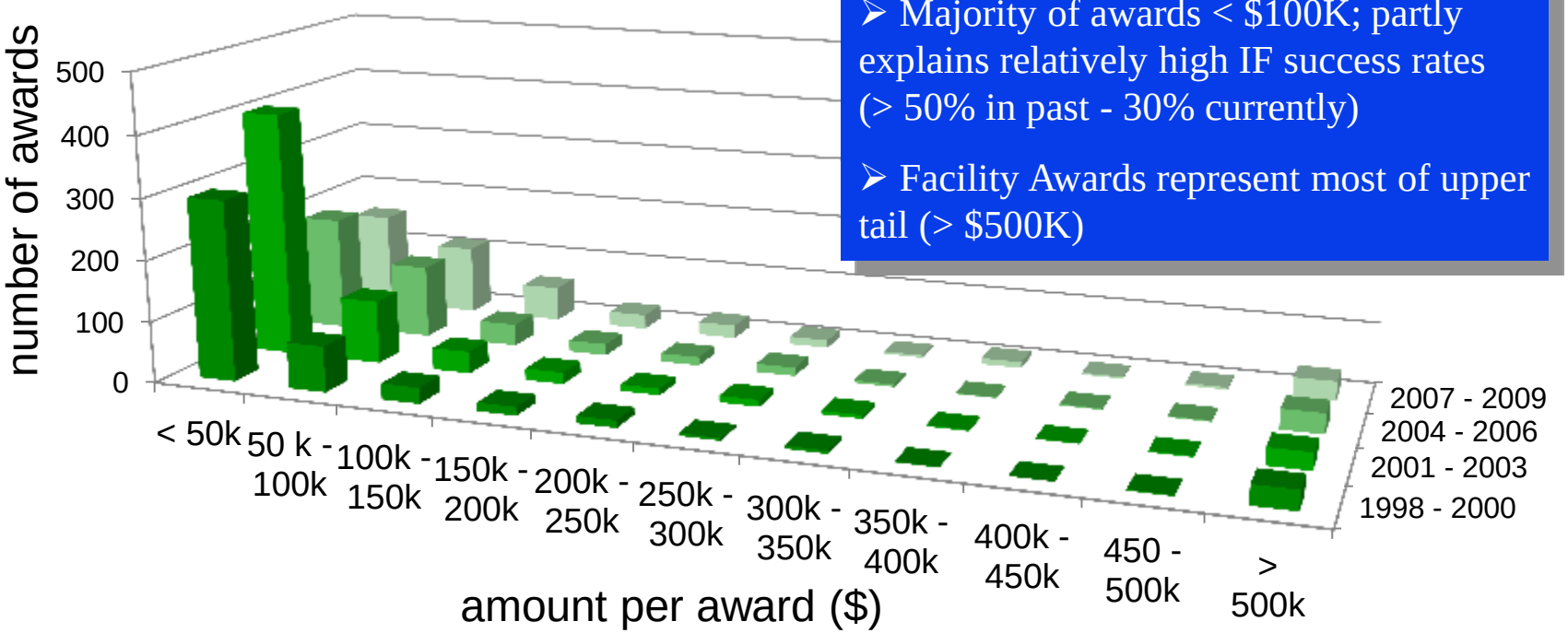
Opening new frontiers in energy and environment research: GC-Isolink + 2yr TS

1) biogeochemical controls on black shale deposition and environmental issues associated with shale gas extraction.
2) gas-fluid-rock interactions in CO_2 sequestration.

National Science Foundation

Distribution of EAR/IF Awards

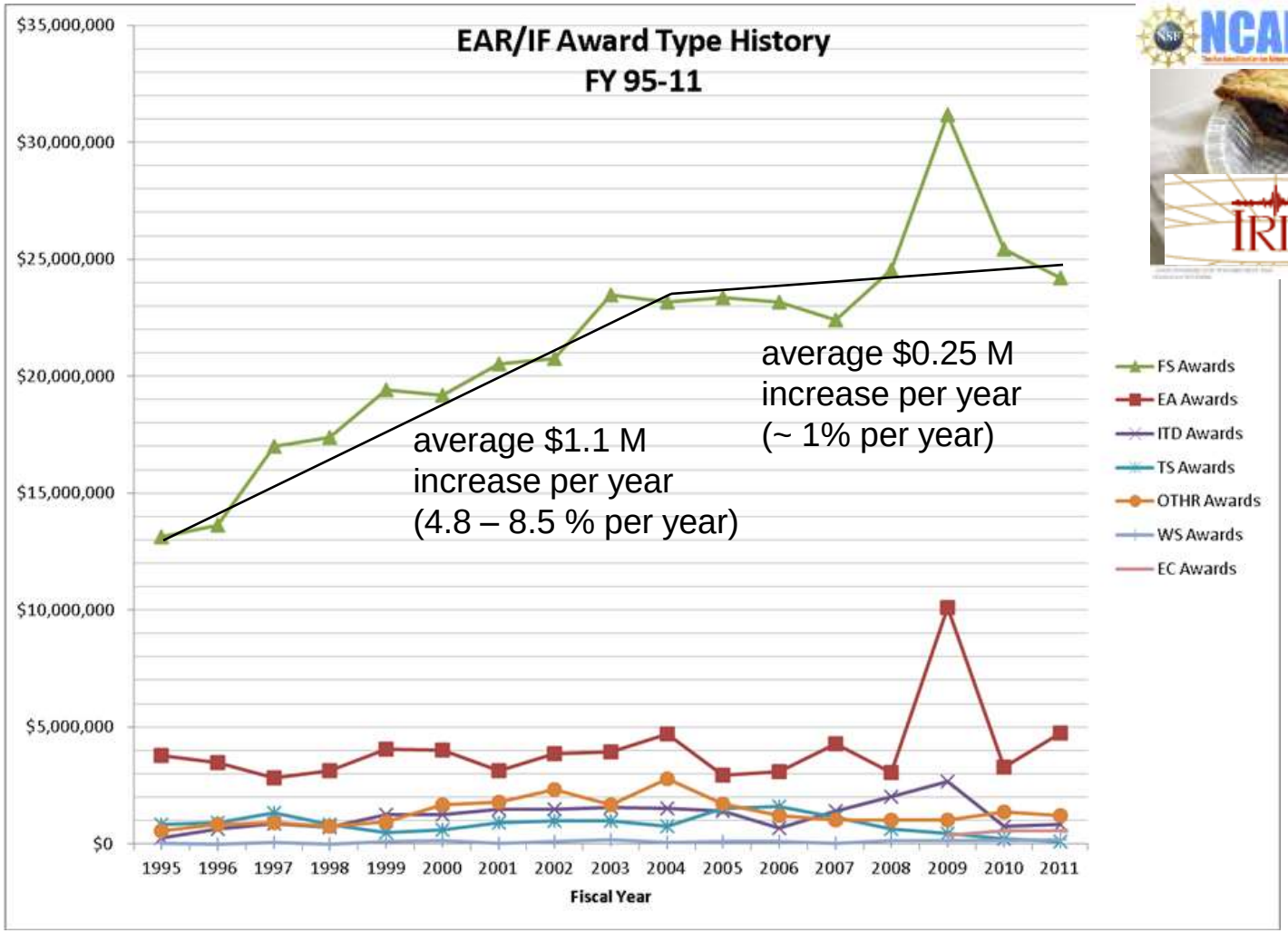
- EAR/IF manages a wide range of request sizes
- Majority of awards < $100K; partly explains relatively high IF success rates (> 50% in past - 30% currently)
- Facility Awards represent most of upper tail (> $500K)



National Science Foundation

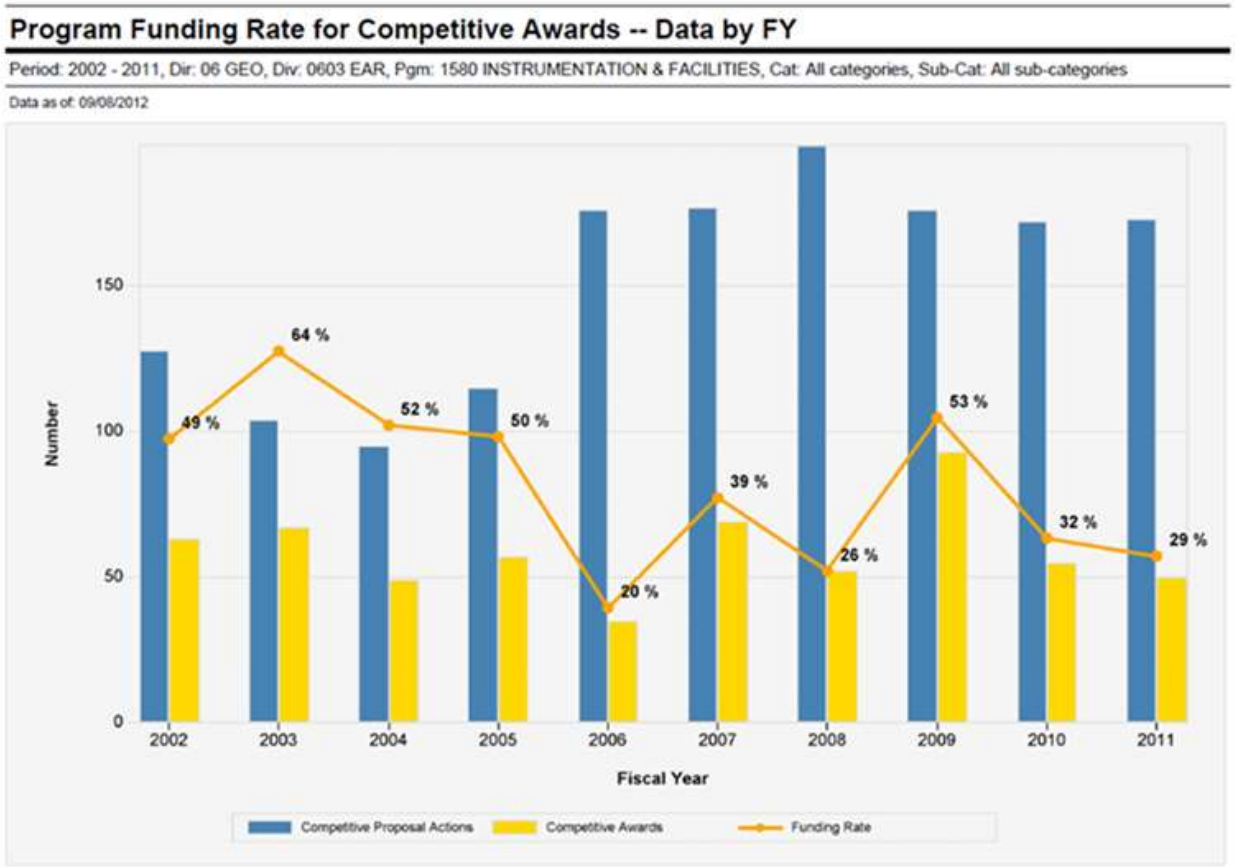
EAR/IF Budgets Then and Now

- **Overall IF Budget Total has remained largely flat since FY 2004/2005 with exception of FY 2009 (ARRA)**
- **Effect of FY 09 ARRA Dramatic**
- **FS is still the largest piece of the pie at ca. 75%**



National Science Foundation

Funding Rate



- FY 2012 statistics are not yet final (not included)
- With exception of FY 2009 (year of stimulus – ARRA), success rate decreased from average of near 50% pre-FY 2006 to near 30% post FY 2005 [effect of change in cost share policies]
- The number of new proposals reviewed each year by EAR/IF also commensurately increased beginning in FY 2006 [also effect of removal of cost share, first as eligibility requirement, then prohibited altogether

National Science Foundation

Other NSF Instrumentation & Facilities Funding Opportunities

1. *Major Research Instrumentation*
   - Annual NSF-wide competition; institutional quota
   - Equipment acquisition (2) & instrument development (1)
   - $100K minimum - $4M maximum
2. *Major Research Equipment & Facilities Construction*
   - Large Facilities Office procedures for development, review
   - Must be approved by NSB before inclusion in NSF budget
   - Needs Congressional approval for construction start
   - ~$100M minimum for GEO projects (>10% of budget)

National Science Foundation

Major Research Instrumentation (MRI) Program

- Annual NSF-wide program (coordinated by OIIA)
- EAR/IF coordinated for GEO since FY 1992
- Average of **$5.4 M/year** addition to EAR "infrastructure" budget for EA and ITD from FY 2003-2012 (**$4.5 M/year** taking out "stimulus effect")
- Review process largely identical to standard EAR/IF EA & ITD proposals (awards managed by EAR/IF)
- Separate competition for > $1 M requests
- In 2001, Congress allocated additional & separate funds for non-PhD granting institutions (cost-share not required)
- In 2005, cost-sharing requirement dropped for all institutions
- In 2008, cost-sharing (30%) reinstituted by *America COMPETES Act* for PhD-granting institutions & ceiling raised to $4M

National Science Foundation

Geoinformatics

- Cyberinfrastructure for the Earth Sciences -

➢ **WHAT IS IT?** Distributed, integrated, digital information system & working environment.

➢ **MISSION** ⇨ Enable innovative studies of the Earth system through the use of advanced information technologies (receive, organize, share, visualize & analyze data).

Investments by the Division of Earth Sciences:

- Long-term facility support to serve geophysical data in near real-time (IRIS, UNAVCO and now EarthScope: earthquake & CTBT)
- Earth science community extremely successful in NSF-wide ITR competition FY 00-01 (SCEC-CME; GEON ⇨ $20M)
- Additional new investments by EAR in FY 03
- First solicitation in FY 06 (22 proposals; 9 awards)
- Platform activities that are *transformative* & with impacts that extend beyond an individual investigator or small group

National Science Foundation

IF & MRI Review Process

- Deadlines: MRI is the fourth Thursday of January; IF proposals can be submitted at any time (no deadline)
- IF proposals with voluntary committed cost sharing will be returned without review
- *Ad hoc* mail review (6-8 reviewers; at least 3 reviews for each proposal)
- EAR/IF decision on proposals to panel (reviews, $$)
- EAR/IF panel meeting @ major facility under review (May, Nov.); ~50 proposals; 8 panel members; 3-year rotation; diverse (specialty, gender, ethnicity)
- Evaluated using general NSF merit review criteria (intellectual merit, broader impacts)
- Additional criteria specifically appropriate to the review of IF proposals are also considered (see the solicitation)
- Process & decisions (award/decline) documented in proposal jackets (paper & electronic “eJacket”)

National Science Foundation

NSF Review Criteria

- **Intellectual merit**
  - Advance knowledge and understanding in field
  - Explore creative and original concepts
  - Organization of proposed activity
  - Sufficient access to resources
  - Qualifications of PI or team
- **Broader impacts**
  - Promote teaching, training, and learning
  - Broaden participation of underrepresented groups (gender, ethnicity, disability, geography, etc.)
  - **Enhance infrastructure for research/education (facilities, instrumentation, equipment, networks)**
  - Benefits to society
- **Careful consideration in making funding decisions**
  - Integration of research and education; Diversity

National Science Foundation

Additional Review Criteria

EAR/IF Program Solicitation NSF 11-544:

1. Intrinsic merit of the research for which the equipment, technique, facility, or effort of a technician is intended (*science award / prop*)
2. Number of investigators who will substantially benefit from the equipment or service of a technician & the strength of their research programs (long-term financial support)
3. Degree to which equipment, technique, facility, or the aid of a technician is appropriate & essential for the intended research
4. Ability to operate & provide technical support for complex equipment during its expected lifetime (O & M; Federal issue)
5. Ability to provide access to a facility intended to serve a regional or national research community (access & fee structure)
6. For **FS** proposals, the size & nature of science community that will make principal use of the facility along with evidence of that communities desire to pool resources in support of the facility

National Science Foundation

Important changes to cost-sharing and their consequences

- National Science Board recommended a major change to NSF cost-sharing policy in August 2009 (NSB 09-20)
- Eliminated most mandatory programmatic & all voluntary committed cost-sharing in 2011 ($500M p.a.)
- Why? Cost to institutions for NSF/OIG audits
- As mandated by the *America COMPETES Act* & NSB-09-20, NSF implemented cost-sharing for the following programs: MRI + Robert Noyce Scholarships, Engineering Research Centers, Industry/University CRC, & EPSCoR (ENG academic-industry partnerships).

- **Impact on IF Program & EAR Community:**
  1. More proposals (filter gone; "barrier to entry")
  2. Success rates are down (from 50% to about 20%)
  3. Expensive instrumentation now out of reach of IF Program
  4. Start-up packages: how to negotiate/utilize effectively?
  5. Voluntary uncommitted cost sharing is permitted (see GPG)

National Science Foundation

Ingredients for Success

- ✓ Read & fully understand the solicitation & GPG
- ✓ Call or visit NSF Program Officer(s)
- ✓ Establish a mentor on campus with NSF funding history if possible (ask them to critique your proposal)
- ✓ Link IF or MRI proposal to strong science program (either already funded or concurrent submission to core program) ⇨ "***EAR footprint***"
- ✓ Track record of PI very important for reviewers
- ✓ Suggest developing track record via modest science proposal that includes a "*plan B*" for instrumentation
- ✓ Develop well thought out O&M and management plan (sustainability of lab very important to NSF)
- ✸ Given new NSF **cost share policy**, may need to rethink how to negotiate/utilize start-up packages