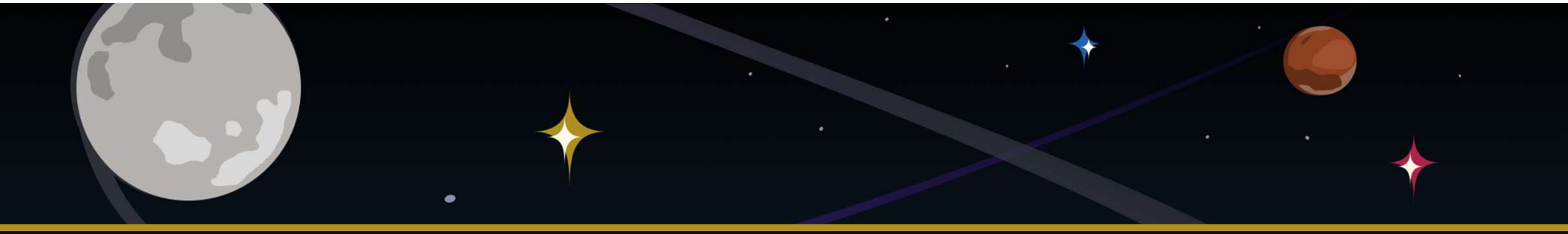

HUMAN FACTORS AND BEHAVIORAL PERFORMANCE EXPLORATION MEASURES IN HUMAN EXPLORATION RESEARCH ANALOG (HERA) CAMPAIGN 6

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4 NASA/Fatigue Countermeasures Laboratory

Human Factors Behavioral Performance (HFBP) Exploration Measures

Human Exploration Research Analog (HERA)


International Space Station (ISS)

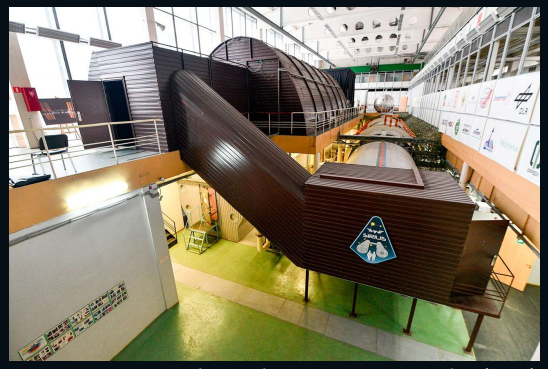

Russian Ground Based Experiment Complex (NEK)

Photo credits: NASA, NEK-IBMP/Oleg Voloshin

HFBP-EM

Physiology/Biomarkers
- Sleep
- Heart Rate

Individual Behavioral Health
- Personality Assessment
- Social Desirability
- Depression
- Mood and Affect
- Neurobehavioral Function

Objective Performance
- Cognition
- ROBoT

Team & Social Dynamics
- Team Performance: MCC Ratings
- Team Performance: Crew Ratings
- Team Cohesion
- Team Processes
- Psychological Safety
- Social Support
- Group Living

Human Exploration Research Analog (HERA) Campaign 6

	Campaign Manipulation	Crew	Mission Scenarios	Days in mission	Habitat Size
HERA C6	Increasing Comm Delay	4, 4-person crews (3 so far)	Travel to Phobos Emergency Event	45	148.6m3

Exterior of HERA

HERA Crewmember in VR goggles

Photo credits: NASA

Human Exploration Research Analog (HERA) Campaign 6

	Campaign Manipulation	Crew	Mission Scenarios	Days in mission	Habitat Size
HERA C6	Increasing Comm Delay	4, 4-person crews (3 so far)	Travel to Phobos Emergency Event	45	148.6m3
HERA C5	Reduced privacy and habitable volume	4, 4-person crews; American	Travel to Phobos Emergency Event	45	148.6m3
HERA C4	Sleep restriction	5, 4-person crews; American	Travel to asteroid Emergency Event	45	148.6m^{3}`
NEK-SIRIUS19	Single 24-hr sleep restriction	1, 6-person crew; multinational	Lunar Landing	120	550 m^3
NEK-SIRIUS21	Three 36-hr sleep deprivations (MD55, MD115, MD235)	1, 6-person crew (3 male, 3 female); multinational	Three lunar landing EVAs (Md61-65, MD122-126, MD190-194)	240	550 m^3

Specific Aims

1. Continue HFBP-EM data collection through HERA Campaign 6
2. Expand the HFBP Risks addressed by assessing individual and team behavioral health and performance impacts of habitat layout and acceptability via addition of the NASA Spaceflight Habitability and Acceptability Questionnaire (SHAQ)
3. Implement and validate several short-form versions for measures of personality, behavioral health, and team performance.

All C6 results are from M1-M3

Are short duration missions sufficient to elicit variability in behavioral health and performance outcomes?

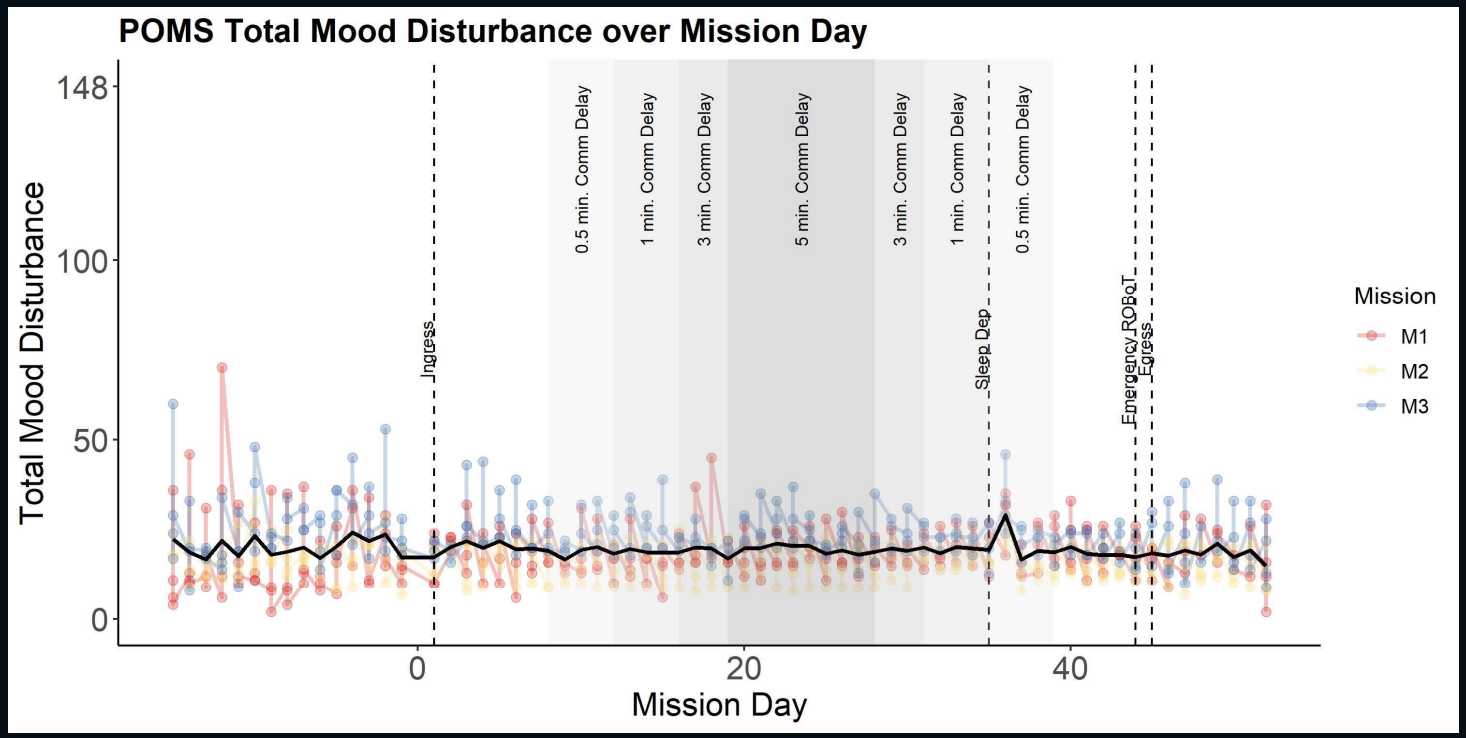
HERA C4-C6 = 45 days

HERA interior

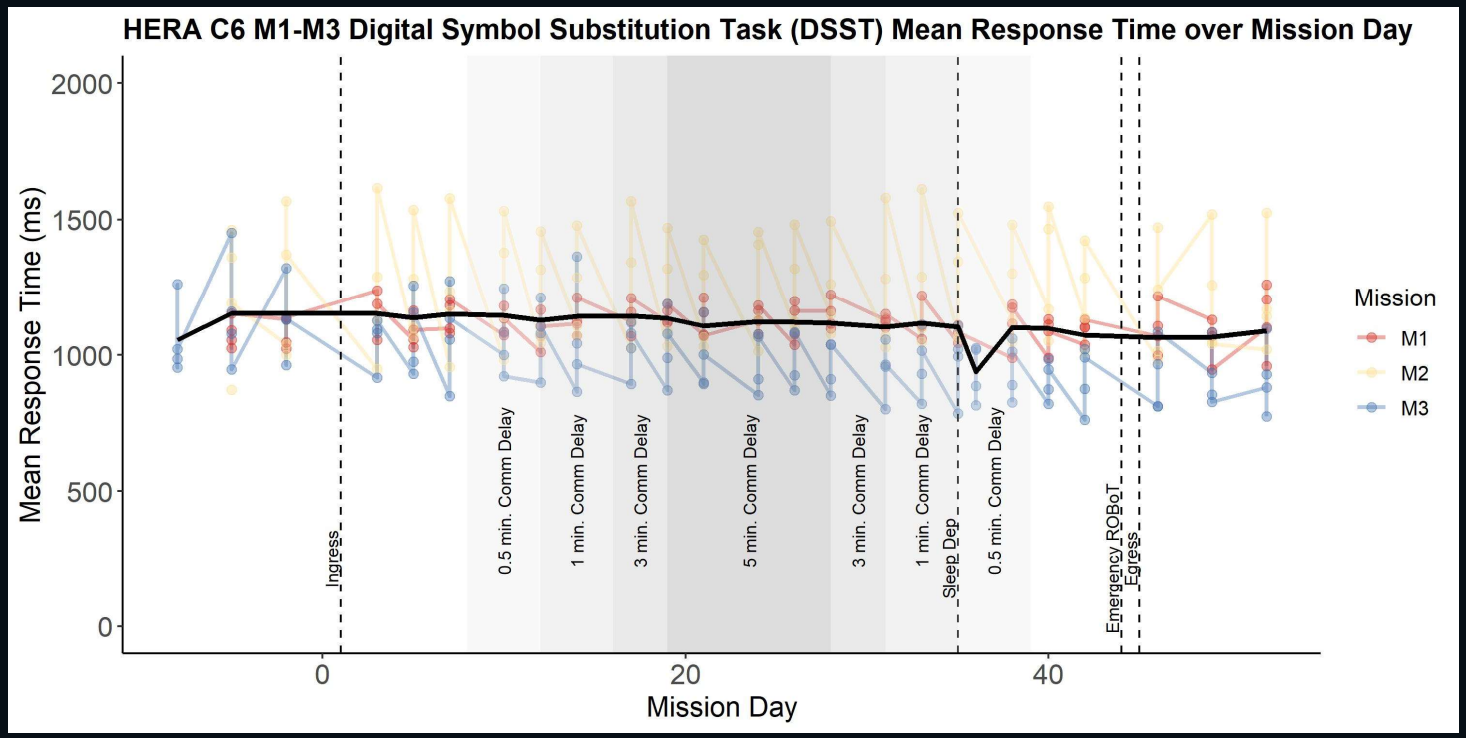
NEK-SIRIUS21 = 240 days

NEK interior

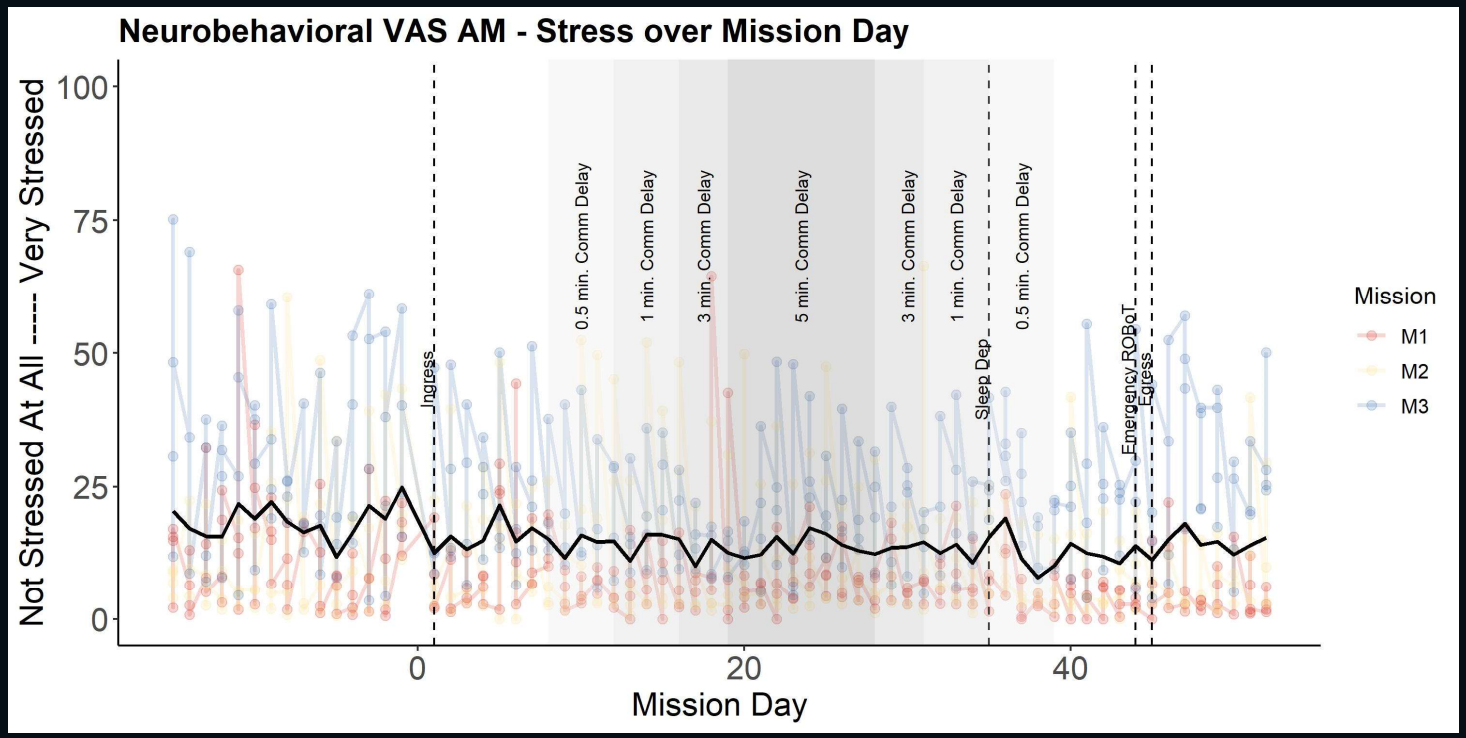
Mood Disturbance Across HERA C6



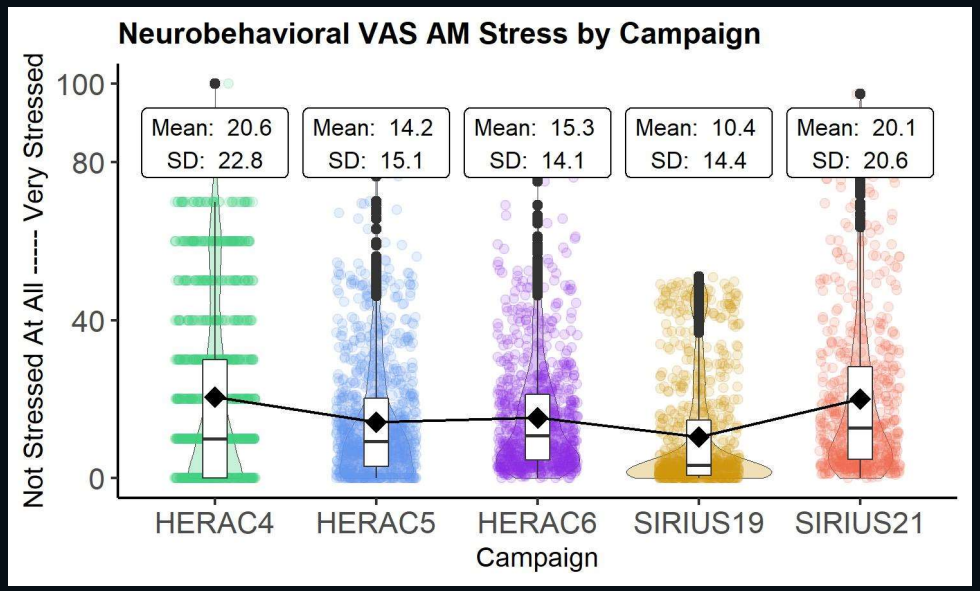
Cognitive performance across HERA C6

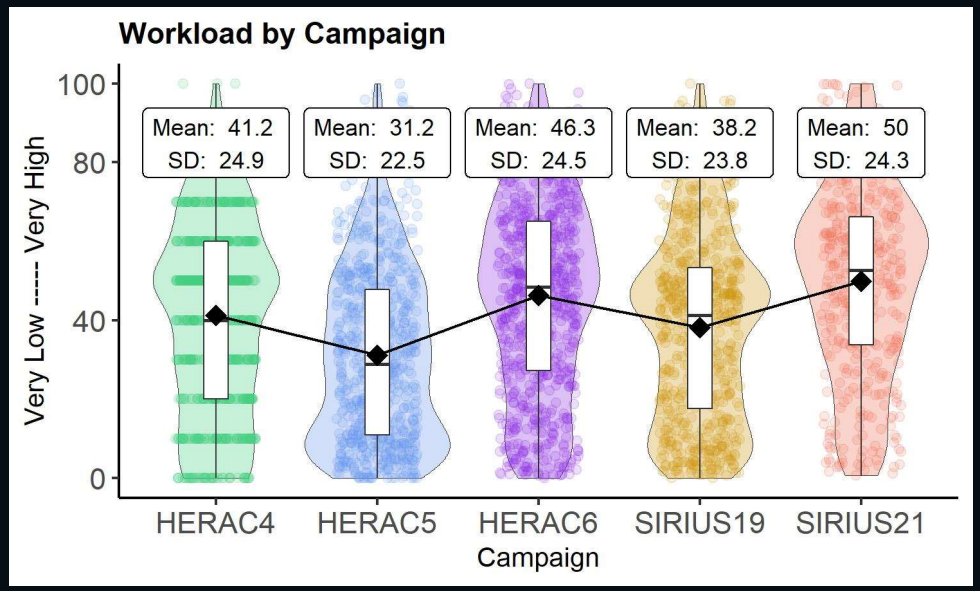


Stress Across HERA C6

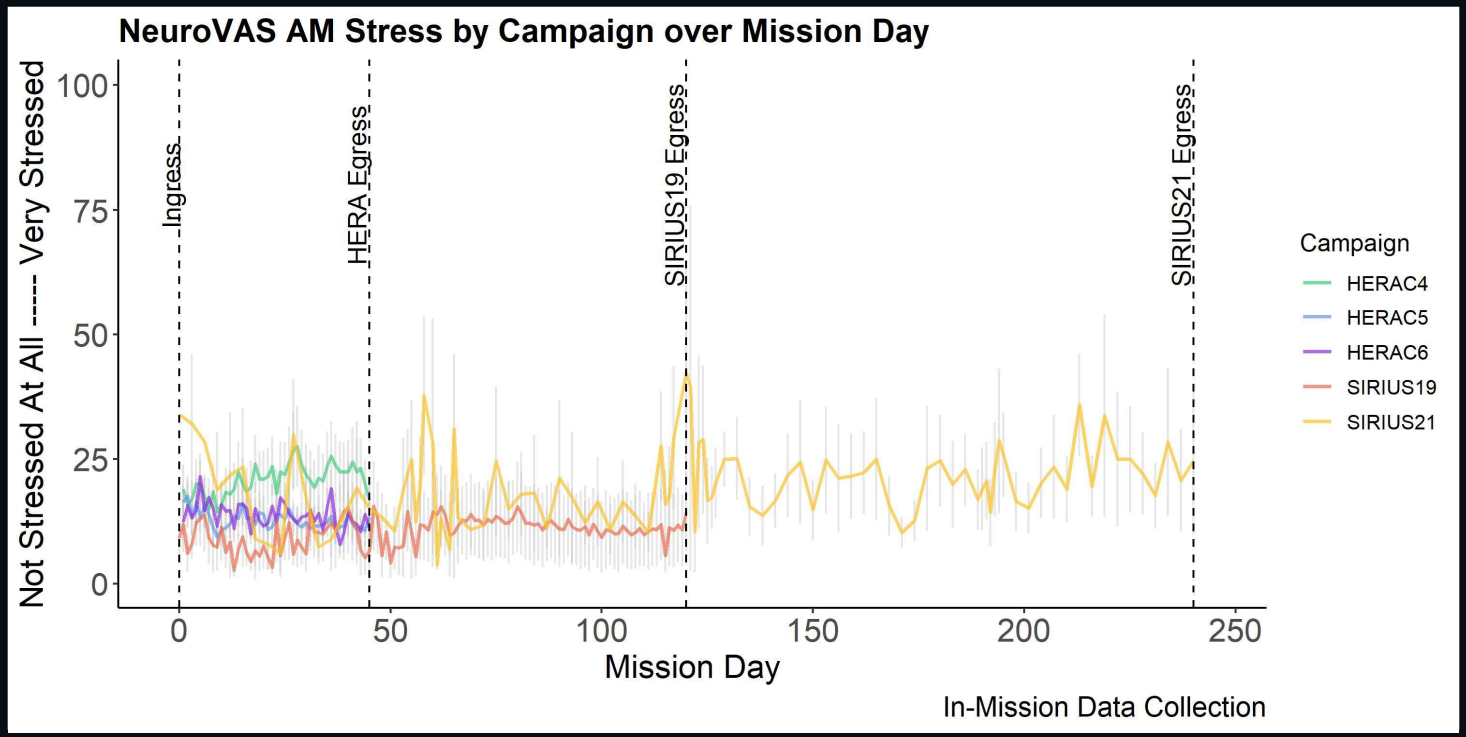


Comparing HERA C6 to other analog missions

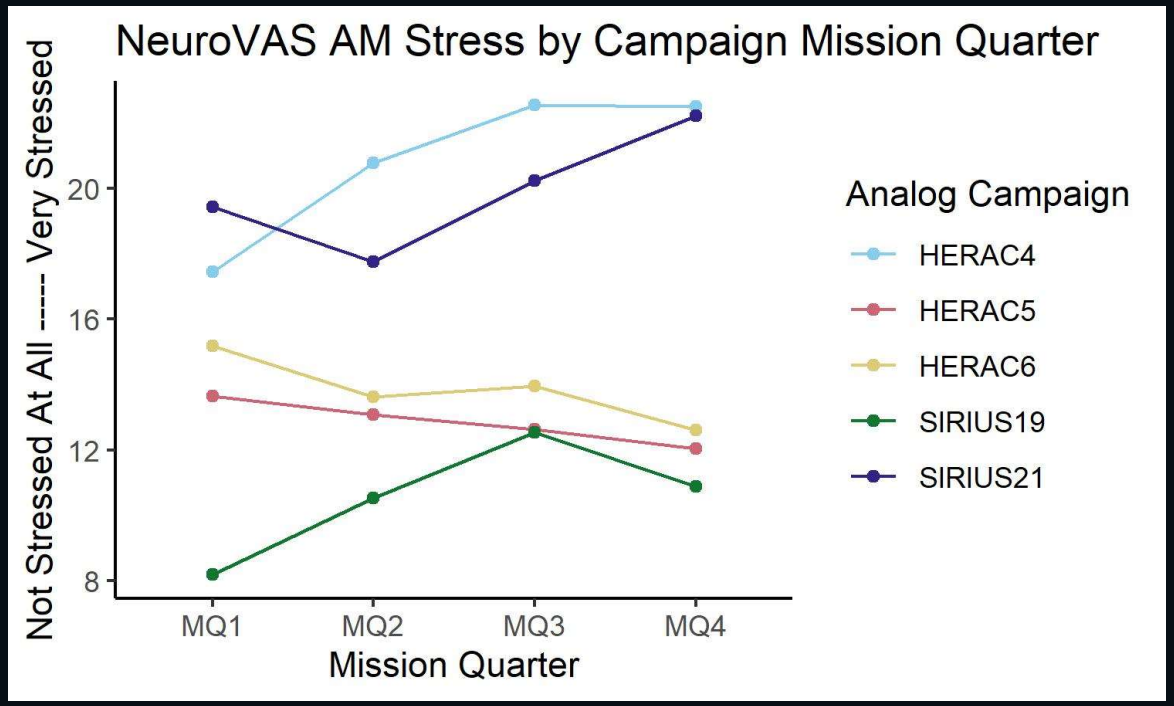




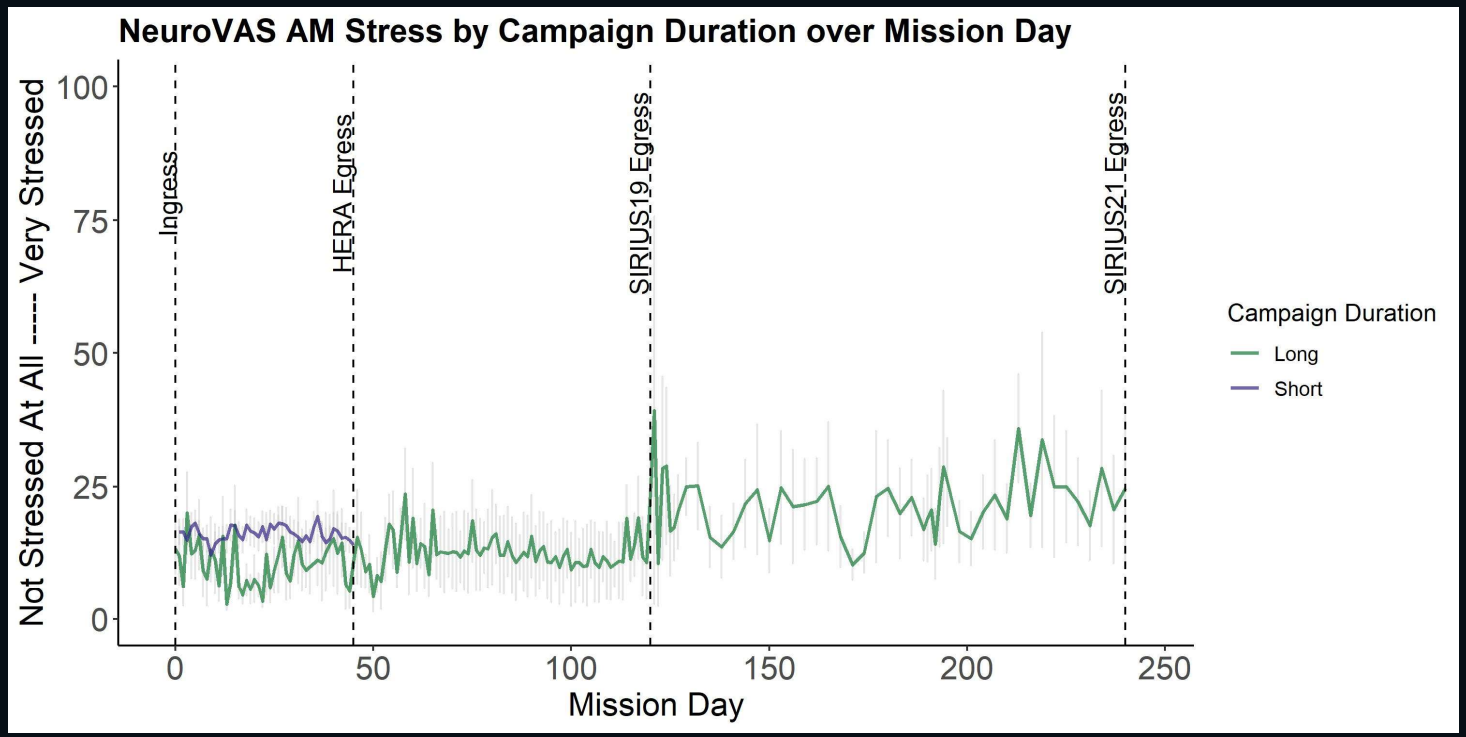
Stress Across Multiple Analog Campaigns



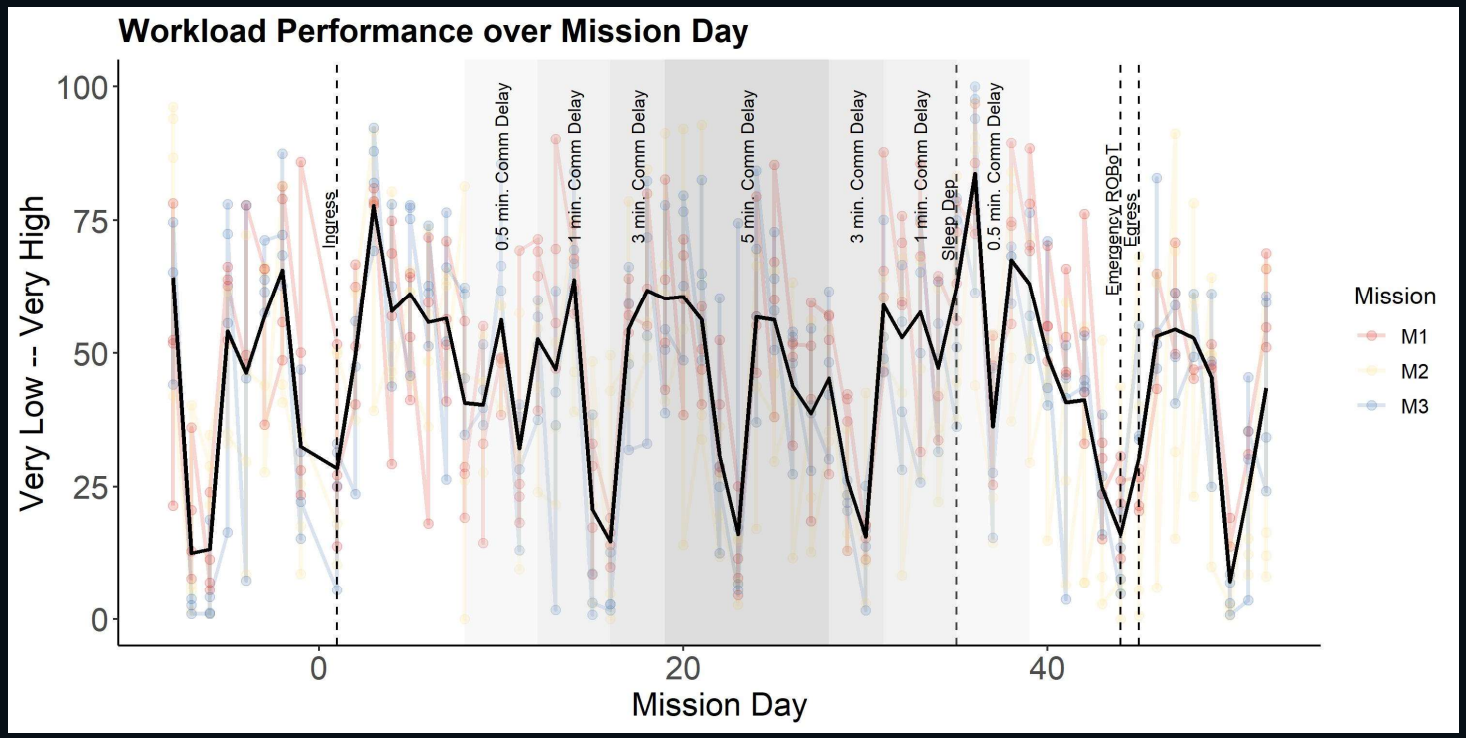
Stress Across Multiple Analog Campaigns



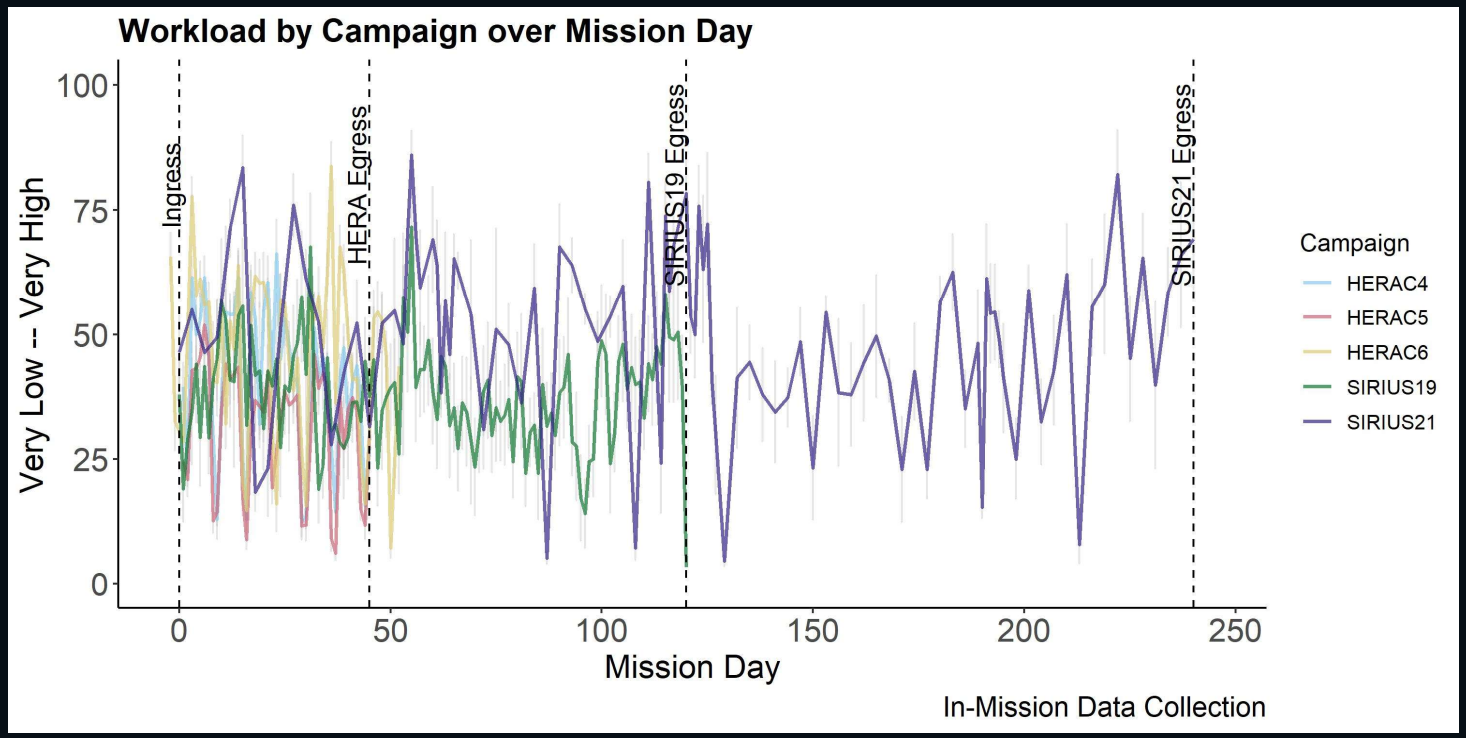
Stress Across Multiple Analog Campaigns



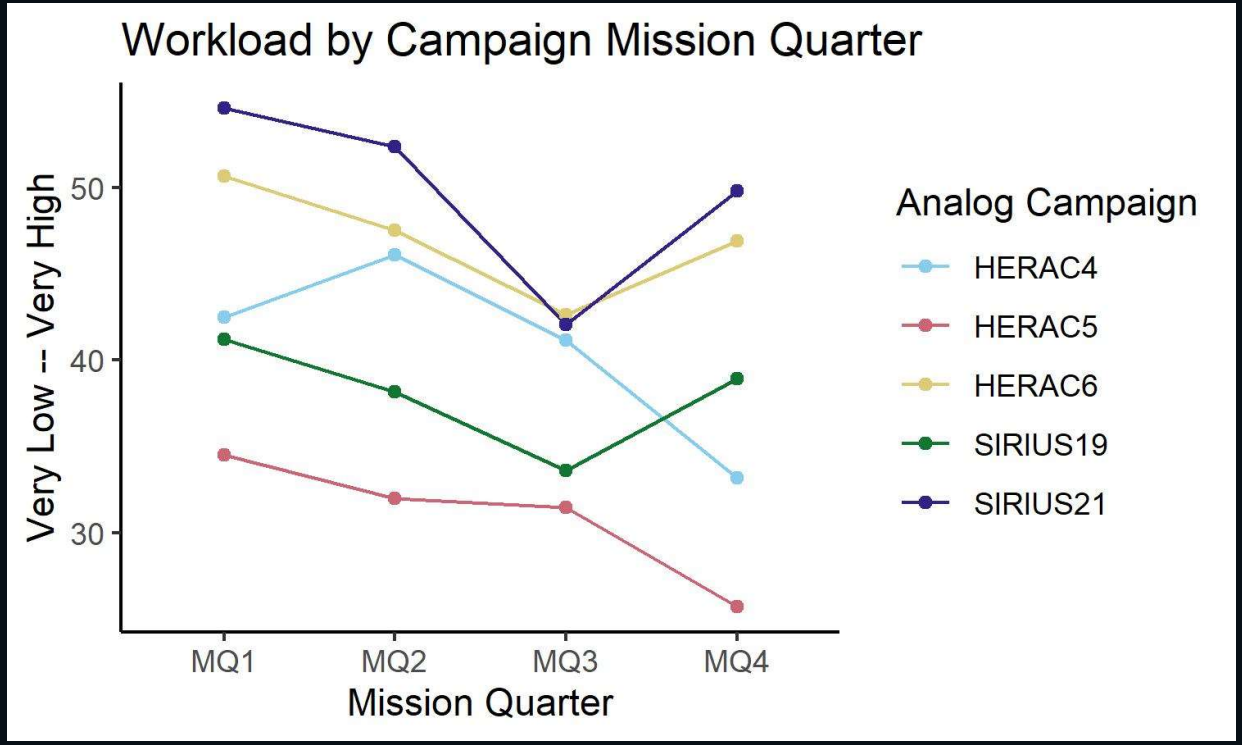
Workload Across HERA C6



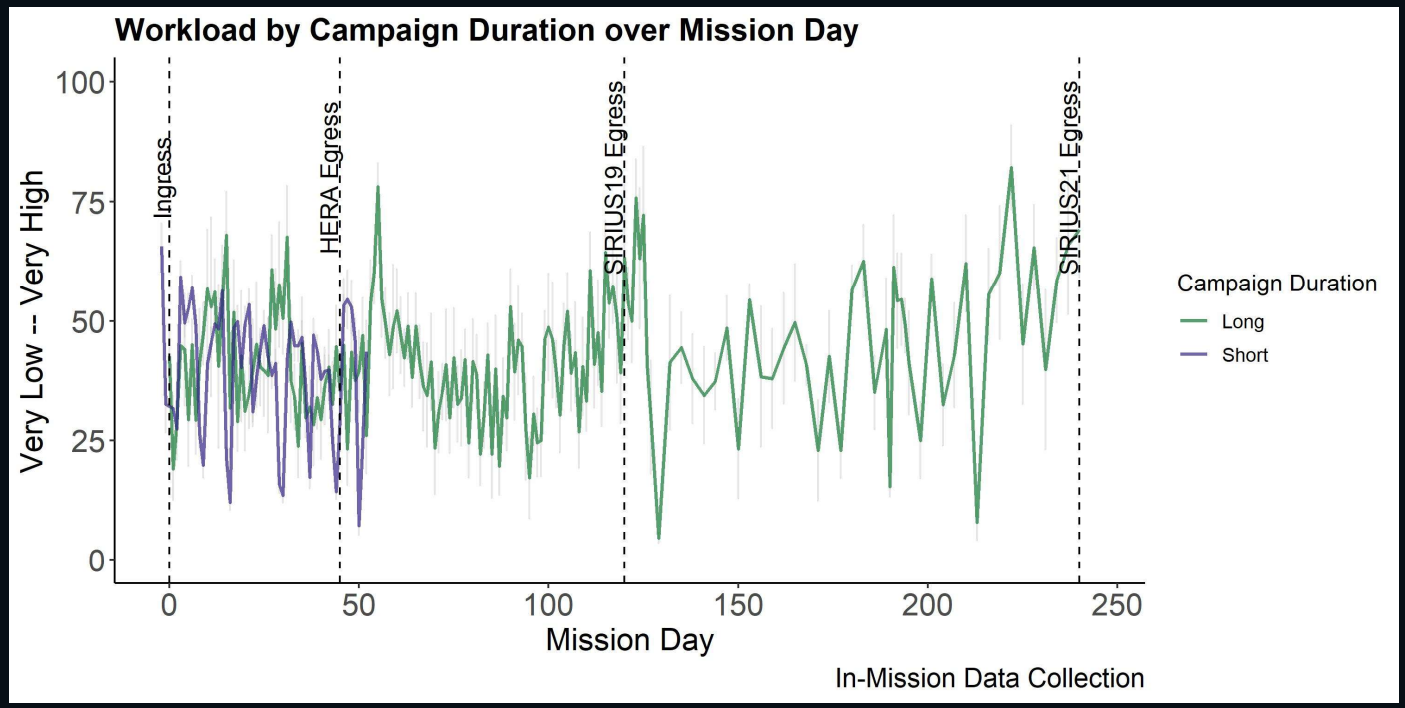
Workload Across Multiple Analog Campaigns



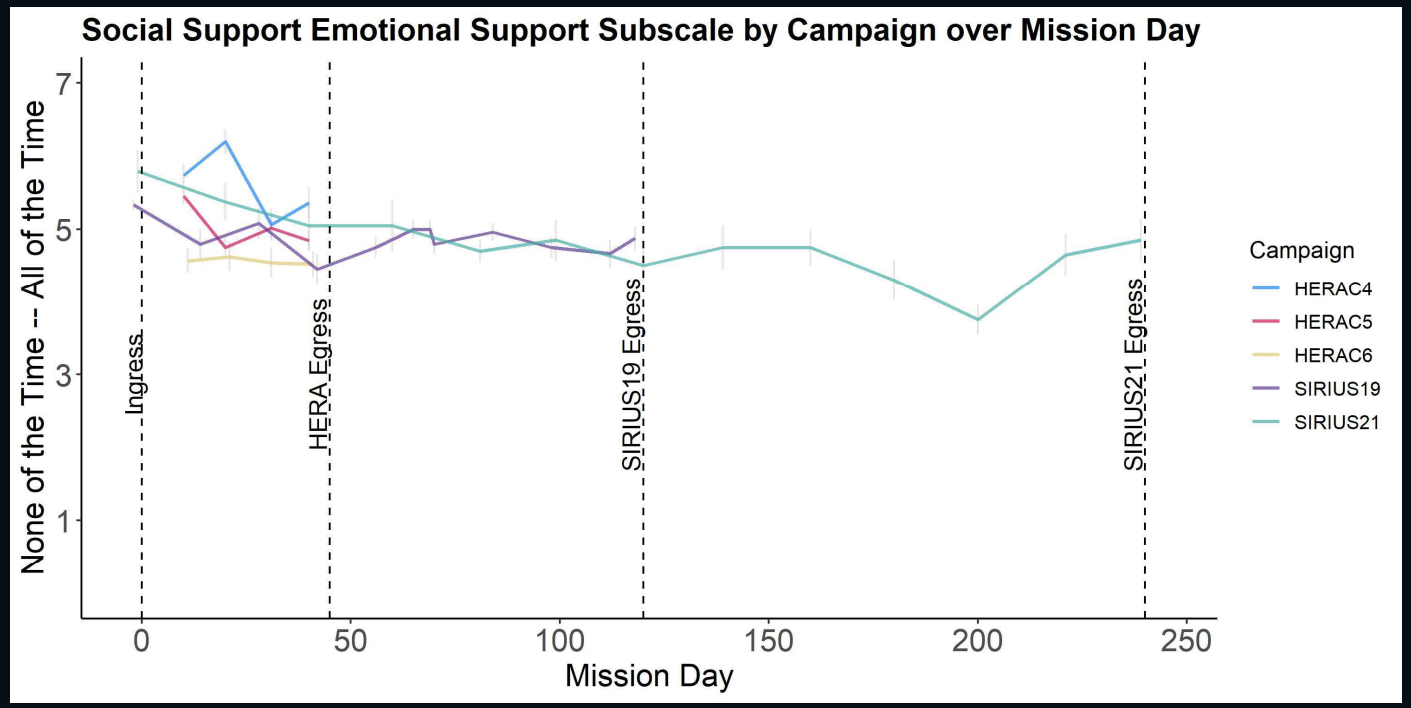
Workload Across Multiple Analog Campaigns



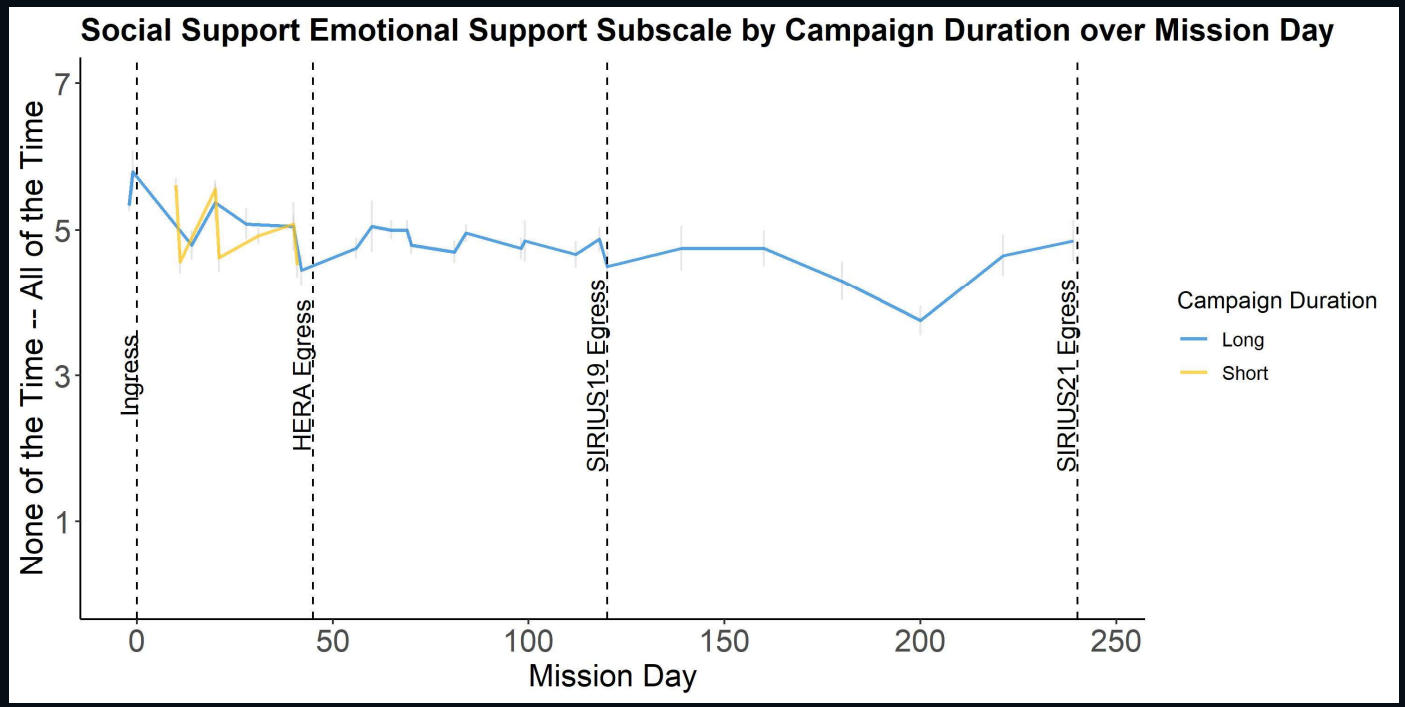
Workload Across Multiple Analog Campaigns



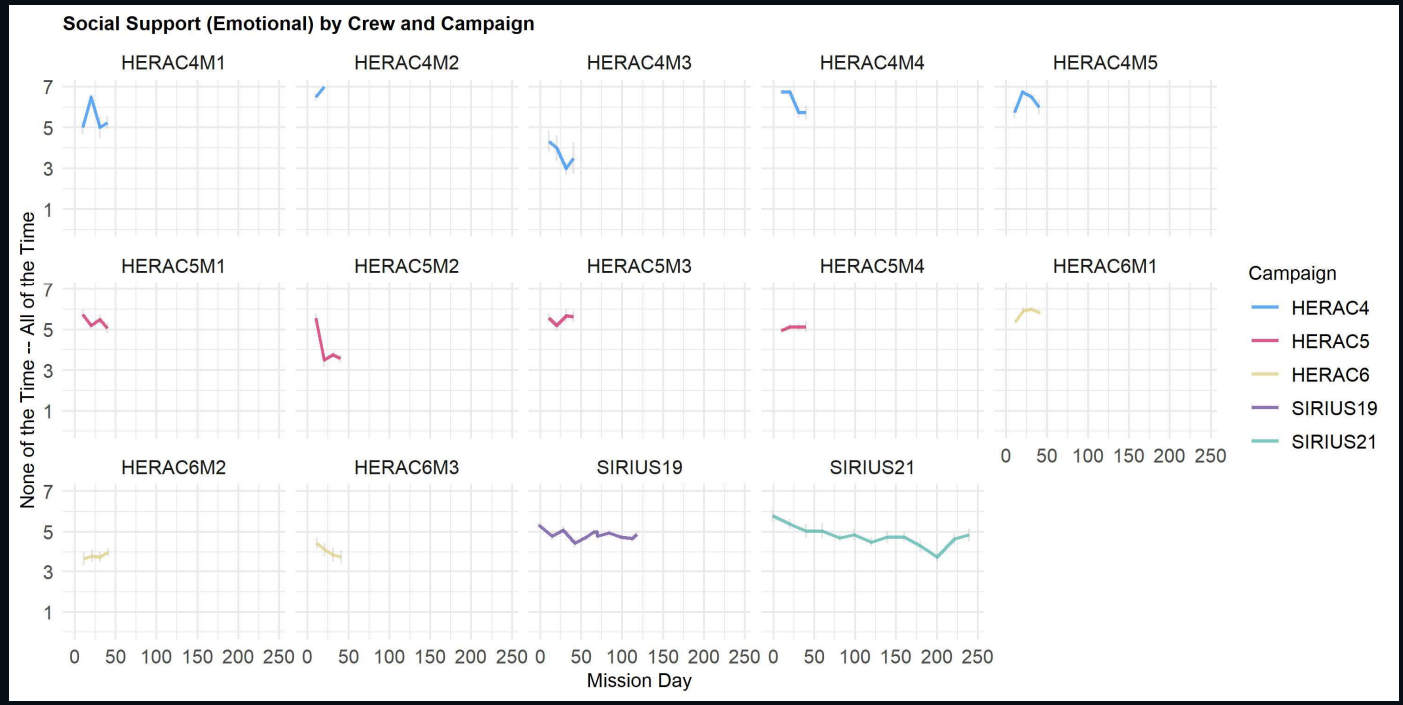
Teams: Social Support (Emotional) by Campaign



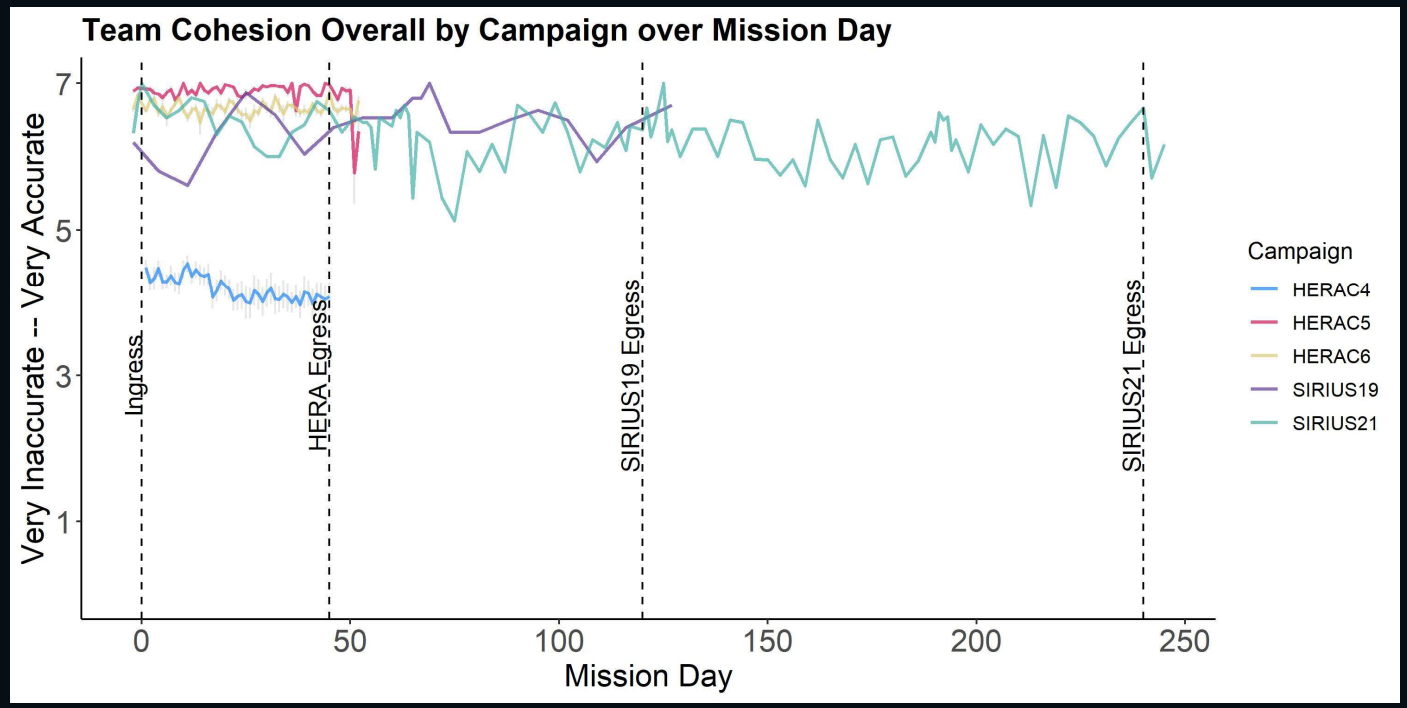
Teams: Social Support (Emotional) by Campaign Duration



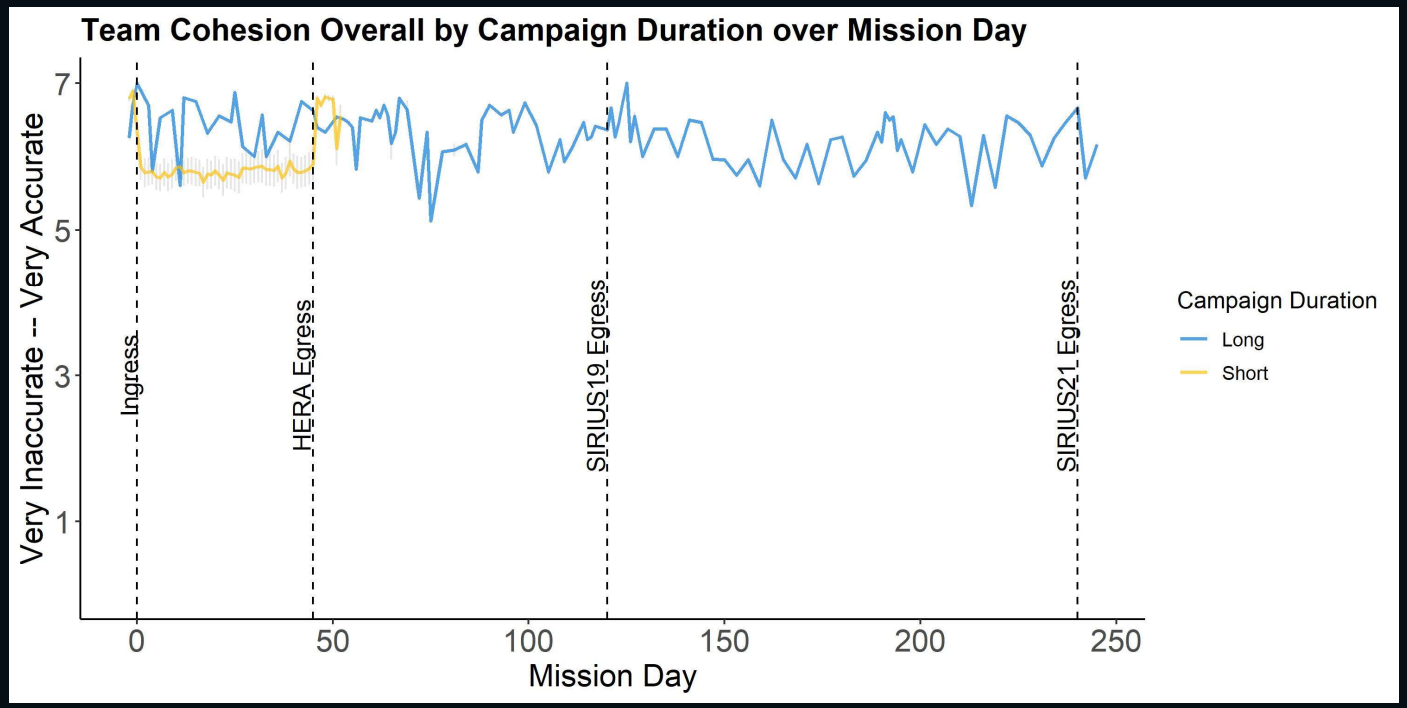
Teams: Social Support (Emotional) by Crew and Campaign



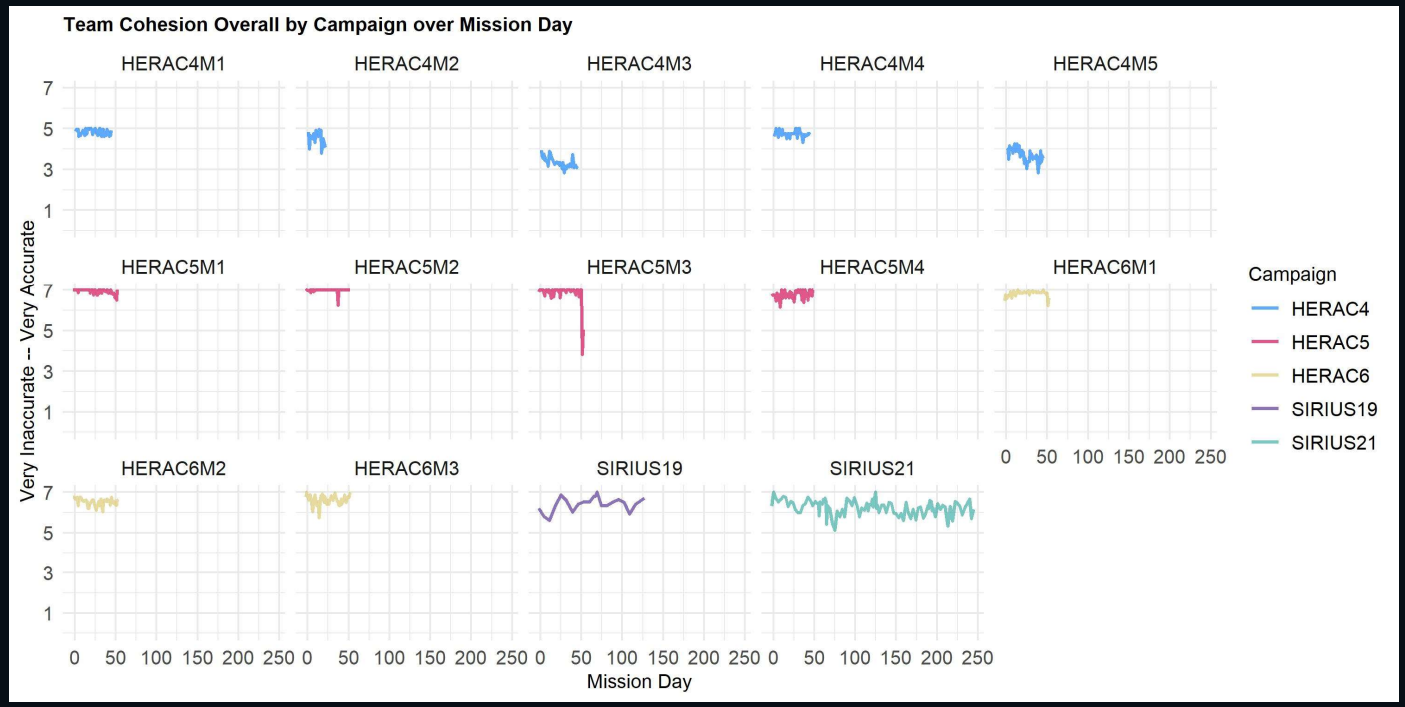
Teams: Team Cohesion by Campaign



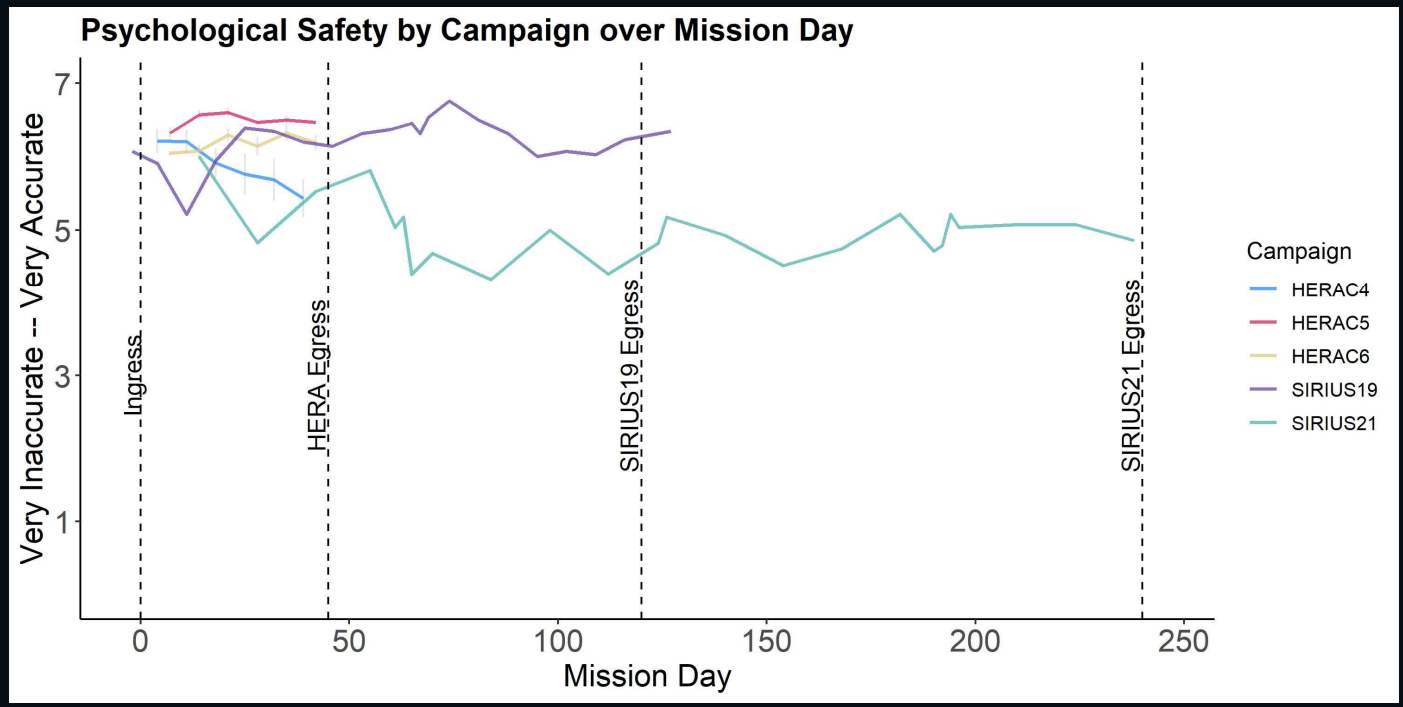
Teams: Team Cohesion by Campaign Duration



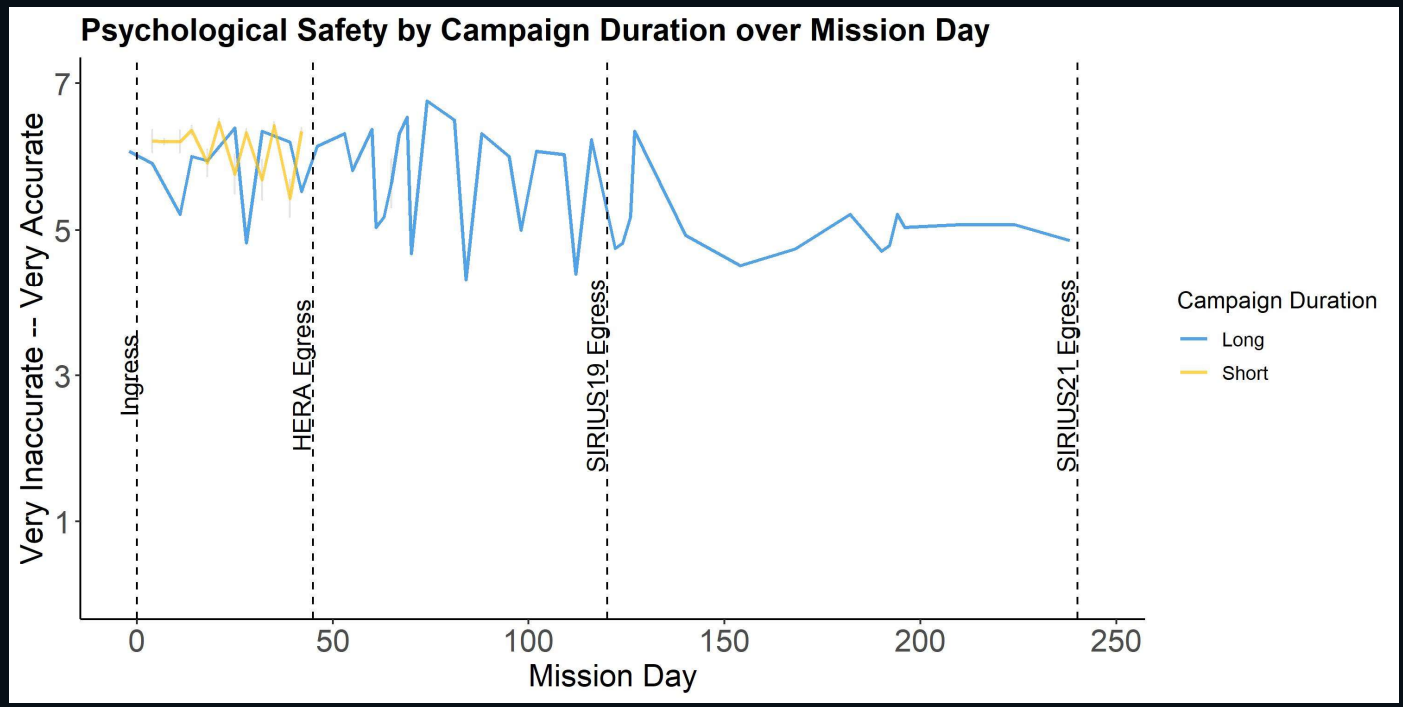
Teams: Team Cohesion by Crew and Campaign



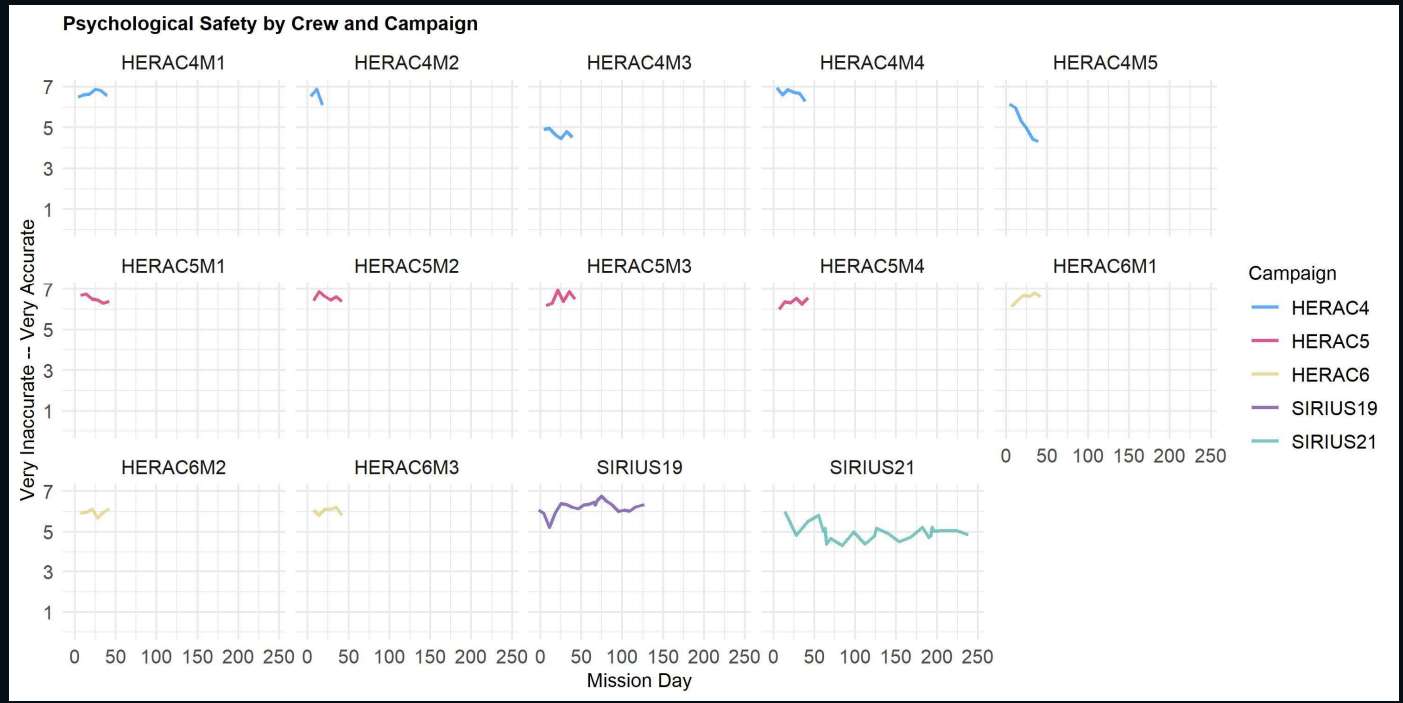
Teams: Psychological Safety by Campaign



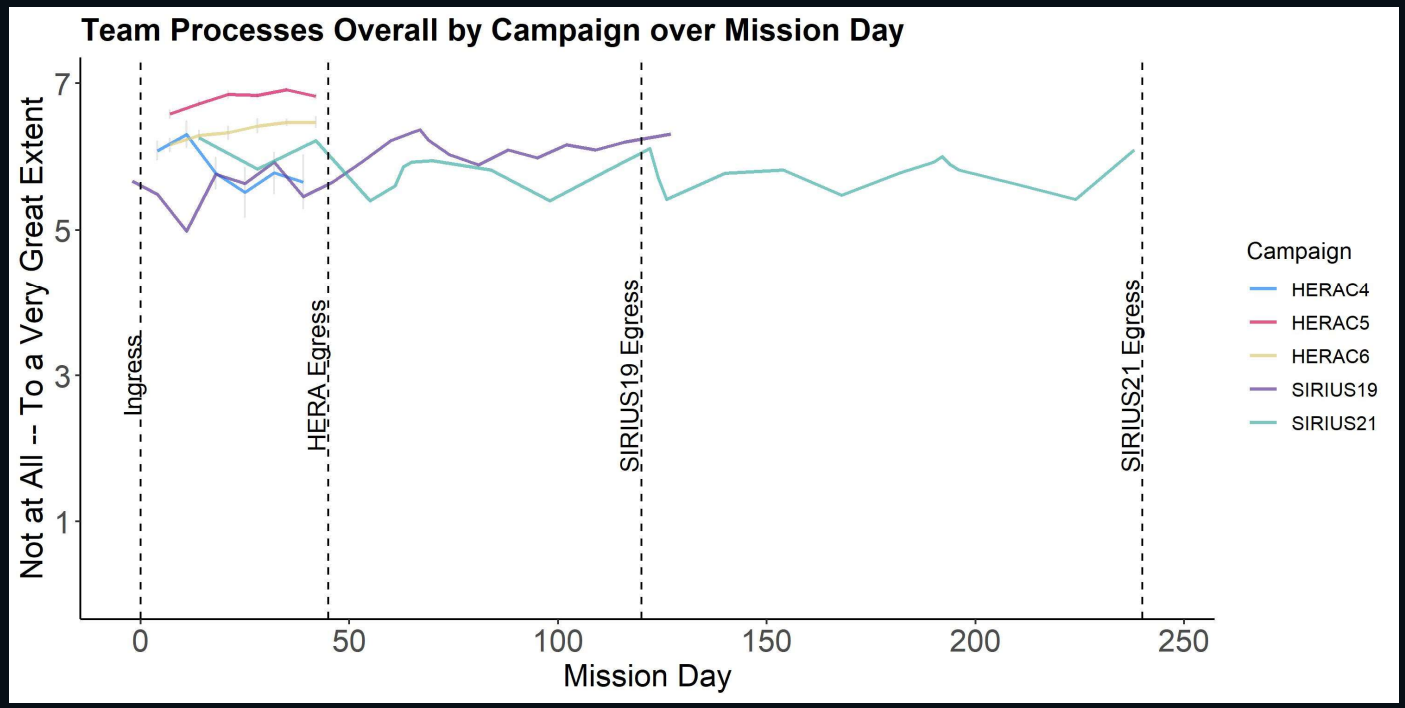
Teams: Psychological Safety by Campaign Duration



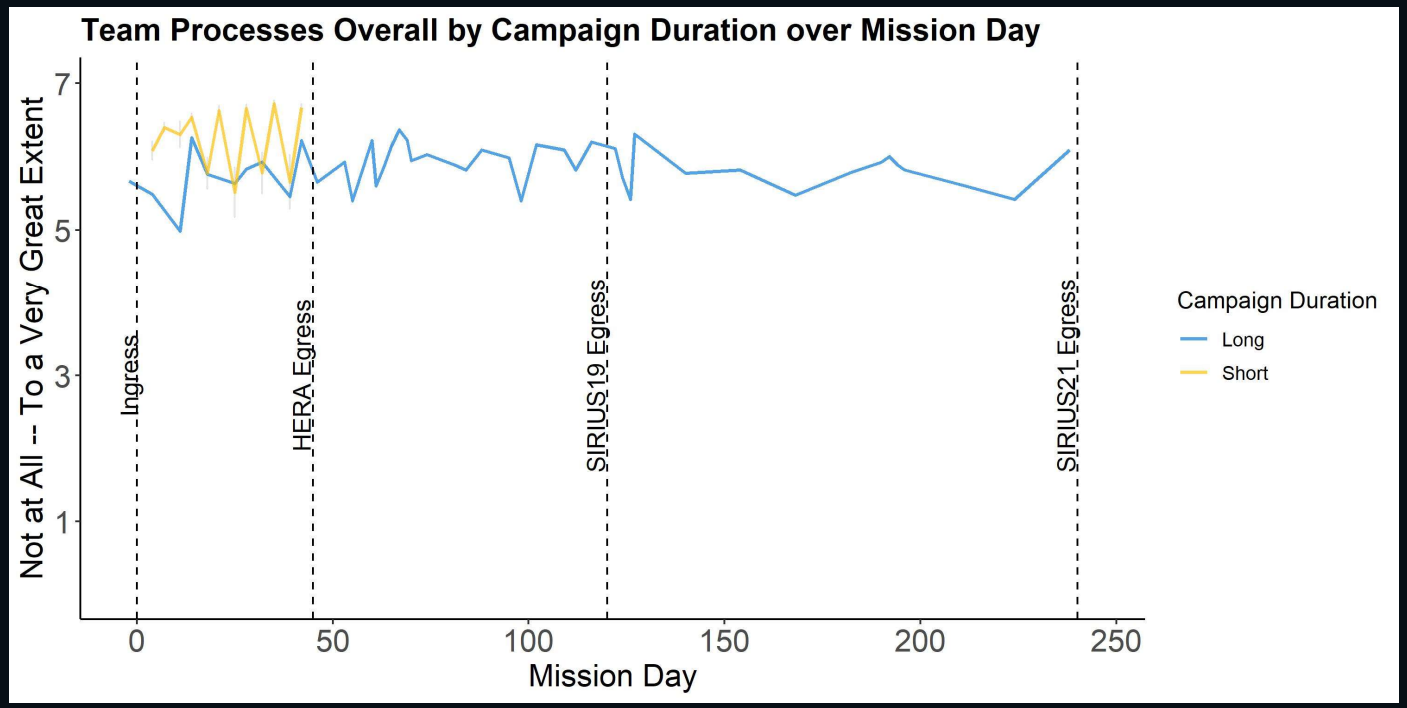
Teams: Psychological Safety by Crew and Campaign



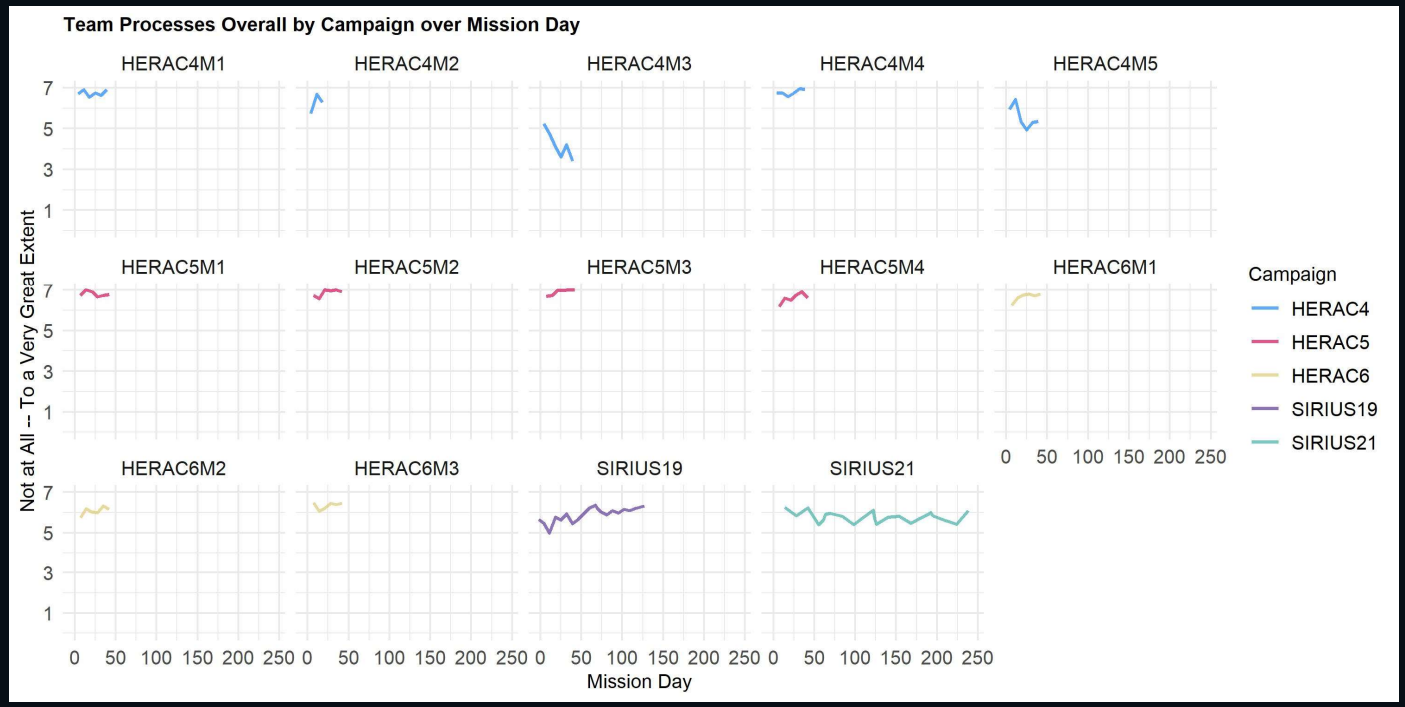
Teams: Team Processes by Campaign



Teams: Team Processes by Campaign Duration



Teams: Team Processes by Crew and Campaign



Key Findings

- Variability in behavioral health and team outcomes were evident in short (45 day) and longer (120+) duration missions
- Some evidence of subtle increases in stress in the longest 240-day mission
- Between team differences in shorter missions (45 day) and continued declines in perceived emotional support and psychological safety over time in the longest mission (240 day)
- More variability in team cohesion in the longer duration crew (240 day) than the shorter missions (45 day)
- Self-report team processes were lower for the longer-duration mission (240 day) than shorter duration missions (45 day) but remained stable over time

Next Steps

- Collect additional long-duration data to tease out between crew versus temporal effects
- Conduct advanced statistical modeling to understand changes over time in short vs. long duration missions
- Compare short vs. long duration missions with other HFBP-EM outcomes
- Investigate cumulative or synergistic behavioral health impacts over long duration missions
- Quantify changes in variability over time

Thank you!
Questions?

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Behavioral Health and
Performance Laboratory