Nuclear Energy Enabling Technologies (NEET)
Advanced Sensors and Instrumentation (ASI)

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Office of Nuclear Energy Webinar on ASI

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Nuclear Energy

- ■ **Purpose: Review the on-going I&C research across NE through presentations and discussion**
  - Inform participants on NE I&C research
  - Evaluate progress of on-going projects
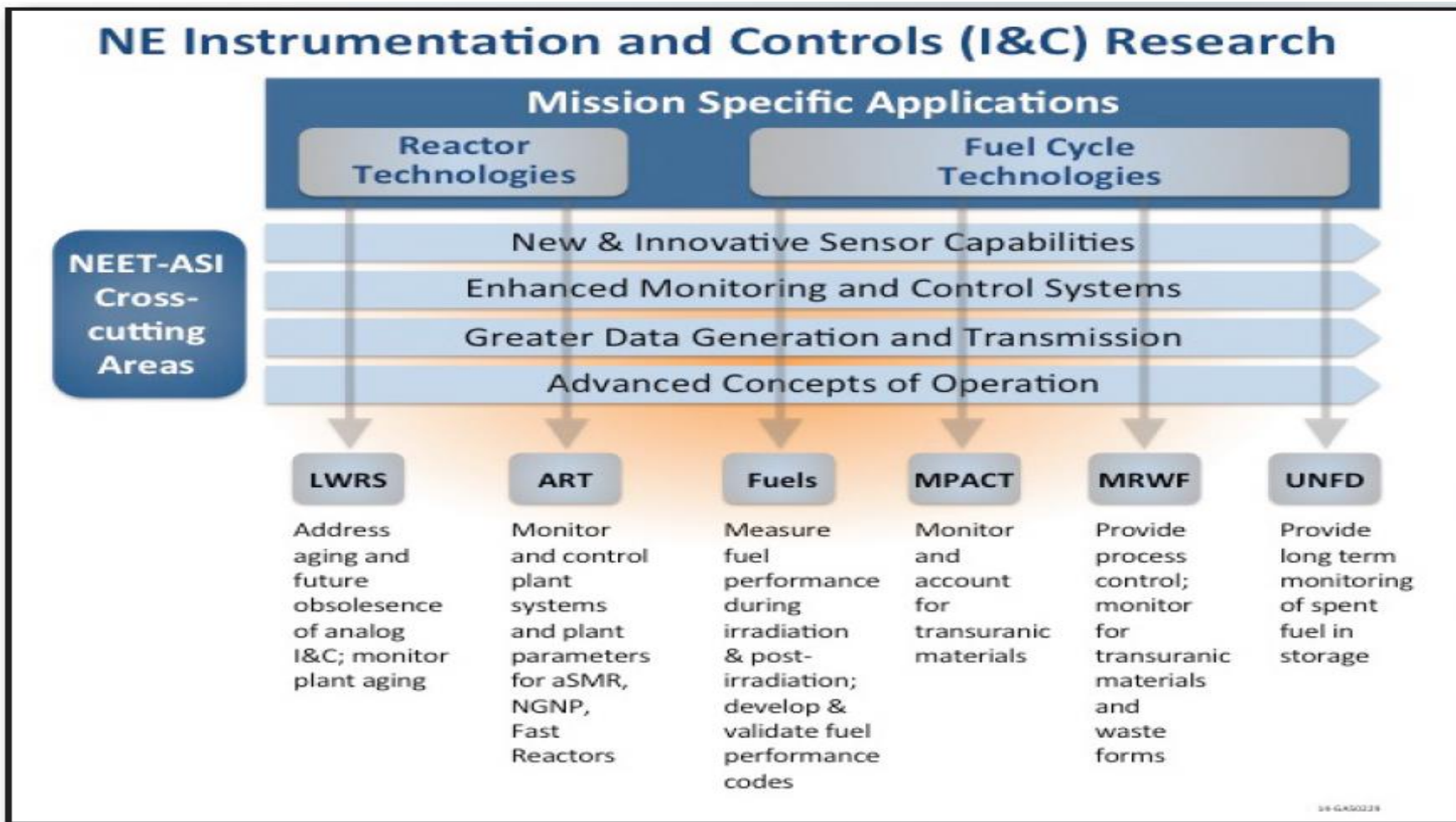 - Get the results from concluding projects

- ■ **Outcome: Better understanding of I&C research across NE**
  - Feedback from R&D Programs on current and planned research
  - Coordination of research activities

- ■ **Materials: Summary of the meeting with presentations**
  - Posted on the NE website www.energy.gov/ne

I&C research across NE

NE Instrumentation and Controls (I&C) Research

Mission Specific Applications

Reactor Technologies　　　　**Fuel Cycle Technologies**

NEET-ASI Cross-cutting Areas

- New & Innovative Sensor Capabilities
- Enhanced Monitoring and Control Systems
- Greater Data Generation and Transmission
- Advanced Concepts of Operation

LWRS	ART	Fuels	MPACT	MRWF	UNFD
Address aging and future obsolesence of analog I&C; monitor plant aging	Monitor and control plant systems and plant parameters for aSMR, NGNP, Fast Reactors	Measure fuel performance during irradiation & post-irradiation; develop & validate fuel performance codes	Monitor and account for transuranic materials	Provide process control; monitor for transuranic materials and waste forms	Provide long term monitoring of spent fuel in storage

16-GA50228

[**LWRS**-Light Water Reactor Sustainability; **ART**-Advanced Reactor Technologies; **Fuels** -Advanced Fuels; **MPACT**-Materials Protection, Accounting and Control Technology; **MRWF**- Material Recovery and Waste Form Development; **UNFD**-Used Nuclear Fuel Disposition]

Nuclear Energy Enabling Technologies: Advanced Sensors and Instrumentation

■ Vision

Develop advanced sensors and instrumentation technologies that address critical technology gaps for monitoring and controlling advanced reactors and fuel cycle facilities

■ Goal

To provide <u>crosscutting</u> research that:

➢ Contributes to the success of the DOE-NE R&D programs

➢ Supports common I&C technology development needs

➢ Overcomes current and future I&C barriers to nuclear energy system deployments

> **A new model of I&C innovative RD&D to overcome nuclear power's impediments to new I&C technology usage**

■ Goal (cont.)

To provide <u>coordination</u> across various DOE-NE R&D programs by:

- ➤ Collecting and communicating information about on-going I&C-related RD&D being conducted under each program

- ➤ Ensuring that each DOE-NE research program has access to expert knowledge of the state of the art for I&C technologies

- ➤ Facilitating more efficient and effective approach to addressing the I&C needs and achieving the full benefits of the technology advancements
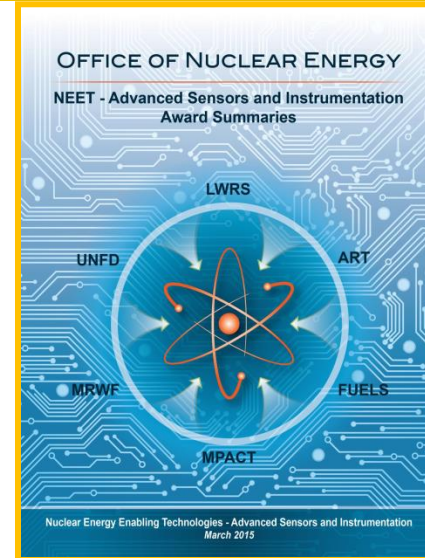
A new model of I&C development that is more collaborative, coordinated, and designed to meet the needs of multiple programs

Integrated Capabilities

- **Create needed ASI technologies essential to realize DOE-NE mission goals**
  - Develop enabling capabilities that address common ASI gaps
  - Yield game-changing results for specific nuclear technologies
  - Address issues beyond the scope of individual R&D programs
  - Coordinate ASI research among programs to avoid duplication and leverage investment to benefit multiple programs.


OFFICE OF NUCLEAR ENERGY

NEET - Advanced Sensors and Instrumentation Award Summaries

LWRS
UNFD
ART
MRWF
FUELS
MPACT

Nuclear Energy Enabling Technologies - Advanced Sensors and Instrumentation
March 2015

- **Four Strategic areas:**
  - Advanced Sensors
  - Digital Monitoring and Control
  - Nuclear Plant Communication
  - Advanced Concepts of Operation

Supports Programmatic Goals & Develops Needed Capabilities

- **Micro Pocket Fission Detectors**
- **Ultrasonic Sensors for In-pile Fuel Irradiation**
- **High Temperature Materials**
- **Radiation Hardened Electronics**
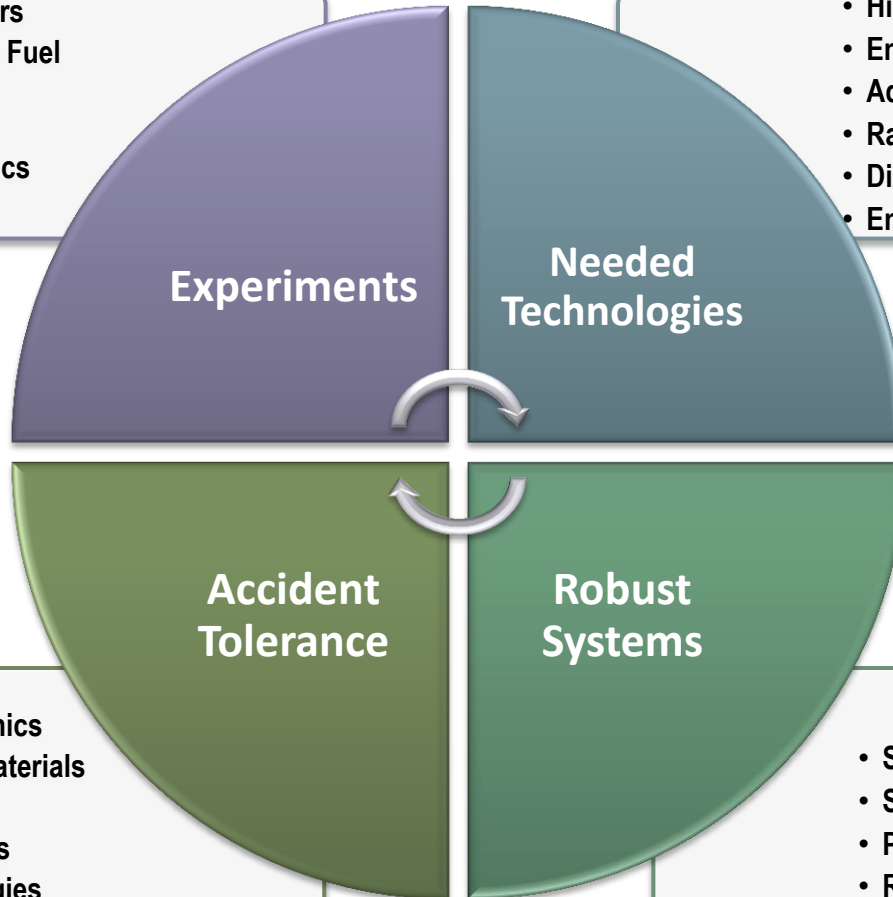
- **High Temperature Fission Chambers**
- **Embedded Instrumentation & Controls**
- **Advanced HSI Technologies**
- **Radiation Hardened Electronics**
- **Digital Technology Qualification**
- **Enhanced Communications**

Experiments

Needed Technologies

Accident Tolerance

Robust Systems

- **Radiation Hardened Electronics**
- **High Temperature Sensor Materials**
- **Distributed fiber optics**
- **Sensor Degradation Controls**
- **Power Harvesting Technologies**

- **Self Calibrating Sensors**
- **Sensor Degradation Controls**
- **Power Harvesting Technologies**
- **Resilient Controls**

FY-13 NEET-ASI Awards

Title	Principal Investigator	Collaborators
Radiation Hardened Electronics Destined for Severe Nuclear Reactor Environments	Keith Holbert, Arizona State University	Laurence Clark, Arizona State University
Radiation Hardened Circuitry Using Mask-Programmable Analog Arrays	Charles Britton, Oak Ridge National Laboratory	Nance Ericson, ORNL and Benjamin Blalok, University of Tennessee
A Method for Quantifying the Dependability Attributes of Software-Based Safety Critical Instrumentation and Control Systems in Nuclear Power Plants	Carol Smidts, Ohio State University	Ted Quinn, Technology Resources

FY-14 NEET-ASI Awards

U.S. DEPARTMENT OF ENERGY
Nuclear Energy

Title	Principal Investigator	Collaborators
Enhanced Micro-Pocket Fission Detector (MPFD) for High Temperature Reactors	Troy Unruh, Idaho National Laboratory	Phillip Ugorowski, Kansas State University; Jean-Francois Villard, CEA
Nanostructured Bulk Thermoelectric Generator for Efficient Power Harvesting for Self-powered Sensor Networks	Yanliang Zhang, Boise State University	Darryl P. Butt, Boise State University; Vivek Agarwal, Idaho National Laboratory; Xiaowei Wang, GMZ Energy, Inc.
Robust Online Monitoring Technology for Recalibration Assessment of Transmitters and Instrumentation	Pradeep Ramuhalli, Pacific Northwest National Laboratory	Guang Lin, PNNL; Susan Crawford, PNNL; Jamie Coble,University of Tennessee Knoxville; Brent Shumaker, AMS Corp.; Hash Hashemian, AMS Corp.
Operator Support Technologies for Fault Tolerance and Resilience	Richard Vilim, Argonne National	Ken Thomas, Idaho National Laboratory
Embedded Instrumentation and Controls for Extreme Environments	Roger A. Kisner – Oak Ridge National Laboratory (ORNL)	Alexander M. Melin, ORNL; David L. Fugate, ORNL; David Holcomb, ORNL; Dane Wilson, ORNL; Timothy Burress,ORNL
High Spatial Resolution Distributed Fiber-Optic Sensor Networks for Reactors and Fuel Cycle Systems	Kevin Chen, University of Pittsburgh	Westinghouse Electric Company LLC; Corning Incorporated

FY-15 NEET-ASI Awards

Title	Principal Investigator	Collaborators
Nuclear Qualification Demonstration of a Cost Effective Common Cause Failure Mitigation in Embedded Digital Devices	Matt Gibson, Sr., Electric Power Research Institute (EPRI)	None
Development and Demonstration of a Model Based Assessment Process for Qualification of Embedded Digital Devices in Nuclear Power Applications	Richard Wood, University of Tennessee	Carl Elks, Virginia Commonwealth University Carol Smidts, The Ohio State University H.M. Hashemian and Brent Shumaker, AMS Corporation

FY-16 NEET-ASI Future Awards

FY 2016 Consolidated Funding Opportunity Announcement (FOA) NEET-2 ASI TOPIC:

Advanced Communication Technology for Nuclear Environment

Challenge: Develop and demonstrate innovative robust methods for transmitting signals and data in a nuclear environment that is applicable to multiple reactors or fuel cycle applications

FOA UPDATE:

- Pre-applications received and under review
- Full proposals request to selected pre-applications on Dec. 18, 2015
- Full R&D Applications Due: February 18, 2016
- For more information visit www.neup.gov

U.S. DEPARTMENT OF ENERGY

Nuclear Energy

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