Plant Productivity Improvement through Advanced Technologies Strategy Group Kick-off Meeting Summary

The EPRI Plant Productivity Improvement through Advanced Technologies Strategy Group Kick-off Meeting was held at the EPRI offices in Charlotte, North Carolina on June 29 & 30, 2010. This strategy group will begin officially in 2011. Membership is open to utilities and other interested organizations.

The Plant Productivity Improvement through Advanced Technologies Strategy Group is being established to help address nuclear power industry expressed concerns about its ability to maintain current high plant performance levels due to aging and obsolescence, knowledge drain, fewer plant staff and new requirements.

1. Aging and obsolescence requires more effort (people, time and money) to maintain the same performance levels of existing equipment and systems.
2. Knowledge drain is occurring as the demographics of the nuclear power industry show that more and more expertise is walking out the door due to the aging workforce nearing retirement and this will only increase. This is aggravated in the United States (and some other countries) by the fact that the nuclear power industry lost 1 to 1 ½ generations of new people entering the industry resulting in reduced normal on-the-job knowledge transfer.
3. Fewer plant staff are available since more people are nearing retirement than coming into the industry and new plants are taking people from operating plant activities.
4. New requirements and commitments (NRC, NERC, EPA, state, local, etc.) lead to additional staff activities and responsibilities; e.g., cyber security requirements.

These concerns will increase as plants extend their operating life. In addition, many in industry have expressed goals to not only maintain the current performance levels, but to improve performance and reduce costs.

The Plant Productivity Improvement through Advanced Technologies Strategy Group will explore ways to use modern technology to address these concerns for operating plants and help avoid them in new plants. Modern technologies can be used to maintain cost-effectively current performance levels and enable shifts to even higher performance levels.

The term advanced technology for this strategy group is somewhat of a misnomer, what is really meant is to bring the nuclear industry up-to-date with other industries. It does not refer to bleeding edge technologies but rather technologies being used extensively in other industries, of which some are beginning to be used in the nuclear industry.

The Plant Productivity Improvement through Advanced Technologies Strategy Group’s high level objectives include:
• Identify new technologies and new approaches to develop and implement successful solutions to address utility needs and take advantage of opportunities to improve performance.
• Take more effective advantage of currently used technologies.
• Remove barriers to successful implementation of performance improvement solutions.
• Explore tools and capabilities for continuous improvements.

In order to have a better understanding of some of the capabilities and available tools that can help improve performance and decision-making, the kick-off meeting contained a substantial number of presentations and demonstrations on applications that have been done in the nuclear power industry and other industries. Understanding what is available and what is possible is important as it enables the identification of applications that can benefit from the capabilities and tools. The presentations and demonstrations during the meeting covered only some of the technologies that will be considered for solutions under this strategy group.

Presentations were given by the following organizations:
• The Boeing Company
• Construction Systems Associates
• Dassault Systems
• Électricité de France (EDF)
• EPRI Advanced Nuclear Technology Program
• EPRI I&C Program
• EPRI Radiation Management Program
• Halden Reactor Project
• Korea Hydro & Nuclear Power Company (KHNP)
• Lockheed Martin
• Resilient Cognitive Systems
• Southeastern Institute of Manufacturing & Technology (SiMT) / EON Reality

Demonstrations were displayed by the following organizations:
• The Boeing Company
• Construction Systems Associates
• Dassault Systems
• Électricité de France (EDF)
• EPRI I&C Program
• Halden Reactor Project
• Lockheed Martin
• Scientech
• Southeastern Institute of Manufacturing & Technology (SiMT) / EON Reality

After the presentations, a brainstorming session was held during the afternoon of the second day. The first part of the brainstorming session was to identify preliminary lists of:
• Plant problems / opportunities that could benefit from advanced tools and capabilities such as those presented in the meeting but not limited to them.
• Obstacles to implementation.
• Gaps and limitations that require research and development to overcome the obstacles (including for tools, capabilities, guidance, requirements, etc.).
The results of the brainstorming session for these three questions are given below.

A. Plant Problems / Opportunities
   1. Work with EDF for switching / tagging evolutions for shutdown cooling.
   2. Work with 3D vendors to develop training for refueling bridges and polar cranes, including just-in-time training.
   3. Put together training as shown in the McDonalds example in the Lockheed presentation for radiation work permit access. Answers from radiation protection (RP) technicians currently depend on the RP tech. Use the training to get consistent and timely answers for RP questions.
   4. “War Rooms” / Outage Control Centers (OCCs): Use large screen display and room for decision making to save time during outages; predict what problems are coming up; includes information and display of data; e.g., communications with operators when moving to wide-range temperature monitors; OCC could pre-warn operators; war-room could be virtual based upon virtual plant, do not need to keep old paradigms; e.g., the conference room.
   5. Wireless deployment and cost justification: the latest sensor technology and RFID is not IEEE 802.11; cyber-security barriers with other wireless standards that use less energy; possible need for nuclear wireless standard.
   6. Use hard-hat mounted camera with worker to obtain required independent verifications reducing the person-hours and dose expended on the independent verifications (some initial work with hard-hat mounted cameras at EDF).
   7. Operation communications capabilities for obtaining remote expertise and advice.
   8. On-line testing of main station batteries similar to Boeing’s wire testing; technology to test by looking at battery vs. outage testing; e.g., Swiss plant testing of breaker operation to eliminate surveillances.
   9. Security training capabilities to allow virtual force-on-force exercises while on post; fire-watch, FME coordinators, and containment access also could benefit from virtual training.
  10. Look at outage task planning in an integrated way to optimize resources, especially during schedule upsets, including look-ahead capabilities.
  11. Operability decision support system: currently done by a panel of experts in a conference room with paper; instead have one person in the field with a camera and virtual environment for decision making.
  12. Electronic P&ID with linked information: this has multiple uses, including linking to other data from this; drawing overlays of information.
  13. “Fed Ex” in the plant to delivery of parts just in time to the worker in the field through the use of bar coding rather than having the worker spend time going to get the parts.
  14. Capability similar to the Southwest Airlines idea of a ramp-down presented by Hanes to automate more efficient reactor cool-down and heat-up strategies.
  15. Radiation data reflecting current area dose rates in real time on a virtual representation; need to be able to see at RP checkpoint.
  16. Monte Carlo risk analysis in scheduling of critical path needs to be easier.
  17. Use of desk-top training vs. tractor-trailer mobile classrooms for staff.
18. Aging workforce and training; use of technology to capture expert knowledge and populate “sim / virtual mentors”.

19. Generic project around visualization: superimposing pipe stresses, RP, chemistry color coding of conditions – data integration.

20. Use virtual worlds to train operators more quickly with higher success levels (2-years for technicians / operators currently); shorten pipeline for getting trained staff; use for NRC examine preparation; walk-arounds (it was suggested that this could help bring NRC acceptance of the digital world).


22. Operations configuration management using intelligent schematics to ensure line-ups are correct; need cheap way of instrumenting some devices, e.g., to provide indication of open / shut valves.

23. Give people alternatives when they need to make decisions.


25. Sensors for change management to capture and create the plant model; e.g., use to support work for temporary LCO’s, support use of robots in confined spaces.

26. Integrated enterprise application software for nuclear plants.

27. Physical security planning based on 3D models to deal with evolving threat and optimize response; use of gaming technology; technology watching places that need to be manned; communication of command to field units with advanced technology.

28. Build a complete operational model of the plant, electrical, thermal, nuclear, physical to have virtual model running parallel to actual plant and spot early deviations; leverages KHNP work presented.

29. Use tools for self-training, allows more frequent training and avoids stigma of asking for help.

30. Effective radiation exposure: use advanced technology to be more accurate with collective radiation exposure; impacts insurance rates.

31. Minimize outage risk with better work planning, work packages, leveraging off laser scans of plant work areas.

B. Obstacles to Implementation

1. Money: capital funds hard to get, especially with current economy; very high ROI requirements (pay for performance, risk sharing potential solution)

2. Getting NRC and INPO to accept virtual training models (note that INPO is using NANTel to train contractors coming in).

3. Perception of risk and expense with digital technology with upper management.

4. Negative perception of things that look like a video game.

5. Lack of knowledge across the plant that 3D laser scans of some items and spaces already exist at the plant; also lack of understanding that 3D laser scans done for one application are likely to be beneficial for several other uses.

6. Data management: need thoughtful management to ensure data quality.

7. Verification and validation for new technologies: use of a new technology that is not properly validated can give a negative view.

8. Difficult to install new technology with corporate IT group.
9. NRC and INPO acceptance of new technology.
10. New technology is very short-lived, short obsolescence time.
11. No one wants to be first.
12. Change management of the tools once deployed.
13. People don’t like change.
14. Business case for individual applications, tools very low; stronger if aggregated over several applications.
15. Fear that bad visualization or abstraction would lead to poor behavior.
16. User becomes dependent on the tool, and then it breaks. Now what?

C. Gaps and Limitations
1. Reduce costs.
2. Knowledge / awareness to understand and communicate to senior management the available capabilities and their benefits; e.g. :
   a. 3D laser scans.
   b. Extend control room simulator training with software, desktop based simulation for training.
3. Group and prioritize activities, develop roadmap and end-state.
5. Acknowledge differences between existing and new plants; lot more data solutions for a new plant, so full 3D model could be closest for a new plant.
6. Within plant process computers, DCS, thermal performance monitoring software, etc. a wealth of existing information exists and needs to be leveraged.
7. Need for collaborative solutions because an operating utility alone has a very high hurdle to overcome, pooling of resources and sharing of benefits would enable solutions.
8. Radiation monitoring might be a good pilot because current systems are aging.
9. Have INPO acknowledge performance improvements through the use of technology as a “strength”.
10. Use power uprate programs to install upgrades.
11. Tie in with plant risk reduction vs. money to bottom line.
12. Establish coordination with NEI, NRC and INPO.

The second part of the brainstorming session was to identify input on the Plant Productivity Improvement through Advanced Technologies Strategy Group initial goals and objectives and future meeting format and content.

The results of the brainstorming session for these two areas are given below.
A. Initial goals, objectives
1. Collaboratively identify problems, prioritize and move forward on solutions.
2. Outreach to educate and provide understanding on problems and solutions.
3. Work with industry and EPRI to leverage new technology pricing.
4. Provide demonstrations, show value: realistic, broad demonstration, then narrow, deep example.
5. Roadmap and end-point vision.
6. Field trips to see what other industries are doing; e.g., Lockheed Martin.
7. Bring in vendor experts to shadow nuclear workers to see how to use better technology to improve performance.
8. Standardization of forward-reverse compatibility; interoperability and open standards.
9. Prioritize potential applications.
10. Interaction with NITSL (Nuclear Information Technology Strategic Leadership)?

B. Meeting Format / Content
1. Meet at same time and place as Interservice / Industry Training, Simulation and Education Conference (I/ITSEC)? (I/ITSEC is the largest tradeshow in the world for modeling, training and simulation industry).
2. Plan meeting around visiting someone or something; e.g., technology provider, utility site.
3. More interaction, working time; focused topic on deliverables; establish in agenda.
4. Face-to-face meetings twice per year, 2 day meeting plus industry visit, preferably Tuesday – Thursday, suggestions for the 2011 meetings are:
   a. 2/2011 at ______?
   b. 11/2011 at I/ITSEC?

The discussion led to the following EPRI actions:
1. Communication from EPRI on why group is important at advisory meetings.
2. Letter of interest for participation in group to vendors.
3. Provide copies of presentations and meeting materials to all EPRI members and meeting participants.
4. Explore what is required to set-up sharepoint / collaboration site.
5. Provide information of standards, rules, etc. for review by potential group members.
6. Continue outreach to members that did not participate in kick-off meeting.

At the end of the meeting, the group identified meeting pluses and deltas.

Pluses:
- Excellent breadth of speakers
- Exhibition room with demonstrations
- Coordination and scheduling very good
- Good schedule adherence
- Food (lunches and reception) brought to exhibition room rather than being served at the cafeteria, food very good

Deltas:
- Long room with people in the back; need microphone for speakers
- Not many operating companies represented
As mentioned above, membership in the Plant Productivity Improvement through Advanced Technologies Strategy Group is open to utilities and other interested organizations. The group will be funded by its members.

For EPRI Members interested in joining the strategy group, this group is on the 2011 Solicitation as a supplemental funded offering. EPRI Members should talk about joining with their appropriate management and/or Manager of EPRI Technical Transfer (METT).

Other organizations interested in joining the strategy group should contact Joseph Naser (650-855-2107, jnaser@epri.com) or Robert Austin (704-595-2529, raustin@epri.com).

If there are any questions about joining the strategy group, please contact Joseph Naser, Robert Austin or the EPRI Account Executives.