A wide-angle photograph of Earth from space, showing the curvature of the planet and the atmosphere. The International Space Station (ISS) is visible in the lower center of the frame, with its complex structure and solar panels clearly defined. The background is the deep blue of the Earth's oceans and the white of the clouds.

Human Factors Engineering in System Design for Operationally Responsive Ground Systems

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Human Factors Engineering

- Human Factors Engineering (HFE) is the essential link between System Design Engineering and End Users/Operators. The field of human factors engineering uses scientific knowledge about human behavior in specifying the design and use of a human-machine system. The application of human factors engineering will “create a human-system interface that will operate within human performance capabilities, meet system functional requirements, and accomplish mission objectives.”

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Human System Integration Challenges – What they are

- Human Perceptual, Cognitive and Performance Characteristics
- Display and Control Design
- Design of Equipment, Vehicles, and Other Systems
- Workplace, Crew Station, and Facilities Design
- Automation and Human-Machine Integration
- Work Design





Human System Integration Challenges – What they are

- Human Perceptual, Cognitive and Performance Characteristics
 - Sensory processes in vision, hearing and other senses.
 - Spatial awareness and perceptual organization
 - Attention, Cognition, Decision-making and Problem Solving
 - Attention, Workload and Situational Awareness
 - Learning and Memory
 - Performance, Speed, Accuracy and Reliability
 - Stress, fatigue, and other psychological and physiological states
 - Individual differences





Human System Integration Challenges – What they are

- Display and Control Design
 - Input Devices and Controls
 - Grouping and Arrangement of Controls
 - Process Control and System Operation
 - Control/Display Integration
 - Information Presentation





Human System Integration Challenges – What they are

- Design of Equipment, Vehicles, and Other Systems
 - Portable Systems and Equipment
 - Remote Handling Equipment:
 - Command and Control Systems
 - Manpower and Crew Size Requirements
 - Maintainability
 - Usability





Human System Integration Challenges – What they are

- Workplace, Crew Station, and Facilities Design
 - Anthropometry
 - Console and Workstation Dimensions and Layout
 - General Workplace and Building Design
 - Design of Non-Work (service) facilities
 - Design of self-contained working/living environments





Human System Integration Challenges – What they are

- Automation and Human-Machine Integration
 - Allocation of Functions between Human and Machine
 - Automation of Human Tasks
 - Aiding of operators, maintainers, and teams
 - Artificial Intelligence
 - Virtual Environments





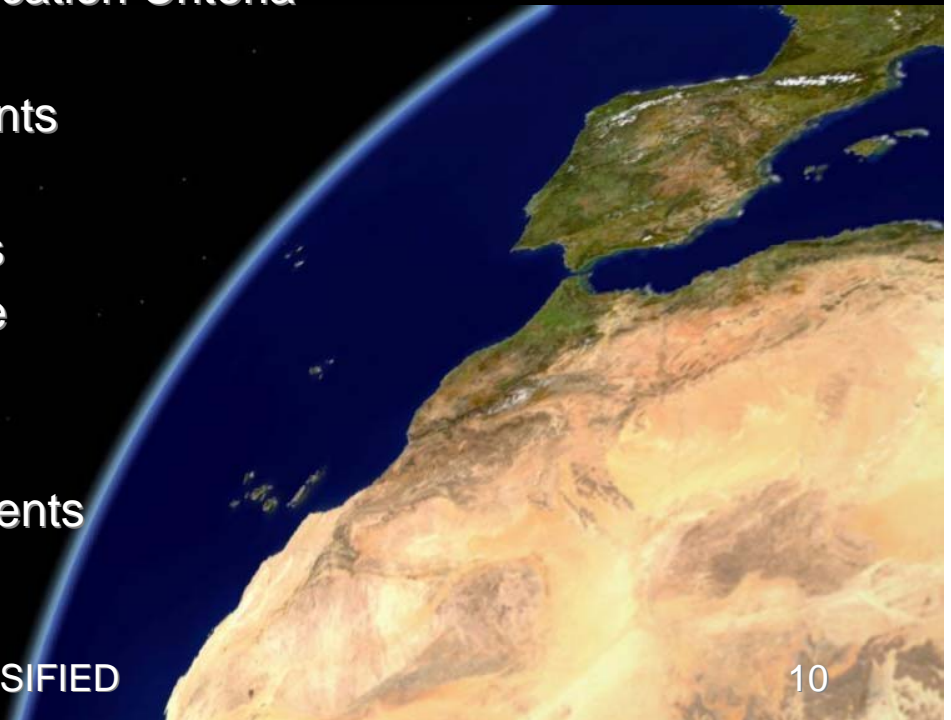
Human System Integration Challenges – What they are

- Work Design
 - Task Description, Task Analysis, and Task Allocation
 - Job skill, structure, and organization
 - Work Duration, Shift Work, and Sustained and Continuous Operations
 - Job Attitudes, Job Satisfaction, and Morale
 - Training, Instructional Manuals, and Job Support



Meeting the Challenges - Implementing and Integrating Human Factors

- Program Proposals, Definition, and Planning
 - Definition of System Operation and Usage
 - High Level Requirements and Verification Criteria
 - HFE Level of Effort
- Design and Development
 - Detailed Requirements and Verification Criteria
 - Design Contributions
 - Preliminary/Predictive Assessments
- Testing
 - Incremental/Interim Assessments
 - Final Verification and Acceptance
- Tools
 - Operability Database
 - Human Engineering Plan Documents



Meeting the Challenges - Implementing and Integrating Human Factors

- Program Proposals, Definition, and Planning
 - Baseline Scenario Development
 - High-Level definition of expected involvement of the human in the overall system
 - Requirements and Verification
 - Scope of HFE effort

Meeting the Challenges - Implementing and Integrating Human Factors

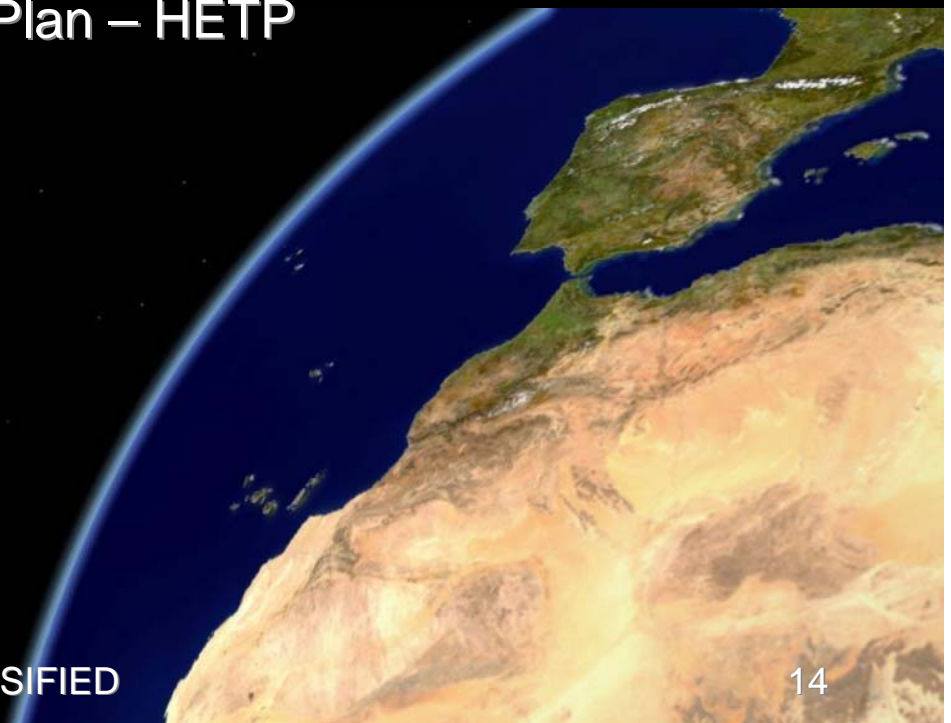
- Design and Development
 - Detailed Requirements and Verification Criteria
 - Human System Interface Design Style Guidance
 - Preliminary/Predictive Assessments
 - Task Analysis
 - Predictive Workload Analyses
 - Manning and Crew Construction
 - Collaboration with Development Engineers
 - Operability Design Team Meetings
 - Reports
 - Collaboration with Training and Operations Group

Meeting the Challenges - Implementing and Integrating Human Factors

- Testing
 - Incremental/Interim Assessments
 - Individual Performance
 - Crew Performance
 - Design Implementation
 - Final Verification and Acceptance Testing
 - Repetition of Incremental/Interim Assessments
 - Operational Environment Assessments

Meeting the Challenges - Implementing and Integrating Human Factors

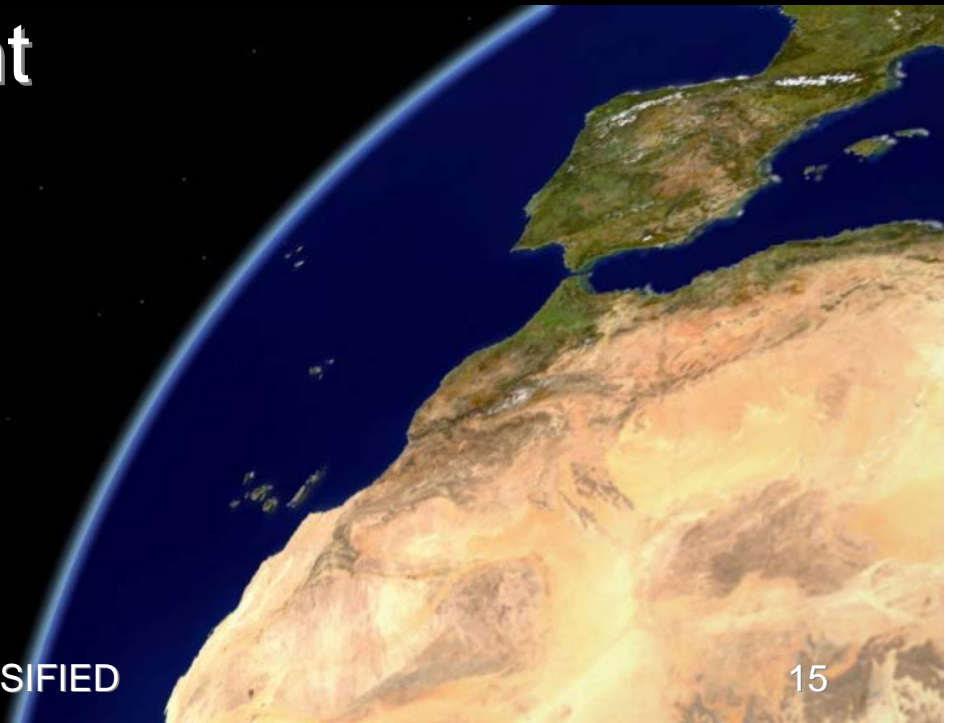
- Tools
 - Operability Database
 - Human Engineering Plan Documents
 - Human Engineering Program Plan – HEPP
 - Human Engineering Test Plan – HETP





Meeting the Challenges - Human Factors Programmatic Activities

- Program Lifecycle Engagement
- Total System Approach
- Concurrent Engineering Approach
- Operator Involvement
- Coordination
- Detailed Plan





Summary

- Ground Systems are challenging to HFE
- Sound Human Factors Engineering principles and practices will enable a program to successfully respond to and conquer the challenges



Questions?



References

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