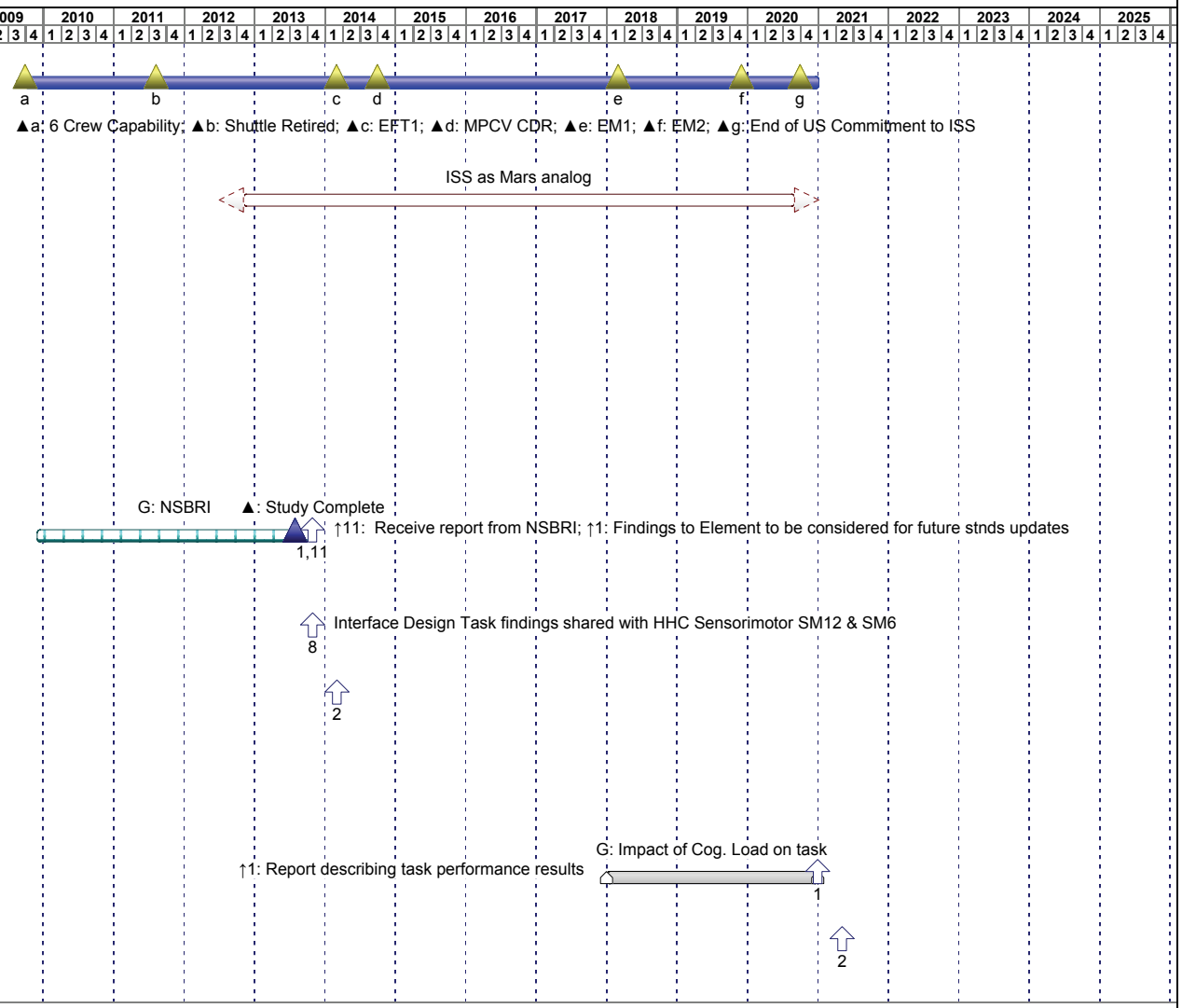
G: Ground Study		**Early Start**		**6) Technology**	
F: Flight Study		**Task To Be Determined After Decision Point**		**7) Countermeasure**	
L: Lunar		**Major Milestone/Event/Accomplishment**		**8) Information To/From other Elements**	
NSBRI		**1) Risk Characterization**		**9) Information to HSRB**	
DA&M: Data Analysis & Modeling		**2) Task↓↑Task**		**10) Requirements**	
FP: Flight Prep		**3) Standards - New**		**11) Study**	
AO: Add on to another study		**4) Standards - Update**		**Stop**	
Planned/unfunded		**5) Tools**		**Major Decision Point**	

Task Name

ISS and other vehicles



Space Human Factors Engineering (SHFE)

RISK OF INADEQUATE HUMAN-COMPUTER INTERACTION (HCI)

SHFE-HCI-01: What are the effects of vibration and acceleration on crew task performance and how can those effects be mitigated?

Robust Human-System Interface Design for Spaceflight-Induced Environments (NSBRI, L. Stone)

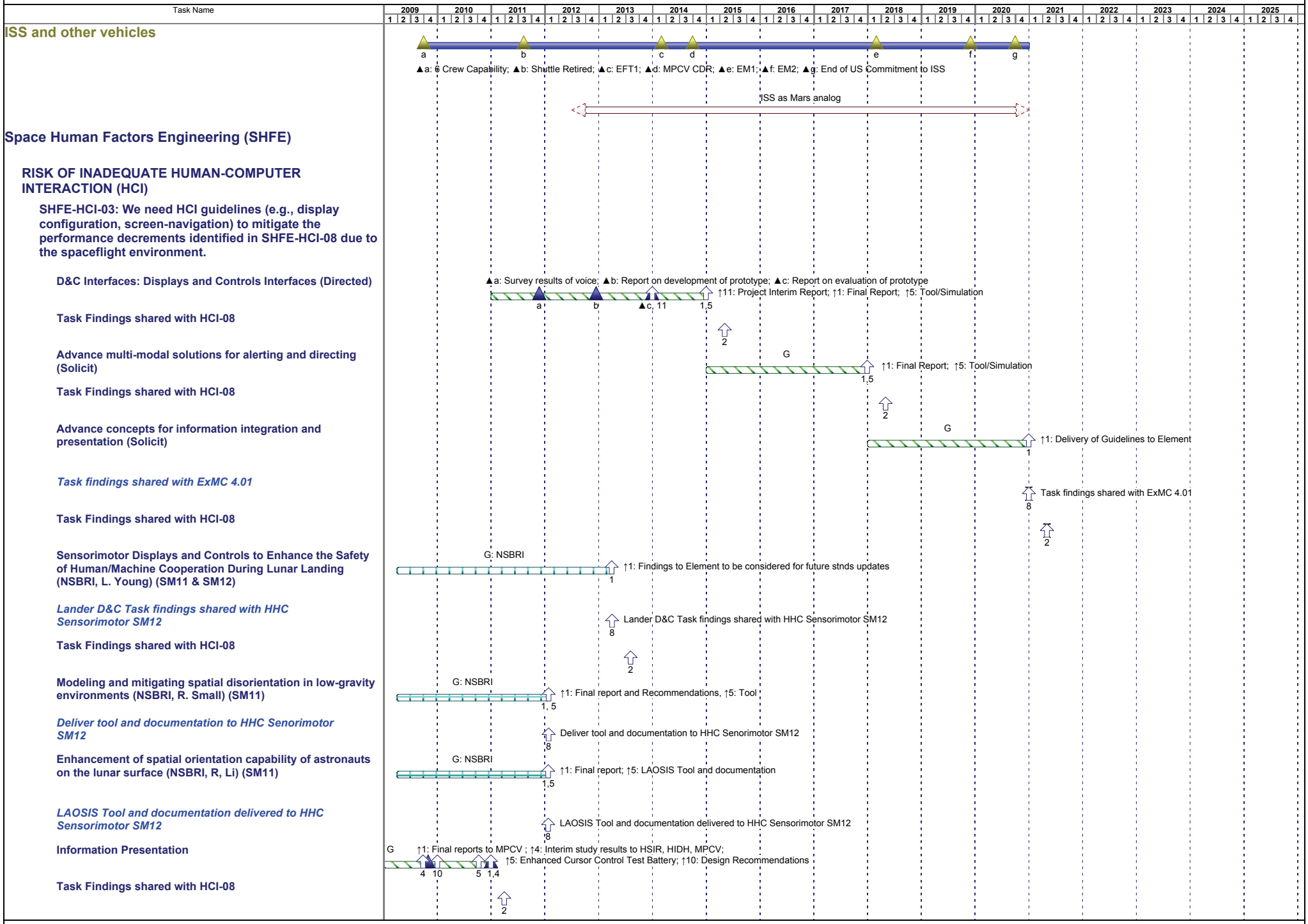
Interface Design Task findings shared with HHC Sensorimotor SM12 & SM6

Task Findings shared with HCI-02, HCI-05 & HCI-03

SHFE-HCI-02: We need to understand what aspects of cognitive function change during long-duration missions and how this affects task performance.

Effects of Attention and Cognitive Load on Long-Duration Task Performance (Unfunded)

Task Findings shared with HCI-05


Task Name
2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
ISS and other vehicles
a b c d e f g
▲a: 6 Crew Capability; ▲b: Shuttle Retired; ▲c: EFT1; ▲d: MPCV CDR; ▲e: EM1; ▲f: EM2; ▲g: End of US Commitment to ISS
ISS as Mars analog
Space Human Factors Engineering (SHFE)
RISK OF INADEQUATE HUMAN-COMPUTER INTERACTION (HCI)
SHFE-HCI-03: We need HCI guidelines (e.g., display configuration, screen-navigation) to mitigate the performance decrements identified in SHFE-HCI-08 due to the spaceflight environment.
D&C Interfaces: Displays and Controls Interfaces (Directed)
▲a: Survey results of voice; ▲b: Report on development of prototype; ▲c: Report on evaluation of prototype
↑11: Project Interim Report; ↑1: Final Report; ↑5: Tool/Simulation
a b ▲c, 11 1,5
Task Findings shared with HCI-08
2
Advance multi-modal solutions for alerting and directing (Solicit)
G
↑1: Final Report; ↑5: Tool/Simulation
1,5
Task Findings shared with HCI-08
2
Advance concepts for information integration and presentation (Solicit)
G
↑1: Delivery of Guidelines to Element
1
Task findings shared with ExMC 4.01
Task findings shared with ExMC 4.01
8
Task Findings shared with HCI-08
2
Sensorimotor Displays and Controls to Enhance the Safety of Human/Machine Cooperation During Lunar Landing (NSBRI, L. Young) (SM11 & SM12)
G: NSBRI
↑1: Findings to Element to be considered for future stnds updates
1
Lander D&C Task findings shared with HHC Sensorimotor SM12
Lander D&C Task findings shared with HHC Sensorimotor SM12
8
Task Findings shared with HCI-08
2
Modeling and mitigating spatial disorientation in low-gravity environments (NSBRI, R. Small) (SM11)
G: NSBRI
↑1: Final report and Recommendations, ↑5: Tool
1, 5
Deliver tool and documentation to HHC Senorimotor SM12
Deliver tool and documentation to HHC Senorimotor SM12
8
Enhancement of spatial orientation capability of astronauts on the lunar surface (NSBRI, R, Li) (SM11)
G: NSBRI
↑1: Final report; ↑5: LAOSIS Tool and documentation
1,5
LAOSIS Tool and documentation delivered to HHC Sensorimotor SM12
LAOSIS Tool and documentation delivered to HHC Sensorimotor SM12
8
Information Presentation
G
↑1: Final reports to MPCV ; ↑4: Interim study results to HSIR, HIDH, MPCV;
↑5: Enhanced Cursor Control Test Battery; ↑10: Design Recommendations
4 10 5 1,4
Task Findings shared with HCI-08
2

Task Name

2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

ISS and other vehicles

a b c d e f g

▲a: 6 Crew Capability; ▲b: Shuttle Retired; ▲c: EFT1; ▲d: MPCV CDR; ▲e: EM1; ▲f: EM2; ▲g: End of US Commitment to ISS

ISS as Mars analog

Space Human Factors Engineering (SHFE)

RISK OF INADEQUATE HUMAN-COMPUTER INTERACTION (HCI)

SHFE-HCI-04: We need to understand how emerging multi-modal and adaptive display and control technologies are best applied to the design of HCI for proposed long-duration DRM (Design Reference Missions) operations.

Tech Watch for Improving HCI in Next-Generation Missions (unfunded)

G: Evaluating the effectiveness of emergent HCI technologies

Planned/Unfunded

5

Task Findings shared with HCI-03, HCI-05, HCI-06 & HCI-08

2

SHFE-HCI-05: We need verifiable requirements that specify standard measurement techniques and metrics for evaluating the quality of user interfaces with specific attention to the usability and evolvability of an interface.

Usability Evaluation(Directed)**

G ↑4: Recommendation to standards;↑10: Usability recommendations for Lander SRR

↑8: Deliver report to HSIR; ▲a: Report on usability of text and labels; ▲b: Summary Report

a b 4,8,10

Task Findings shared with HCI-08

2

Human Factors Analysis Support Tool (H-FAST) SBIR

PHASE II H-FAST

G:SBIR

PHASE II: H-FAST Stop

5

PHASE II: H-FAST Decision Point (Continue to Phase III?)

Continue to Phase III?

Yes ↓ No → Stop

PHASE III H-FAST

G: refine prototype

Planned/unfunded

Task Findings shared with HCI-08

2

Task Name

2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

ISS and other vehicles

a b c d e f g

▲a: 6 Crew Capability; ▲b: Shuttle Retired; ▲c: EFT1; ▲d: MPCV CDR; ▲e: EM1; ▲f: EM2; ▲g: End of US Commitment to ISS

ISS as Mars analog

Space Human Factors Engineering (SHFE)

RISK OF INADEQUATE HUMAN-COMPUTER INTERACTION (HCI)

SHFE-HCI-06: We need guidelines to ensure crewmembers receive all of the information required to accomplish necessary tasks in a timely fashion, even when operating autonomously.

Information Architecture for Exploration Missions (Solicit)

↑5: Final version of interactive IA prototype demonstrating recommended approach

G 5,1

↑1: Report with suggested guidelines and recommendations to SHFE/SHFH

Task Findings shared with HCI-08

2

Information Integration for Electronic Procedures (unfunded)

↑1: Report with suggested guidelines and recommendations to SHFE/SHFH

Planned/Unfunded 1

Task findings shared with ExMC 4.01

Task findings shared with ExMC 4.01

8

Task Findings shared with HCI-08

2

Task Name

2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

ISS and other vehicles

a b c d e f g

▲a: 6 Crew Capability; ▲b: Shuttle Retired; ▲c: EFT1; ▲d: MPCV CDR; ▲e: EM1; ▲f: EM2; ▲g: End of US Commitment to ISS

ISS as Mars analog

Space Human Factors Engineering (SHFE)

RISK OF INADEQUATE HUMAN-COMPUTER INTERACTION (HCI)

SHFE-HCI-07: Can crewmember spatiomotor abilities be more accurately predicted and countermeasures and training techniques developed to mitigate spatial disorientation during spaceflight? (Gap merged with HCI-03)

This gap was merged with SHFE-HCI-03

2

SHFE-HCI-08: We need to define the acceptable level of risk for HCI performance relative to terrestrial baselines.

A Research Roadmap Approach to Defining the Risk of Inadequate HCI (Unfunded)

Planned/Unfunded

↑1: HSRB presentation-for an acceptable level of Risk 1