



# Cost-Benefit Analyses through Integrated Online Monitoring and Diagnostics

**Advanced Sensors and Instrumentation  
Annual Webinar**

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**Dave Grabaskas  
Argonne National Laboratory**

# Project Overview

**Project Goal:** Improve advanced reactor economics through:

- Optimization of the reactor sensor network design
- Intelligent asset-management decision-making during operation

## Participants



**PI:** Dave Grabaskas  
Roberto Ponciroli  
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**THE OHIO STATE UNIVERSITY**

Carol Smidts  
Xiaoxu Diao  
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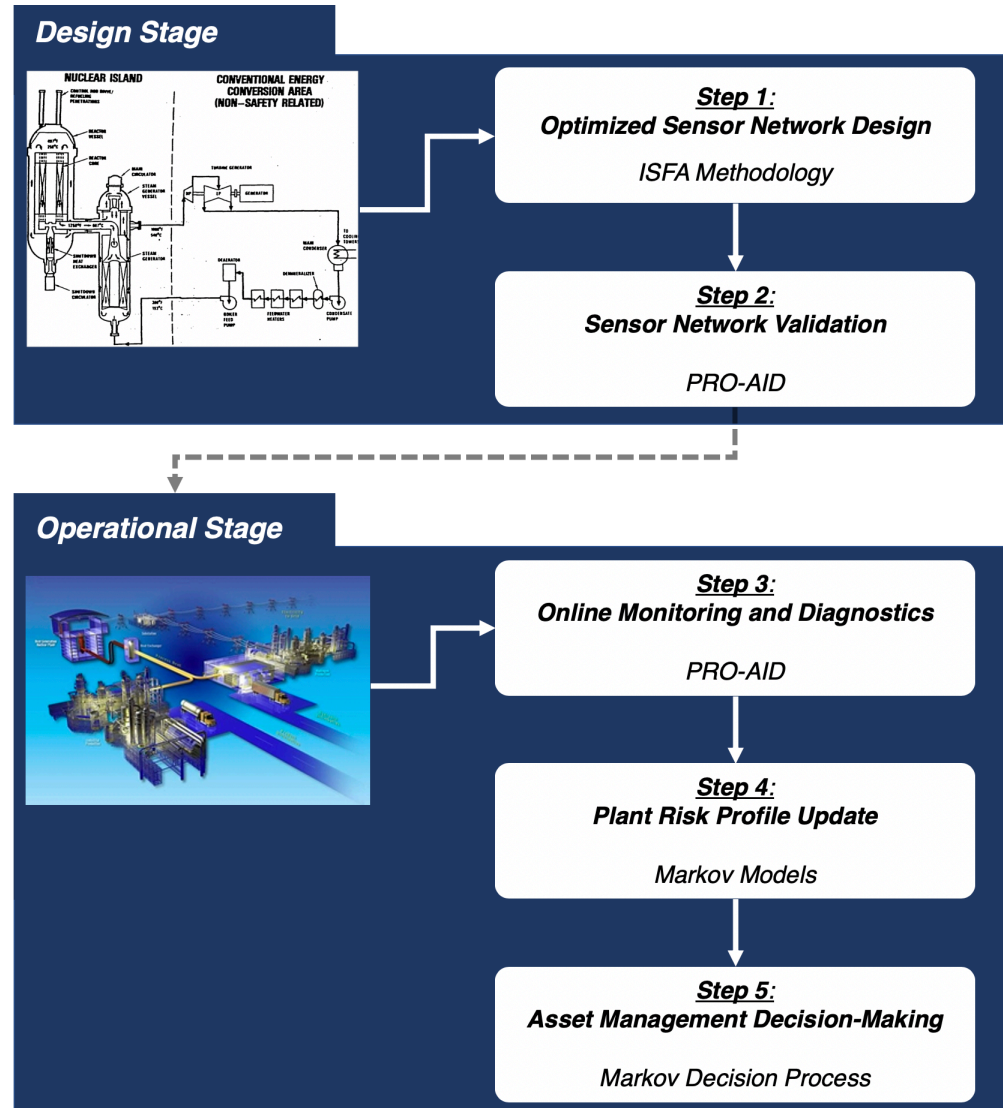


Brian Mays  
Many others...

**Schedule:** FY20 - FY22

# Summary of accomplishments

- **Process Development**
  - Established overarching strategy
  - Provides a complete approach from design through operations
  - Leveraging existing tools and methods
  - Expanding capabilities and integrating methods



# Summary of accomplishments

- **Sensor Network Optimization**
  - M3: Optimization Acceptance Criteria
    - Identifies key criteria for sensor network optimization method, such as cost, system penetrations, reliability, security, etc.
- **Intelligent Asset Management**
  - M3: Integration of Online Monitoring into Risk Profile
    - Methodology developed for integrating online monitoring information into a real-time plant risk profile, consisting of the probabilistic risk assessment (PRA) and generation risk assessment (GRA)
- **M2: FY20 Project Progress Report**

# Technology Impact

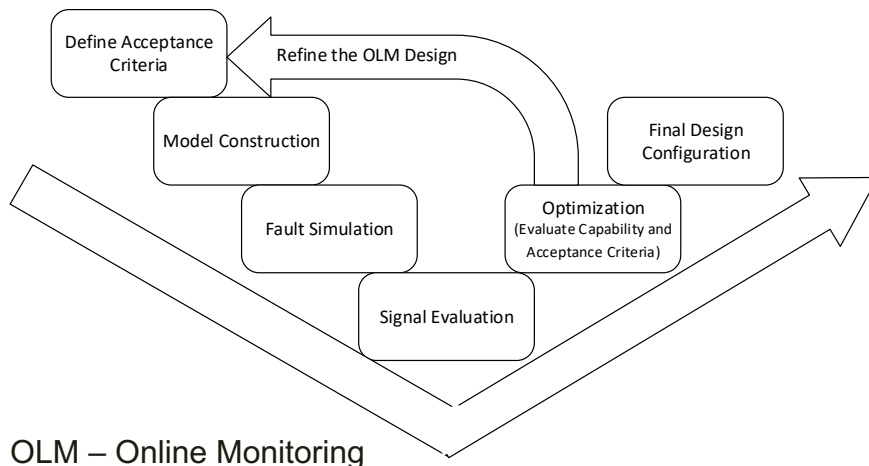
- Economics is the #1 focus
- Maximizing the value of instrumentation and expanding the impact of monitoring data
- Taking tools and methods that have been developed by alternate DOE programs (ARPA-E, NEET, ART) and creating an integral approach
- Working directly with industry to advance to demonstration and pursue commercialization

# Accomplishments (1/3)

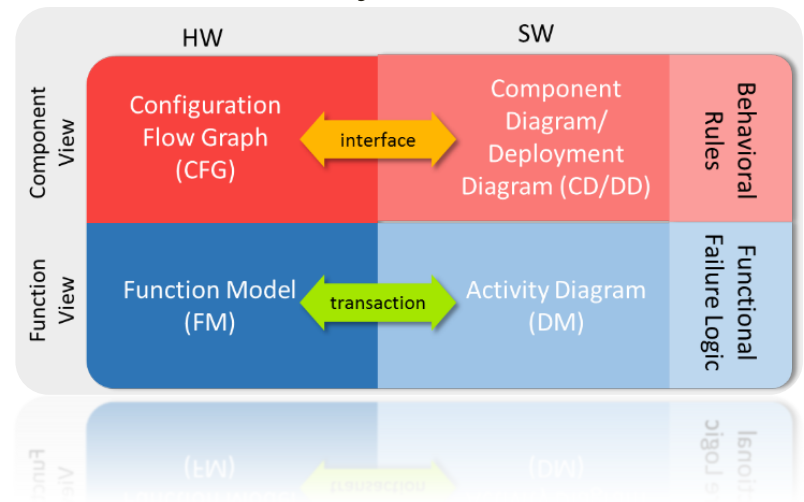
- **Sensor Network Optimization**

- Integrated System Failure Analysis (ISFA) method
  - Developed by Ohio State University
  - Efficiently explores alternative sensor network designs
  - Expanding capabilities to facilitate new optimization acceptance criteria and allow sensor grading

ISFA Methodology



ISFA Analysis Framework



# Accomplishments (2/3)

- **Online Monitoring and Diagnostics**

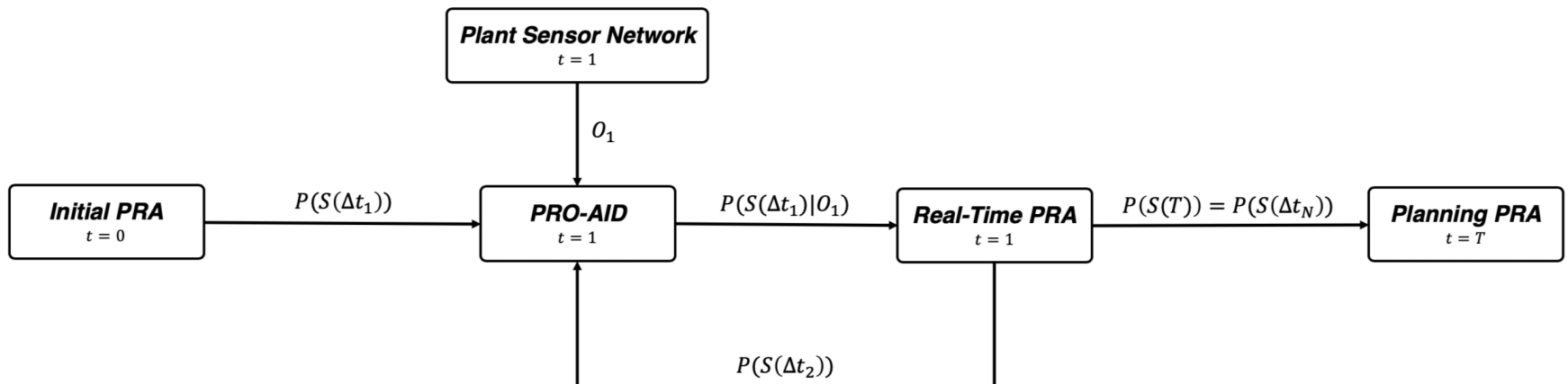
- Argonne tool: PRO-AID

- Combines operational data & physics to diagnose plant conditions

- Plant Risk Profile

- Risk profile consists of both safety (PRA) and economic (GRA) perspectives

- Method developed to integrate PRO-AID and risk analysis techniques to create a real-time plant risk profile



# Accomplishments (3/3)

- **Demonstration Analysis**

- General Atomic (GA): MHTGR design concept
  - Similar to the Framatome SC-HTGR design concept but significant design and analysis information available in the public domain (PSID, PSER, PRA, Design Package), which alleviates proprietary restrictions
  - Considering several test cases for suitability as part of demonstration analysis
  - Working with Framatome to identify relevant problems of interest





# Looking Ahead...FY21 Activities

- **Sensor Network Optimization**
  - Complete expansion of ISFA capabilities
  - Finalize structure for ISFA and PRO-AID communication
- **Intelligent Asset Management**
  - Integrate machine learning technique of Markov Decision Processes (MDP) into existing Framatome asset-management methods and tools
- **Demonstration Analysis**
  - Initiate MHTGR analysis, to be completed in FY22

# Conclusion

- Seeking to improve advanced reactor economics through advancements in sensor network design and asset-management decision-making
- Overall framework established and tools are in place, now diving into the details before FY22 demonstration analysis
- Further Questions: [dgrabaskas@anl.gov](mailto:dgrabaskas@anl.gov)