



# HUMAN-SYSTEMS INTEGRATION (HSI) CONSIDERATIONS IN CONTROL SYSTEMS

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# Engineering Human Needs into Drilling Control Systems

- ▶ Human Factors Engineering (HFE)
  - ▶ The practice of designing products, systems or processes that fully consider interaction between them and people who use them
- ▶ Automation removes the human – why consider human needs?
  - ▶ Completely engineering human out of drilling operations is unlikely
  - ▶ HFE processes will help define a phased automation plan that will be tailored to fit the changing needs of personnel

# Review of Automation Levels

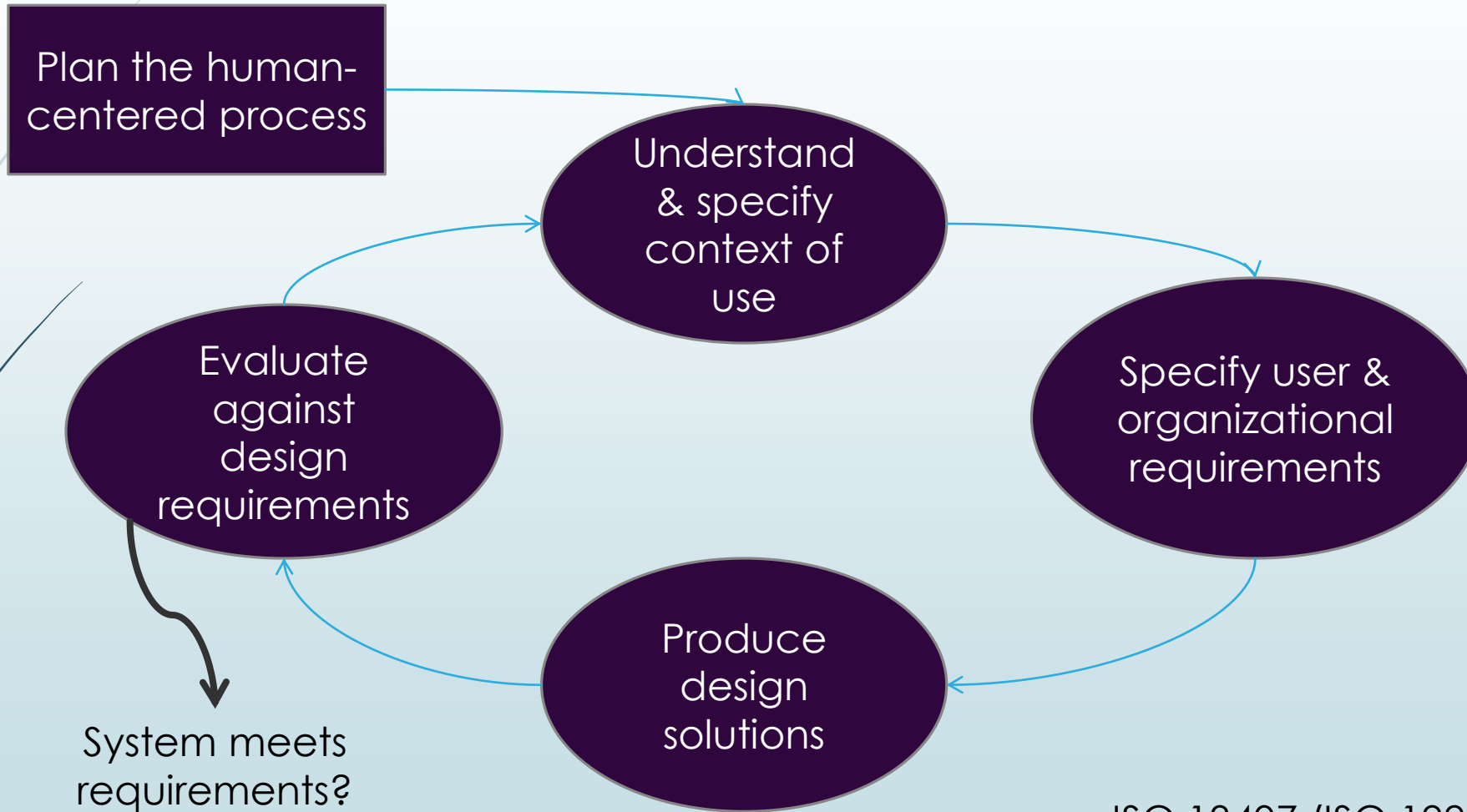
Automation Level	Automation Description
1	System offers no assistance; the human must do it all.
2	System suggests alternative ways to do the task.
3	System suggests one way to do the task and
4	...executes that suggestion if the human approves, or
5	...allows the human a restricted time to veto before automatic execution, or
6	...executes the suggestion automatically, then informs the human, or
7	...executes the suggestion automatically, then informs the human only if asked.
8	System selects the method, executes the task, and ignores the human.



# Strategy for Implementing Automation

- ▶ Highest Priority – Take people out of harm's way
- ▶ Reliance on methods such as task analysis to
  - ▶ dissociate simple from complex tasks
  - ▶ understand what, how & why personnel are performing a task
- ▶ Implement automation in gradual steps beginning with simple tasks first
- ▶ HFE will take into account human performance needs and limitations at all stages of implementing drilling systems automation

# Human-Centered Design



ISO 13407 (ISO 1999)



# Why Human-Centered Design?

- ▶ Safety – Adherence to HF design principles avoids setting the stage for operator error
- ▶ Efficiency – Meeting operator requirements improves operator efficiency!
  - ▶ If technology is intuitive less time is spent analyzing complex information and more time successfully executing job tasks
- ▶ ROI – Recommendation of 10% investment in HSI efforts at the outset of development project
  - ▶ Upfront HSI investment prevents costly redesign of unsafe and onerous systems
  - ▶ Computer usability: 200% – 500% return on a 6% budget investment (Nielson, 1993)



# Human Systems Integration

- ▶ Process originating from the Department of Defense
- ▶ Refers to relationship between humans and environment and how systems are designed and used relative to that relationship
- ▶ Principal goal - to ensure safe and effective relationship between human and system that meets the mission.



# Human Systems Integration

- ▶ Assures the systems takes into account:
  - ▶ System manpower
  - ▶ Personnel
  - ▶ Training
  - ▶ Safety and occupational health
  - ▶ Habitability
  - ▶ Personnel survivability
  - ▶ Human factors engineering





# Human Systems Integration

- Using automation to optimize Manpower for safe and efficient operations
  - Promoting safety by removing people from rig floor and from drill site
  - Removing personnel from off-shore has a large impact on reducing costs
  - During times when there are a lack of personnel to support operations, automation through remote means helps bridge personnel gap
  - Benefit to having multiple teams in a collaborative cross crew environment
  - Gains in performance – doing more with less personnel



# Human Systems Integration

## ■ Personnel

- Defining benchmark personnel roles in drilling operations
- How will these roles change with the introduction of automation?
- What workforce development initiatives will be required?
- Automated rigs during demonstration phases may require higher educated people; then tailor training programs to ensure competency for people without an engineering degree.
- Applied engineering degree programs for drill rig personnel – community college and university level programs



# Human Systems Integration

## ► Training

- Are current training programs adequate for existing job roles?
- Can we look to other industries to compare training programs?
- How will the programs need to be modified to ensure skills and mental models of drilling operations remain intact?
- Requires a plan to update training to reflect the addition of automated technology.



# Human Systems Integration

## ► Training

- Silo training, very specialized; directional downhole and surface
- Training may need to be cross-disciplined
- Simulators on a regular basis to train for emergency situations
- Complacency – 100% trust not a good idea (chronic unease)



# Human Systems Integration

- Safety and occupational health
  - Adoption of Safety Management System for not only personnel safety but process and technology / equipment safety
  - Adoption of safety reporting system for operators and contractors
    - Encourage reporting of process and technology / equipment safety
  - Get folks off the rig – general approach



# Human Systems Integration

- ▶ Human factors engineering
  - ▶ Area focuses on human-machine interface
  - ▶ Critical factors in the HMI
    - ▶ Optimizing workload with adaptive and adaptable automation
    - ▶ Optimizing controls, information displays and visualization tools to promote situational awareness
    - ▶ Plan to combat complacency (chronic unease)
    - ▶ Addressing skill degradation with embedded knowledge in the design of the HMI
    - ▶ Addressing operator distrust – careful attention to system status messages, alarms and system reliability



# Got Questions?

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