## Risk of Reduced Crew Performance and of Injury Due to Inadequate Human-System Interaction Design

### Gateway Lifecycle Milestones

<table>
<thead>
<tr>
<th>Ground Flight Element</th>
<th>Integration</th>
<th>Planetary</th>
<th>Undefined</th>
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### DST Planning Milestones (PPBE19)

<table>
<thead>
<tr>
<th>DST NHV &amp; Layout Standards; Tools Validated</th>
<th>Validated Human Performance</th>
<th>Updated Human Performance</th>
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<tbody>
<tr>
<td>Gateway Assn (ISS Hab) - Greene (667) - HAB</td>
<td>HAB Assessment (ISS Hab) - Greene (667) - HAB</td>
<td>DST NHV &amp; Layout Standards</td>
</tr>
<tr>
<td>Vehicle Design with VR - Anderson (1250) - HAB</td>
<td>VR Requirements Assessment (Adolf)</td>
<td>Habitat Standards &amp; Evaluation Tools - EM7</td>
</tr>
<tr>
<td>OMB2017: Tools</td>
<td>Spacecraft Optimization Layout and Volume (SOLV) - Validated Tool</td>
<td>Habitat Standards &amp; Evaluation Tools - EM7</td>
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<tr>
<td>Habitat Standards Maturation for DST</td>
<td>DST NHV &amp; Layout Standards</td>
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### Habitat Standards & Evaluation Tools - EM7 (2019)

<table>
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### HFBP Countermeasures Integrating with Vehicle Hardware - EM7 (2021)

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<th>DST NHV &amp; Layout Standards</th>
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<td>BMed</td>
<td>Habitat Standards Maturation for DST</td>
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*Color reflects last HSRB baseline decision that represents a three year Mars Planetary Visit/Habitation. HSRB decision for 2 year Mars Flyby is in process with CR expected in the first quarter of 2018.*
### Gateway Lifecycle Milestones

**DST Planning Milestones (PPBE19)**

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<th>FY17</th>
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### HSI/HARI/MPTASK

**PPBE20**

- **Adv. Multimodal Lit Review (Wenzel) - HCI**
- **Electronic Checklists for Robotics-Oman (1129) - HCI**
- **Electronic Procedures-Holden (1131) - HCI**
- **Onboard Planning - Hillenius - MPTASK**
- **Human-Automation Teaming (Vera) - HARI**
- **Autonomy/Intel Sys/Smart Hab TIM - HARI**
- **Contextual Inquiry - MPTASK**
- **Standards and Guidelines Capture - HCAAM**
- **HCAAM Test Environment**
- **Operational Performance Measures to VNSCOR**
- **ROBot for HFBP - Beutter - HARI**
- **Automate Metrics (Salas) - HARI**
- **HF Standard Measures (Wenzel) - HCI**
- **Ops Knowledge-1 (Vos) - MPTASK**
- **Operational Performance Measures**
- **Playbook Datamining - HARI**
- **Interim - Human Capabilities Assessment for Autonomous Missions (H -CAAM) EM7 (2019)**

### Risk of Reduced Crew Performance and of Injury Due to Inadequate Human-System Interaction Design

- **Risk Defined (OMB, etc.)**
- **Ext Delivery:**
  - ISS not required
  - ISS Required
- **Rev PPBExx**
- **Non-ISS DRM**
- **Delivery to OCHMO**
## Risk of Reduced Crew Performance and of Injury Due to Inadequate Human-System Interaction Design

**Gateway Lifecycle Milestones**

- **DST Planning Milestones (PPBE19)**
  - GW SRR
  - GW PDR (proj)
  - GW CDR (proj)
  - Crew Sel (proj)
  - Standalone HW/SW

- **HSID**
  - FY17
  - FY18
  - FY19
  - FY20
  - FY21
  - FY22
  - FY23
  - FY24
  - FY25
  - FY26
  - FY27
  - FY28
  - FY29

### Interim - Human Capabilities Assessment for Autonomous Missions (HCAAM) EM7 (2021)

- **Cognitive Aids (McLaughlin)**
- **Task Analysis for LDM (Stuster)**
- **Robotic Functional Allocation (Feigh - HARI)**
- **Team Task Switching - DeChurch Team**

### Human Capabilities Assessment for Autonomous Missions (HCAAM) EM7 (2023)

- **HCAAM Maturation Standards**
- **HCAAM Test Environment**
- **Tasks for VNSCOR**
- **H-CAAM VNSCOR**
- **BHP Display Requirements to ExMC TIO - BMED**
- **Key Components of Successful Autonomous Space Missions (Fischer) - Team**

- **HSID**
  - ISS Required
  - ISS Not-Required
  - Risk Defined (OMB, etc.)
  - Ext Delivery: ISS not required
  - Ext Delivery: ISS Required
  - ISS DRM
  - Non-ISS DRM
  - Delivery to OCHMO

- **Milestones Slip**
  - Rev PPBEEx
  - Rev PPBEEx
  - Delivery to OCHMO
Risk of Reduced Crew Performance and of Injury Due to Inadequate Human-System Interaction Design

HSID

Gateway Lifecycle Milestones
DST Planning Milestones (PPBE19)

HCI/HARI/MPTASK
PPBE20

Human Capabilities Assessment for Autonomous Missions (HCAAM) (2030)

HFBP Integrated Monitoring Guidelines & Tools - EM7 (2023)

Crew Ops Training Standards & Guidelines - EM9 (2026)

Crew Performance Standards for Advanced Robotics- EM13 (2032)

 Gateway Lifecycle Milestones

 FY17 FY18 FY19 FY20 FY21 FY22 FY23 FY24 FY25 FY26 FY27 FY28 FY29

 Ground Flight Element Integration Planetary Undefined

 ISS Required ISS Not-Required Risk Defined (OMB, etc.) Ext Delivery: ISS not required Ext Delivery: ISS Required

 Transition to Ops Delivery to Ops

 Milestones Slip Rev PPBExx Rev PPBExx

 Crew/HARI Performance Advanced Benchmark

 Fine Motor Skills Holden (881)

 Training Best Practices - Dempsey Team/Train

 Generalizable Skills (1165) Billman - Train

 Standards/Guidelines for Software and Hardware HARI Non-Planetary

 HCAAM Requirements to ExMC Updated Standards and Guidelines for Software and Hardware

 H-CAAM Capabilities Refinement

 HFBP: Integrated Monitoring Tools - EM7 (BMed PRR)

 HFBP: Crew Ops Training Standards - & Guidelines - EM9 (BMed PRR)

 JITT for Teleops - Wenzel Train

 Telerobotics HARI Task Difficulty

 Current Robotic Allocations HARI

 HARI Trade Analysis

 Crew/HARI Performance Advanced Benchmark

 Standards/Guidelines for Software and Hardware

 Crew/HARI Performance Advanced Benchmark

 Risk Defined (OMB, etc.) Ext Delivery: ISS not required Ext Delivery: ISS Required

 Delivery to OCHMO

 5/3/18