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Performance Data Report

Space Medicine Division
Human Research Program
Behavioral Health & Performance Research Element

March 31, 2011

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Houston, Texas

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Acronyms

BHP	Behavioral Health & Performance
BME	Biomedical Engineer
BMed	Behavioral Medicine
CAPCOM	Spacecraft Communicator
CB	Astronaut Office
CMX	Crew Member Exchange
CNS	Central Nervous System
EVA	Extravehicular Activity
ITCB	International Training Control Board
IOM	Institute of Medicine
IRP	Integrated Research Plan
ISS	International Space Station
JSC	Johnson Space Center
LMX	Leader-Member Exchange
LSAH	Longitudinal Study of Astronaut Health
LSDA	Life Sciences Data Archive
MCC	Mission Control Center
MOD	Mission Operations Directorate
MRI	Magnetic Resonance Imaging
PDRS	Payload Development and Retrieval System
POC	Point of Contact
SD	Space Medicine Division
SFRM	Space Flight Resource Management
SK	Human Adaptation and Countermeasures Division
SLSD	Space Life Sciences Directorate
SME	Subject Matter Expert
TMX	Team Member Exchange

Introduction

This report is the result of a collaborative effort between NASA's Behavioral Health & Performance (BHP) Research and Operations Group to investigate and determine the availability of data pertaining to behavioral performance (and other pertinent variables) that have been collected by the laboratories at NASA's Johnson Space Center (JSC).

The Behavioral Health & Performance Group at JSC has two components—operations and research—and each of these components focuses on a specific role in supporting current and future flight missions. The BHP Operations group provides direct and indirect psychological services to the International Space Station (ISS) astronauts and their families. Beginning with the Shuttle-Mir Program, services available to the crews and families have gradually expanded as experience was gained in long-duration flight. Enhancements to the overall BHP program have been shaped by crew members' personal preferences, family requests, specific events during the missions, programmatic requirements, and other lessons learned. The BHP Operations program focuses its work on two areas—operational psychology and behavioral medicine—and provides consultation in two other related areas, human-to-system interface and sleep and circadian rhythm. Within these areas of focus are psychological and psychiatric screening for astronaut selection as well as many resources that are available to the crew members, families, and other groups such as crew surgeons and various levels of management within NASA. Services include preflight, in-flight, and postflight preparation; training and support; provision of resources by the Family Support Office; in-flight monitoring; clinical care for astronauts and their families; and expertise in the workload and work/rest scheduling of crews on the ISS (Sipes & VanderArk, 2005).

The BHP Research Element is one of six elements of the Human Research Program. It is responsible for research on three of the Risks in the Human Research Roadmap, namely the Risk of Adverse Behavioral Conditions and Psychiatric Disorders (Behavioral Medicine [BMed]), the Risk of Performance Decrements due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team (Team), and the Risk of Performance Errors due to Sleep Loss, Circadian De-Synchronization, Fatigue, and Work Overload (Sleep). BHP has the task of designing, implementing, and managing a research program composed of focused and applied research tasks (or projects) that develop operationally relevant deliverables and products (such as tools, technologies, protocols, and countermeasures), to mitigate the high-priority BHP health and performance risks to flight crews (and mission ground support crews) during long-duration missions and promote rapid return to terrestrial levels of functioning after such missions. Specific gaps (knowledge and technology) within each of the

BHP Risks identify areas of research that needs to be done to prevent or reduce the overall level or consequences of risk associated with long-duration missions (Table 1). Many of these areas of research require collection of astronaut data on performance and other variables in order to address the gaps. Specifically, BHP Research has a need to obtain objective measures that assess performance in space flight. In addition to personality and behavioral performance data, BHP Research also needs astronaut job and mission performance data to determine and rank the most salient personality characteristics and behaviors of the highest-performing astronauts. Concerns have been acknowledged both in the Institute of Medicine (IOM) Report (2007) and also in the Space Life Sciences Directorate's (SLSD's) Senior Management roundtable discussions. The criticism in the IOM Report on the Behavioral Medicine Evidence Report echoed this problem, stating that the Behavioral Medicine Evidence Report failed to include a "substantive review of personality and behavioral performance that would be most likely to promote effective crew performance..." (p. 9, Institute of Medicine, 2007).

Thus, BHP is challenged with obtaining such needed information by gaining access to these data or creating these data for the needs of the specific research task and the overall BHP risk reduction research strategy. To address this challenge, BHP's Operations and Research groups collaborated to systematically identify what types of performance data are needed in relevant BHP performance domains and also to conduct structured interviews with NASA personnel to identify which data do or do not exist currently (and for instances where such data exist, to evaluate the type, quality, accessibility, and confidentiality of those data). To complete this first objective, the authors took the following steps:

1. Defined outcome categories of performance that encapsulate BHP performance domains
    - Performance Outcome Categories: Behavioral Health, Task Performance, Team Performance, Psychosocial Adaptation, Cognitive Performance
2. Mapped BHP Research Risks and Gaps onto those performance outcome categories (see below)
3. Identified and prioritized indicators for each outcome category (for example, burnout may be an indicator of psychosocial adaptation)

In conjunction with completing the second objective as discussed above, the team completed the following steps:

1. Identified key points of contact (subject matter experts [SMEs]) as potential interviewees
2. Created a template for structured interview questions about sources and accessibility of performance data
3. Coordinated and conducted structured interviews with the SMEs
    - Targeted completion of 30 interviews

It became clear during collaboration that for the team to fully understand which data on performance metrics exist within NASA, it was important to understand how these performance metrics are related to the concept of mission success. In particular, if performance was imagined to be composed of factors beyond what is generally understood as task performance in the world of operations, it was important to capture these other factors so that analyses could clearly demonstrate their impact on mission success. Some other dimensions of performance are behavioral health and well-being, and teamwork. Thus, the interviews were used to capture different perspectives on performance and analyze how these different views influence performance metrics. To illustrate this concept, Figure 1 depicts a model of performance and how it relates to mission success. Certain predictors (such as stress, isolation, confinement, and other characteristics of a long-duration mission) were posited to influence specific outcomes (5 dimensions of performance) that, in turn, influence mission success.

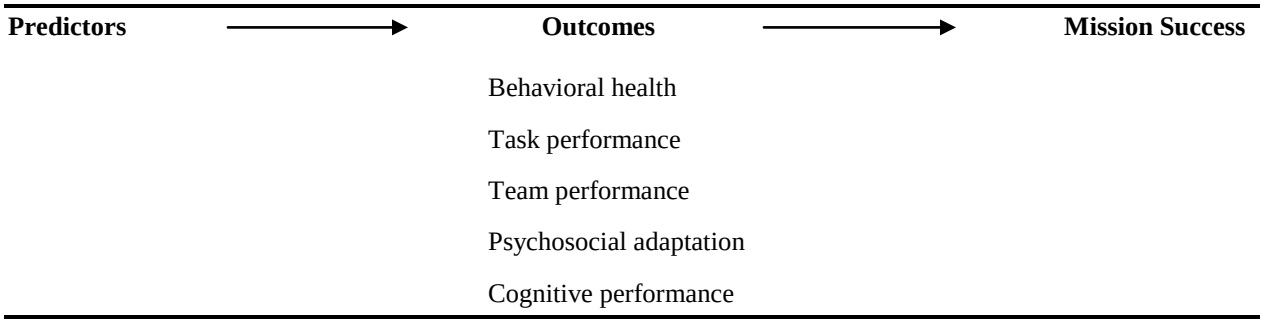


Figure 1. Overall model.

This evaluation demonstrated that certain forms of performance data do exist within NASA JSC, and the BHP Element and Operations groups need access to those data sources. A total of 22 forward action items were identified to pursue access to existing performance-related data; 11 of those items will require SLSD intervention, 10 require BHP follow-up, and 1 requires re-consenting of crew members. In other cases, data may need to be generated to address the requirements of the BHP Element for research on risk reduction and the needs of the BHP Operations group. The methodology, results, and implications of this effort, as well as forward work needed, are discussed below.

Methodology

The team began by first defining the outcomes (dimensions of performance) that comprise performance from the BHP collaborative perspective, according to the identified set of objectives for completing this task. Five dimensions of performance were identified: behavioral health, cognitive performance, psychosocial adaptation, task performance, and teamwork. Definitions based on current discipline standards were developed for each of these dimensions by the authors and are provided below.

Outcome Categories Defined for Behavioral Health & Performance[1]

1. Behavioral Health
   - Refers to the relationship between an individual's behavior and the well-being (psychological and physiological) of the whole person (spirit, body, and mind) within his/her environment (cultural, vocational, social, and physical).
2. Cognitive Performance
   - An individual's ability to utilize mental processes including memory, attention, and executive functioning within his/her environment.
3. Psychosocial Adaptation
   - Goodness of fit between an individual's psychological strategies and the social exchange conditions of space flight environments.
4. Task Performance
   - The effectiveness with which individuals perform goal-directed activities or provide needed materials or services that contribute to mission success.
5. Teamwork
   - The level of effective coordination of team members' cognitive, verbal, and behavioral activities to organize task work and achieve collective goals that contributes to mission success.

The specific gaps that reside within the BHP Research Element were then compared to each of the 5 performance dimensions. The gaps for each of the three BHP Risks are defined below (Table 1); the definitions are followed by a table (Table 2) that illustrates what dimensions of performance are related to a specific gap within a given risk.

Behavioral Health & Performance Risks

Behavioral Medicine Risk: the Risk of Adverse Behavioral Conditions and Psychiatric Disorders

Team Risk: Risk of Performance Decrements due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team

***Sleep Risk*:** Risk of Performance Errors due to Sleep Loss, Circadian De-Synchronization, Fatigue, and Work Overload

[1] Key outcomes were identified and defined by the authors: the collaborative team of individuals from BHP Research and Operations Groups.

Mapping Gaps onto Defined Outcomes

Table 1. Gap for each Risk

Gap	Gap Description
BMed 1	What are the optimal methods to enhance behavioral health and prevent decrements before, during and after space flight missions?
BMed 2	What are the optimal methods to predict, detect, and assess decrements in behavioral health (which may negatively affect performance) before, during, and after space flight missions?
BMed 3	What aspects, if any, of cognitive performance change during flight? If there are changes, do they persist post mission? If so, for how long?
BMed 4	What are the optimal methods for detecting and assessing cognitive performance during exploration missions?
BMed 5	What individual characteristics predict successful adaptation and performance in an isolated, confined, and extreme environment, especially for long-duration missions?
BMed 6	What are the optimal methods for treating the individual to remedy behavioral health problems during space flight missions (including behavioral health medicines)?
BMed 7	What are the optimal methods for modifying the environment to prevent and remedy behavioral health problems during space flight missions?
BMed 8	How do family, friends, and colleagues affect astronauts' behavioral health and performance before, during, and after space flight?
Team 1	Given the context of long-duration missions, what are the most likely and serious threats to task performance, teamwork, and psychosocial performance?
Team 2	Given the context of long-duration missions, what are the optimal ways to create tools to monitor and measure task performance, teamwork, and psychosocial performance?
Team 3	Given the context of long-duration missions, what additional approaches would enhance current in-flight interventions and countermeasures for supporting task performance, teamwork, and psychosocial performance?
Team 4	Given the context of long-duration missions, what are the optimal ways to select individuals and compose crews to ensure, optimize, and facilitate task performance, teamwork, and psychosocial performance?
Team 5	Given the context of long-duration missions, what are the optimal ways to train crews, leaders, and ground support to ensure, optimize, and facilitate task performance, teamwork, and psychosocial performance?
Team 6	Given the context of long-duration missions, what are the optimal ways to support and enable multiple distributed autonomous teams to support task performance, teamwork, and psychosocial performance?
Team 7	Given the context of long-duration missions, how does constrained communication impact task performance, teamwork, and psychosocial performance?
Sleep 1	What are the best tools for detecting, monitoring, and assessing performance decrements due to sleep loss, circadian desynchronization, fatigue, and work overload?
Sleep 2	How is performance on ISS and Exploration missions affected by sleep loss, circadian desynchronization, fatigue, and work overload?
Sleep 3	Does sleep loss continue on ISS and Exploration missions, or does adaptation occur?
Sleep 4	How can an individual astronaut's vulnerabilities to sleep loss and circadian rhythms best be determined?
Sleep 5	How can light be used to prevent and mitigate health, performance, and safety problems due to circadian, neuroendocrine, and neurobehavioral disruption, for flight, surface, and ground crews?
Sleep 6	How can individual crew members optimally use sleep and alertness medications before and during space flight?
Sleep 7	What are the health outcomes associated with chronic sleep loss, circadian desynchronization, fatigue, and work overload?
Sleep 8	What is the best way to integrate predictions of the effects on performance of chronic work-rest schedules (for example, sleep restriction at different circadian phases, or split-sleep [nap] schedules at different circadian phases), and to mitigate these effects?
Sleep9	What are the countermeasures needed to recover from chronic partial sleep loss and/or slam sleep shifting, that permit recycling back into the same sleep-restricted schedules?
Sleep10	What tools, flight rules, and recommendations improve sleep loss, circadian desynchronization, fatigue, and work overload for flight and ground crews?

Behavioral Health and Performance Gaps by Outcome Category[2]

Table 2. Dimension of Performance

BMed Gaps	Team Gaps	Sleep Gaps	Outcome Category
1, 2, 3, 7, & 8	1-7	1, 2, 6, 8, & 9	Behavioral Health
4 & 5	1-7	1, 2, 6, 8, & 9	Cognitive Performance
6, 7, & 8	1-7	1, 2, 3, & 6	Psychosocial Performance/Psychosocial Adaptation
5	1-7	1, 2, 6, 8, 9, & 10	Task Performance
1, 2, 6 & 7	1-7	2, 6 & 8	Teamwork

Finally, an exhaustive list of possible indicators (measures) was developed for each of the performance dimensions, and the collaborative team came to a consensus on prioritizing each of these indicators for each outcome category. First, indicators were categorized according to their relevance to the 5 outcome categories. They were then prioritized into groups (1, 2, 3, etc.) according to their subjective proximity to the outcome category. The following question was posed to aid in this exercise: "If we had only one measure for an outcome, what would it be?" Indicators that were rated as most important were given a rating of "1." Those that were second in importance were given a rating of "2," and so on. The results of this deliberative process are shown in Table 3.

[2] Relevant gaps within BHP research were matched with target outcomes, so that each gap is grouped under outcome categories that are affected by that specific gap.

Prioritization of Indicators for Each Outcome Category

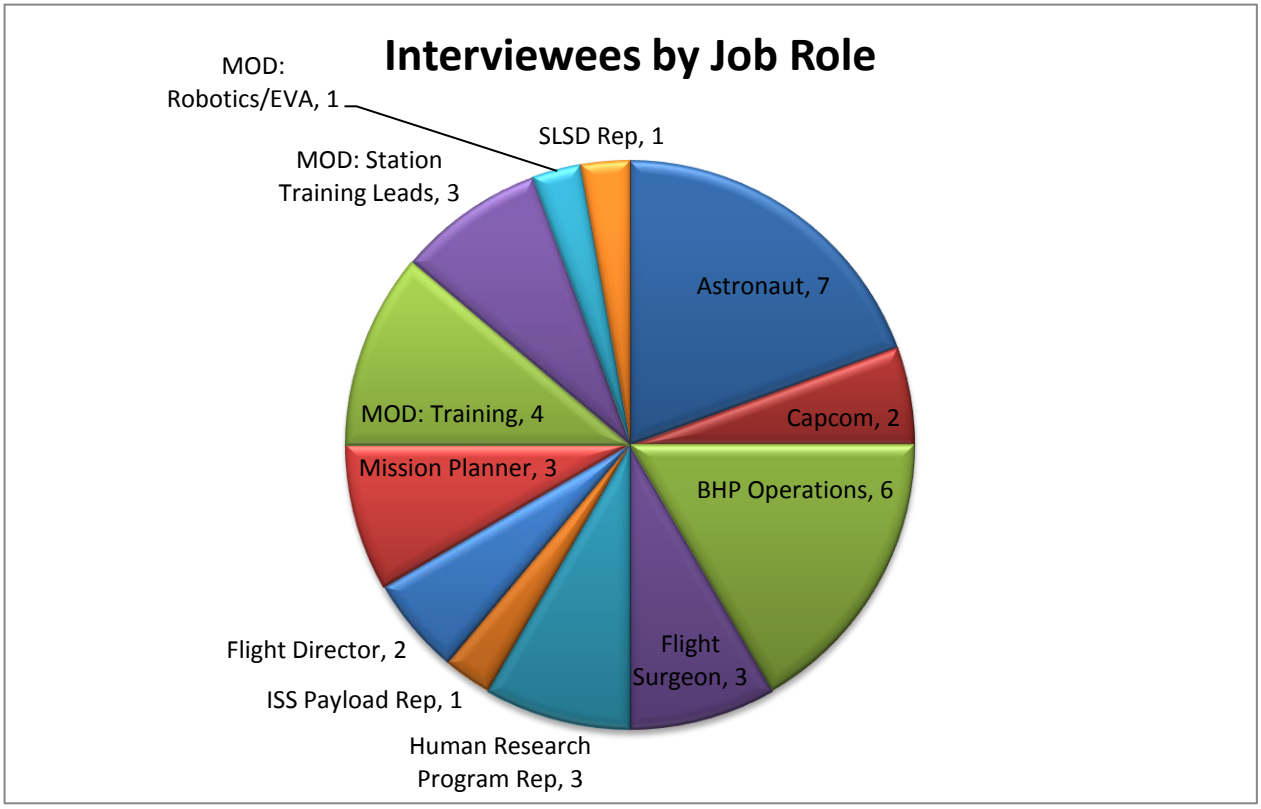
Table 3. Indicators / Outcome Categories

Indicators	Outcome Categories				
	Behavioral Health	Cognitive Performance	Psychosocial Adaptation	Task Performance	Teamwork Performance
Adequate Coping	1		2		
Central Nervous System (CNS) – health of brain	3	3			
Cognitive Assessment		1			
Conflict Resolution					2
Connection with Family			2		
Crewmate Rankings (sociometrics)			1		2
Efficiency, Effectiveness, and Quality of Communications				2	1
Emotional Labor/Load/Burnout	1		1		
Fatigue (physical and mental)	3	4			
Healthy Level of Stress	2		3		
Housekeeping Performance				2	
Irritability/High Frustration/Tolerance/ Resilience	1		2		
Leadership Role					3
Learning/Memory Impairment		2			
Life/Job Satisfaction	2		1		3
LMX/TMX/CMX (leader-member, team member, and crew member exchange)			1		1
Meaningful Work			2		
Percentage of Tasks Completed				2	
Persistent Negative Mood/Affect States	1				
Personal Goals	3		3	3	
Physical Well-being	3				
Public Relations Events				2	
Quality of Support	2		3		
Rank Mission Objectives (# completed)				1	
Ratio of Tasks Completed to Their Duration				1	
Space Flight Resource Management (SFRM)				1	1
Social Support	2		3		

Indicators	Outcome Categories				
	Behavioral Health	Cognitive Performance	Psychosocial Adaptation	Task Performance	Teamwork Performance
Synergy					3
Teamwork Coordination					1
Time of Task Completion				2	
Time Needed to Adapt to Mission or Environment			2		
Us vs. Them (crew vs. ground mentality, rather than crew and ground working together as one team)				3	2

This initial exercise resulted in the development of the structured interview template (Appendix A) and an analysis of data to determine which performance data metrics were priority measures from both components of BHP—Research and Operations. In conjunction with the development of the template, the collaborative team also made a list of key SMEs believed to be critical to interview owing to their operational experience, roles or responsibilities in the NASA JSC organization, or knowledge base with regard to the objectives of this activity. Efforts were made to ensure that a representative sample of organizations and departments that would likely possess different types of performance metrics was obtained. The following job roles were targeted: astronauts, CAPCOMs [i.e., spacecraft communicators], flight directors, Mission Operations Directorate (MOD) trainers, various job roles within MOD (mission planners, Robotics and extravehicular activity [EVA] representatives), representatives from the Human Research Program, a representative from the ISS Payload area and flight surgeons. Thirty interviews were completed over a 3-month period. Graph 1 illustrates the different job roles of those who were interviewed (note: the number exceeds the 30 represented in Graph 1, as certain individuals have more than one job role).

Graph 1. Number of Interviewees by Job Role



Interviews were conducted by the collaborative team with at least one representative from each area (BHP Operations and BHP Research); consent was obtained from the individual to record their interview. The template consisted of two portions; for the first portion of the interview, individuals were asked about examples of performance data for each of the 5 outcomes of performance. For the last portion, individuals were asked to describe how they would define mission success and to then provide specific examples of positive and negative examples of mission success, based on the definition they provided.

Analysis and Results

Interview transcriptions yielded a large amount of information pertaining to performance data metrics as well as definitions of mission success. Each of the performance measures suggested by interviewees was captured in a table illustration, along with the other information that was collected for it (Appendix B). To collect the other information for each measure, interviewers asked (when relevant) each individual for the name of the point of contact (POC), whether data for that measure existed, whether it could be obtained by BHP, and as a follow-up to the preceding question, if it couldn't, why not. Once this information was captured from each interview, the BHP Operations and Research team discussed and analyzed the performance metrics that were recommended. These discussions identified what forward work should be pursued.

Once all forward work was identified for each data point, it was then pertinent to focus on the measures with highest priority (listed in Table 4). The performance measures were prioritized according to the following criteria: ability of data to address specific gaps for BHP Research,[3] ability to validate psychological support practices (such as training, social support, and selection), quality of data, availability of data to BHP Ops and Research, and cost/benefit ratio of time and investment. Appendix B provides a full listing of all performance measures that were suggested by interviewees (please note that the performance measures were first categorized by the performance dimension, followed by the existence of the data, and finally, our current accessibility to that data).

Table 4 summarizes the information relevant to the dimensions of performance (outcome categories) defined above that was gleaned from the interviews. Some basic limitations of these data should be noted. To begin with, some of the data that were claimed to exist (represented in the charts) may not actually exist. Thus, when reviewing the results in Table 4 and Appendix B, the reader should examine all columns for each data point to determine the existence and quality of the data as well as identified future work for the data point. In addition, the interviewees may not have given an accurate representation of the departments and organizations within JSC that might have performance metrics of interest to BHP. Furthermore, the results of this segmented effort may influence the data that are reported, and the reader should be aware that the authors were unable to obtain an exhaustive list of data that may exist. (See Appendix C for examples of actual data that were provided from SMEs while these interviews were being conducted.) Lastly, a note regarding the quality of the data: the reader should also be aware that much of the data that was suggested by the interviewees is anecdotal, subjective, and not standardized.

[3] As determined by the Human Research Program (HRP) Integrated Research Plan (IRP) and 2009 HRP Standing Review Panel Report.

Table 4. BHP High-Priority Performance Measures and Information Obtained from Interviews

Performance Dimension	Measure	Point of Contact	Does it Exist?	Can we Get it?	Why or Why Not?	BHP Forward Work
Behavioral Health	1. Russian training metrics	Russian chair of International Training Control Board (ITCB)	Yes	Yes	Requires internal agreement	Action item for SLSD Director to contact POC
	2. Medical occurrences	Biomedical Engineer (BME)	Yes	Yes	Possible anecdotal evidence	BHP to follow up with POC
	3. Supervisor evaluations	Astronaut Office (CB) Chief	Yes	No	Confidential; need agreement between CB and HRP	Recommend to SLSD director to contact POC for acquisition of data
	4. Medical kits inventory	Pharmacology/ Flight Surgeons	Yes	No	Private medical data; quality of tracking is questionable	Recommend to SLSD Director to contact POC
	5. Astronaut selection data	BHP Chief	Yes	No	Private medical data; would require consent	BHP to contact POC to discuss further
	6. Operational psychology debriefs	BHP Ops	Yes	Unsure	Unsure if data exists, useful, collected	BHP to contact POC to see what is collected
Cognitive Performance	7. Robotics target accuracy	Payload Development and Retrieval System (PDRS) Group Lead	Yes	No	Unsure if confidential or usable data	BHP to contact POC for further info
	8. Russian measures	Russian Mission Control Center (MCC)	Yes	No	Unsure if confidential or usable data; international collection & collaboration	BHP to consider application of these data to SRP rec.
	9. MRIs for astronauts	Flight Surgeons	Yes	No	Private medical information/ data	Re-consent individuals to include in future study; in flight and postflight as a baseline
Psychosocial Performance	10. Crew-ground interaction recordings	MOD	Yes	Yes	Limited resources to collect these data; numerous requests to no avail	Request to SLSD chief to formalize acquisition of these data
	11. BHP countermeasure metrics	BHP Ops Psyc Support Lead	Yes	Yes		BHP to contact POC to collect information
	12. Peer evaluations	CB Chief	Yes	No	Confidential	Request SLSD director to contact chief of CB for acquisition of data
	13. Observe astronauts in training flow	CB Chief	Yes	No	Confidential employment data; would require an agreement	Request SLSD director to contact chief of CB for acquisition of data
	14. Structured Interviews with Payloads Operations Director (POD)	POD	Yes	Unsure	Not really sure what the data are	Contact POC

Performance Dimension	Measure	Point of Contact	Does it Exist?	Can we Get it?	Why or Why Not?	BHP Forward Work
Task Performance	15. Mission objectives completed	MOD/Increment Flight Lead	Yes	Yes	Unsure of informative potential of data	BHP to contact POC
	16. CB evaluation	CB Chief	Yes	No	Confidential data/employee information	Request to SLSD to contact POC and collaborate to create new agreement
	17. EVA and Robotics feedback (data)	PDRS Group Lead	Yes	Unsure	Unsure if confidential or usable data	BHP to contact POC for further info
	18. Docking performance data	MOD	Yes	Unsure	Not sure of quality of data or accessibility	BHP to identify a POC and follow up
	19. Training proficiency data	MOD/DA7	No	No	No formal training ratings done currently	Request SLSD Director to contact POC to initiate systematic data collection
Teamwork	20. Crew-ground recordings (redundant from above)	MOD	Yes	Yes	Limited resources to collect these data; numerous requests to no avail	Request to SLSD chief to formalize acquisition of these data
	21. Watch/observe training flows (redundant from above)	CB Chief	Yes	No	Confidential employment data; would require an agreement	Request SLSD director to contact chief of CB for acquisition of data
	22. Observation of simulations	SFRM/MOD	No	No	Currently not formally collected	BHP recommendation to SLSD to establish formal data collection

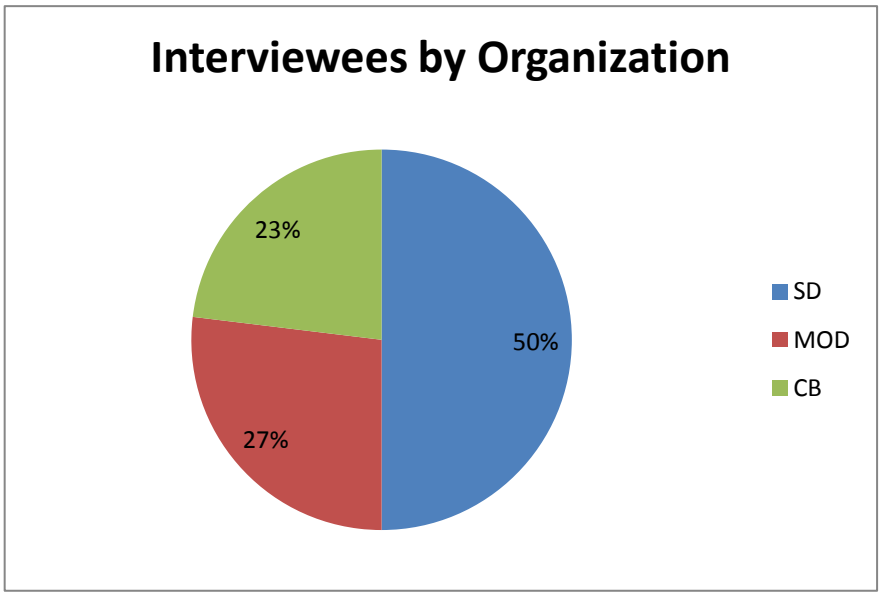
The definitions of mission success were also captured. This part of the interview was transcribed and then coded for two different purposes: first, to determine the viability of the 5 original dimensions of performance; and second, to create a parsimonious categorical structure that would fully encapsulate the definitions provided by the interviewees. This approach served to validate whether the 5 dimensions of performance map to the definitions of mission success across the organization. In the first method of coding, definitions of mission success were coded according to the original 5 dimensions of performance (behavioral health, cognitive performance, psychosocial performance, task performance, and teamwork). Upon completion of this coding method, the responses were re-coded according to overarching categories of mission success definitions that were identified. The following seven categories were used: area vision, mission objectives/goals, personal perspective, maintenance of crew health & well-being, performance, family & support group, and team dynamics (see Table 5 for definitions of these categories). Graphs 2 and 3 illustrate these different coding strategies for all of the participants. Graph 4 depicts the percentage

of interviewees from each organization (the Space Medicine Division [SD], the MOD, and the Astronaut Office [CB]), whereas Graphs 5-10 illustrate the two coding strategies by NASA organization.

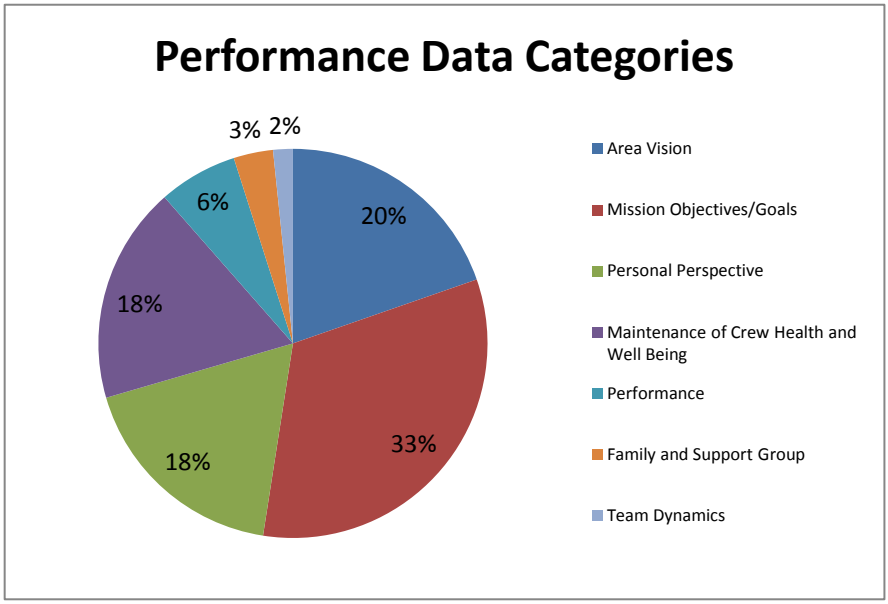
Table 5. Definitions of Mission Success Categories

Area Vision	How a particular organization, section, or department defines and views "mission success"; typically, it represents their concrete criteria for mission success (for example, flight surgeons' primary concern is health of crew).
Mission Objectives/Goals	Objectives and goals are set and prioritized for each mission. If goals are met, or a percentage of goals are met, the mission is considered successful, and vice versa, if goals are not met, the mission is unsuccessful.
Personal Perspective	How the interviewee views "mission success" from their own personal, individual perspective, not taking into consideration their current or past organization's purposes and directions.
Maintenance of Crew Health and Well-Being	How a crew member's health is affected by a mission, comparing their health before the mission to their postflight health.
Performance	How well, or not, a crew member or crew does on tasks they complete or attempt to complete.
Family and Support Group	How the family members or immediate support group of the crew (friends, others outside of immediate family) fared before, during, and after the mission.
Team Dynamics	Any variables related to aspects of teams (for example, cohesiveness and teamwork) and how effective they were over the course of the mission.

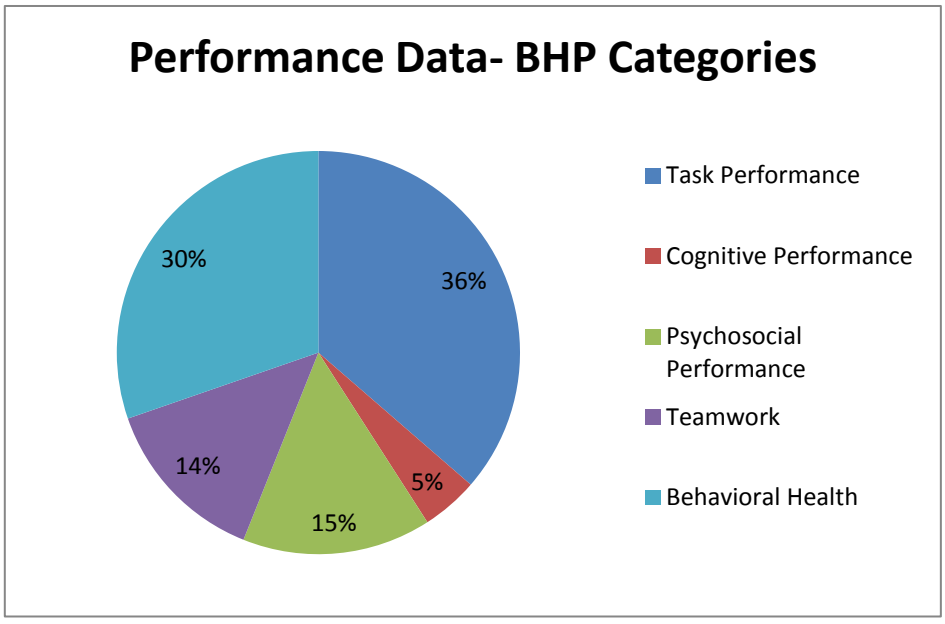
Graph 2: Percentage of Interviewees from each of Three NASA Organizations



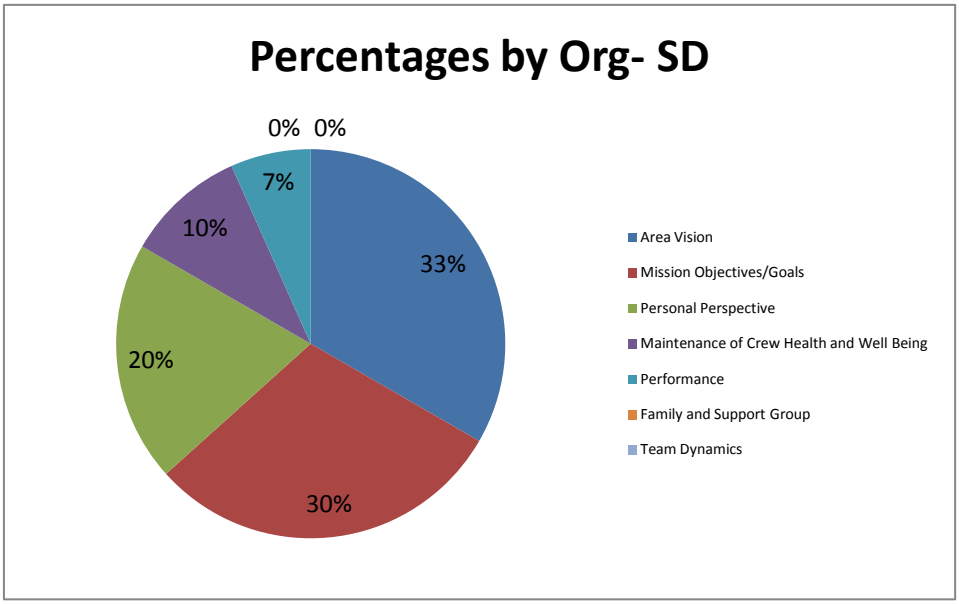
Graph 3: Mission Success Definitions: Performance Data Categories from all Interviewees



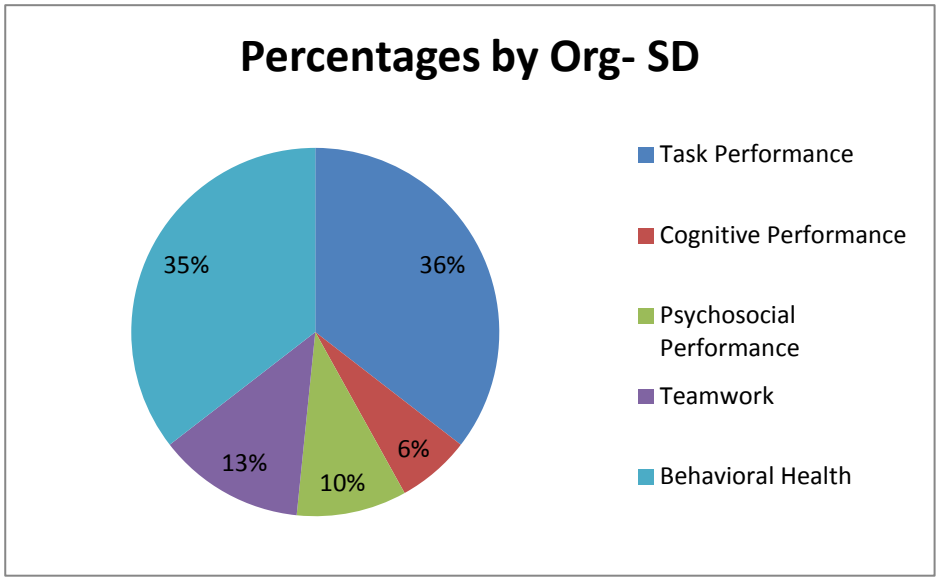
Graph 4: Mission Success Definitions: BHP Performance Data Categories from all Interviewees



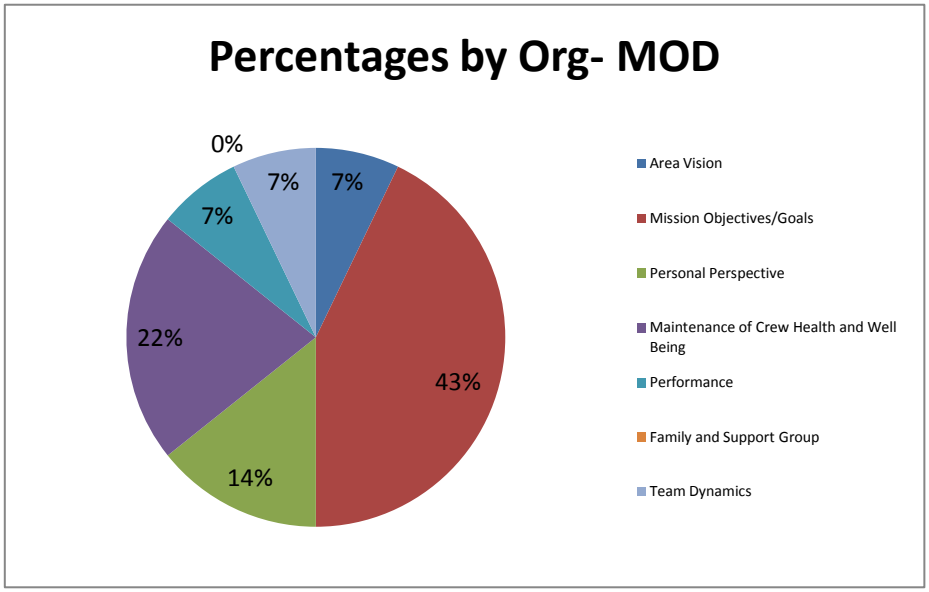
Graph 5: Mission Success Definitions: Performance Data Categories from SD Interviewees



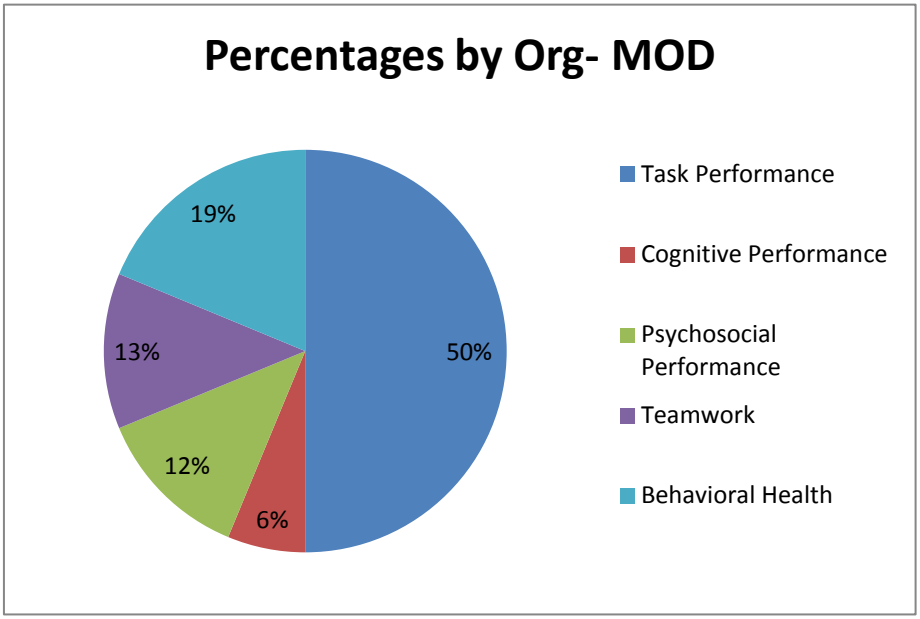
Graph 6: Mission Success Definitions: BHP Performance Data Categories from SD Interviewees



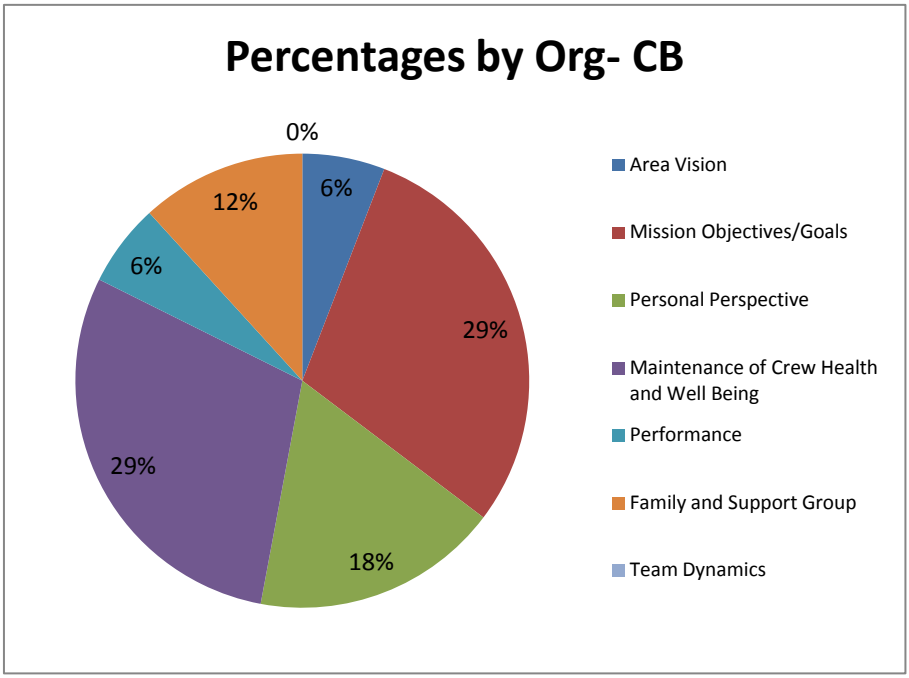
Graph 7 Mission Success Definitions: Performance Data Categories from MOD Interviewees



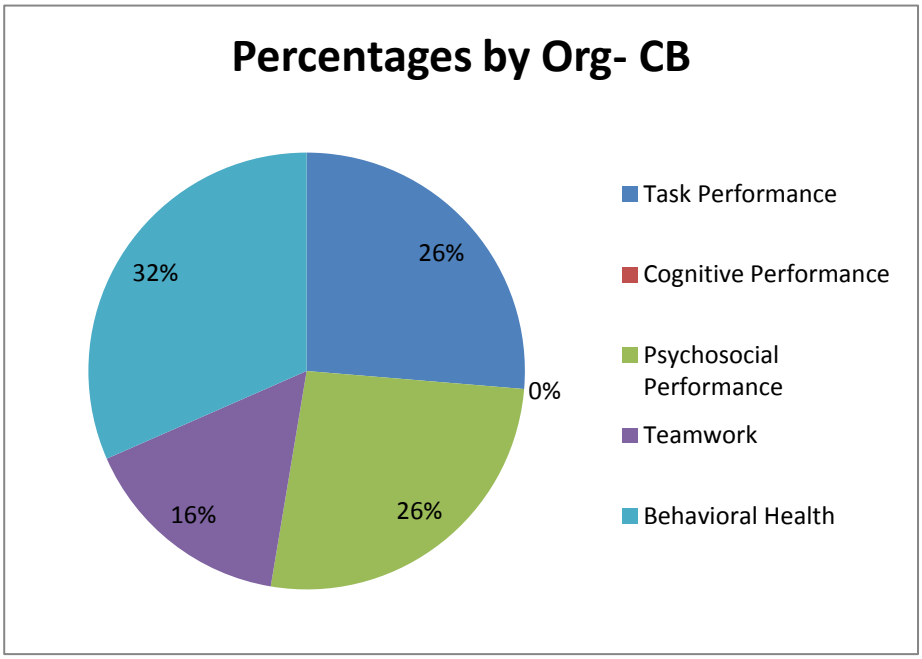
Graph 8: Mission Success Definitions: BHP Performance Data Categories from MOD Interviewees



Graph 9: Mission Success Definitions: Performance Data Categories from CB Interviewees



Graph 10: Mission Success Definitions: BHP Performance Data Categories from CB Interviewees



Discussion

Summary

This collaborative effort was an initial step in establishing a systematic approach to identifying what performance data currently exist within NASA JSC that may be relevant to both components of BHP—Operations and Research. Specifically the effort yielded a systematic approach for objectively assessing the existence and accessibility of current performance-related data owned by different groups at JSC. As part of this effort, interviewees were asked to describe measures (indicators) of performance and to give their definitions of mission success, to evaluate how the relevant BHP-related performance data compared with the varied definitions of mission success that were captured from the interviewees. Identifying and defining mission success also needed to be done to theoretically link the identified performance measures with factors of ultimate mission success that they might mediate. The conclusions drawn from both the mission success definitions and the performance indicators (measures) that were identified are provided below.

To begin with, as is apparent from the pie charts (Graphs 2-10), interviewees provided many interpretations of mission success, with differences not only between interviewees but also between organizations. In general, we may interpret these results as indicating that mission success is multifaceted and comprises many factors beyond simply the safety and performance aspects of the crew that are usually cited. It is noteworthy that a large disparity existed in the level of specificity provided by these interviewees; some individuals provided specific definitions of mission success (perhaps related to their group or departmental organization), whereas others provided more generic definitions of mission success, describing more of an overall NASA perspective of success (for example, all missions have been successful, even the failures, because lessons were learned)

Some noteworthy quotations that provide more insight into the level of disparity of these definitions about mission success are provided below:

- "Every player in the chain of operation probably has a different definition."
- "Compensating with the system for what the human doesn't do so well"
- "It's hard for the agency to acknowledge anything less than success & it's hard for the agency to quantify success."
- "I don't believe mission success is complete if the training flow, mission, and results at the end cause so much family strife that the family is destroyed."
- “If nobody dies, it’s a success.”

However, analyses mapping these different definitions (with varied levels of scope) to the initial 5 categories (behavioral health, cognitive performance, psychosocial performance, task performance, and teamwork) that were developed through this collaborative effort were successful. Thus, it was possible to place each interviewee's definition of mission success in one of the defined categories.

The ability to categorize all of these dynamic and varied definitions in the 5 BHP Performance Data Categories may signify that the performance categories were too broadly defined and served as "catch-all" buckets that any definition of mission success would seemingly fit under. Although this possible limitation is acknowledged, it is more likely that these 5 categories identify a unique contribution to mission success, and that mission success represents more than just task performance, as it is often defined at a general level by the organizational culture. To exemplify this point, the authors conducted a quick Internet search with the terms "NASA mission success." It yielded many results that focused solely on completing mission objectives and on safety practices. Thus, one conclusion that may be drawn from this analysis of mission success is that the NASA organization must consider a broader definition of mission success across the entire organization. Because many groups in NASA work in areas outside of the narrow scope of completing mission objectives and working safely, the communication of what defines mission success must have a broader scope. All NASA groups provide a critical component to achieving mission success, and the aforementioned aspects are not clearly represented in these narrow definitions. This recommendation will be discussed further in the Forward Work section of the report.

To summarize the collection and analysis of the performance measures that were obtained, this collaborative effort was able to obtain a high volume of potential data; however, much of the data was not of high quality and/or accessible to the BHP groups. In addition, much of the data was not systematically collected in all 5 of the BHP Performance Data Categories that were defined; metrics that were provided were often anecdotal, and if quantitative, were often haphazardly collected and not systematically kept. Finally, much data that was identified and systematically kept and maintained often fell within a confidential category in which the data were inaccessible to the BHP groups. This collection and analysis effort has brought many conclusions, which are described below.

First, it is concluded that there is a low level of standardization for data collection across the entire NASA organization; no repository exists for data that are currently being collected that addresses the performance categories that have been discussed. Although efforts like the Longitudinal Study of Astronaut Health (LSAH), the Life Sciences Data Archive (LSDA), and the SF Operations Habitability Database (OpsHab dbase) have established databases that may yield information relevant to some of the

categories defined by BHP, not all categories are represented. In addition, raw data in some of these repositories still lack accessibility, which creates further limitations in being able to utilize the data.

Second, it is concluded that much of the performance data that were identified is most often subjective; thus, access to objective data is severely lacking. Also, although some anecdotal data that were collected may be considered objective (such as the VAMS [Video Asset Management System] video library), this information is often provided in a public forum or is made available to the public; thus, these data are often sanitized, which adds to range restriction issues.

Finally, when data have been deemed relevant and of high potential to be useful to BHP, accessibility issues arise. Accessibility is also an issue for data that were identified as a need but did not actually exist. For example, a mechanism for collecting systematic debriefs of returning astronauts that is relevant and accessible to both BHP Operations and Research does not currently exist. When considering the other forward work actions designated in Appendix B for each performance data metric, it is important to note that availability of resources is a critical factor in obtaining existing and accessible data, as gathering, cleaning, and analyzing data metrics that have been identified as having high potential will require a large number of labor hours.

Forward Work

For forward work, the authors make the following recommendations:

- **An accessible data repository for knowledge management should be established by the Agency.**
    - To capitalize on existing data collection efforts, utilize data that is collected to its full potential, and move toward a more innovative approach in which research and operational groups within NASA work together synergistically to achieve mission success, it is imperative to establish a Knowledge Management System for data. Further, an organizational culture in which integrated data are collected, shared, and analyzed must be established to support such a Knowledge Management System as the one proposed. As part of this management system and organizational culture shift, it will also be important that participants (including flight control personnel, astronaut crews, and others) do not feel objectified, and that feedback from those who analyze the collected data is shared with the participants (while protecting confidentiality). Finally, within this Knowledge Management System, research data collected should be used to validate and improve practices in operations.

- **Standardize methods to collect and store data across the Agency.**
    - Standardization of methods to collect and store performance data would allow accessibility to those who have a valid justification for access and use of the data. However, it is acknowledged that different levels of access must be considered, especially with highly private and confidential data.

- **Establish an encompassing mission success definition.**
    - As was described, it is apparent from the data collected for this effort that mission success is a multi-level, multi-dimensional concept. Thus, there is a need for the organization to articulate a mission success definition that is more current and encompassing.

If data collection continues to be conducted as it has in the past and present, problems with accessing data, silo issues in different groups across the organization, and an overall lack of integration of critical data to both promote operational success and reduce risk of future missions will continue. These issues are also associated with continued repeated and wasted effort, exorbitant and unnecessary costs, and unnecessary duplication of collecting data from participants (this is especially true when considering astronaut time and resources).

Specifically to the BHP Performance Data Effort, the collaborative team will begin with addressing the high-priority items from the performance measures that were identified in Table 4. From the data that are ultimately obtained and deemed usable, BHP Research will utilize any data that are ultimately collected to address research gaps, whereas BHP Operations will utilize meaningful data to validate current practices. In addition, specific measures that were identified as high priority (see Appendix B) will be carried forward to the SLSD director, either for data that may not exist but should, or data that do exist but BHP cannot currently access.

Lastly, forward work should address some of the limitations in this current effort. As was described above, interviewees were specifically only from JSC and did not include personnel from the other NASA centers. Furthermore, not all organizations within JSC were represented (such as Human Adaptation and Countermeasures Division [SK] and SD). For these reasons, it is likely that many performance data metrics were not captured that may exist and may be relevant to the BHP Performance Data Categories as they are defined. Thus, we recommend that this effort be continued and carried by the SLSD to capture all organizations within JSC, all centers across NASA, and a larger population of interviewees in operations, as many of the interviewees were research personnel. This effort should coincide with the task of developing an accessible repository for knowledge management across NASA.

References

Sipes, W. & VanderArk, S. (2005) Operational Behavioral Health and Performance Resources for International Space Station Crews and Families. Aviation, Space, and Environmental Medicine 76 (6), 36-41.

Bachmann, R.E., Sowin, T.W., Bagian, J.P., Bauer, M.S., Fraser, J.R., Yerkes, S.A., Holmes, E.K., & DeLaney, P.M. (2007) NASA Astronaut Health Care System Review Committee. Institute of Medicine (IOM).

Appendix A: Template for Structured Interviews

Structured Interviews for Performance Data Effort

Name: _____ Date: _____

Organization: _____

Job Background: _____

Interviewed by:

Ops: Al Lacey Kelley

Research: Lauren Camille Kathryn Cristina

A. Mission Success

Please describe how you would define and measure mission success? Then, please provide specific examples of both successful and unsuccessful missions.

B1. Performance Data

1. Behavioral Health

Construct	Data/ Measure	Does data exist?	Feasibility

2. Cognitive Performance

Construct	Data/ Measure	Does data exist?	Feasibility

3. Psychosocial Performance/Psychosocial Adaptation

Construct	Data/ Measure	Does data exist?	Feasibility

4. Task Performance

Construct	Data/ Measure	Does data exist?	Feasibility

5. Teamwork

Construct	Data/ Measure	Does data exist?	Feasibility

B2. Performance Data

What specific data do you have (or 'house', or are responsible for, or you are aware of that is in your area) that would be helpful to this effort?

Ex: selection data/medical files/winscat/training

C. Additional Questions

1. Is there any other type of data available that we should take into consideration?

2. Can you recommend anyone else that we should talk to that either (a) has access to data or (b) is knowledgeable about existing data?

Appendix B: Forward Work Decisions

Decision Points (for each Outcome Variable):

- **Yes, Yes**
- **Yes, No**
- **Yes, Unsure**
- **No, No**
- **No, Yes**
- **No, Unsure**

Behavioral Health; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
1. Russian Training Metrics	Russian chair of ITCB	Yes	Yes	Requires internal agreement	Action item for SLSD Director to contact POC
2. Making time for Self Care	Astronaut	Yes	Yes	Limited; Captured in Stuster's journals (recreation/ leisure)	Action item to BHP to request more objectives measures in future studies
3. Actual vs. Scheduled sleep time	Schedulers	Yes	Yes	Schedulers provide info	BHP needs to collect this info
4. Publications	Kirkelar Book- 90 Days in Space (28)Astronauts, spouses, blogs, books, journals, twitter (7)	Yes	Yes	On going task	BHP to continue collecting & analyzing publications
5. Sleep Debt	Flight Activities Officers	Yes	Yes	Have samples and can get access	Archival data collection will address BHP gaps

Behavioral Health; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
6. Emotional/ SFRM response of flight controller to command errors (recovery of performance)	SFRM	Yes	Yes	Have samples	Lacey has data
7. Information from former BHP Chiefs	BHP Performance Data Team	Yes	Yes	Gained through these interviews	Completed
8. Track where they are on the timeline	Flight Activities Officers	Yes	Yes	Have samples of this data and can request more	Kathryn has data
9. Scheduling Changes	MOD Supervisor/ Mission Ops integration	Yes	Yes	Can get from Scott Curtis	BHP to consider whether data collection would address our gaps
10. Medical occurrences	BME	Yes	Yes	Possible anecdotal evidence	BHP to follow up with POC

Behavioral Health; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
11. Performance Errors	MOD	Yes	No	No systematic data collection exists	BHP to consider whether data collection would address gaps and BHP Ops needs
12. Physical Health; Inpatient Medical Data; Medical Records; Annual Exams	NBL Training Records & Flight Surgeons	Yes	No	Private Medical Information/ Data	BHP to consider request to reconsent or alteration of current consent
13. Interviews – PFCs	BHP Chief	Yes	No	Private Medical Information/ Data	BHP to consider request to reconsent or alteration of current consent
14. Private Weekly FD Conference; In-Flight Data conferences	MOD	Yes	No	Not recorded; Just a private conversation	Recommend to SLSD to consider data collection requirement
15. Number of visits to Clinical Psych	BHP Chief	Yes	No	Mainly family members; private med data, quality of data questionable	BHP to consider request to reconsent or alteration of current consent
16. Meds Prescribed	Flight Docs	Yes	No	Private Medical Information/ Data	BHP to make rec. to SLSD to establish data management repository
17. Supervisor Evaluations	CB Chief	Yes	No	Confidential; Need agreement between CB and HRP	Recommend to SLSD director to contact POC for acquisition of data
18. NOLS	CB Chief	Yes	No	CB rejected request (data too weak to be beneficial)	BHP to make consideration for improved data collection
19. PPCs	Flight Surgeons & BHP Chief	Yes	No	Private Medical Information/ Data	BHP to consider request to reconsent or alteration of current consent

Behavioral Health; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
20. Med Kits Inventory	Pharmacology/ Flight Surgeons	Yes	No	Private Medical Data, quality of tracking is questionable	Recommend to SLSD Director to contact POC
21. Physiological data from bed rest	FAP Project Scientist	Yes	No	Research medical data	BHP BMed RAM look at informed consent to determine if we can have data
22. Eye screening for vision issues for Bed Rest study	FAP Project Scientist	Yes	No	Research Medical Data	BHP to consider collecting data: assigned to BMed Ram
23. Post Flight PPC Debriefs	BHP Chief	Yes	No	Private medical information/ data	BHP to make recommendation to SLSD to obtain consent
24. Astronaut Selection Data	BHP Chief	Yes	No	Private medical data; would require consent	BHP to contact POC to discuss further
25. PMCs	Flight Surgeons	Yes	No	Private medical data; unsure if data is useful	BHP will not pursue data at this time due to quality of data
26. Actual vs. Scheduled sleep time	Barger Studies	Yes	No	PI owns data	BHP to make recommendation to SLSD to establish data management repository
27. Regular comm. w/ family; Family Support; Frequency of PFCs	BHP Ops, BHP Chief	Yes	No	Not consented to share that information/data	BHP to consider request to reconsent or alteration of current consent

Behavioral Health; YES-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
28. Attendance at scheduled exercise	Life Sciences Lead Researcher	Yes	Unsure	Data is not relevant bc BHP not a valid indicator; Scheduled exercise is not-indicative of health	BHP will not pursue data at this time
29. Weight Change	Flight Surgeons	Yes	Unsure	BHP doesn't need it; too robust	BHP will not pursue data at this time
30. Cortisol	Pharmacology, Immunology	Yes	N/A	May be no reason to get, not useful, archival collection not beneficial	BHP to consider collecting cortisol data to address BHP gaps (Contact Ginger Wotring)
31. Photo-Content analysis	Flight Surgeon	Yes	N/A	Data voluminous with small # of incidence-difficult to tie to specific BHP issues	BHP will consider to start task with increase in resources
32. Daily reports from ISS—content analysis—PAO	PAO	Yes	N/A	Data voluminous with small # of incidence-difficult to tie to specific BHP issues	BHP will consider to start task with increase in resources
33. Physiological Heart Rate	Unsure	Yes	N/A	May be no reason to get, not useful, archival collection not beneficial	BHP to consider collecting physiological data to address BHP gaps
34. TAMS	MOD	Yes	N/A	Data doesn't address BHP needs; not useful	BHP Recommends to SLSD to request or require better training statistics collected and training progress tracked

Behavioral Health; YES-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
35. Centrifuge Study Data	Neurobehavioral Lab	Yes	Unsure	May have published data	BHP to investigate and research with POC
36. Lunar Analog Study Data	Project Scientist for FAP	Yes	Unsure	Research medical data	BHP to investigate and research with POC
37. Campaign 3 Data	Project Scientist for FAP	Yes	Unsure	Research medical data	BHP to investigate and research with POC
38. Doubles (DBLS)- Daily Bone Load Stimulus Data	Project Scientist for FAP	Yes	Unsure	Research medical data	BHP to investigate and research with POC
39. Bone Loss Data	HHC Manager	Yes	Unsure	Research medical data	BHP to investigate and research with POC
40. Op Psy Debriefs	BHP Ops	Yes	Unsure	Unsure if data exists, useful, collected	BHP to contact POC to see what is collected
41. Robotic Docking Data	Robotics Training Lead	Yes	Unsure	Unsure if data is useful; may be confidential	BHP to contact Robotics/POC to inquire about data and accessibility
42. SFRM ratings collected on team-care, self-care, and conflict management	SFRM Instructor	Yes for operators	Unsure	We can have it; data collection not systematic	fwd work would require getting consent from operators and astronauts; and recommend more systematic data collection for future collection

Behavioral Health; NO-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
43. Info from Flight Surgeons	Flight Surgeons	No	No	People have not been interviewed yet	BHP to interview Flight Surgeons
44. NASA Mir CMs	CB	No	No	People have not been interviewed yet	BHP to interview Mir Astronauts
45. Individual Activity level compared to baseline levels (depression/ anxiety)	N/A	No	No	Currently not formally recorded/ collected	BHP to consider whether data collection would address our gaps
46. Perceived frustration levels and outlets	N/A	No	No	Currently not formally recorded/ collected	BHP to consider whether data collection would address our gaps
47. Venting to ground controller	CAPCOM & Flight Director	No	No	Currently not formally recorded/ collected	BHP to consider whether data collection would address our gaps
48. Interview Lead Crew Rep.	MOD	No	No	Currently not formally recorded/ collected	BHP to consider whether data collection would address our gaps

Behavioral Health; NO-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
49. Electing to do extra projects	Astronaut, CB Office	No	Yes	Create or Request it	Action item to BHP: Consider request measures in future studies

Behavioral Health; NO-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
50. Interviews for data/ opinions	Astronauts	No	N/A	Not systematically collected	BHP will incorporate forward work into current IRP tasks BMed 1 & 2
51. Showing up at meal times	Astronaut	No	N/A	Not systematically collected	BHP make recs to fwd data collection (ie Stuster's journals); Team gap 3-start collecting nutrition/meal time data Other element studies where possible (eg - AFT, nutrition)
52. SFRM ratings collected on team-care, self-care, and conflict management	SFRM Instructor	No for astronauts	N/A	We can have it; data collection not systematic	Forward work would require getting consent from operators and astronauts; and recommend more systematic data collection for future collection

Cognitive Performance; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
53. Life Sciences Data Archive	SD Supervisory Computer Scientist	Yes	Yes		BHP to investigate/ analyze the archive
54. Chapter in Space Physiology Book	Astronaut/ Payload Specialist	Yes	Yes; Have		Review chapter to search for data or data sources
55. Cognitive Deficits (timeline/ schedule)	MOD	Yes	Yes	Data is accessible but noisy data	BHP To Review data provided by Gail Hansen
56. Crew Evaluation Feedback Database	CAPCOM	Yes (see website)	Yes		BHP to contact POC to get access to website
57. PVT Data	BHP PI – David Dinges	Yes	Yes		BHP to determine what specific data we need
58. Performance speed; Planned time v. actual time to do a task	Mission Planners	Yes	Yes		Follow up with POCs and mission planners; difficult to tie to cog perf.
59. Publications	N/A	Yes	Yes	On going task	BHP to continue collecting & analyzing publications

Cognitive Performance; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
60. WinSCAT	BHP Psychologist	Yes	No	Need to have astronauts themselves reconsent	Kelley Slack to contact POC to request the report of the data
61. Robotics- Target Accuracy	PDRS Group Lead	Yes	No	Unsure if confidential or useable data	BHP to contact POC for further info
62. Docking statistics	MOD	Yes	No	Unsure if confidential or useable data	BHP to contact Clarence Sams to find correct POC
63. EVA statistics	PDRS Group Lead	Yes	No	Unsure if confidential or useable data	BHP to contact POC for further info
64. Russian Measures: voice stress patterns, speech content, errors	Russian MCC (SOOP)	Yes	No	Unsure if confidential or useable data; international collection & collaboration?	BHP to consider this data's application to SRP rec.; contact SVA or John McBrine
65. MRIs for astronauts just beginning (infer pre and post mission)	Flight Surgeons	Yes	No	Private Medical Information/ Data	Reconsent individuals to include in future study in flight and post flight as a baseline
66. Shuttle Landing Parameters	MOD	Yes	No	Don't want because short duration mission data; no means of getting	BHP will not pursue data at this time
67. PPCs	BHP Ops; Flight Surgeons	Yes	No	Private Medical Information/ Data	Reconsent or alteration of current consent
68. PMCs (Space Stupids)	Flight Surgeons	Yes	No	Private medical data; unsure if data is useful	BHP will not pursue data at this time

Cognitive Performance; YES-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
69. Debriefs of systems and payloads	MOD	Yes	Unsure	Not relevant, not needed because shuttle data	BHP will not pursue data at this time
70. Cortisol—clinical lab	CPHS Coordinators	Yes	Unsure	Unsure if private, confidential data	Start with Scott Smith, Kathleen m. & Virginia Wotring to investigate if want data
71. Single system tests- Technical	MOD	Yes	Unsure	Unsure of confidentiality and quality of data	Contact Marc Reagan to determine if we can access the data
72. Feedback from Sims	MOD	Yes	Unsure	Not relevant to Cognitive Performance	BHP will not pursue data at this time

Cognitive Performance; NO-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
73. WinSCAT at NEEMO	BHP Ops	No	No	Not collected at NEEMO	BHP will not pursue data at this time
74. Psych Screening	BHP Ops	No	No	Private Medical Information/ Data	BHP will not pursue data at this time
75. Loss of STM (Short term Memory)	BHP Ops	No	No	Currently not formally recorded/ collected	BHP to consider collecting in future research
76. Post/Pre/In Flight Evals	MOD	No	No		BHP to follow up with Al Holland
77. Drug medication problems (eg, drug overdose)	BHP Ops/Flight Surgeons	No	No	Doesn't formally exist; Only evidence available may be anecdotal	BHP currently in work reviewing Astro bios; request to SLSD director to implement standardized drug tracking system/process

Cognitive Performance; NO-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
78. Self-report of cognitive deficits	Individual ISS Astronauts; MOD CAPCOM	No	Yes		BHP currently conducting interviews; will consider interviewing ground control team

Psychosocial Performance; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
79. Journals	BHP PI – Jack Stuster	Yes	Yes (and possibility to get specific astronaut's data)		Work in progress, received Stuster's final report
80. Sleep Logs	BHP PI – Laura Barger	Yes	Yes		On going research with PI, will obtain data once study is completed
81. Crew-Ground Interaction Recordings	MOD	Yes	Yes	Limited resources to collect this data; Numerous requests to no avail	Request to SLSD chief to formalize acquisition of this data
82. Off-Nominal Video Clips	VAMS Website	Yes	Yes	Limited resources and low incidence rates	SLSD to consider feasibility of pursuing this further
83. Crew perceptions regarding language, travel, scheduling, medical, social, etc.	Multiple (interviews; bios)	Yes	Yes		Currently conducting interviews and reviewing literary resources
84. Mir survey done about mood	BHP PI – Nick Kanas	Yes	Yes	Published	N/A; already have these articles; Complete
85. Number of unanswered calls from ground to crew	Technical Productions Office	Yes	Yes	Limited resources to collect this data; numerous requests to no avail	Request to SLSD chief to formalize acquisition of this data

Psychosocial Performance; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
86. Lack of sleep	BHP PI – Laura Barger	Yes	Yes	BHP PI	Team and Sleep RAM to determine if connection to psychosocial performance
87. Poor sleep	BHP PI – Laura Barger	Yes	Yes	BHP PI	Team and Sleep RAM to determine if connection to psychosocial performance
88. BHP Countermeasure Metrics: IP Phone, PFCs, Crew Webpage, crew discretionary events	BHP Ops Psy Support Lead	Yes	Yes		BHP to contact POC to collect information
89. 3rd Quarter Effects for Crew	BHP PIs	Yes	Yes	Data has been collected and reported	BHP to determine whether prev. data collection is sufficient to address 3rd quarter effect or if future research is needed
90. Morale boosting events (Count/ Anecdotal)	BHP Ops Psy lead	Yes	Yes	Some of it is publicly accessible	BHP to determine if any of it is useful/relevant to address gaps
91. Immunology (viral susceptibility)	Life Sciences Researcher	Yes	Yes	Data would need to be summarized in a report	BHP to determine if data needed; currently collaborating with them
92. Data from Chamber Studies, including regenerative life support system	PIs – David Dinges	Yes	Yes	BHP PIs are participating	BHP to obtain reports

Psychosocial Performance; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
93. Time scheduled to do a task is adjusted by length of stay in space	Schedulers	Yes	Yes	Provided by a lead scheduler	BHP to determine if this addresses psychosocial performance
94. Publications	N/A	Yes	Yes	On going task	BHP to continue collecting & analyzing publications
95. Narrative from the post flight crew presentation at Space Center Houston	Oral History Office	Yes	Yes	Publicly accessible; Robust data with little incidence	BHP will not pursue data at this time
96. Divorce Rates	Public Record	Yes	Yes		In progress, will cross-reference for accuracy
97. Medical Requirements Data	Manager, Epidemiology & Information Management Section	Yes	Yes	Data stored on NASA Sharepoint	BHP to investigate and determine relevancy
98. Antarctic Research	BHP PIs	Yes	Yes	Published	In progress; Reviewing literature

Psychosocial Performance; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
99. Mission Debriefs/ Interviews	CB Office	Yes	No	No agreement with astronaut office to share data	Request SLSD Director to discuss with CB Chief
100. Peer Evaluations	CB Chief	Yes	No	Confidential	Request SLSD director to contact chief of CB for acquisition of data
101. Supervisor Evaluations	CB Chief	Yes	No	Confidential; Need agreement between CB and HRP	Action item for SLSD director to contact POC for acquisition of data
102. Training Evaluations	CB Chief	Yes	No	Confidential	Request SLSD director to contact chief of CB for acquisition of data
103. Commander Evaluations (NOLS)	CB Chief	Yes	No	Confidential	Request SLSD director to contact chief of CB for acquisition of data
104. Anxiety and depression screening for Bed Rest study	FAP Project Scientist	Yes	No	Private Medical Information/ Data	BHP to determine need for data (would require reconsenting)
105. SFRM Data	SFRM Lead	Yes	No	Training data; Need consent and agreement	BHP to contact SLSD Director to contact DA7 to request data

Psychosocial Performance; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
106. PFCs	BHP Ops	Yes	No	Private Medical Information/ Data	Reconsent or alteration of current consent
107. Tone of Voice (Russian Measures)	Russian MCC (SOOP)	Yes	No	Unsure if confidential or useable; international collection & collaboration?	BHP to consider this data's application to SRP rec.; contact SVA or John McBrian
108. PMCs	Flight Docs	Yes	No	Private Medical Data; unsure if data is useful	BHP will not pursue data at this time
109. Pre/In/Post Medical Data (L-, R+)	BHP Ops	Yes	No	Private Medical Data; unsure if data is useful	BHP will not pursue data at this time
110. PPCs	BHP Ops & Flight Surgeons	Yes	No	Private Medical Information/ Data	Reconsent or alteration of current consent
111. Adaptation Plan	Former BHP Ops Psychologist	Yes	No	Not sure where/if recorded/ preserved	No forward work; current class doesn't produce any data
112. Observe astronaut in training flow (narratives for ASCANS)	CB Chief	Yes	No	Confidential employment data; Would require an agreement	Request SLSD director to contact Chief of CB for acquisition of data

Psychosocial Performance; YES-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
113. Structured interviews with payload operations directors (POD)	POD	Yes	Unsure	Not really sure what the data is	Contact POC
114. Nutrition Lab Reports/Data	HHC Element Scientist	Yes	Unsure	Not sure if confidential or accessible	BHP to follow up with POC
115. FC Weekly Evals (Peer)	Mission Ops integration	Yes	Unsure	Unclear if data is accessible for BHP use	Investigate correspondence with POC and follow up with POC
116. PANAS	Immunology Group	Yes	Unsure	Not sure of accessibilty or useability	BHP to contact immunology
117. Perceived Stress Scale - looking at its relation to cortisol activation	Immunology Group	Yes	Unsure	Not sure of accessibilty or useability	BHP to contact immunology
118. Structured interviews with payload operations directors (POD)	POD	Yes	Unsure	Not really sure what the data is	Contact POC

Psychosocial Performance; NO-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
119. Behavioral Adaptation (metrics for adaptation)	Astronaut	No	No		BHP will not pursue data at this time
120. Prior experience with interpersonal interaction	may be related to family and/or team experiences	No	No	Currently doesn't exist	BHP to consider more formalized sociometric evaluations
121. Talking to spouses; Family Support info Summary	FSO Lead	No	No	Does not exist formally; only anecdotal	BHP consider interviewing these people
122. Conv. w/ Lead Scheduler, FD, Capcom, Crew Rep	MOD	No	No	Currently not formally recorded/ collected	BHP to evaluate application to gaps for future research opportunities, relevancy and need
123. Psychosocial Performance/ Adaptation - Team Debriefs	Each MC system group lead	No	No	Closed debrief sessions	Contact each team lead to determine if anything is relevant and if we could obtain it
124. In-flight Data (Ground Crew interviews)	CAPCOM, psychological support, shift flight director	No	No	Currently not formally recorded/ collected	BHP To determine if data should be generated

Psychosocial Performance; NO-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
125. Errors; Human mistakes made in space that are documented	MOD	No	No	Errors made in space are not recorded, rare, and non attributable	Investigate ways to collect errors in existing studies
126. Social Support	Astronaut	No	No	Currently not formally recorded/ collected	BHP to generate data; design a study; collaborate with ops
127. Family Adjustment	Spouses & Astronauts	No	No	Currently not formally recorded/ collected	BHP to generate data; design a study; collaborate with ops
128. Repatriation	Spouses & Astronauts	No	No	Currently not formally recorded/ collected	BHP to generate data; design a study; collaborate with ops
129. Document preferences and how they have changed (social media)	BHP Ops	No	No	Currently not formally recorded/ collected	BHP to determine relevancy for future study
130. Ask the crew how much longer they could have stayed (or alternatively, what would be your ideal mission length) and correlate with the personality data we have	Astronauts	No	No	Currently not formally recorded/ collected	BMed RAM to determine gaps to address (1&2); if necessary to address

Task Performance; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
131. Integrated Medical Model, 2 places for debriefs	Shuttle (Knowledge Management)-ISS (Epidemiology)	Yes	Yes	Not sure how data is kept and if accessible/ useable to us	BHP to follow up, investigate and determine relevancy
132. Mission Objectives accomplished	MOD/ Increment Flight Lead	Yes	Yes	Unsure of informative potential of data	BHP to contact POC
133. # of changes to schedule once been finalized (ISS)	Mission Planners	Yes	Yes	Unsure of quality of data; too few resources	BHP to review gaps to determine relevancy
134. Log of issues that need to be worked	Lead Flight Director	Yes	Yes	Unsure of quality of data; too few resources	BHP to review gaps to determine relevancy
135. Payload anomaly reports (PAR); Performance errors	Physical Scientist	Yes	Yes, Public Information	Not sure of quality of data or accessibility	BHP to contact POC
136. Increment lessons learned; Performance improvement?/ errors?	Aerospace Engineers	Yes	Yes, Public Information	Not sure of quality of data or accessibility	BHP to contact POC

Task Performance; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
137. Timeline-time scheduled for each task	Mission Planners	Yes	Yes	Limited resources to collect this data	BHP to consider which gaps could possibly be addressed by this
138. # of times had to rework schedule	Mission Planners	Yes	Yes	Limited resources to collect this data	BHP to consider which gaps could possibly be addressed by this
139. Science Lab Weekly Updates	HRP	Yes	Yes	Limited resources to collect this data	No forward work; does not adequately address gaps
140. Flight Controller Command Totals and Command Errors (Database)	Flight Systems Training and Ops - MOD	Yes	Yes	Already have access	BHP to investigate & determine useability
141. Task performance accuracy for Ground Controllers; training and during mission	Flight Systems Training and Ops - MOD	Yes	Yes	Already have access	BHP to investigate & determine useability
142. Flight Requirements Doc	MOD	Yes	Yes	Limited resources to collect this data	BHP to consider which gaps could possibly be addressed by this

Task Performance; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
143. Flight Director Evaluations of Flight Controllers	MOD/Flight Directors	Yes	No	Not centrally maintained	Request to SLSD to contact POC to initiate systematic data collection
144. Cosmonaut command errors	Russian counterpart	Yes	No	Unsure of data; may be sensitive	BHP to contact Steve Vanderark for initial POC
145. Self Report during PPC	BHP Ops	Yes	No	Private Medical Information/ Data	BHP capturing this data in other dimensions; bhp to consider creating own metrics from interviews thru research efforts
146. Self report during post flight debrief	BHP Ops	Yes	No	Private Medical Information/ Data	BHP capturing this data in other dimensions; bhp to consider creating own metrics from interviews thru research efforts
147. Medical Ops Data	Flight Surgeons	Yes	No	Private Medical Information/ Data	Request to SLSD to contact Med Ops Director to obtain data that is non-identifiable
148. FCPC evaluations for certification and quarterly reviews	DA7	Yes	No	Employee data owned by USA contractor	BHP to contact DA7 to request info or identify POC
149. CB Eval	CB Chief	Yes	No	Confidential data/Employee information	Request to SLSD to contact POC and collaborate to create new agreement

Task Performance; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
150. NOLS Training	CB Office	Yes	No	CB rejected request (Data too weak to be beneficial)	BHP to make consideration for improved data collection
151. Performance Appraisal	CB Chief	Yes	No	Confidential; Need agreement between CB and HRP	Action item for SLSD director to contact POC for acquisition of data
152. Multiple Debriefs & Reports	CB Office	Yes	No	No agreement with Astronaut Office to share data	Request SLSD Director to discuss with CB Chief
153. EVA & Robotics Feedback	PDRS Group Lead	Yes	Unsure	Unsure if confidential or useable data	BHP to contact POC for further info

Task Performance; YES-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
154. SHFH Debrief Data	Element Manager	Yes	Unsure	Unsure what data they have and if useable	BHP to contact POC
155. Shuttle landing day performance data collections	MOD/Shuttle Sim supervisor	Yes	Unsure	Not sure how data is kept and if accessible to us	BHP to contact POC
156. FC Peer Evals (Schedulers)	Mission Ops Integration	Yes	Unsure	Unsure of quality of data	BHP contact POC
157. Time (to master system)	Flight Training	Yes	Unsure	Unsure of quality of data and if accessible	BHP to contact POC (to evaluate for "clean" data points)
158. Qualifications; Crew qualifications & responsibilities matrix (CQRM)	Group Lead – Flight Training	Yes	Unsure	Unsure of accessibility of data	BHP to contact POC
159. Feedback Database	Robotics Group	Yes	Unsure	Not sure of quality of data or accessibility	BHP to contact POC
160. Robotics Ops-Practice vs. Actual	Astronaut	Yes	Unsure	Not sure of quality of data or accessibility	BHP to contact Mark Kelly
161. Docking performance data	MOD	Yes	Unsure	Not sure of quality of data or accessibility	BHP to identfy a POC and follow up
162. Pilot performance data; simulation & in-flight data	MOD/Shuttle Sim Supervisor	Yes	Unsure	Not sure how data is kept and if accessible to us	BHP to contact POC

Task Performance; NO-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
163. Training Ratings	MOD/DA7	No	No	No formal training ratings done currently	request to SLSD Director to contact to POC to initiate systematic data collection
164. Did task require help from ground/crew?	Unsure	No	No	Currently not formally recorded/ collected	BHP to consider recording this data, if resources allow
165. CAPCOM Evaluations	CAPCOM	No	No	Assume not currently collected	BHP to contact POC
166. MOD Evaluations	MOD	No	No	Currently not formally recorded/ collected	BHP to consider recommendation & determine if addresses gaps
167. Flight Director Evaluations	Flight Directors	No	No	Currently not formally recorded/ collected	BHP to consider recommendation & determine if addresses gaps
168. % of tasks worked on during free time	MOD/Flight Schedulers	No	No	Currently not formally recorded/ collected	BHP to consider recommendation & determine if addresses gaps
169. EVAs- NBL vs. Actual	MOD/CB Office	No	No	These comparisons do not exist	Request to SLSD to systematically collect this data
170. Training proficiency data	MOD/DA7	No	No	No formal training ratings done currently	Request SLSD Director to contact POC to initiate systematic data collection

TEAMWORK; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
171. Ground Team- notes, recordings	Technical Productions	Yes	Yes	Limited resources to collect this data; numerous requests to no avail	Request to SLSD chief to formalize acquisition of this data
172. Volitional teamwork	(ISS PS toolbox); is willing to give us spreadsheet of data	Yes	Yes	Unsure of quality of data	BHP to Contact Julie Robinson to follow up
173. Watch/ Observe Training	CB Office	Yes	Yes		BHP Ops currently doing this; attempting to increase number of trainings allowed to observe
174. Team Conflict; Audio recordings	Technical Productions	Yes	Yes	Limited resources to collect this data; numerous requests to no avail	Request to SLSD chief to formalize acquisition of this data
175. Books by astronauts (Publications)	Diary of Cosmonaut, Linenger book, Foale's book, House in Space	Yes	Yes	On going task	BHP to continue collecting & analyzing publications
176. Public appearance discussions	Astronauts/ CB/ PAO	Yes	Yes	High investment with low yield; Filtered data	BHP to consider creating task with increase in resources

TEAMWORK; YES-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
177. Narrative from the post flight crew presentation at Space Center Houston	Oral History Office/AstronautsCB/ PAO	Yes	Yes	High investment with low yield; Filtered data	BHP to consider creating task with increase in resources
178. SFRM Case Studies Examples for Flight Controllers	SFRM WG Lead	Yes	Yes		BHP to contact POC
179. Management presentation about errors related to particular shuttle missions.	MOD	Yes	Yes	High investment with low yield	BHP will not pursue data at this time
180. Summary factors from MODs debriefings of mission concerns and command errors from ground perspective	MOD Management	Yes	Yes	High investment with low yield	BHP will not pursue data at this time
181. Frequency crew eats together	Audio/Visual POC; Flight Directors; Commander	Yes	Yes	Limited resources and low incidence rates	BHP to consider creating task with increase in resources
182. Number and type of humorous interactions among crewmembers (from different cultures)	Audio/Visual POC; Flight Directors; Commander	Yes	Yes	Limited resources and low incidence rates	BHP to consider creating task with increase in resources

TEAMWORK; YES-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
183. Basic Training-NOLS	CB Office	Yes	No	CB rejected request (Data too weak to be beneficial)	BHP to make consideration for improved data collection
184. PPC Form-part of adaptation	Flight Surgeons & BHP Ops	Yes	No	Private Medical Information/ Data	Reconsent or alteration of current consent
185. CB Eval	CB Chief	Yes	No	Confidential data/Employee information	Request to SLSD to contact POC and collaborate to create new agreement
186. Quality of individual crew members (Selection Data)	BHP Ops	Yes	No	Private Medical Data; Employment Data. Exception: 2009 class was consented	BHP Research to contact POC to request 2009 data
187. Interpersonal issues w/ crewmember	BHP Ops/PPC contact/Flight Directors/Flight Surgeons	Yes	No	Private Medical Information/ Data	BHP to consider creating new data/task to address gaps

TEAMWORK; YES-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
188. SFRM Feedback	DA7- within MOD	Yes for operators	Unsure	We can have it; data collection not systematic	Fwd work would require getting consent from operators and astronauts; and recommend more systematic data collection for future collection
189. FC Peer Evals (only done 50% of time- negatively skewed)	Mission Planning Group	Yes	Unsure	Interviewers did not probe further	BHP to contact POC to ask for permission to data
190. Op Psy Debrief	BHP Ops Psy Lead	Yes	Unsure	Not sure of confidentiality and usefulness of data	BHP to contact POC
191. Foreign Language Skills (Proficiency)	Language Lab; CB training files	Yes	Unsure		BHP to follow up with POC & CB
192. Crew reports from Mir	FCOD Website/ CB	Yes	Unsure	No longer on website	BHP to follow up with POC
193. Crew Ratings (in database)	SF3	Yes	Unsure	Unsure of confidentiality	BHP to contact POC
194. Supervisor performance (Ratings of Mission Control)	MOD Flight Leads	Yes	Unsure	Unsure of confidentiality & standardization of data	BHP recommendation to SLSD to formalize ratings & allow BHP access
195. Station EVA- evals related to teamwork	Robotics Group	Yes	Unsure	Unsure of confidentiality	BHP to contact POC

TEAMWORK; NO-NO

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
196. Flight Director Eval	MOD	No	No	Currently not formally recorded/ collected	BHP to consider creating research task to collect data
197. Crew Eval	CB	No	No	Currently not formally recorded/ collected	BHP to consider creating research task to collect data
198. Comm Eval	CB	No	No	Currently not formally recorded/ collected	BHP to consider creating research task to collect data
199. CAPCOM Eval	CB	No	No	Currently not formally recorded/ collected	BHP to consider creating research task to collect data
200. Officemates	CB	No	No	Currently not formally recorded/ collected	BHP to consider creating research task to collect data
201. FD, Flight Surgeon, Capcom, Lead Scheduler, Crew Rep, IP (Conduct Interviews)	MOD/BHP Ops/IPs	No	No	Currently not formally recorded/ collected	BHP to conduct interviews
202. Teamwork under pressure (look specifically at EVA and Robotics)	MOD/Robotics Group	No	No	Not formally recorded or formally observed by team evaluator	BHP to consider forward research to collect data
203. Observation of Sims (Assigned CM, Certified FC)	SFRM/MOD	No	No	Currently not formally recorded/ collected	BHP recommendation to SLSD Director to advocate formal ratings during Sim Training with POC
204. Post-mission Peer Ratings (Astro and Flight Control)	Astronauts	No	No	Currently not formally collected	BHP recommendation to SLSD to establish formal data collection

TEAMWORK; NO-YES

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
205. Whether they make accommodations for those requiring less or more sleep	Astronauts/ Flight Directors/ BHP-Research	No	Yes		BHP to consider whether data collection will address gaps

TEAMWORK; NO-UNSURE

Data/Measure	Point of Contact	Does it exist?	Can we get it?	Why? Why not?	BHP Forward Work
206. SFRM Feedback	SFRM Instructor	No for astronauts	Unsure	We can have it; data collection not systematic	Fwd work would require getting consent from operators and astronauts; and recommed more systematic data collection for future collection

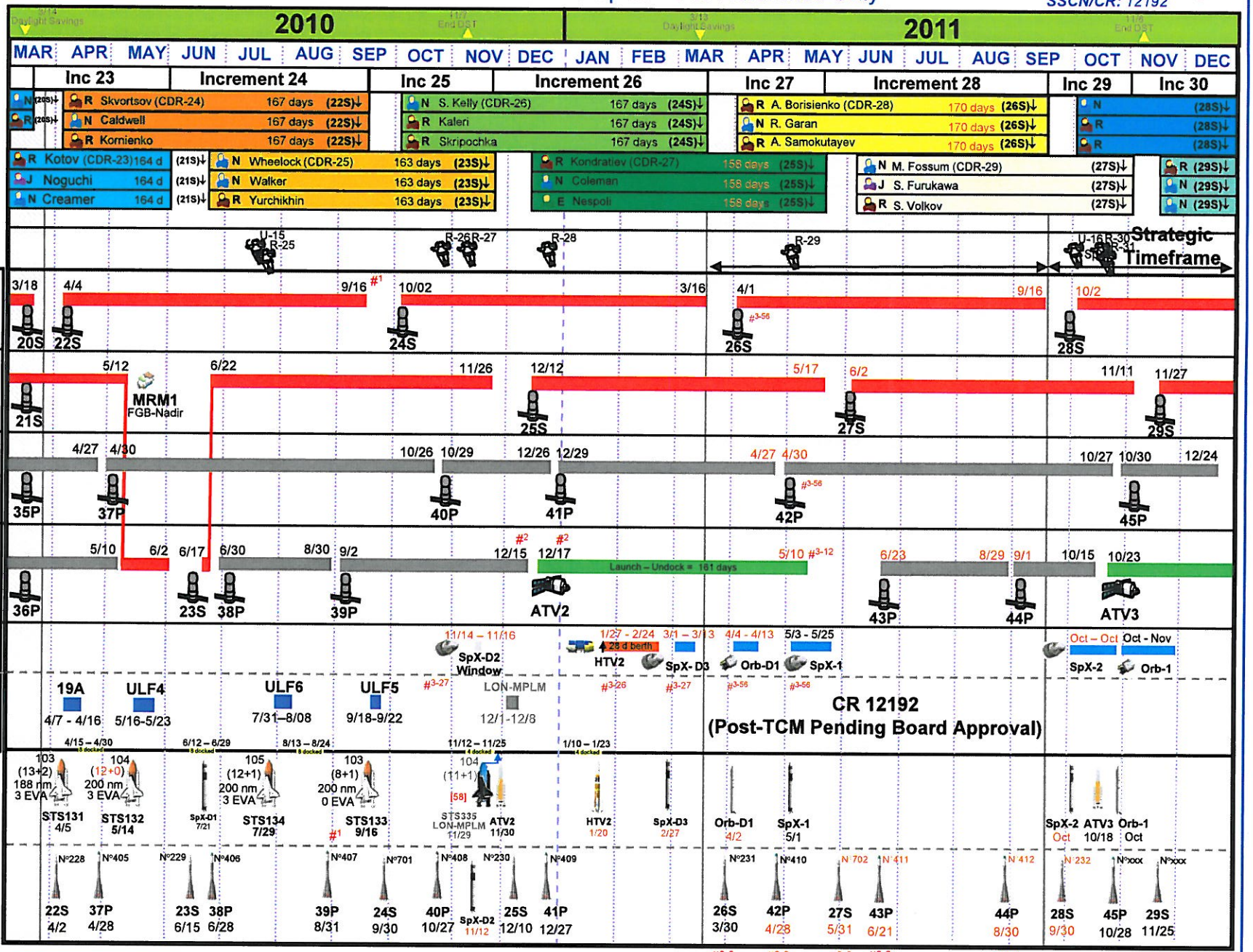
Appendix C: Examples of Data

For current baseline refer to SSP 54100 IDRD Flight Program

Flight Program Working Group (FPWG)

Crew Rotation and Port Utilization Graphic – For Reference Only

NASA Official: Sean Fuller
Prepared by: Scott Paul
Chart Updated: March 23rd, 2010
SSCN/CR: 12192



Joint Shuttle-ISS Operational Flight Rules Annex

STS-130/20A

ISS Expedition 22

Mission Operations Directorate

Final

December 7, 2009

Revision A

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PCN-2

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National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

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PRIORITIES AND MISSION DURATION

20A_C2-11 ON-ORBIT PRIORITIES [RI] [C] [E] [J]

A. THE INTERNATIONAL SPACE STATION PROGRAM OFFICE AND SPACE SHUTTLE PROGRAM OFFICE HAVE AGREED ON THE FOLLOWING JOINT PRIORITIES:

MISSION PRIORITY	TASK	CAT
1.	DOCK SHUTTLE FLIGHT 20A TO PMA2 PORT AND PERFORM MANDATORY CREW SAFETY BRIEFING FOR ALL CREWMEMBERS.	1
2.	TRANSFER MANDATORY QUANTITIES OF WATER FROM ORBITER TO ISS PER FLIGHT 20A TRANSFER PRIORITY LIST (TPL).	1
3.	TRANSFER AND STOW CRITICAL ITEMS PER FLIGHT 20A TPL.	1
4.	INSTALL NODE 3 TO NODE 1 PORT CBM USING SSRMS. A. REMOVE NODE 3 STARBOARD PASSIVE COMMON BERTHING MECHANISM (PCBM) CONTAMINATION COVERS (EIGHT) AND INSPECT NODE 3 PCBM. B. DISCONNECT NODE 3 ORBITER SPACE STATION POWER DISTRIBUTION UNIT (SPDU)/LTA HEATER CABLES. C. OPEN NODE 1 PORT CBCS FLAP. D. PERFORM HIGH LEVEL INSPECTION OF NODE 1 PORT CBM. E. REMOVE NODE 3 FROM ORBITER PLB AND INSTALL TO NODE 1 PORT CBM. F. REMOVE J612 (A/L SUPPLEMENTARY POWER) AND J602, AND CONNECT NODE 3 LTA HEATER CABLES TO NODE 1, AND ACTIVATE HEATERS (NOTE: THESE ARE NOT THE SAME LTA CABLES USED IN THE ORBITER). G. INSTALL FOUR NODE 3 TRUNNION AND ONE KEEL PIN COVERS.	1
5.	CONNECT NODE 3 INTERNAL AND EXTERNAL AVIONICS AND AMMONIA JUMPERS. A. INSTALL 1553 BUS TERMINATOR (P104) ON NODE 3 (J104). B. INSTALL THE P1-FGB AND P2-FGB TERMINATORS AND THERMAL BOOTIES. C. INSTALL 8 ON-ORBIT INSTALLABLE HANDRAILS ON NODE 3. D. COMPLETE NODE 1 TO NODE 3 VESTIBULE OUTFITTING. (1) REMOVE FOUR NODE 1 PORT ACBM CONTROLLER ASSEMBLIES. (2) INSTALL SEVEN WIRE HARNESSES (1553A/STATION LAN, 1553B, MSS VIDEO, MSS BCP, UHF COAX, VIDEO/AUDIO BUS A, AUDIO BUS B.) (3) INSTALL FUEL CELL (FC) WASTE WATER HOSE ASSEMBLY, AIR REVITALIZATION SYSTEM (ARS), MODERATE TEMPERATURE LOOP (MTL) SUPPLY, AND RETURN JUMPERS. E. COMPLETE MATING OF NODE 1 RELOCATION MOD KIT HOSES/WIRE HARNESSES (1553A AND B, UHF COAX, 02 AND N2). F. COMPLETE ROUTING AND MATE S0 TO NODE 3 AVIONICS UMBILICALS (EIGHT CONNECTORS). G. CONNECT/INSTALL U.S. LAB TO NODE 3 AMMONIA JUMPERS (FOUR) WITH THERMAL SHROUDS.	2

®[DN 5]

THIS RULE CONTINUED ON NEXT PAGE

20A_C2-11 ON-ORBIT PRIORITIES [RI] [C] [E] [J] (CONTINUED)

MISSION PRIORITY	TASK	CAT
6.	ACTIVATE AND CHECK OUT NODE 3. A. ACTIVATE NODE 3 SYSTEMS. B. DEACTIVATE NODE 3 LTA HEATERS. C. INGRESS NODE 3. D. INSTALL ONE PORTABLE FIRE EXTINGUISHER (PFE) AND TWO PORTABLE BREATHING APPARATUS (PBA) IN NODE 3. E. ENABLE EMERGENCY LIGHTING POWER SUPPLY (ELPS) F. INSTALL 02 AND N2 HOSE ASSEMBLIES IN NODE 1/NODE 3 VESTIBULE AND PURGE NODE 3 02 AND N2 LINES. G. REMOVE NODE 3 STARBOARD NEGATIVE PRESSURE RELIEF VALVES (NPRV'S) (TWO) AND REPLACE WITH INTRA MODULE VENTILATIONS (IMV'S) (TWO). H. INSTALL NODE 1/NODE 3 IMV VESTIBULE JUMPERS AND SILENCERS (TWO). I. REMOVE STARBOARD POSITIVE PRESSURE RELIEF VALVE (PPRV) AND REPLACE WITH MANUAL PRESSURE EQUALIZATION VALVE (MPEV). J. INSTALL CAP ON AFT AND NADIR PPRV'S. K. INSPECT AFT NPRVS.	2
7.	RELOCATE CUPOLA FROM NODE 3 PORT CBM AND INSTALL ON NODE 3 NADIR CBM. A. OPEN NODE 3 PORT HATCH AND INSTALL IMV CAPS ON INTERNAL AND EXTERNAL NODE 3 PORT AFT IMV INTERFACE. B. INSTALL NODE 3 AXIAL ACBM CENTER COVER. C. INSTALL CENTERLINE BERTHING CAMERA SYSTEM (CBCS) IN NODE 3 NADIR CBM. D. OPEN NODE 3 NADIR ACBM CENTER DISK COVER FLAP. E. CLOSE NODE 3 PORT HATCH AND DEPRESSURIZE CUPOLA. F. RELEASE NODE 3 NADIR ACBM PETAL RESTRAINTS AND HATCH LATCH PINS. G. PERFORM HIGH LEVEL INSPECTION OF NODE 3 NADIR CBM. H. REMOVE CUPOLA FROM NODE 3 PORT CBM AND INSTALL ON NODE 3 NADIR CBM USING SSRMS.	2
8.	ACTIVATE AND CHECK OUT THE CUPOLA. A. PRESSURIZE CUPOLA AND OPEN NODE 3 NADIR HATCH. B. REMOVE FOUR NODE 3 NADIR ACBM CONTROLLER ASSEMBLIES. C. REMOVE CUPOLA PCBM MLI AND CBCS TARGETS. D. RECONFIGURE CUPOLA CORNER PANELS FROM LAUNCH TO ON-ORBIT CONFIGURATION. E. CONNECT CUPOLA UTILITIES (THERMAL CONTROL SYSTEM (TCS), ELECTRICAL POWER SYSTEM (EPS), AND AVIONICS JUMPERS). F. ACTIVATE CUPOLA HEATERS. G. FILL NODE 3/CUPOLA INTERNAL THERMAL CONTROL SYSTEM (ITCS) LINES AND CONFIGURE NODE 3 ITCS LINES TO SUPPORT CUPOLA.	2

®[DN 5]

THIS RULE CONTINUED ON NEXT PAGE

20A_C2-11 ON-ORBIT PRIORITIES [RI] [C] [E] [J] (CONTINUED)

MISSION PRIORITY	TASK	CAT
9.	TRANSFER REMAINING CARGO ITEMS PER FLIGHT 20A TPL. A. ACTIVATE AND CHECK OUT COMPOUND SPECIFIC ANALYZERS-COMBUSTION PRODUCTS (CSA-CP) B. INSTALL AND RETURN RADIATION AREA MONITORS (RAM'S).	2
10.	PERFORM DAILY ISS PAYLOAD STATUS CHECKS AS REQUIRED PER SSP 54021_54022-ANX 5.	3
11.	THE FOLLOWING TASKS ARE DEEMED TO FIT WITHIN THE EXISTING EVA TIMELINES; HOWEVER, MAY BE DEFERRED IF THE EVA IS BEHIND SCHEDULE. THE EVA WILL NOT BE EXTENDED TO COMPLETE THESE TASKS. A. DEPLOY NODE 3 AXIAL ACBM CORNER DEBRIS SHIELDS (FOUR) AND CONFIGURE FOR PERMANENT INSTALLATION. B. REMOVE NODE 3 AXIAL PORT CORNER DEBRIS SHIELD LAUNCH RESTRAINTS (EIGHT) FROM NODE 3 STOVEPIPE. C. REMOVE CUPOLA THERMAL COVER. D. RELEASE CUPOLA SHUTTER LAUNCH LOCKS. E. REMOVE SPDM ORU TEMPORARY PLATFORM (OTP) IN PREPARATION FOR ULF4. F. INSTALL NODE 3 ACS NON PROPULSIVE VENT. G. CONNECT PMA 3 UMBILICALS TO PROVIDE ADDITIONAL STOWAGE. H. DISCONNECT NODE 3 LTA CABLE FROM NODE 1 AND RECONNECT THE A/L SUPPLEMENTARY POWER (J612 CONNECTOR) AFTER NODE 3 ACTIVATION. I. INSTALL NODE 3 WORKSITE INTERFACES (THREE) AND REMAINING EVA HANDRAILS (SIX). J. INSTALL GAP SPANNERS (EIGHT) TO PROVIDE TRANSLATION PATHS BETWEEN NODE 1 AND NODE 3, AND U.S. LAB AND NODE 3 HANDRAILS. K. DEPLOY S3 LOWER INBOARD PAS (FOR FLIGHT ULF5).	3
12.	PERFORM DAILY MIDDECK ACTIVITIES TO SUPPORT PAYLOADS (INCLUDES CASES WHERE SHUTTLE CREW ALSO PERFORMS PAYLOAD ACTIVITIES ON THE ISS) PER SSP 54021_54022-ANX 5.	3
13.	TRANSFER, INSTALL, ACTIVATE, AND CHECK OUT THE FOLLOWING NODE 3 RACKS: A. ARED FROM NODE 102 TO NODE 302 B. WATER RECOVERY SYSTEM (1) WRS # 1 FROM LAB1D4 TO NOD3D5 a. REMOVE CARGO FROM NODE 3 INTEGRATED STOWAGE PLATFORMS (ISP'S). b. REMOVE NODE 3 ISP AND STOW IN LAB1P2. (2) WRS #2 FROM LAB1P4 TO NOD3D4 a. REMOVE CARGO FROM NODE 3 ISP. b. REMOVE NODE 3 ISP AND STOW IN LAB1P1. c. TEMPORARILY MOUNT AND GROUND TOTAL ORGANIC CARBON ANALYZER (TOCA) IF NOT TRANSFERRED TO NODE 3. (3) WASTE AND HYGIENE COMPARTMENT (WHC) FROM LAB1P2 TO NOD3F4 REQUIRES NODE 3 FUEL CELL WATER BUS FILL AND CONNECT TO ISS BUS IN NODE 1 C. AIR REVITALIZATION SYSTEM (ARS) FROM JPM102 TO NOD3A4 D. OXYGEN GENERATION SYSTEM (OGS) FROM THE U.S. LAB1P1 TO NODE 3A5	3

®[DN 5]

THIS RULE CONTINUED ON NEXT PAGE

20A_C2-11 ON-ORBIT PRIORITIES [RI] [C] [E] [J] (CONTINUED)

MISSION PRIORITY	TASK	CAT
14.	PERFORM ISS PAYLOAD RESEARCH OPERATIONS TASKS.	3
15.	PERFORM THE FOLLOWING NODE 3 OUTFITTING TASKS: A. RELEASE AVIONICS RACK LAUNCH RESTRAINTS, INSTALL KNEE BRACE ATTACHMENT REPLACEMENTS (K-BARS) AND PIVOT FITTINGS ON AVIONICS RACK 1. B. DEPLOY STATION SUPPORT COMPUTER (SSC) (ONE) IN NODE 3 (INCLUDES INSTALLING HARDWARE AND POWER SUPPLY). C. REMOVE CLOSEOUT PANEL LAUNCH BOLTS (> 700 BOLTS) AND LAUNCH STRUCTURES. D. INSTALL HATCH LATCH HANDLE GUIDE ASSEMBLIES (TWO) ON NODE 3 STARBOARD AND NADIR. E. REMOVE NODE 3 COMMON CABIN AIR ASSEMBLY (CCAA) ANTI-VIBRATION MODULE (AVM) LAUNCH BRACKETS (FOUR). F. REMOVE MTL AND LOW TEMPERATURE (LT) PUMP PACKAGE ASSEMBLIES AVM LAUNCH BRACKETS. G. INSTALL ITCS SAMPLE TOOLS (TWO) IN NODE 3 STARBOARD ENDCONE, PERFORM SAMPLING, AND RETURN SAMPLE FOR GROUND ASSESSMENT. H. FILL NODE 3 TO NODE 1 MTL LINES AND CONFIGURE NODE 3 ITCS LINES TO SUPPORT A/L MTL. I. OPEN NODE 3 STARBOARD ARS MANUAL VALVE.	3
16.	PERFORM CUPOLA OUTFITTING TASKS. A. SET UP ROBOTICS WORKSTATION. B. INSTALL CUPOLA AUDIO TERMINAL UNIT (ATU), UTILITY OUTLET PANELS (UOP) (TWO), SUN VISORS (TWO), AND CREW RESTRAINTS. C. CONFIGURE CUPOLA PANELS IN THE ON ORBIT CONFIGURATION. D. INSTALL, ACTIVATE, AND CHECK OUT THE ROBOTICS WORKSTATION (RWS).	3
17.	TRANSFER OXYGEN (O2) FROM THE ORBITER TO THE ISS AIRLOCK HIGH PRESSURE GAS TANK (HPGT). REQUIRED QUANTITIES SHALL BE CONSISTENT WITH THE PLAN TO HAVE ISS AIRLOCK (A/L) TANKS FULL AT SHUTTLE RETIREMENT.	3
18.	TRANSFER NITROGEN (N2) FROM THE ORBITER TO THE ISS AIRLOCK HIGH PRESSURE GAS TANK (HPGT). REQUIRED QUANTITIES SHALL BE CONSISTENT WITH THE PLAN TO HAVE ISS AIRLOCK (A/L) TANKS FULL AT SHUTTLE RETIREMENT.	3
19.	PERFORM REMAINING NODE 3 AND CUPOLA OUTFITTING TASKS.	4
20.	PERFORM PROGRAM-APPROVED EVA GET-AHEAD TASKS. THE FOLLOWING EVA GET-AHEAD TASKS DO NOT FIT IN THE EXISTING EVA TIMELINES; HOWEVER, THE EVA TEAM WILL BE TRAINED AND READY TO PERFORM SHOULD THE OPPORTUNITY ARISE. EVA/MOD HAS THE FLEXIBILITY TO SELECT THE TASKS TO BE COMPLETED BASED ON EFFICIENCIES GAINED IN PERFORMING THE ALREADY SCHEDULED REQUIRED TASKS: REMOVE THE P1-FGB AND P2-FGB TERMINATORS AND THERMAL BOOTIES AND MATE THE FGB PVGF DATA LINES TO THE J1FGB AND J2FGB CONNECTORS ON THE NODE 3 STARBOARD STANCHION.	4

®[DN 5]

THIS RULE CONTINUED ON NEXT PAGE

20A_C2-11 ON-ORBIT PRIORITIES [RI] [C] [E] [J] (CONTINUED)

MISSION PRIORITY	TASK	CAT
21.	REBOOST THE ISS WITH THE ORBITER IF MISSION RESOURCES ALLOW AND ARE CONSISTENT WITH ISS TRAJECTORY ANALYSIS AND PLANNING.	4
22.	PERFORM IMAGERY SURVEY OF THE ISS EXTERIOR DURING ORBITER FLYAROUND AFTER UNDOCK.	4
23.	PERFORM (PAYLOADS OF OPPORTUNITY) - (NOT REQUIRED DURING DOCKED OPS) IF PROPELLANT AVAILABLE. A. RAM BURN OBSERVATIONS-2 (RAMBO-2) B. MAUI ANALYSIS OF UPPER ATMOSPHERIC INJECTIONS (MAUI) C. SHUTTLE EXHAUST ION TURBULENCE EXPERIMENTS (SEITE) D. SHUTTLE IONOSPHERIC MODIFICATION WITH PULSED LOCAL EXHAUST (SIMPLEX)	4
24.	TRANSFER TOCA FROM LAB1P4 TO NOD3D5.	4
25.	INSTALL HAM RADIO IN COLUMBUS TO ESTABLISH AN OPERATIONAL CAPABILITY IN THE USOS.	4
26.	PERFORM PROGRAM-APPROVED IVA GET-AHEAD TASKS. THE FOLLOWING IVA GET-AHEAD TASKS DO NOT FIT IN THE EXISTING IVA TIMELINES; HOWEVER, THE INCREMENT CREW WILL HAVE THE OPTION TO PERFORM THEM SHOULD THE OPPORTUNITY ARISE. A. UNPACK 20A MIDDECK CARGO. B. REMOVE CARGO FROM NOD3F5 ISP, DISASSEMBLE AND TEMPORARY STOW ISP IN **TBD** LOCATION.	4
27.	PERFORM SDTO 13005-U, ISS STRUCTURAL LIFE VALIDATION AND EXTENSION, DURING NODE 3/CUPOLA BERTHING (IWIS REQUIRED).	4
28.	PERFORM SDTO 13005-U, ISS STRUCTURAL LIFE VALIDATION AND EXTENSION, DURING SHUTTLE MATED REBOOST (IWIS REQUIRED).	4
29.	PERFORM SDTO 13005-U, ISS STRUCTURAL LIFE VALIDATION AND EXTENSION, DURING 20A ORBITER UNDOCKING (IWIS HIGHLY DESIRED, BUT NOT REQUIRED).	4

®[DN 5]

B. THE MISSION WILL BE EXECUTED PER THE PRIORITIES IN PARAGRAPH A UNLESS OTHERWISE DIRECTED VIA CHIT.

20A_C2-15 **MINIMUM DURATION FLIGHT [RI]**

FOR ORBITER FAILURES REQUIRING A MINIMUM DURATION FLIGHT (MDF), THE MISSION MANAGEMENT TEAM (MMT) WILL DETERMINE FLIGHT DURATION BASED ON THE SEVERITY OF THE FAILURE AND WITHIN THE GENERAL CONSTRAINTS DEFINED IN RULE {20A_C2-11}, ON-ORBIT PRIORITIES. FOR STS-130/20A, THE INITIAL MDF PLAN AND ADDITIONAL CONSIDERATIONS TO BE EVALUATED BY THE MMT ARE AS FOLLOWS (ASSUMES FD3 RENDEZVOUS): ®[DN 37]

A. LAUNCH; FD02 OBSS SURVEY; RENDEZVOUS/DOCK; NODE3/CUPOLA INSTALLATION/EVA1 AND ATTACH LTA CABLES; CREW OFF-DUTY; UNDOCKING/POST-UNDOCK INSPECTION; ENTRY/LANDING PREP; AND ENTRY/LANDING (7-DAY MISSION)

A 7-day mission (landing on FD8) is required in order to accomplish all category 1 objectives.

B. ADDITIONAL DOCKED DAYS TO ACCOMPLISH LOWER-PRIORITY MISSION OBJECTIVES MAY BE CONSIDERED BY THE MMT.

Lower-priority objectives (category 2 and below) may be considered by the MMT, balancing additional docked days for mission success with the risk of remaining on-orbit. The associated risk trades will be heavily dependent on the specific failure(s) driving the MDF situation. ®[DN 37]

Space Shuttle Program
FLIGHT DATA FILE

JSC-48000-130

Flight Plan

STS-130/20A

(FDO 12+1+2 FRR Trajectory)

Mission Operations Directorate
Operations Division

Final
December 18, 2009

Launch Date: Thursday, February 4, 2010
Launch Time: 035/10:45:04 GMT
February 4, 04:45:04 EDT

For the latest working copy of the Flight Plan, visit
http://modspops.jsc.nasa.gov/mod/DO/DO4/Joint/130_20A/default.aspx

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

Verify this is the correct version for the pending operation (training, simulation or flight).
Electronic copies of FDF books are available. URL: http://mod.jsc.nasa.gov/do3/FDF/index.html

MISSION OPERATIONS DIRECTORATE

FLIGHT PLAN
STS-130

FINAL
December 18, 2009

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FLIGHT PLAN
STS-130

LIST OF EFFECTIVE PAGES

FINAL 12/18/09

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ii	*	130/FIN
iii	*	130/FIN
iv	*	130/FIN
v	*	130/FIN
vi	*	130/FIN
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* – Omit from flight book

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INTRODUCTION vi

OVERVIEW TIMELINE 1-1

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DETAILED TIMELINE 3-1

OVERVIEW TIMELINE

STS-130/20A Overview Timeline 13+1+2 (3 EVAs)
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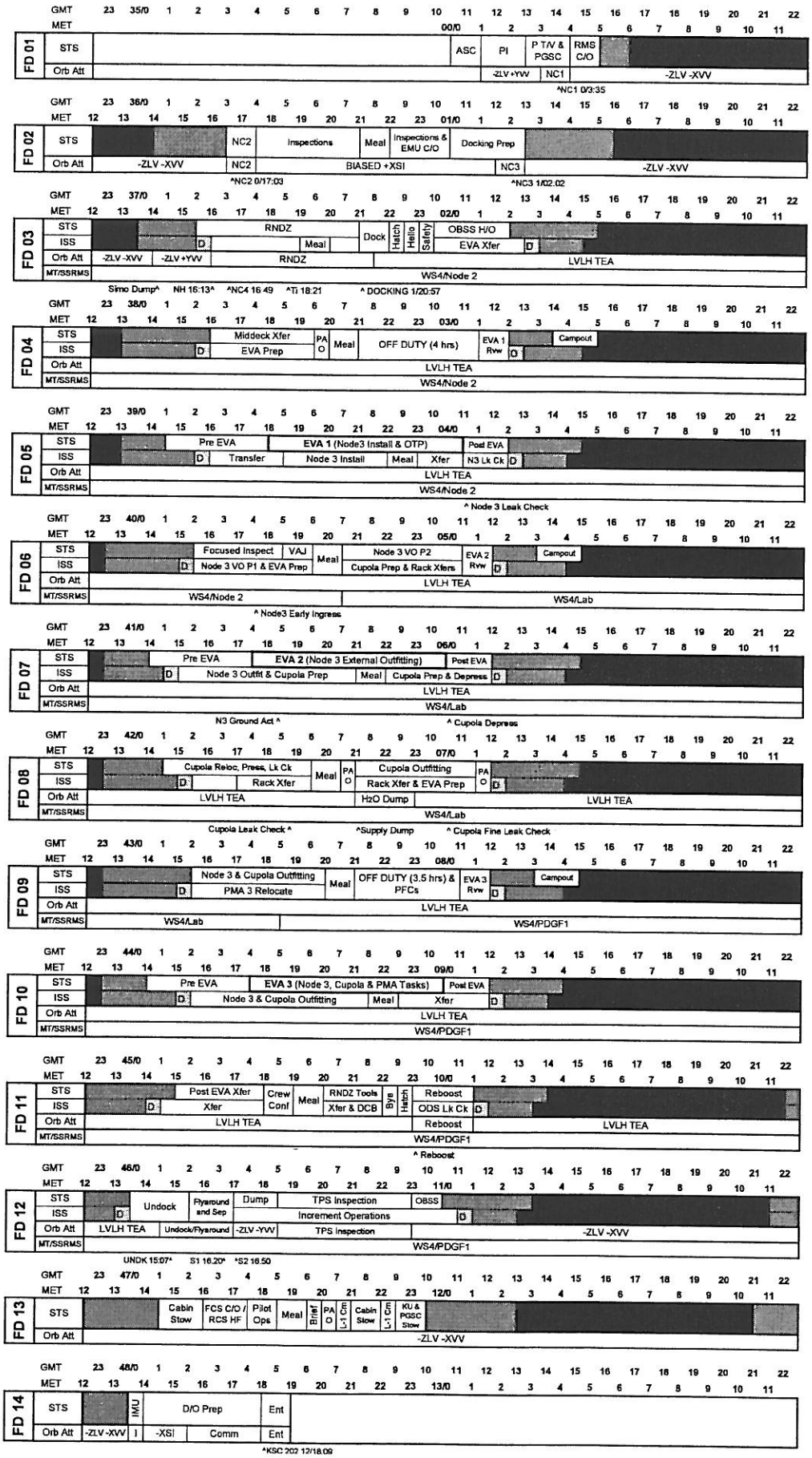

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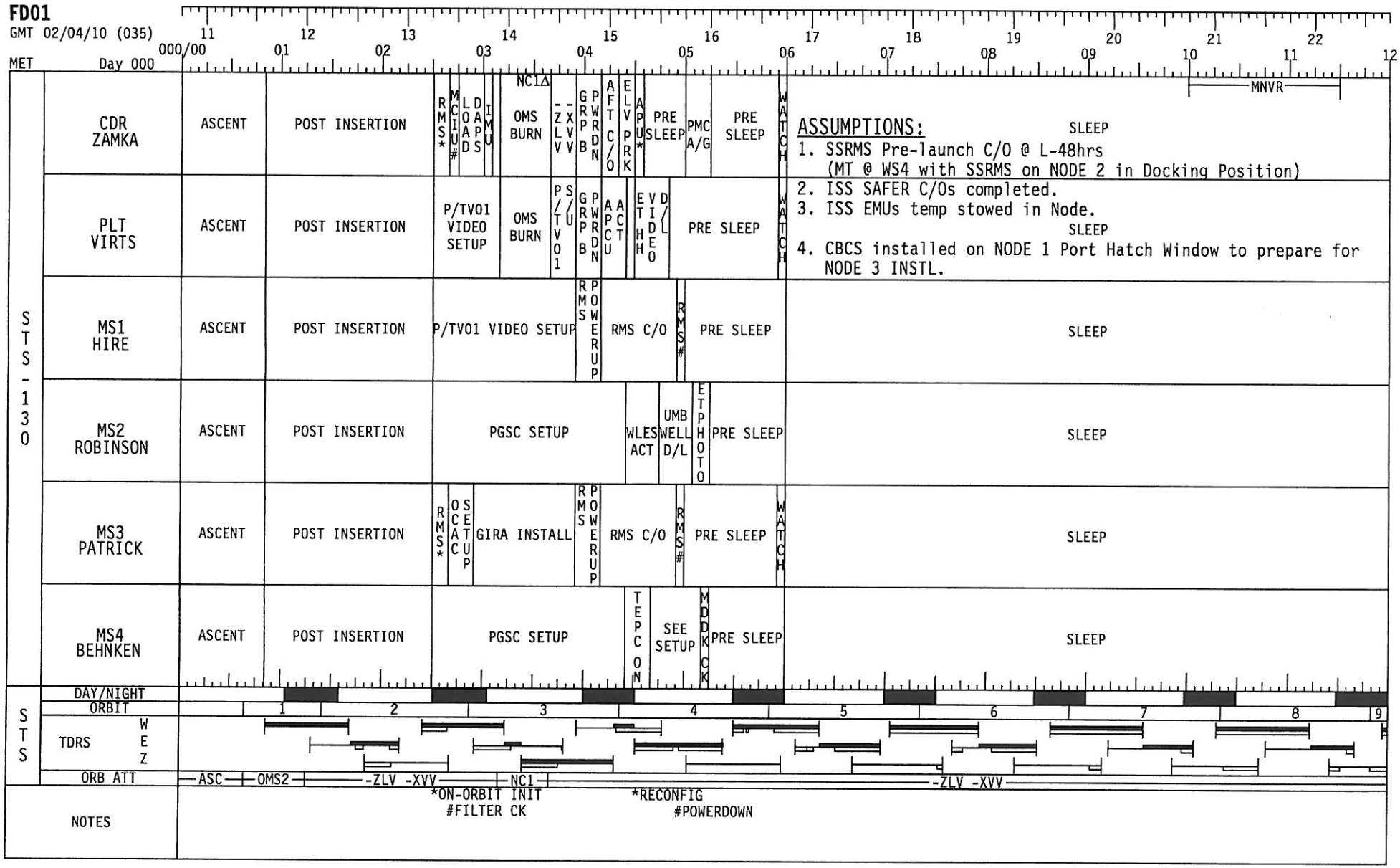
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MDDK CK
PRE SLEEP
SLEEP
ASSUMPTIONS:
1. SSRMS Pre-launch C/O @ L-48hrs
(MT @ WS4 with SSRMS on NODE 2 in Docking Position)
2. ISS SAFER C/Os completed.
3. ISS EMUs temp stowed in Node.
4. CBCS installed on NODE 1 Port Hatch Window to prepare for NODE 3 INSTL.
STS
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TDRS W E Z
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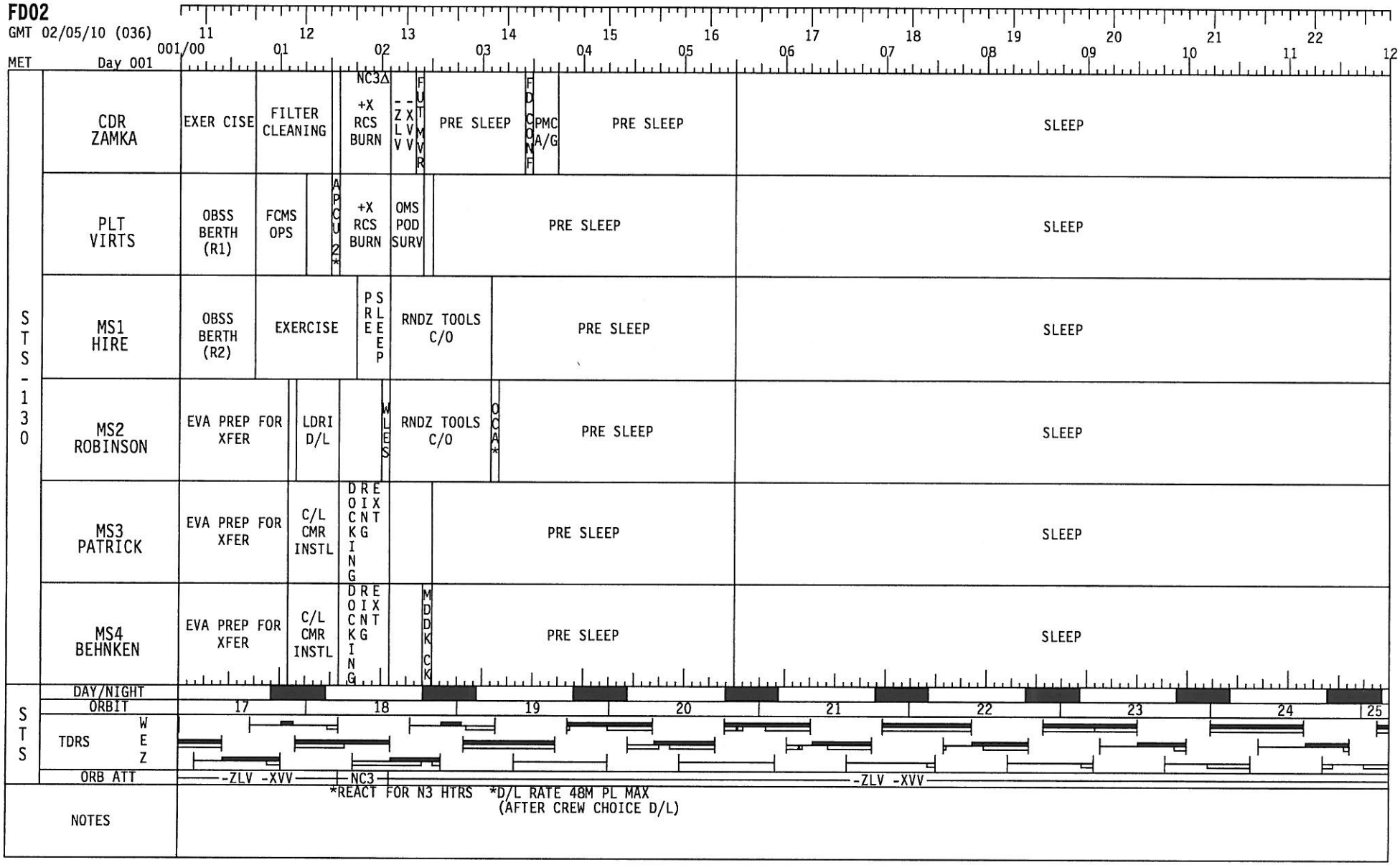
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+X RCS BURN
OMS POD SURV
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EVA PREP FOR XFER
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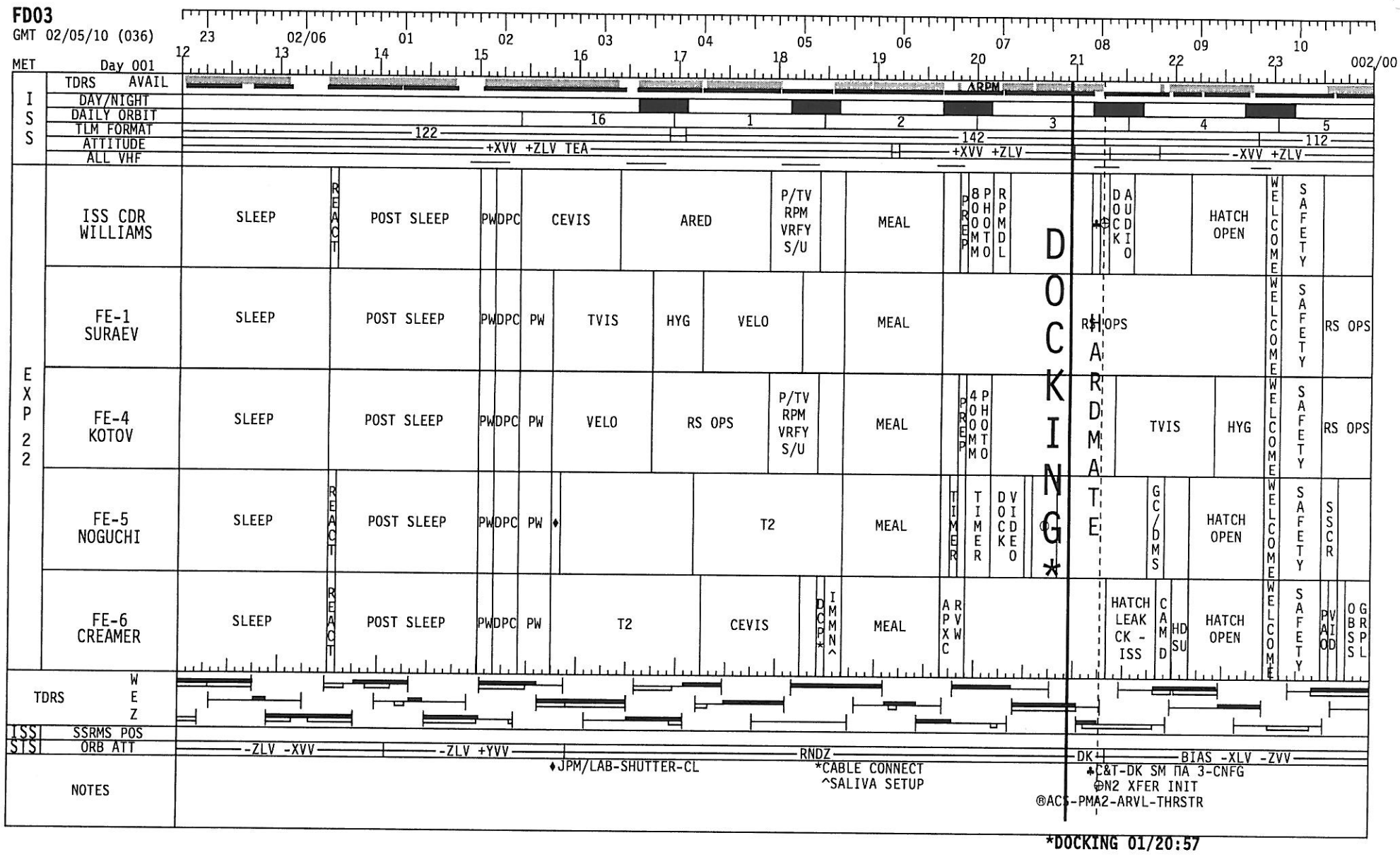
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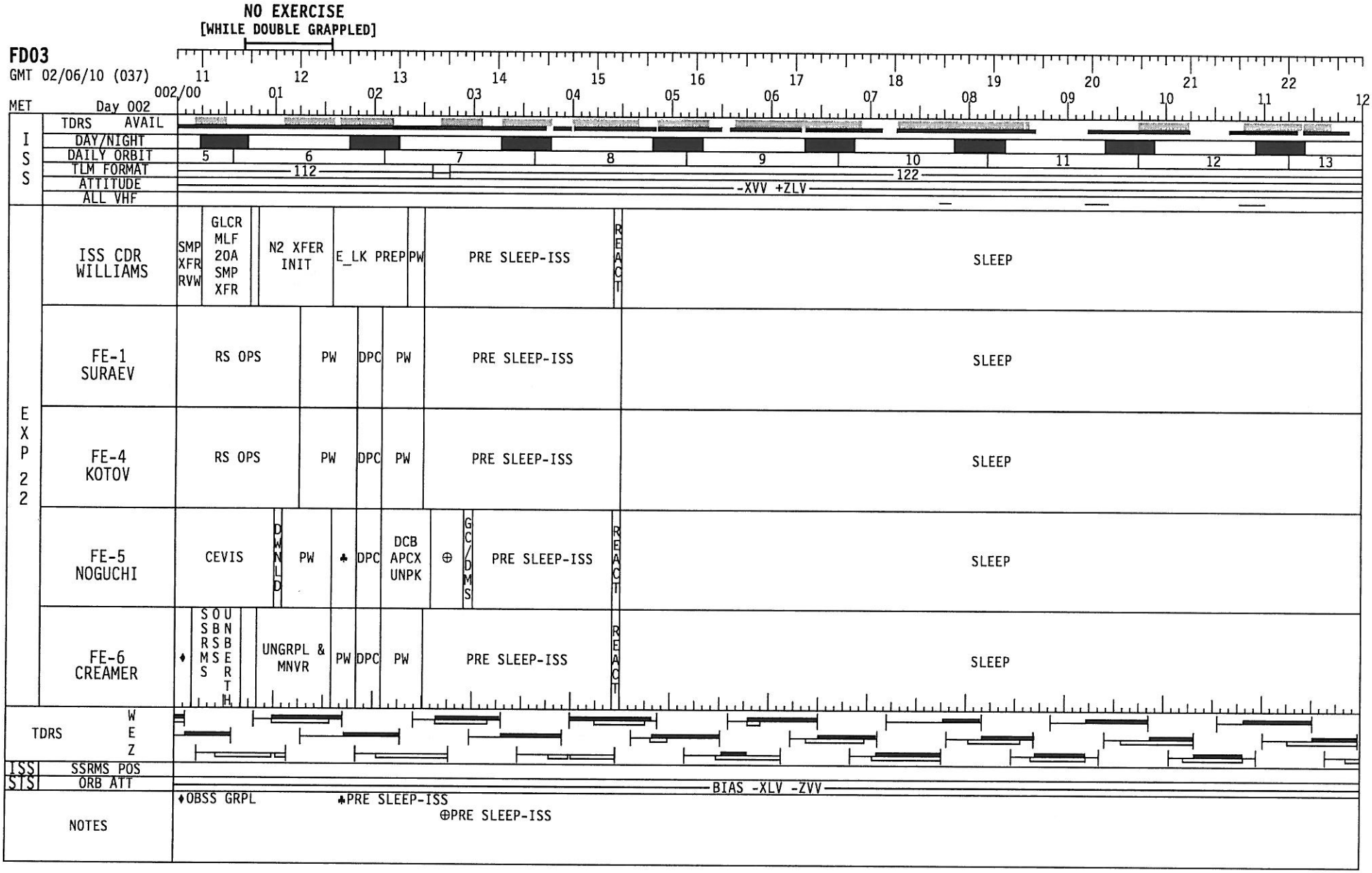
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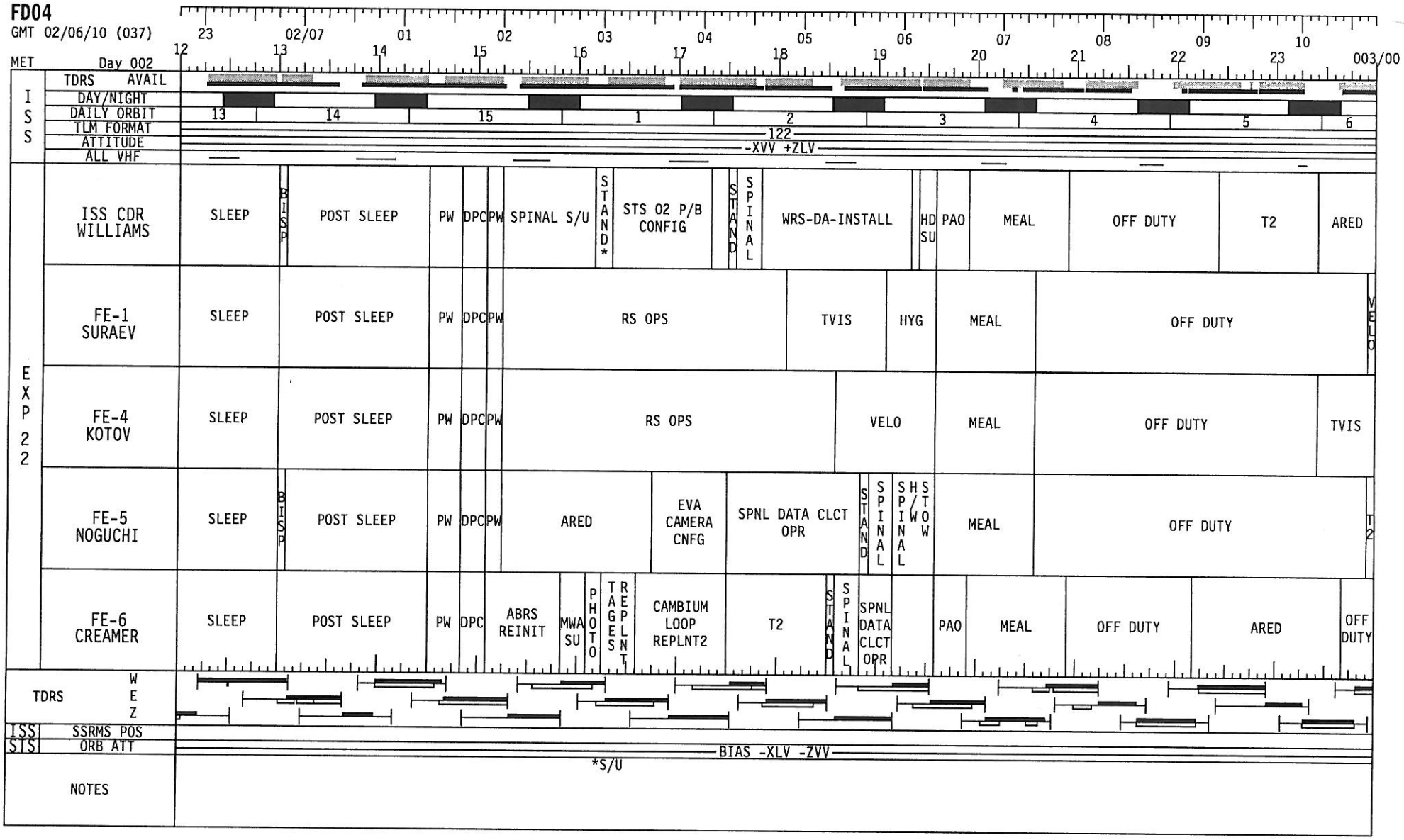
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MEAL
OFF DUTY
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FE-4 KOTOV
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POST SLEEP
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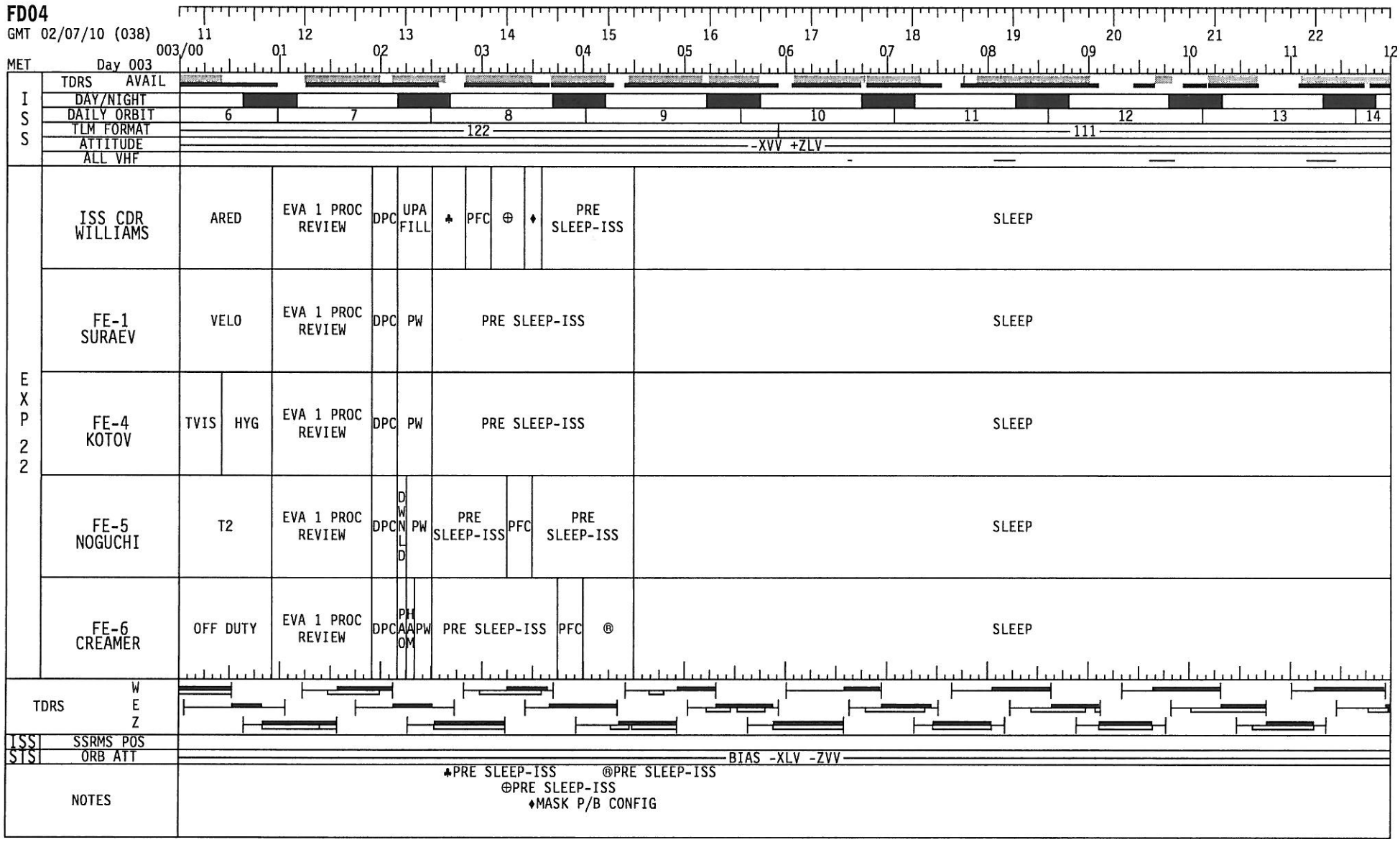
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13. ABSTRACT *(Maximum 200 words)*
This report is the result of a collaborative effort between NASA's Behavioral Health & Performance (BHP) Research and Operations Group to investigate and determine the availability of data pertaining to behavioral performance (and other pertinent variables) that have been collected by the laboratories at NASA's Johnson Space Center. BHP's Operations and Research groups collaborated to systematically identify what types of performance data are needed in relevant BHP performance domains and also to conduct structured interviews with NASA personnel to identify which data do or do not exist currently (and for instances where such data exist, to evaluate the type, quality, accessibility, and confidentiality of those data). The authors defined outcome categories of performance that encapsulate BHP performance domains, mapped BHP Research Risks and Gaps onto those performance outcome categories, and identified and prioritized indicators for each outcome category. The team identified key points of contact (subject matter experts [SMEs]) as potential interviewees, created a template for structured interview questions about sources and accessibility of performance data, and coordinated and conducted structured interviews with the SMEs. The methodology, results, and implications of this effort, as well as forward work needed, are discussed in this report.

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