



# Establishing Trust in NASA's Artemis Campaign Computer-Human Interface (CHI) Implementation

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# Agenda



- Background
- Artemis Computer-Human Interface(CHI) Elements
- Principles of Space Systems Human Rating Requirements
- Establishing Trust In Crew Controls
- Conclusion

# Background



## Artemis Campaign

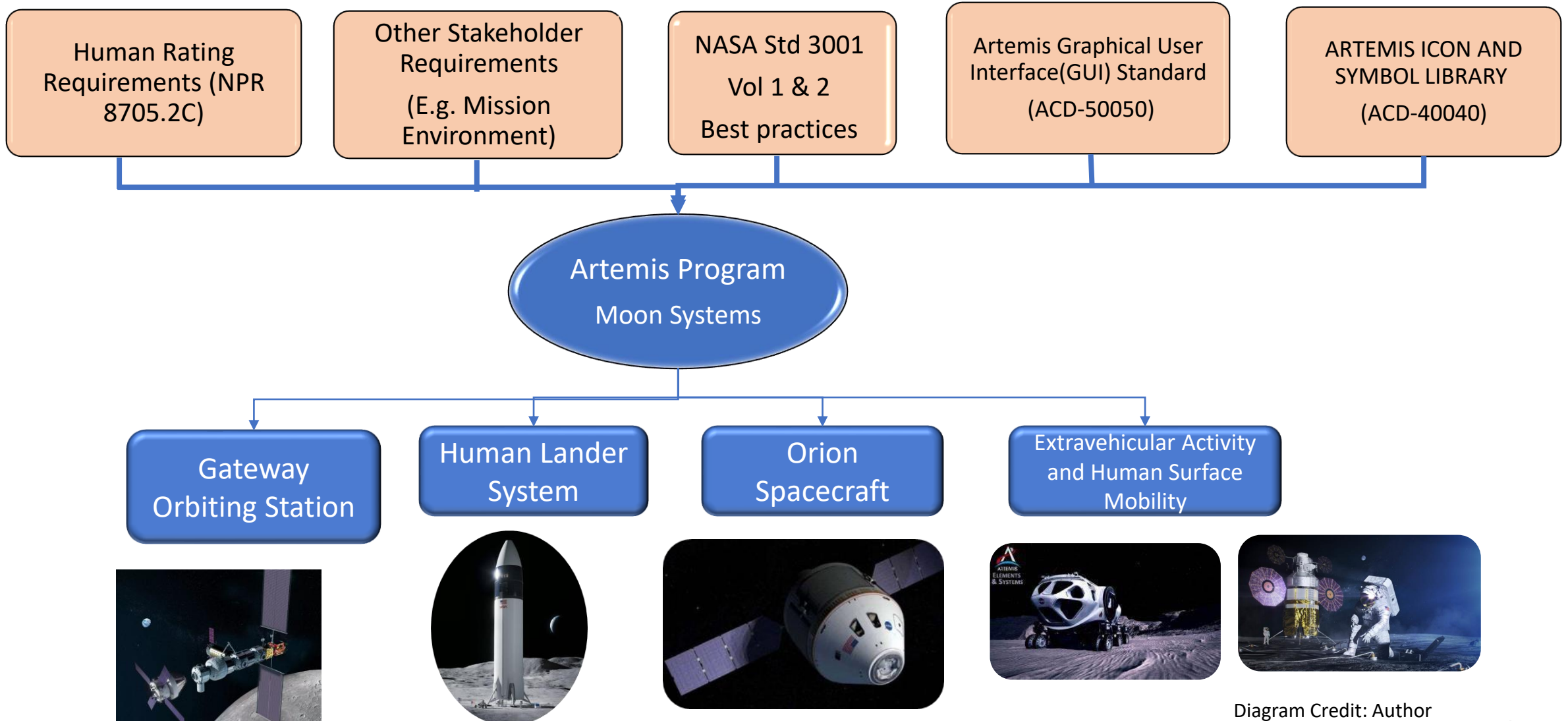
**In LEO**  
Commercial & International  
partnerships

**In Cislunar Space**  
A return to the moon for  
long-term exploration

**On Mars**  
Research to inform future  
crewed missions



# Artemis Campaign-Human Requirements



# Notional Space System CHI Elements

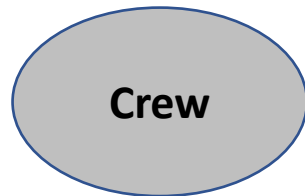


Ground Control

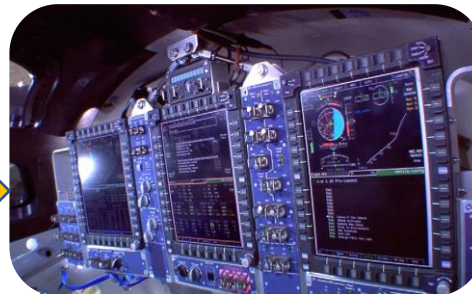
**Crew Controls/Displays**



Space System Avionics



Crew



Imagery  
(Internal/External)



Lighting (internal/External)



Audio (Internal/External)



# Human-Rating Space Systems



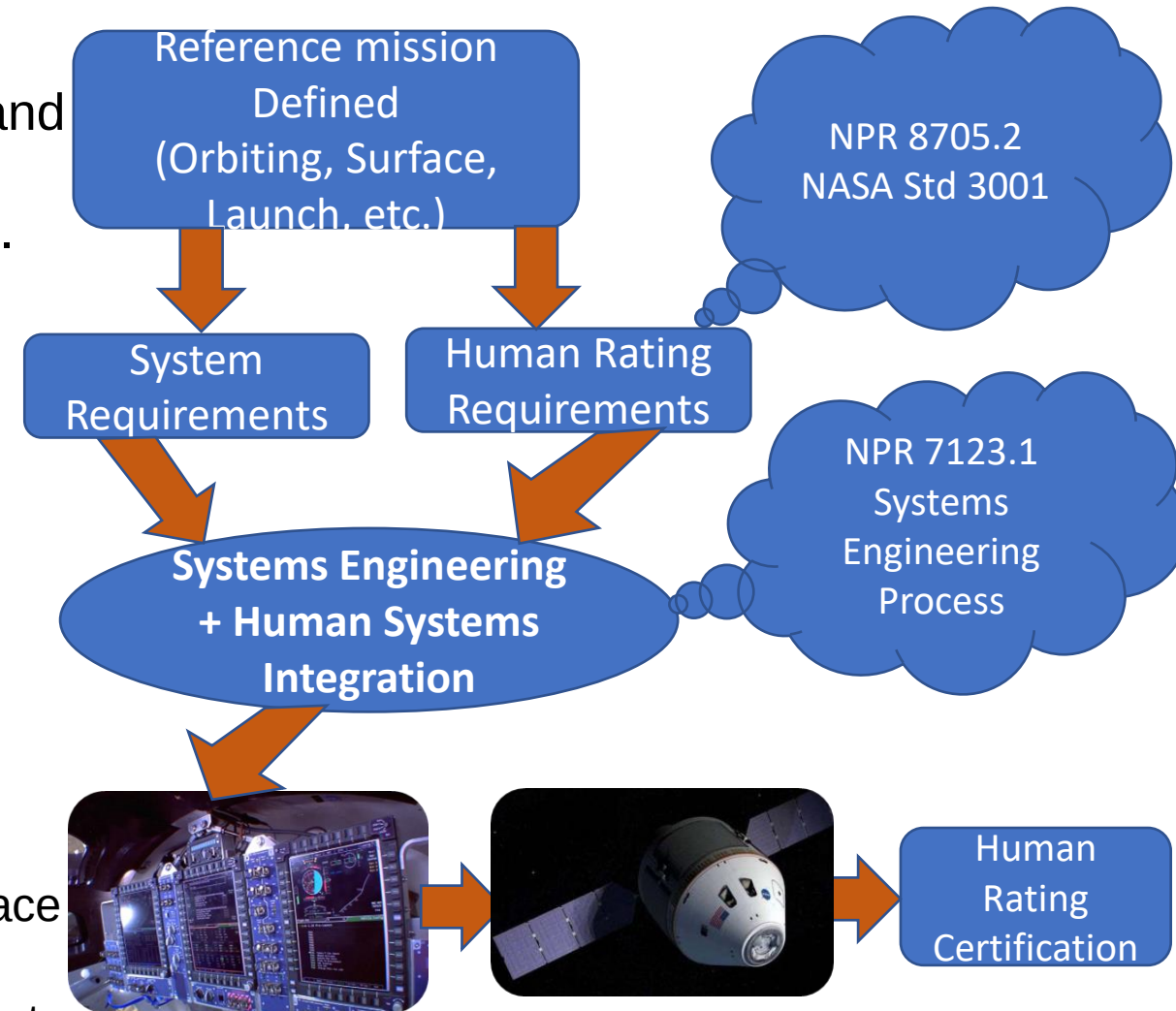
- Human rating certification is at the vehicle level but applies at the Crew Controls subsystem level too.
- Certification of a space system or launch vehicle that can safely accommodate and transport humans.
- Space mission risks cannot be totally eliminated.
  - Mitigated through additional processes, procedures, and requirements that accommodate human needs, capabilities, and limitations.
- Human rating consists of three fundamental principles
  1. System can safely conduct the required human mission
  2. Human interaction design features/capabilities to enhance overall safety and mission success
  3. Design features/capabilities to enable the safe recovery of the crew from hazardous situations





# Establishing Crew Controls Trust?

- What is it?
  - Proven confidence that the human, the machine, and the interactions/interdependencies between them successfully perform a specific function or mission.
- How is trust obtained?
  - Human rating certification process
    - ❖ Processes and standards used
    - ❖ Designing the system
    - ❖ Verifying and validating the system capabilities/performance
    - ❖ Flight Test the system
    - ❖ Certifying/operating the human-rated system
- Why is it important?
  - Ensure human error is minimized when controlling a space system
  - Provide confidence and assurance the system will operate consisting as expected.



# Human Systems Integration

- An interdisciplinary and comprehensive management and technical process that ensures the human element is factored in the design of the system.
  - Technical process to ensure human performance issues related to H/W & S/W are addressed as part of the SE process
  - Management process to ensure human-related concerns are addressed at all aspects of the program/project—risk management, planning, etc.

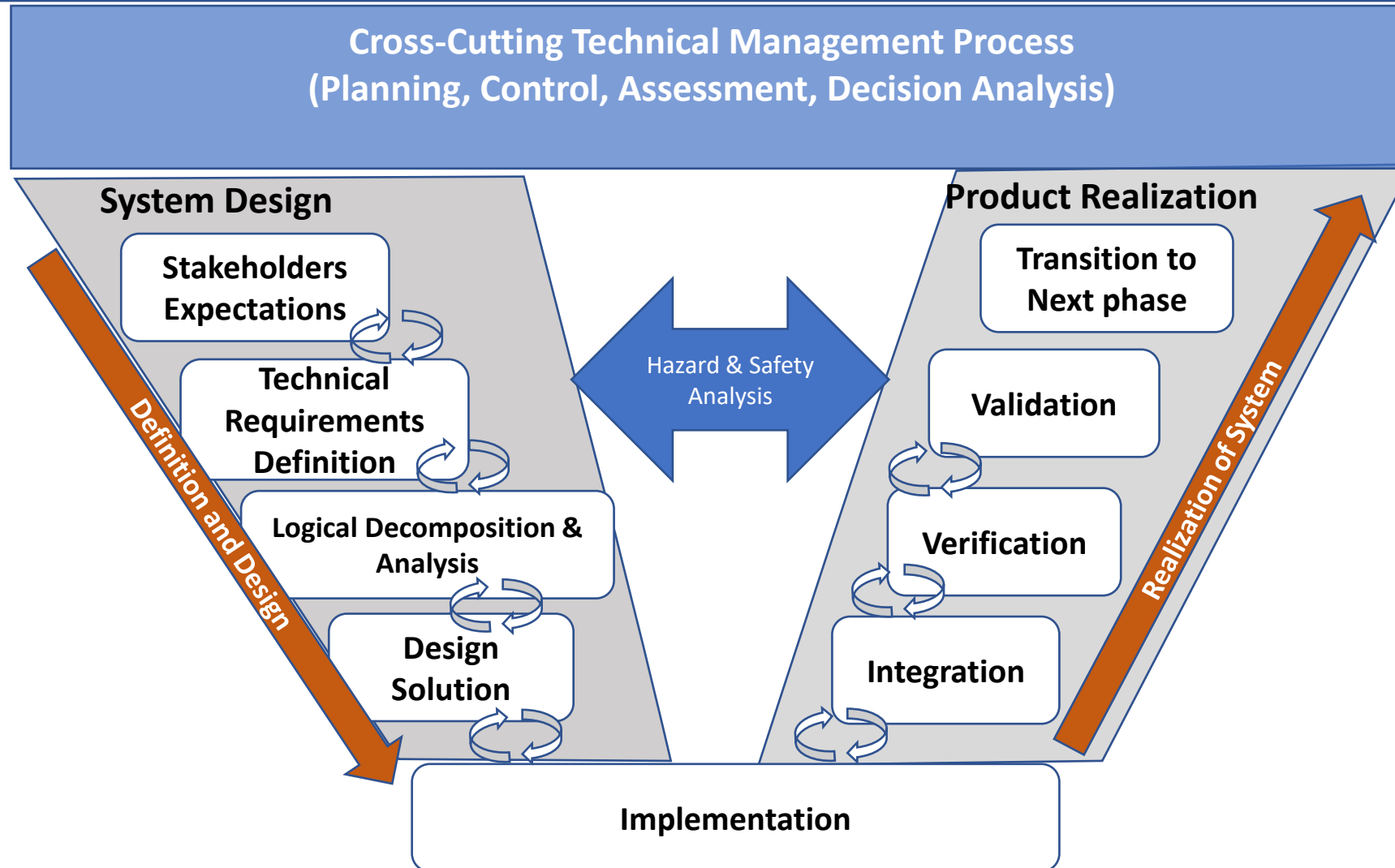


Integration within each domain=Optimize Human Performance  
Integration across domains= Optimize total system performance  
**System performance \* Human Systems Performance**



# Systematic Development Approach

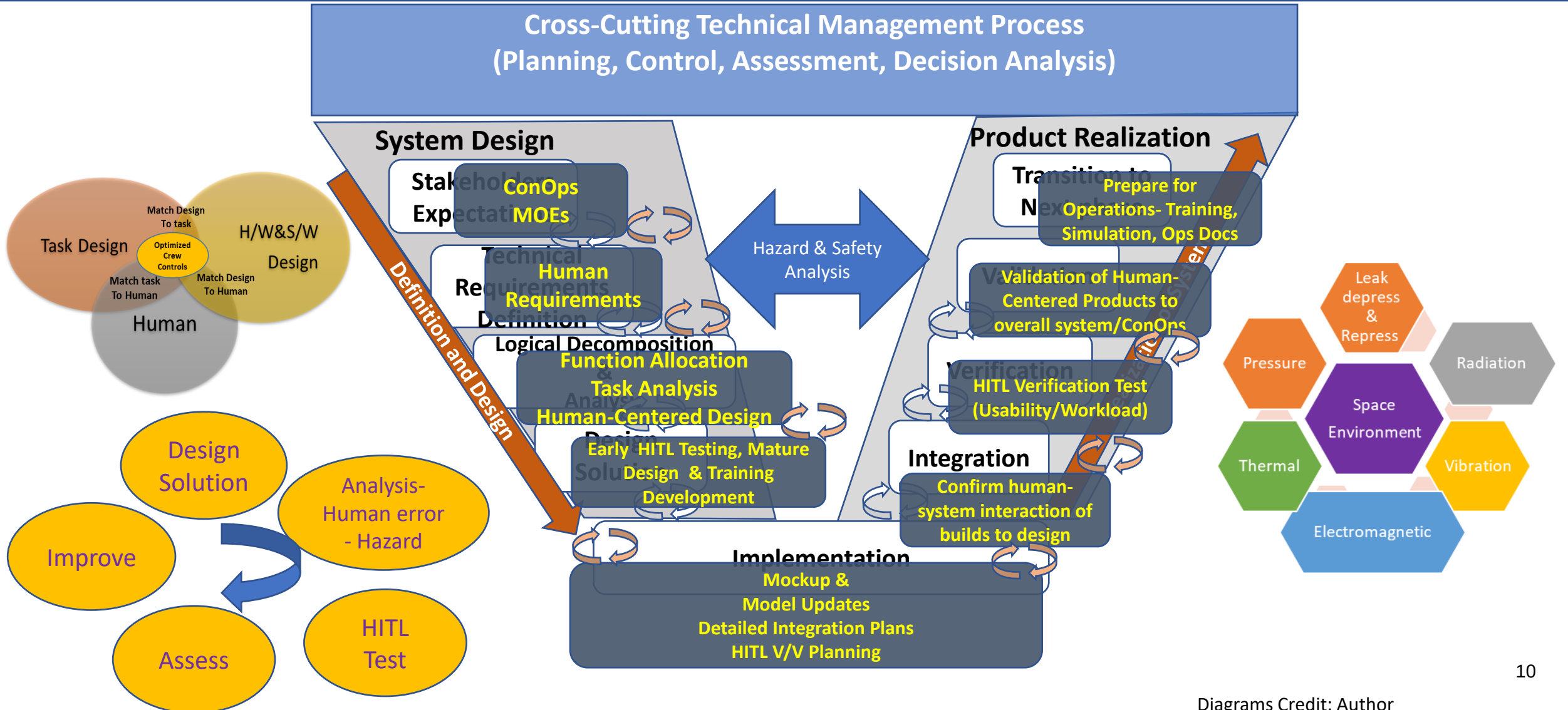
## Systems Engineering + Human Systems Integration(HSI)





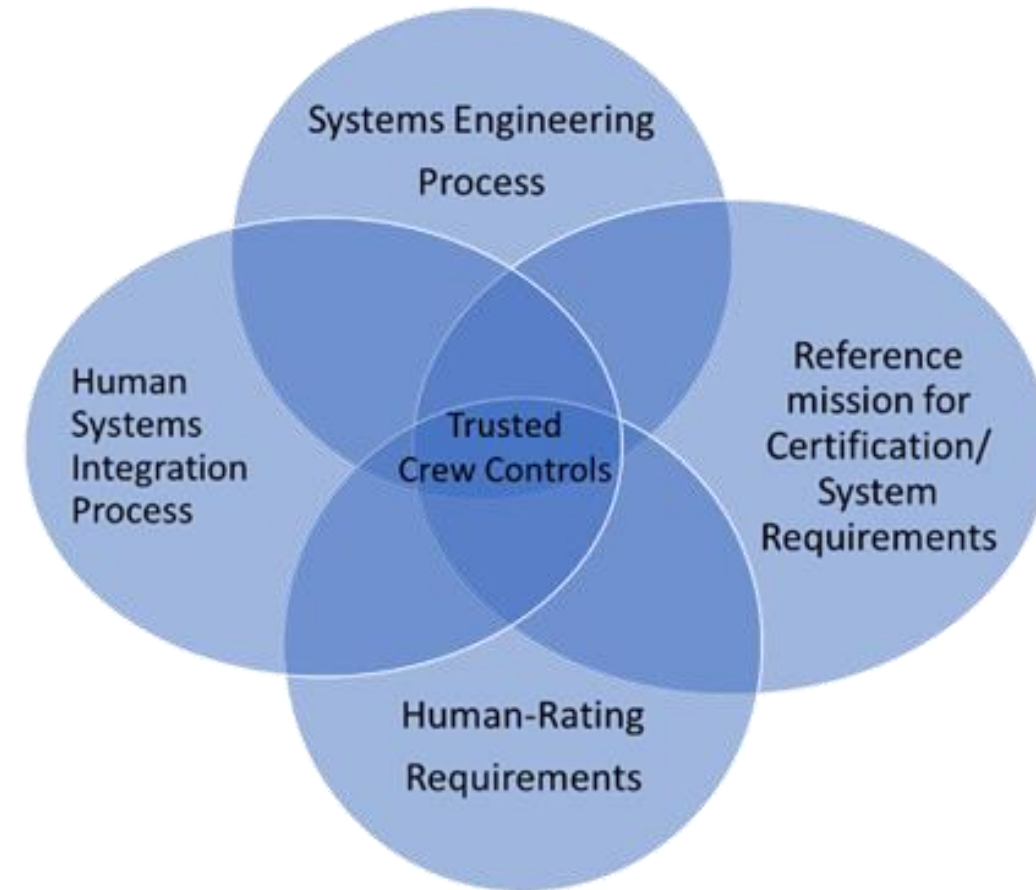
# Systematic Development Approach

## Systems Engineering + Human Systems Integration(HSI)



# Crew Control Trust Summary

- Reference mission defines the system and human requirements
- Human Rating Certification
  - Identifies what processes and activities are required to human rate a system
- HSI Process
  - Ensures technical and management processes factor the human element into the system development
  - Human-centered design along with safety/hazard/human error analysis to mature the design
- Systems Engineering Process
  - Orchestrates a structured, systematic approach to system development & risk reduction
  - Ensures all processes and activities associated with the human rating are executed
    - ❖ Verification and Validation events



# Conclusion



- Deep space missions' complexity will demand safer, more efficient, and more effective crew control subsystem.
- Crew controls will play a critical role in ensuring mission success.
- Human rating certification ensures the design **accommodates human needs, effectively utilizes human capabilities**, controls hazards, and manages safety risks associated with human spaceflight
- Establishing trust in crew controls entails human rating certification that combines systems engineering and human systems integration processes and procedures.
- Trust will provide confidence to the crew that the crew controls will operate consistently and effectively in the mission.

# Questions

