



U.S. DEPARTMENT OF  
**ENERGY**

**Nuclear Energy**

# **Nuclear Science User Facilities (NSUF) Gateway to Nuclear Research**



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# Topics

- **NSUF General Overview**
- **NSUF Partnerships**
- **NSUF Capabilities**
- **NSUF Recent Developments**
  - **Applying to NSUF (Integration into CINR)**
  - **Nuclear Energy Infrastructure Database (NEID)**
  - **NSUF Sample Library**



# NSUF Purpose



- The research performed to support nuclear energy development requires specialized (expensive) and increasingly rare capabilities
  - High flux reactors
  - Hot cells
  - Ion Beams
  - Support infrastructure (shipping, casks, test fabrication, etc.)
  - State-of-the-Art instrumentation
- But also intellectual capital
  - Universities
  - Nuclear Industry
  - Innovative Small Businesses
  - National Laboratories
- The NSUF aims to merge the national nuclear research infrastructure with intellectual capital to pair the best ideas with needed capability
- The NSUF offers access to capabilities and expertise at no cost to the user. The NSUF can fund experiment design, fabrication, transport, irradiation, and post irradiation examination (PIE) activities.
- The NSUF core purpose is to provide an avenue for innovative ideas that address NE mission needs to be realized.



# NSUF Overview



- Established 2007 under INL IFM funding
- DOE Office of Nuclear Energy first and only user facility
- Total of ~\$104M in DOE support (2008-2014)
- 5 types of projects:
  - Irradiation + PIE (\$1.2M - \$4.0M, up to 7 years)
  - PIE only (~\$500K, up to 3 years)
  - Irradiation only (\$500K - \$3.5M)
  - “APS” (beamline at other user facilities, \$100K - \$250K))
  - Rapid Turnaround Experiments (RTE, up to \$50K)
- Total of 22 projects executed (excluding RTEs)
- Total of 14 projects currently ongoing (excluding RTEs)
- Total of 68 RTEs executed
- Total of 29 RTEs ongoing
- Open competitive proposal process
  - Non proprietary projects only
- Non competitive projects
  - CRADA or WFO
  - Proprietary or non-proprietary
- University, National Laboratory, Industry, International

- **Partner Facilities established starting in 2008 (self selection)**

- 8 Universities
- 2 National Laboratories (2 under consideration)
- 1 Industrial

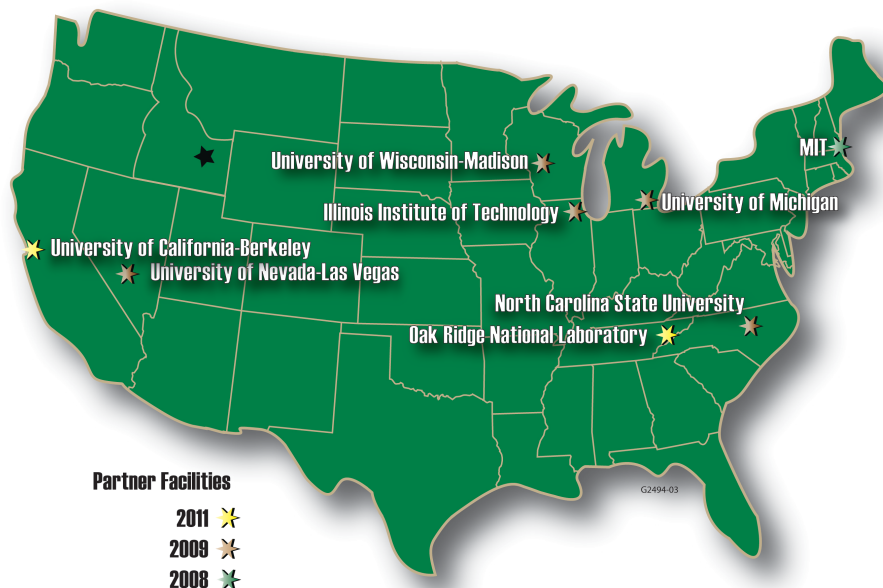




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# NSUF Partnerships Distributed Research Capabilities



- **Massachusetts Institute of Technology – MITR and hot cell**
- **North Carolina State University – PULSTAR reactor**
- **Illinois Institute of Technology – MRCAT beamline at Advanced Photon Source**
- **University of Michigan – Ion Beam Laboratory and Irradiated Materials Laboratory**
- **University of Wisconsin – Tandem Accelerator Ion Beam, Characterization Laboratory for Irradiated Materials**
- **UC Berkeley – PIE instruments**
- **University of Nevada, Las Vegas – Radiochemistry Laboratory**
- **Purdue University – CMUXE**
- **INL – ATR, hot cells, and PIE facilities**
- **ORNL – HFIR, hot cells, and PIE facilities**
- **PNNL – hot cells and PIE facilities**
- **Westinghouse – hot cells and PIE facilities**
- **CAES – MaCS Laboratory**



# NSUF General Capabilities



## ■ Neutron Irradiations

- ATR (loop, rabbit), ATRC, HFIR (rabbit), MITR (loop), PULSTAR

## ■ Ion Irradiations

- Tandem Accelerator Ion Beam (U. Wisc), Michigan Ion Beam Lab (U. Mich)

## ■ Hot Cells

- INL (HFEF, FCF, AL, IASCC), ORNL (IFEL, IMET, REDC), PNNL (RPL), U. Mich (IMC), Westinghouse (MCOE)

## ■ High radiation level measurements/instrumentation

- Neutron radiography, elemental & isotopic analyses, gas sampling and analyses, profilometry, gamma scanning, mechanical testing, electron and optical microscopy, thermal analyses, eddy current, IASCC, EPMA, AES, XPS, SIMS, focused ion beam (FIB)

## ■ Low radiation level measurements/instrumentation

- SEM, TEM, APT, FIB, hardness, micro- & nano-indentation, tensile, thermal analyses, XRD, XPS, AES, SIMS, NMR, PAS

## ■ Beamlines

- X-ray (ANL APS: MRCAT, IIT)
- Neutron, positron (PULSTAR, NCSU)

## ■ Visit [nsuf.inl.gov](http://nsuf.inl.gov) under Research Capabilities tab for details at individual facilities

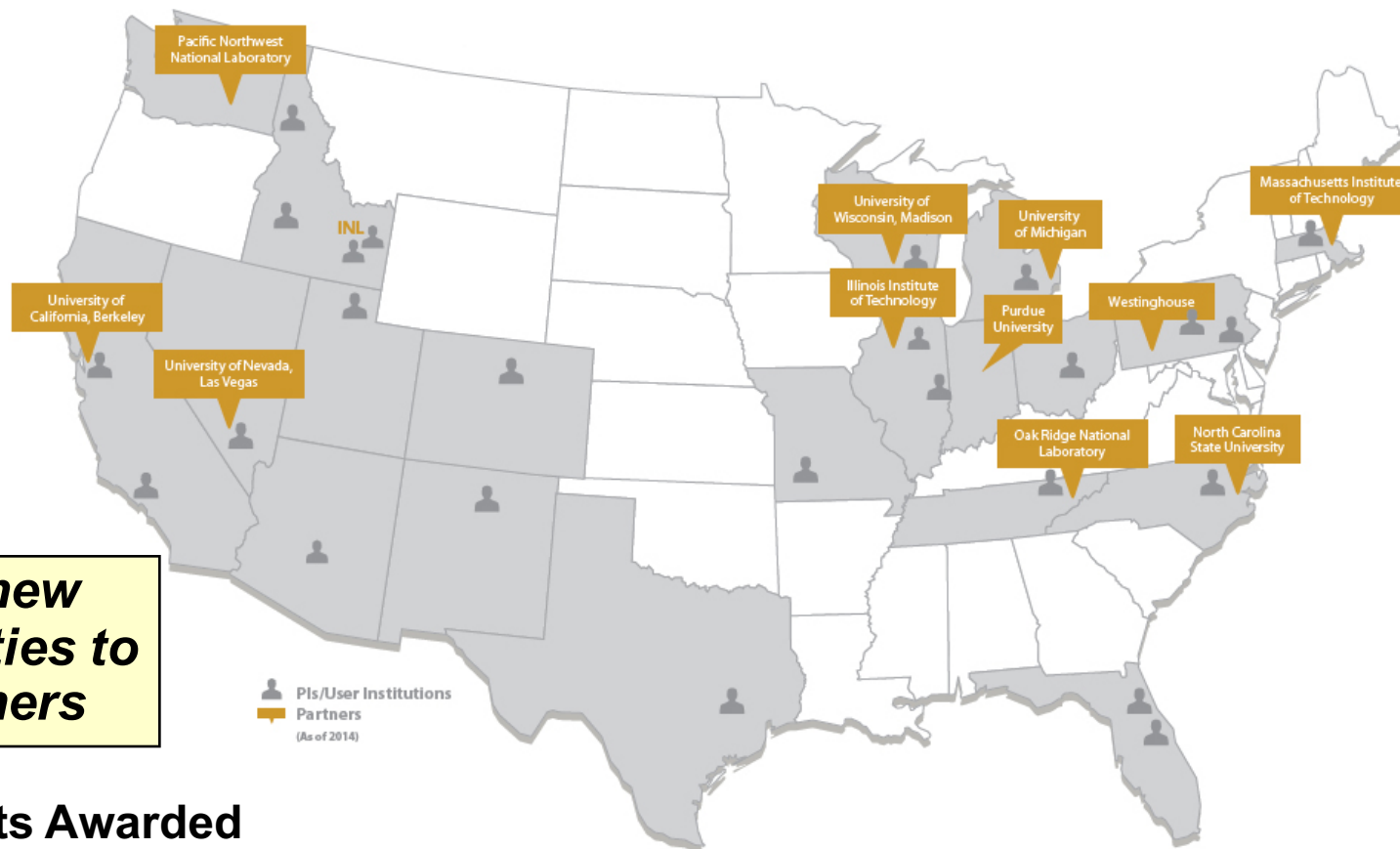




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# Distribution of NSUF Projects



***Opening new opportunities to researchers***

- **133 Projects Awarded**
  - 98 to 27 universities
  - 35 to 4 national and 1 international laboratories
  - 18 states plus UK and Australia





# NSUF Recent Developments



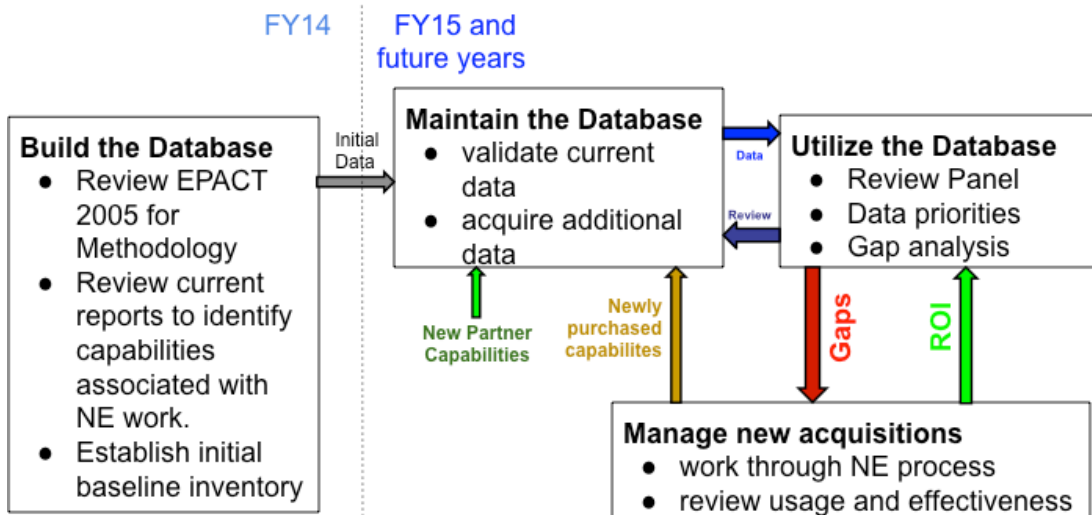
- **Integration of NSUF into FY14 and FY15 Consolidated Innovative Nuclear Research (CINR – NEUP/NEET) Funding Opportunity Announcements (FOA)**
  - **Applications open to university, national laboratory, industry, small business researchers**
  - **NEUP/NEET provides R&D funding**
  - **Letter of Intent (LOI) and Pre-application stage of proposal process implemented (not for RTE calls)**
  - **Single evaluation of entire scope of proposal and will include**
    - **Technical review**
    - **Relevancy review (according to workscope applied to)**
    - **Feasibility review**
      - **Ensure project scope can be performed at cost on schedule**
      - **May require negotiation between proposer(s) and facilities**
      - **Will require communication and interaction with NSUF Tech Leads and experimenters at earliest time (starting with LOI)**
    - **Firm cost estimate in full proposal (forward funded)**
  - **41 LOIs, 31 Pre-apps, 17 full apps in FY14 (80 LOIs in FY15)**
  - **13 R&D + NSUF (7 workscope), 4 NSUF-only, awarded 3 NSUF-only and 1 R&D + NSUF in FY14 call**



- **Move to only forward funded projects from mortgaged funding profile**
  - Mortgaged funding profile created some “confusion” in past (e.g. project is awarded but not yet funded) due to volatility in annual NSUF budgets
  - All back mortgages covered by end of FY15
  - Created some budgetary challenges
  - Requires firm scope of work, cost estimate, and schedule before project awarded
  - Better ensure project performance and facility access/priority
  - Require management reserve account
  - Large “carry-over” budget
- **New directive: catalogue, analyze, “manage” NE infrastructure**
  - NSUF to help DOE increase efficiency of existing capabilities utilization and guide future investments
  - Brenden Heidrich leads (start date 6/30/2014)
  - Nuclear Energy Infrastructure Database (NEID) established
- **Enhancement of Sample Library**
  - Sample “librarian”
  - Set policy
  - Increase sample catalogue and user friendly database



- **New directive: catalogue, analyze, “manage” NE infrastructure**
- **A formal program for managing infrastructure acquisitions with the NEUP/NEET infrastructure calls.**
  - Establish the Nuclear Energy Infrastructure Database (NEID)
  - NSUF will lead/manage this program and establish needs/priorities in call.
  - NSUF will continue to monitor acquisitions for effectiveness
- **NSUF will use database analysis to establish needs**



- **NSUF will take input from NE programs, Users Org, SRB, NEAC, ANIAC, RFI for needs**
- **NSUF will collect and analyze international capabilities and perform feasibility/cost analysis of material transport vs national implementation.**



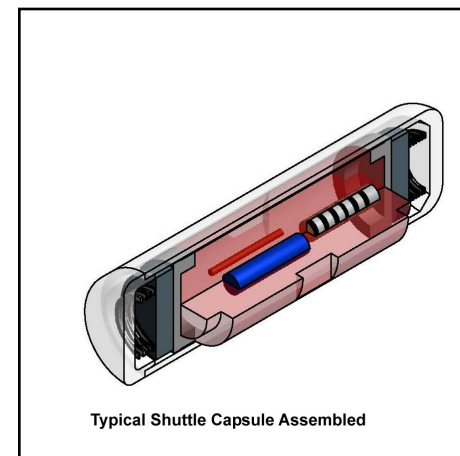
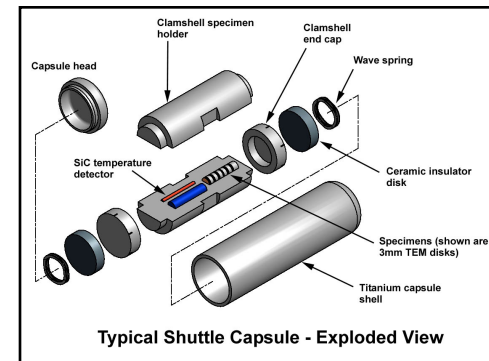
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# NSUF Sample Library



- Critical to reducing costs and taking advantage of new ideas and future analysis techniques and equipment.
- A detailed inventory of samples in the library has been completed in the form of excel spreadsheets that will be used to populate a searchable database that can be put on-line for users to locate samples of interest (online searchable database is in progress).
- Hired “librarian”.
- Working to establish pedigree of materials throughout DOE complex for potential incorporation in sample library. Data would be available on website.
- A subset of samples have been removed from the hot-cells and made available to the user community through the NSUF proposal process. This action of relocating larger quantities of samples for easy access will continue.





# Expanded NSUF Vision

Building  
sustainable  
value over  
the long  
term

**High  
Impact  
Results**

Focus on High Impact Results Addressing Most Pressing Issues or Areas Offering Greatest Potential for Advancement. Advanced Understanding of Most Important Phenomena. Increased Public Awareness.

**Projects**

Competitive Awards (Focused CINR Scope). Non-Competitive Awards (NE Programs, CRADA). Proprietary. Forward Funded.

**Capability  
Maintenance  
Replacement**

**Sample  
Library**

Keep Core Infrastructure Functional. Reduced Costs. Management of High Value Materials. Aid in Disposition Decisions

**Infrastructure  
Management**

**High  
Performance  
Compute**

Identifying and Analyzing Capability Status and Needs. Validation & Verification. Coupling Experiment to Computation. M&S.

**Human  
Capital**

**Capability  
Enhancement**

**Capability  
Development**

Cutting Edge, State of the Art Instrumentation. Internationally Recognized Expertise. Other User Facility Leveraging

