Answers to Nine Questions from the
Staff Requirements Memorandum for COMPBL-07-0001

The following paragraphs summarize responses to the questions contained in the Staff Requirements Memorandum for COMPBL-07-0001, "Development of a U.S. Digital Instrumentation and Control and Human-Machine Interface Test Facility," dated April 5, 2007.

QUESTION 1: What potential participants might be interested in joint participation, collaboration, and funding of such a facility, and to what extent might this include industries outside the nuclear industry?

The United States has a robust digital instrumentation and control and human-machine interface (DI&C/HMI) community with well-established capabilities and technical communities that support existing needs through professional meetings, oversight, and other forums. Because well-established facilities meet their needs, organizations outside the nuclear community expressed little interest as potential collaborators regardless of the arrangement and capabilities of any facility.

Within the nuclear community, industry representatives suggested that they may be interested in well-defined short-term topics on a case-by-case basis. Universities and U.S. Department of Energy (DOE) laboratories expressed interest in being research partners. No participant in this assessment expressed interest in becoming a funding partner.

In conclusion, at this time, there is some interest in research collaboration within the nuclear industry but no interest in providing funding to build a single integrated facility.

QUESTION 2: If the nuclear industry participated, how could conflict-of-interest issues be addressed?

The U.S. Nuclear Regulatory Commission (NRC) staff would evaluate organizational conflict-of-interest (OCOI) issues with nuclear industry collaborators on a case-by-case basis. The NRC established statutory and regulatory requirements for conducting research and avoiding OCOI issues would be used. Participants expressed a preference for third-party leadership to lessen potential conflicts in collaborations if a new facility is built. The NRC staff, however, is concerned that third-party leadership could limit the NRC's influence over directing a collaborative effort.

QUESTION 3: Do examples of similar facilities currently exist and, if so, what can be learned from their successes and challenges?

Examples of facilities with DI&C and HMI capabilities can be found within large organizations that include National Aeronautical and Space Administration, DOE laboratories, universities, several large DI&C vendors, and the Halden Reactor Project (HRP). This assessment identified various examples of government agency-industry-university partnerships in the U.S. The Industry-University Cooperative Research Centers organized by the National Science Foundation are examples of these partnerships.

The Federal Highway Administration's (FHWA) Turner-Fairbank Highway Research Center in Mclean, VA is a specific example of an integrated test bed facility to meet one industry's needs. This Federally owned and operated research facility manages and conducts research in various fields for improving highway safety. It comprises several laboratories including an advanced electronics laboratory and a human-centered systems laboratory. The facility coordinates activities with other FHWA and U.S. Department of Transportation offices, State and local government partners, academia, industry partners, military research offices, and professional organizations. The Turner-Fairbank Highway Research Center could serve as a model for an NRC-sponsored research facility.

An example of a facility established and extensively funded as a Federally Funded Research and Development Center by the NRC is the Center for Nuclear Waste Regulatory Analyses (CNWRA). The CNWRA focuses on identifying and resolving technical issues and developing tools needed to review the anticipated DOE application to evaluate the Yucca Mountain site. The facility has contractually mandated restrictions which serve to avoid any organizational conflicts of interest.

In discussing existing facilities, participants indicated the lack of a dedicated domestic simulator for human factors regulatory research applications. Following the workshops, the NRC staff has learned that efforts to design, construct, and staff such a simulator exist at the DOE Idaho National Laboratory. The staff is currently investigating the availability of this facility for NRC use.

Lessons learned from these facilities and partnerships include (1) the need for a clearly defined and focused mission for short-, mid-, and long-term timeframes, (2) strong leadership and management, and (3) the need for consistent funding to meet long-term objectives. If the NRC were to build a DI&C/HMI facility, participants recommended that the NRC capture the lessons available from the existing facilities and partnerships.

In conclusion, examples of facilities addressing DI&C/HMI issues do exist. If the NRC decides to build a research facility, the staff should contact representatives from existing facilities to gain additional insights.

QUESTION 4: What siting options are most viable (e.g., universities where integration with graduate studies might be encouraged, national laboratories, etc.), taking both cost and ease of technical information exchange into account?

Participants indicated that different siting options offered distinct advantages for certain technical areas. For example, DOE laboratories offer distinct advantages over other options in cyber security because they already have existing facilities and strong core staffs. University locations offer the potential to train the next-generation workforce as well as access to potential research subjects for basic HMI research. These siting options have lower initial costs than a new facility. However, challenges may involve sharing proprietary information, and maintaining staff continuity because of an aging workforce. The selection of a location for an NRC-sponsored facility would depend on the mission to be accomplished and long-term research objectives.

In conclusion, several siting locations with distinct benefits exist. Site selection depends heavily on the mission of the facility, and long-term research objectives that are not fully defined.

QUESTION 5: To what extent could such a facility be designed to be reconfigurable to the expected variety of plant control room and HMI designs?

The ability to reconfigure a facility is especially desirable for testing hardware and software integration, data exchange among distributed systems, and human factors research. Participants thought that a facility could be designed to be reconfigurable to meet some but not all of the NRC's research needs because of the equipment required to support the research and the variety of expected plant control room and HMI designs. To complement the reconfigurable facility, participants thought that the NRC staff could explore collaborating with vendor training facilities (simulators) for addressing issues that require plant-specific DI&C/HMI configurations.

QUESTION 6: To what extent could such a facility be designed to also be able to be used as an advanced reactor training simulator for NRC staff?

Participants discussed the potential synergies of dual-use and co-located facilities for research and training purposes. Potential benefits include shared staff, such as laboratory technicians for troubleshooting, and information that may lead both to better research and better training. Drawbacks include the loss of configuration control and operational mistakes because of personnel working on both training and research platforms. Needs for one purpose (i.e., training) may take priority and hinder progress in the other mission.

Existing control room training simulators may complement research simulators because they are being upgraded to digital systems and because there is a need for generic and plant-specific data. Further discussions with the NRC Technical Training Center (TTC) staff involved with planning for NRC new reactor simulation capabilities confirmed the potential for the Office of Nuclear Regulatory Research to use any new reactor simulation capabilities that the TTC acquires for HMI collaborative efforts.

In conclusion, participants noted that a dual research and training facility could be built but did not recommend this approach. Participants suggested that existing training facilities might be useful in providing plant-specific HMI data and should be examined further.

QUESTION 7: What impediments, if any, to information sharing among participants and to external stakeholders might exist?

Impediments to information sharing include information security, and intellectual property policies. Information security is an impediment in that diverse independent agencies can have different security standards that potentially conflict. Other concerns identified by participants include policies and practices that address intellectual property, OCOIs, and separating collaborator roles.

The sharing of data with external collaborators is not necessarily an impediment for NRC participation. The NRC has frequently participated in collaborative research programs with external organizations, and evaluates the research data independent from the other organizations.

QUESTION 8: What could be the benefits, or adverse impact, to existing and established international collaborative activities in this area?

Possible impacts to existing collaborations include increased competition for a few qualified personnel, the possibility of repeating existing research capabilities, and interruptions to short-term and long-term industry and regulatory projects. Internationally, the NRC staff has collaborated with the Halden Reactor Project (HRP) on DI&C/HMI research initiatives for many years. Current collaboration efforts with HRP include performing safety assessments on commercial-off-the-shelf equipment, ranking software engineering practices and testing digital reliability assessment methods, human reliability benchmarking, teamwork, alarm systems, and computerized procedures. Participants recommended that international collaborative efforts should not be abandoned because such efforts allow the NRC to keep pace with worldwide digital technology advances and standard practices.

QUESTION 9: What could be the NRC's legal, budgetary, and oversight role?

Participants expressed concerns about the relationship between the NRC in its regulatory role, and others in a collaborative research structure. Specifically, they cited the potential that the NRC staff could expand the scope of regulatory scrutiny beyond areas of regulatory concern and promote specific technical products through DI&C/HMI research at this facility. Instead, they suggested that the NRC's legal, budgetary, and oversight role could be that of a collaborative participant that funds projects to address nuclear-related issues in DI&C/HMI. With regard to oversight, participants expressed the preference for third-party leadership of any facility used for collaborative research to minimize OCOI and other organizational issues. However, the NRC staff noted that third-party leadership could inhibit the NRC's prioritization of research activities and that there has been extensive cooperation in the past. That is, a model for NRC participation exists.

In conclusion, participants expressed concerns with NRC involvement in a single facility and suggested that the NRC's role be that of a funding participant for projects that address nuclear-related DI&C/HMI issues.