

## Process Control Operator Training: Identifying Needs and Research Priorities

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### *Summary Overview*

The purpose of this project was to consider process control operator performance from a training perspective and to identify, describe and discuss training challenges and opportunities for the process control industry. The researchers visited one refinery and one paper mill. At these facilities, they conducted structured and unstructured interviews and also observed process control operators to gain insight into the domain. Next, the researchers integrated their observations and interview notes with the applicable training research literature, drawing, in particular, on the researchers' experience supporting training in the aerospace and defense sectors. The results are organized and described in terms of the fundamentals of training, team performance, and expertise.

#### Fundamentals of training

This portion of the report provides background information on training and includes a description of possible transfer of training issues. Transfer of the knowledge and skills acquired in training to on-the-job performance depends on characteristics of the trainee, the training strategy, and the work environment. Although all the console operators tended to be mechanically minded individuals who had worked both outside and indoor positions, the console operators varied in terms of number of years of experience as console operators, comfort with technology, and degree of self-efficacy. Work environment characteristics including perceived workload and decision-making autonomy also varied between the two plants. Training departments who consider where the personnel fall on these characteristics can select programs to best fit their needs. Both plant training departments had vast amounts of domain expertise, which could be complemented with their developing knowledge of the science of training. The appendix offers a review of existing "off-the-shelf" short courses for process control operators.

#### Team Performance

Process control operators are members of highly interdependent teams. This includes teams consisting of indoor-outdoor personnel, the indoor process control team itself, and the console operator, engineer, & operations management team. With many similarities to military and aviation teams, an opportunity exists to apply military and aviation team performance research to process control. This includes identifying the team knowledge, skills, and attitudes that are most crucial to process control teams along with the accompanying training methods.

#### Expertise

Both plants had console operators with decades of experience. As described in the expertise literature, in-house expertise of this nature can be a veritable gold mine for an



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organization. In one plant, management policies appeared to appreciate the level of expertise and, for example, gave the console operators some degree of decision-making autonomy, whereas the other plant struggled with the expert operators for various reasons. Training suggestions will differ for these two situations.

### Training strategies

This section describes a dozen possible training strategies. Based on research in training, team performance, and expertise, the strategies aim to advance the reliability of process control facilities through both team coordination and development and preservation of individual expertise. One strategy to foster team coordination is the Distributed Diagnosis Exercise, a scenario-based strategy focused on helping crews work together to quickly diagnose and respond to system anomalies and events. One training strategy aimed to foster individual expertise is Mentee-Driven Mentoring and helps plants to take advantage of existing mentoring arrangements.

### Future Research

Possible future research includes developing domain specific training tools/resources, designing and implementing the training strategies, surveying the defense simulation industry for simulation options for process control, and conducting organizational surveys to better understand the impact of plant organizational culture on plant performance.

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