Nuclear Science User Facilities

NSUF Overview

J. Rory Kennedy
Director, NSUF

FY 2016 NSUF Annual Program Review
DOE NE Germantown Facility
November 1-2, 2016
NSUF Support Structure and Technical Expertise

DOE
Mr. Shane Johnson
Mr. Mike Worley
Mr. Tom Miller
Ms. Alison Hahn
Mr. Brooks Weingartner

NSUF Staff (INL)
Dr. J. Rory Kennedy
Mr. Dan Ogden
Ms. Lindy Bean
Mr. Jeff Benson
Dr. Brenden Heidrich
Dr. John Jackson
Mr. Collin Knight
Ms. Sarah Robertson
Ms. Kelly Cunningham
Mr. Jonathan Kirkham
Ms. Renae Soelberg
Dr. Sebastien Teysseyre

Neutron Irradiation
Dr. Donna Guillen (INL)
Dr. Paul Murray (INL)
Dr. Lin-wen Hu (MIT)
Dr. Gordon Kohse (MIT)
Dr. Joseph Nielson (INL)
Dr. Randy Nanstad (ORNL)
Dr. Keith Jewell (INL)
Mr. Kevin Clayton (INL)
Mr. Dave Schoonen (INL)
Ms. Debra Utterbeck (INL)
Dr. Sean O’Kelly (INL)
Dr. David Senor (PNNL)
Mr. Mike Heighes (INL)
Mr. Brian Durtschi (INL)

Examinations
Dr. Assel Aitkaliyeva (INL)
Dr. Brandon Miller (INL)
Dr. Jian Gan (INL)
Dr. Yaqiao Wu (CAES)
Ms. Joanna Taylor (CAES)
Dr. Andrew Casella (PNNL)
Dr. Kurt Terrani (ORNL)
Dr. Maria Okuniewski (Purdue)
Dr. Peter Hoseman (UCB)
Mr. Ron Crone (INL)
Dr. Mitch Meyer (INL)
Dr. Dan Wachs (INL)
Ms. Katelyn Wachs (INL)
Dr. Jim Cole (INL)
Meimei Li (IVEM, ANL)

Synchrotron Irradiation
Dr. Jeff Terry (IIT)
Dr. Lynne Ecker (BNL)

Ion Beams
Dr. Gary Was (UM)
Dr. Beata Tyburska-Puchel (UW)
Dr. Meimei Li (ANL)

And many more scientists, engineers and technical staff at all partner facilities to help get things done
Topics

- NSUF General
- FY 2016 Accomplishments – Milestones
- FY 2016 Accomplishments – Highlights
- FY 2017 Action Areas and Milestones
Established 2007 as DOE Office of Nuclear Energy first and only user facility

- Idaho National Laboratory is lead institution
- Irradiation effects in nuclear fuels and materials
- Provide access to capabilities and expertise at no cost to user
- Support design, fabrication, transport, irradiation, PIE, disposition
- Link intellectual capital with nuclear research infrastructure to fulfill mission of DOE-NE

Generally select projects through open competitive proposal processes

- Consolidated Innovative Nuclear Research (CINR FOA, 1 call/year)
  - Irradiation + PIE ($1.0M - $4.0M, up to 7 years)
  - PIE only (~$500K, up to 3 years)
  - Irradiation only ($500K - $3.5M)
  - Beamlines at other user facilities
- Rapid Turnaround Experiments (RTE, 3 calls/year, limited $\$, executed within 9 months)
- Proposals welcome from University, National Laboratory, Industry, Small Business, Int’l researchers
NSUF – A consortium
A group formed to undertake an enterprise beyond the resources of any one member

- Expanded capabilities
  - Need for additional capabilities outside INL recognized early
  - Partner facilities program established in 2008

- Partner Facilities to date
  - 8 Universities + 3 Universities in CAES (3 currently expressed interest)
  - 4 National Laboratories (4 expressed interest)
  - 1 Industrial

- FY 2017 Establish Partner Facilities Working Group – hold meeting
  - General Meeting
NSUF General Capabilities

- **Neutron Irradiations**
  - ATR (loop, rabbit), ATRC, HFIR (rabbit), MITR (loop), PULSTAR, NRAD (Future: BR2 – SCK-CEN Belgium), Halden – Norway ?)

- **Ion Irradiations**
  - Tandem Accelerator Ion Beam (U. Wisc), Michigan Ion Beam Lab (U. Mich), IVEM (ANL) (Future: TAMU, SNL, LANL)

- **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, 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; BNL NSLS-II: XPD, NST Dept)
  - Neutron, positron (PULSTAR, NCSU)

- Visit nsuf.inl.gov under Research Capabilities tab for details at individual facilities
Total of 29 awarded CINR type projects executed
Total of 20 CINR type projects currently ongoing
Total of 106 RTEs executed
Total of 21 RTEs ongoing
186 total projects awarded
- 125 projects to 25 US universities
- 54 projects to 5 national laboratories
- 1 project to industry
- 6 projects to 3 international (Oxford U., Manchester U., ANSTO)

180 total projects across 33 states
Total of ~$153M in DOE support (2007-2016)
Effective FY2016 budget: ~$29M ($11.7M increase from FY15)

Personnel changes in FY 2016
- Jim Cole, Chief Scientist left (10/1/15) – need Chief Irradiatin Scientist + Chief Post Irradiation Scientist
- Jonathan Kirkham (10/1/15) – NEID specialist
- Kelly Cunningham (11/4/15) – NFML “librarian” + contracts assistant
NSUF and GAIN

R&D TEST BED
Rapid and cost-effective advancement of scientific underpinning and retirement of technical and licensing risk for innovative technologies.

DEMO PLATFORM
Reduce the commercialization cost and associated risk by minimizing one-time costs. Reduce the cost uncertainty for commercial units.

Low TRL level innovative concepts to be captured by GAIN for accelerated market implementation. Fundamental systematic studies on high TRL level materials – e.g. RPVs, Zr cladding, austenitic and F/M cladding for LWR life extension and new reactor concepts. Basic actinide properties, advanced manufacturing on existing materials.

Technology Readiness Levels (TRL)

Proof-of-Concept Proof-of-Performance Proof-of-Operations
Completed all (13) level 2 milestones on time

- Provide NSUF RTE Award Recommendations for the FY16 1st Call - 11/30/2015 (11/20/2015)
- EPRI-3 Ready to Insert - 12/24/2015 (12/22/2015)
- Complete As-run Analyses on NSUF Experiments Irradiated in ATR – 3/31/2016 (3/30/2016)
- Provide NSUF RTE Award Recommendations for the FY16 2nd Call – 3/31/2016 (3/28/2016)
- Provide Award Recommendations for the FY 2016 CINR FOA – 6/15/2016 (5/24/2016)
- Ion Beam Investment Options Workshop Report - 6/30/2016 (6/30/2016)
- Provide NSUF RTE Award Recommendations for the FY16 3rd Call – 7/29/2016 (7/27/2016)
- GAIN Execution Plan – 8/31/2016 (8/26/2016)
- Establish the Nuclear Fuels and Materials Library Web-based Interactive Database – 9/29/2016 (9/26/2016)
- Complete 100% of the FY 2015 awarded RTE's - 9/30/2016 (9/23/2016)
Completed 25 of 32 level 3 milestones on time
Completed 1 of 32 level 3 milestones late (1 week)
6 of 32 level 3 milestones pushed into FY 2017

- Complete UCF-1 Sample Shipment to NSLS-II (Brookhaven National Laboratory) – 12/15/2015 (11/19/2015)
- UCF-3 Ready-to-Insert in ATR cycle 158B – 12/24/2015 (11/15/2016)
- SAM-1 Ready to Insert in ATR Cycle 158B – 12/24/2015 (1/25/2016)
- Complete BSU design review – 1/28/2016 (11/30/2016)
- Compile and Analyze FY 2015 Performance Metrics – 3/30/2016 (3/30/2016)
- Complete Utah State University (USU) PIE – 3/31/2016 (3/31/2016)
- Complete Microscopy Analysis for EPRI X-750 tensile specimens – 3/31/2016 (1/6/2016)
FY 2016
Level 3 Milestones

- Complete installation of the HFEF in-cell load frame feedthrough – 5/31/2016 (4/16/2016)
- Ship first set of U of Illinois 8305 samples to APS – 5/31/2016 (3/22/2016)
- Implement LabView SCC/Fracture control software in CAES or EIL test system – 5/31/2016 (5/31/2016)
- Perform Type B Experiment Shipment, ATR to HFEF – 7/26/2016 (6/27/2016)
- GAIN Technology Focused Workshops Report – 8/30/2016 (8/30/2016)
- Complete procurement and initial phase 1 mockup of new extensometer for HFEF Instron – 9/30/2016 (9/28/2016)
- FY 2016 Cycle 3 IVEM Utilization – 9/30/2016 (9/21/2016)
- Provide year-end HPC utilization data for NSUF projects – 9/30/2016 (9/28/2016)
- Complete procurement and initial phase 1 mockup of new, multi-zone furnace for HFEF Instron – 9/30/2016 (9/28/2016)
Sign a CRADA with SCK-CEN to initiate collaborative activities – 9/30/2016 (12/22/2016)

Submit FY 2016 Year End IVEM Utilization Report – 9/30/2016 (9/22/2016)

Complete UI 355 Testing at MRCAT – 9/30/2016 (5/3/2016)

Knowledge & Validation Center planning document update – 9/30/2016 (9/29/2016)

GAIN Communication Plan – 9/30/2016 (9/27/2016)

Submit memo to the NSUF Director documenting completion of examination on the first set of U of Illinois 8312 Samples – 9/30/2016 (9/28/2017)

Complete first set of INL MO 8418 beamline experiments at APS – 9/30/2016 (4/28/2016)
NSUF reporting presentations or participation

- Nuclear Engineering Department Head Organization Meeting – NEDHO (November, 2015)
- Nuclear Energy Advisory Committee - NEAC (December, 2015)
- EPRI Nuclear Power Council Meeting (February, 2016)
- NSUF FY 2015 Annual Program Review Meeting (March, 2016)
- Nuclear Fuel Industry Research – NFIR Karlsruhe, Germany (April, 2016)
- NEAC Subcommittee on Infrastructure (May, 2015)
- INL NS&T Directorate Review (May, 2016)
- BWR Vessel and Internals Program Committee (June, 2016)
- National User Facilities Organization – NUFO (June, 2016)
- NSUF Users Organization Meeting (June, 2016)
- Nuclear Engineering Department Head Organization Meeting – NEDHO (June, 2016)
- NSUF Scientific Review Board Meeting (August, 2016)
- UK Nuclear Academics Discussion Meeting – Bristol, UK (September, 2016)
NSUF general presentations, exhibits, or other

- Test, Research, and Training Reactor Conference – TRTR (October, 2015)
- EPRI Primary Systems Corrosion Technical Advisory Committee (October, 2015)
- ANS Winter Meeting (November, 2015) – exhibit
- EPRI Nuclear Vendor Forum (November, 2015)
- MRS Winter Meeting (December, 2015) – exhibit
- TMS Annual Meeting (February, 2016) – exhibit
- Ion Beam Investment Workshop (March, 2016)
- Nuclear Regulatory Commission (April, 2016)
- NSUF Users Meeting (June, 2016)
- ANS Annual Meeting (June, 2016) – 2 NSUF Sessions in Nuclear Fuels and Structural Materials Embedded Topical (June, 2016)
- MeV School (July, 2016)
- EPRI Webinar (August, 2016)
- Nuclear Innovation Bootcamp (August, 2016)
- DOE-NE Cross-cut Coordination Meeting (August, 2016)
- Test, Research, and Training Reactor Conference – TRTR (August, 2016)
- EPRI Int’l LWR Materials Reliability Conference and Exhibition (August, 2016) – exhibit
- TopFuel (September, 2016) – exhibit
- Hot Lab Conference – Karlsruhe, Germany (September/October, 2016)
FY 2016 Accomplishments
Highlights
Increasing Interest & Support

- CINR type projects support
  - FY 2014 – $400K, 8 full proposals, 3 awards
  - FY 2015 – $4.1M, 41 LOIs, 31 pre-proposals, 17 full proposals, 5 awards (1 R&D coupled, 4 NSUF only)
  - FY 2016 – $9.7M ($5.7M in FOA), 80 LOIs, 67 pre-proposals, 32 full proposals, 12 awards (8 R&D coupled, 4 NSUF only)
Rapid Turnaround Experiments

- 75 proposals submitted from 24 institutions
  - 16 US Universities
  - 5 National Laboratories
  - 2 Foreign Institutions (UK Universities)
  - 1 Industry

- 39 experiments accepted from 18 institutions
  - 11 US Universities
  - 5 National Laboratories
  - 2 Foreign Institutions (UK Universities)

- 8 NSUF facilities performed experiments
  - 17 CAES
  - 9 LAMDA
  - 3 IVEM
  - 1 Massachusetts Institute of Technology
  - 2 North Carolina State University
  - 2 University California, Berkeley
  - 3 Idaho National Laboratory
  - 2 Pacific Northwest National Laboratory
FY 2016 Accomplishments

Highlights

Outcome of FY2016 CINR

- **Effects of High Dose on Laser Welded, Irradiated AISI 304SS (NEET CTD)**
  - Boise State University
  - $613K, PIE only
  - INL, Westinghouse

- **Understand the phase transformation of thermally aged and neutron irradiated duplex stainless steels used in LWRs (NEET CTD)**
  - University of Florida
  - $579K, Beamline
  - IIT, MRCAT (APS)

- **Enhancing Irradiation Tolerance of Steels via Nano-structuring by Innovative Manufacturing Techniques (NEET CTD)**
  - Idaho National Laboratory
  - $2459K, Irradiation + PIE
  - INL, ATR

- **Irradiation Performance Testing of Specimens Produced by Commercially Available Additive Manufacturing Techniques (NEET CTD)**
  - Colorado School of Mines
  - $2030K, Irradiation + PIE
  - INL, ATR
Feasibility of Combined Ion-Neutron Irradiation for Accessing High Dose Levels (Nuclear Reactor Technologies)
- University of Michigan
- $187K, Irradiation + PIE
- MIBL (UM), ORNL

Radial Heat Flux – Irradiation Synergism in SiC ATF Cladding (Fuel Cycle R&D)
- Oak Ridge National Laboratory
- $843K, Irradiation + PIE
- HFIR, ORNL

Fission Product Transport in TRISO Fuel (Advanced Reactor Technologies)
- University of Michigan
- $22K, Irradiation
- MIBL (UM)

Radiation Enhanced Diffusion of Ag, Ag-Pd, Eu and Sr in Neutron Irradiated PyC/SiC Diffusion Couples (Advanced Reactor Technologies)
- Oak Ridge National Laboratory
- $518K, Irradiation + PIE
- MIBL, HFIR, ORNL
FY 2016 Accomplishments
Highlights
Outcome of FY2016 CINR

- Irradiation Testing of LWR Additively Manufactured Materials (NSUF Only)
  - GE-Hitachi Nuclear Energy
  - $1982K, Irradiation + PIE
  - ATR, INL

- Effect of Gamma Irradiation on the Microstructure and Mechanical Properties of Nano-modified Concrete (NSUF Only)
  - Vanderbilt University
  - $185K, Irradiation
  - ORNL

- Correlative Atom Probe and Electron Microscopy Study of Radiation Induced Segregation at Low and High Angle Grain Boundaries in Steels (NSUF Only)
  - Oak Ridge National Laboratory
  - $185K, PIE only
  - ORNL

- Role of Minor Alloying Elements on Long Range Ordering in Ni-Cr Alloys (NSUF Only)
  - Oregon State University
  - $90K, Irradiation
  - University of Wisconsin
Irradiation Activities

Static Capsule Irradiation Experiments

- Completed irradiations FY 2016:
  - None

- On-going irradiations in FY 2016:
  - EPRI-ZG-C & EPRI-ZG-D – “Irradiation and Post-irradiation Examination (PIE) to Investigate Hydrogen Assisted Anomalous Growth in Zirconium Alloys”

- Started (design) in FY 2016:
  - UCF-3 – “Microstructural Evolution in Low Fluence Irradiated Metallic Fuels”
  - BSU-269 – “High Temperature In-pile Irradiation Test of Single Phase U3Si2”
  - BSU-8242 – “Irradiation Influence on Alloys Fabricated by Powder Metallurgy and Hot Isostatic Pressing for Nuclear Applications”
  - INL-JD-8389 – “Ultrasound-Based Sensors for Enhanced Monitoring of Irradiation Testing”
Irradiation Activities

- Instrumented Lead Experiments
  - None

- Pressurized Water Loop (Loop 2A) Experiments
  - Completed irradiations in FY 2016:
    - EPRI-3 - “Irradiation and PIE of Alloys X-750 and XM-19”
  - On-going irradiations in FY 2016:
    - None

- Hydraulic Shuttle (rabbit) Irradiation Experiments
  - Completed irradiations in FY 2016:
    - SAM-1
  - Started (design) in FY 2016:
    - UCF-2 “Microstructural Evolution in Low Fluence Irradiated Metallic Fuels”

- New tools – reactor fluxes vs dpa and burnup achievements
PIE Activities

Materials Projects

- Completed PIE in FY 2016:
  - Utah State University – “Irradiation Effect on Thermophysical Properties of Hf$_3$Al-Al Composite: A Concept for Fast Neutron Testing at ATR”
  - University of Illinois – 355 - “Post Irradiation Tensile Performance of Fe-Cr Base Alloys”
  - CNL (AECL) – “Characterization of X-750 garten springs from CANDU reactor”

- On-going PIE in FY 2015:
  - EPRI-ZG-A and EPRI-ZG-B – “Irradiation and Post-irradiation Examination (PIE) to Investigate Hydrogen Assisted Anomalous Growth in Zirconium Alloys”
  - EPRI-2 – “Irradiation and PIE of Alloys X-750 and XM-19”
  - NRC – “Irradiation and PIE od 304SS”

- Started PIE in FY 2016:
  - University of Illinois – 8305 – “In-situ Synchrotron Wide-Angle X-ray Scattering (WAXS) Tensile Investigation of Neutron Irradiated Ferritic Alloys”
PIE Activities

Fuels Projects
- Completed PIE in FY 2016:
  - University of California, Berkeley – “Hydride LWR Fuel Rod Irradiation”
- Ongoing PIE in FY 2016:
  - University of Central Florida - 1 – “Microstructural Evolution in Low Fluence Behavior of Metallic Fuels”
- Started PIE in FY 2016:
  - Purdue University – 8418 “Microstructural Evolution in Low Fluence Behavior of Metallic Fuels”

Instrumentation Projects
- None
Industry Programs

- Strong and increasing industry interest
  - FY14/FY15 – 0 CINR type pre-apps
  - FY15/FY16 – 3 pre-apps, 2 full apps, 1 awarded + 1 user facility
  - FY16/FY17 –
    - 1 RTE application
    - 10 industry PI applications
    - 2 small business PI applications
    - 5 industry co-PI applications
    - 7 small business co-PI applications
    - 1 international co-PI
    - 3 user facility use applications
FY 2016 Accomplishments

Communications

- **Promotion**
  - Very successful (applications and partner applications)

- **Branding**
  - New INL PIE Guide (50 pages)
  - New Users Organization factsheet
  - Updated exhibit materials
  - Annual Report

- **New Website**

Partner utilization

- Partner facilities are more engaged
  - Applications were submitted by and/or for all partner facilities except Purdue and UNLV (ORNL especially pro-active)

- Partnering interest growing
  - Argonne National Laboratory/IVEM – accepted as partner facility in FY2016
  - Brookhaven National Laboratory/NSLS-II – partnering negotiations underway
  - Los Alamos National Laboratory - applied
  - Sandia National Laboratory - applied
  - Texas A&M University – applied
  - Lawrence Livermore National Laboratory – applied
  - The Ohio State University - applied
FY 2016 Accomplishments
Highlights

**Metrics – all metrics met**
- Efficient use of funding for new awards
  - >50% funding to new awards (>60%)
- Effective use of NSUF capabilities
  - >20% funding to partner facilities (>30%)
- Publications and presentations
  - >20 peer reviews articles or presentation proceedings (>30)
- Prominence and positive exposure for NSUF
  - Invited lectures, etc. 5% increase per year
- Expand and diversify NSUF user community
  - Analyze data and act on trends

**High Performance Computing**
- HPC access emphasized in CINR
- System in place for quickly granting NSUF access and prioritizing work
- Support as-run, thermal, neutronics, and structural analyses
- Moose-Bison-Marmot (MBM) support
  - Considering MBM workshop/training in place of users meeting in FY17
- Tools to improve and simplify user experience
  - Falonviz, website, training
FY 2016 Accomplishments
Highlights
Project Materials Distribution

Irradiation/PIE/CINR/APS Materials
- Fuels: 12 (21%)
- Ceramics: 14 (26%)
- F-M Steels/Alloys: 11 (20%)
- Austenitic Steels/Alloys: 13 (26%)
- RPV Materials: 8 (14%)
- TRISO: 3 (5%)

RTE Materials
- Fuels: 43 (34%)
- Ceramics: 14 (11%)
- F-M Steels/Alloys: 11 (20%)
- Austenitic Steels/Alloys: 13 (10%)
- TRISO: 12 (9%)
- RPV Materials: 13 (10%)
- Austenitic Steels/Alloys: 11 (20%)
FY 2016 Accomplishments Highlights
Overall Area and Cost

Large Scale Project Distribution

Irradiation/PIE/CINR/APS Research Area
- Additively Manufactured Materials 25%
- Advanced Instrumentation and Controls 51%
- Advanced Fuel Cycles 4%
- Cladding and Other Structural Materials 10%

Irradiation/PIE/CINR/APS Cost Distribution
- Additively Manufactured Materials $17,485,351 48%
- Advanced Instrumentation and Controls $10,746,635 29%
- Advanced Fuel Cycles $6,662,751 18%
- Cladding and Other Structural Materials $1,762,427 5%
FY 2016 Accomplishments
Highlights
Overall Area and Cost

Small Scale Project Distribution

**RTE Research Area**
- Additively Manufactured Materials
- Advanced Instrumentation and Controls
- Advanced Fuel Cycles
- Cladding and Other Structural Materials

**RTE Cost**
- Additively Manufactured Materials
- Advanced Instrumentation and Controls
- Advanced Fuel Cycles
- Cladding and Other Structural Materials
Infrastructure / Capabilities
- Hired NEID capabilities scientific support
- Nuclear Energy Infrastructure Database (NEID) updating/expansion continued
- Over 125 institutions operating over 450 facilities housing over 950 instruments
- Current NEID users include researchers from 75 Federal Government and National Laboratories, 38 Universities and NGOs, and 25 Industry organizations.
- Used for infrastructure gap analysis, RFI, FOA

Nuclear Fuels and Materials Library (NFML)
- Hired NFML “librarian”
- Increased library content (10K by 2016 year end)
- 12 experiments used NFML materials
- Collaboration with UK NNUF material archive progressed. Other international interest developed.
- First SAM irradiation (SAM-1) completed

FY 2016 Accomplishments Highlights
DOE-NE / NSUF / INL and SCK-CEN / BR2 / LHMA
- In-kind contributions
- CRADA with four tasks
  - Reactor Performance and Thermal Modeling Benchmarking Using SiC Temperature Monitors.
  - Disc Irradiation for Separate Effects Testing with Control of Temperature (DISECT)
  - Cooperative In-Pile Instrumentation Development

DOE-NE / NSUF and UK / NNUF
- UK National Nuclear User facility (NNUF)
  - National Nuclear Laboratory (NNL)
  - Dalton Nuclear Institute (U. Manchester)
  - Culham Centre for Fusion Energy
- Initial area of mutual user facility interest and cooperation
  - Nuclear Fuels and Materials Library (Archive)
- NSUF to allow access through NNUF
  - Agreement in early stages of development
DOE-NE / NSUF and Norway / Halden Reactor / IFE
- Excess irradiation testing capacity at Halden
- Range of specialized testing rigs
- Re-fabrication facilities
- Visit and discussions initiated in August 2016

DOE-NE / NSUF and Sweden / Studsvik
- Likely only w/r/t irradiation at Halden Reactor (transport issue)
- Visit and discussions initiated in August 2016

AREVA BWR thermal hydraulic facility in Karlstein, Germany
- Visit and discussions initiated in September 2016

European Commission (EC) Joint Research Centres (JRC)
- Restructured putting all nuclear activities under one directorate
- Dr. Maria Betti, Director of Nuclear Safety and Security Directorate expressed interest in NSUF function and will visit US in FY 2017
FY 2017
FY 2017 Action Areas

- Execute awarded projects (CINR, pre-CINR, RTEs, CRADAs)
  - Irradiation coordination
  - PIE coordination
- CINR (FY17 - ?, FY16 - $10M, FY15 - $4.1M, FY14 - $400K)
  - 124 LOIs (80 in FY16), 108 pre-proposals (67 in FY16), ~50-60 full proposals (32 in FY16)
  - Cost and resource challenge

- Rapid Turnaround Experiments (3 calls per year, 39 awarded in FY16)
- Nuclear Energy Infrastructure Database (NEID)
  - Continue to update (international + area expansion)
- Nuclear Fuels and Materials Library (NFML)
  - Improve web based interactive tools
  - Increase capacity and content including SAM series
  - Enable easier and less expensive access
- Expand beamline access and international cooperation/collaboration
Industry
- Mechanical testing – IASCC (crack growth, fracture, and tensile testing)

High Performance Computing
- ~30% of cpu time on Falcon machine available through NSUF
- Continue to offer and emphasize through CINR and RTE calls

Infrastructure Support
- National Laboratory capability enhancement
- Reactor and university competitive calls

Instrumentation/scientist support
- Support instrument scientists at ~20% time to maintain instrument, develop/adapt/implement cutting edge techniques and maintain or establish international reputation

Communication/Training/Development/Expansion/
- Users Meeting, website development, exhibits, interns
- Ion Beam Roadmap Committee, ThermoHydraulics Workshop, Partner Facilities Working Group
FY 2017 Action Areas

- GAIN support
  - Management and execution

- TREAT support
  - Limited view hodoscope refurbishment
  - Data acquisition system
  - Full view hodoscope design and implementation
  - Experimental vehicle development and PIE preparations

- Knowledge & Validation Center (NEKVaC)
  - Management and execution

- Molten Salt Reactor Feasibility Study

- NEAC and NEAC Subcommittee support
FY 2017 Milestones

- 14 Level 2 Milestones (13 in FY 2016)
- 35 Level 3 Milestones (30 in FY 2016)
- 53 Work Packages

1st Quarter (10/1/2016 – 12/31/2016)
- 4 Level 2 milestones
- 4 Level 3 milestones

2nd Quarter (1/1/2017 – 3/31/2017)
- 2 Level 2 milestones
- 4 Level 3 milestones

3rd Quarter (4/1/2017 – 6/30/2017)
- 3 Level 2 milestones
- 10 Level 3 milestones

4th Quarter (7/1/2017 – 9/30/2017)
- 5 Level 2 milestones
- 17 Level 3 milestones