

**NOTEBOOK MATERIAL  
FOR THE 565th ACRS FULL COMMITTEE MEETING, September 10-12, 2009  
RELATED TO THE REVIEW OF THE DIGITAL I&C SYSTEMS**

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**Reference(s):**

- (1) Digital I&C Plan FY 2010 – FY 2014

Also supporting material for review:

- (1) Status of NRC Digital System Research Plan FY2005 -2009  
(2) Mapping of DI&C Research Plan of FY2005-FY2009 to FY2010-FY2014

Cognizant ACRS Member:  
Cognizant ACRS Staff Engineers:

George Apostolakis  
Christina Antonescu

**565th Advisory Committee on Reactor Safeguards Meeting  
Rockville, MD  
September 10, 2009**

**5) Draft Digital Instrumentation and Control (DI&C) Research Plan**

**3:30 P.M. – 5:00 P.M.**

**- AGENDA -**

**Cognizant Staff Engineer: Christina Antonescu (301-415-6792, [cea1@nrc.gov](mailto:cea1@nrc.gov) or [Christina.Antonescu@nrc.gov](mailto:Christina.Antonescu@nrc.gov))**

	<b>Topic</b>	<b>Presenter(s)</b>	<b>Time</b>
<b>5.1</b>	<b>Opening Remarks</b>	<b>G. Apostolakis, ACRS</b>	<b>3:30pm – 3:35pm</b>
<b>5.2</b>	<b>Draft Digital I&amp;C Research Plan for FY2010 - FY2014</b>	<b>R. Sydnor D. Santos</b>	<b>3:35 – 5:00 pm</b>

**Notes:**

- **Presentation time should not exceed 50% of the total time allocated for a specific item.**
- **Number of copies of presentation materials to be provided to the ACRS - 35.**

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
DIGITAL INSTRUMENTATION AND CONTROL SYSTEMS SUBCOMMITTEE MEETING  
ROCKVILLE, MD  
August 25, 2009**

**STATUS REPORT**

**PURPOSE**

The purpose of this session is for the Committee to be briefed by the Office of Nuclear Regulatory Research (RES) staff on the DI&C Research Plan, FY 2010 – FY 2014.

**BACKGROUND**

The ACRS reviewed the staff activities related to digital I&C Research Plan at the August 19-21, 2009, subcommittee meeting. The staff presented information on the Digital I&C Plan as it needs to supplement and augment current review guidance and develop technical bases to support risk-informed digital system reviews and operational assessments. Some of the issues captured in the DI&C Plan are: understanding of associated failure modes, complexity and potential new failure modes, limited operating history, higher level of system integration and complex communication schemes, cyber vulnerabilities and others.

The roles of the Office of Research (RES) is to develop technical bases, guidance, and methods to support regulatory decisions which is accomplished through confirmatory and anticipatory research, testing and analyses, development of tools, data, and analytical models and national and international collaboration. Also, NRC research collaborates with industry research when the research and products are complementary. For example, RES and EPRI are working under a MOU between EPRI and RES and use the DI&C research plan to help identify areas for potential collaborative research.

Based on the 1997 NAS report “Digital Instrumentation and Control Systems in Nuclear Power Plants: Safety and Reliability Issues” the NRC Digital System Research Plan, FY01 - FY04 was developed which focused on several NAS report recommendations.

The NRC Digital System Research Plan, FY05 - FY09 continued previous research and added significant new research topics such as: Cyber Security, What constitutes adequate diversity? What are the guidelines for developing FPGA-based safety systems? Highly integrated control rooms etc.

In 2007 the NRC Steering Committee for Digital I&C was created to address specific industry questions which led to re-prioritization of research with focus on supporting development of ISGs. Thus RES provided technical support and information to various seven Task Working Groups (TWGs) research programs such as: Diversity and Defense in Depth (D3), Highly Integrated Control Rooms- Communications, Cyber Security, Risk-Informed Digital I&C, Highly Integrated Control Rooms-Human Factors, Licensing Process and Fuel Cycle Facilities

Current draft DI&C Plan is the result of input from the I&C staff, I&C branch chiefs, and senior advisors from program offices (NRR, NRO, NSIR and NMSS). Comments, needs, and priorities

of the various offices have been incorporated. Such comments included: Continue digital I&C PRA work; evaluate the capabilities and limitations of automated tools used in various life-cycle activities; improve understanding of digital technology failure modes and effects and their analyzes; provide specific deliverables: staff guidance, acceptance criteria, tools and methods, review procedures, training curricula etc.

The draft DIC research plan was made publicly available on July 29th, 2009 and is on NRC's ADAMS under accession number ML082470725. As of August 17, 2009, the staff had not received any public comments. Public and stakeholder commenting period is until September 20th, 2009. The DI&C Research Plan will go into formal NRC concurrence (office director concurrence) following incorporation and resolution of all ACRS and public comments. The staff aims to have the research plan published by the end of calendar year 2009.

## **SUMMARY ON THE DIGITAL I&C STEERING COMMITTEE ACTIVITIES**

### **DIGITAL I&C RESEARCH PLAN FY2010 - FY2014**

The DI&C Research Plan is a continuation of research programs that support regulatory needs of the NRC licensing offices. Thus a need for periodic reviews and update of the DI&C Research Plan is in order to ensure that the research programs are supporting the NRC licensing offices.

In the DI&C Plan the research projects have been combined into five topics:

Safety Aspects of Digital Systems

Security Aspects of Digital Systems

Advanced Nuclear Power Concepts

Knowledge Management

Additional Carryover Projects from Digital System Research I&C Plan FY05 - FY09

The latter, the FY05 – FY09 projects that were not started and not selected for FY10 – FY14 scope are:

COTS Digital Systems

THD effects on DI&C

Radiation Hardened ICs

Smart Transmitters

Advanced NPP Digital Risk

Please note the expected baseline schedule in **Figure 2.2 “ Expected Project Scheduling of the Digital System Research Plan FY 2010 - 2014”** of the DI&C Plan since the projects are driven by needs of the licensing offices (NRR, NMSS and NSIR) and budgets.

Also another noteworthy topic example is **Figure 2.4** “Digital System Research for Incorporating Risk Insights into Regulatory Reviews Roadmap” involving work with Ohio State (Dynamic Risk Modeling), BNL (Traditional Risk Modeling), ORNL (Operational Experience Review) and UVA (Development Software Reliability Models) **and** Appendix I, Table 1: List of Dependencies between Project and Deliverables. In addition, a number of projects share information with each other. Specifically, these dependencies and interrelationships that exist with other branches are indicated in Table 1 of Appendix 1.

In addition, the following supporting material is included:

- (1) The Status of NRC Digital System Research Plan FY2005 -2009 that show all the delivered products (with **hyperlinks** to the documents) and remaining work to be done, and
- (2) The Mapping of DI&C Research Plan of FY2005-FY2009 to FY2010-FY2014 that shows overall key differences between the two plans and the remaining work to be done.

The Draft DI&C Research Plan has been recently made available for a 30 day public comment period. Following resolution of ACRS and public comments the staff will finalize the plan for formal internal concurrence and NRC management approvals. The staff's goal is to have the new plan in place before the end of the year in 2009

### **EXPECTED FULL COMMITTEE ACTION**

During the upcoming meeting on September 10, 2009, the full committee will be expected to review the draft DI&C Research Plan for its consideration, providing a report on this matter.

### **REFERENCES**

- (1) Digital I&C Plan FY 2010 – FY 2014
- (2) Status of NRC Digital System Research Plan FY2005 -2009 (attached)
- (3) Mapping of DI&C Research Plan of FY2005-FY2009 to FY2010-FY2014 (attached)