CADMOS Comments/questions on GRIP GRASP Combined commissioning proposed activities

GRIP

We understand that the tasks performed during GRIP C/O part would be as follow:

2 Sub-sessions (instead of 3 in a nominal science session) + 1 "commissioning task session"

Sensor and Trackers checks: various tasks to be performed to check the hardware (seated)

- "Sensor Check" (via maintenance script?)
- Target Mask moved around (via maintenance script)
- Mass shuffling activities (via maintenance script)

Sub-session 1: Seated (Tasks from Dynamics Seated and from Reference Seated)

Friction

- Firmly
- Moderately
- Lightly

Oscillations

- 1 1 Hz 800 gr Eyes Open
- 2 1 Hz 400 gr Eyes Open
- 3 1 Hz 600 gr Eyes Open
- 1.33 Hz 600 gr Eyes Open
- 0.66 Hz 600 gr Eyes Open

Targeted

- Vertical 800 gr Eyes Open
- Vertical 800 gr Eyes Open
- Horizontal 800 gr Eyes Open
- Horizontal 800 gr Eyes Open

⇨ Change of protocol to go to Reference Seated protocol

Collisions

- Vertical 600 gr Eyes Open
- Vertical 600 gr Eyes Open

Discrete

- Vertical 600 gr Eyes Open
- Vertical 600 gr Eyes Closed
- Horizontal 600 gr Eyes Open
- Horizontal 600 gr Eyes Closed

Sub-session 2: Supine (Tasks from Reference Supine)

Friction

- Firmly
- Moderately
- Lightly

Collisions

- Vertical 600 gr Eyes Open
- Vertical 600 gr Eyes Open

Discrete

- Vertical 600 gr Eyes Open
- Vertical 600 gr Eyes Closed
- Horizontal 600 gr Eyes Open
- Horizontal 600 gr Eyes Closed

Q1 CADMOS: Could you please indicate the ID of each task (ex Friction firmly = 101), as we at CADMOS don't have the information on the mass weight or frequency of oscillation. Furthermore, can you indicate the ID of the tasks to be performed in the "Sensor and Tracker Checks".

A1: Yes, we will provide this information shortly.

Q2 CADMOS: can you evaluate the number of file needed to be updated to create on GRIP display two sessions "GRIP Commissioning Seated" and " GRIP Commissioning Supine" allowing the crew to perform the tasks mentioned above back-to-back without having to do back and forth between the ISS Laptop and GRIP.

A2: I believe that this would require changing 3 files, one for each of the two new sessions and the subject file to create a 'commissioning' subject ID that uses the new definitions. Each of these files is a short list of the tasks to be performed and a pointer to the already existing scripts.

Q3 CADMOS: We understand that these two sessions (seated and supine) should be performed in two different days, do you confirm?

A3: The two sub-sessions ***can*** be performed on two separate days but this is not a requirement. The defined sessions are short enough that the question of fatigue will be minimized. Furthermore, we are looking to validate the functionality of the system, not the precise science, so maintaining a constant level of alertness is not a hard requirement. The activities to change from seated to supine would be a sufficient pause between the two newly defined sub-sessions, although a somewhat longer pause (1 hour) to perform other activities is perhaps desirable.

GRASP

We understand that the tasks performed during GRASP C/O part would be as follow:

<u>GRASP Commissioning protocol – seated</u>

- Alignment
- Coda head alignment (via maintenance scripts)
- Visual-Visual
  - Task Review
  - Blocks 1 – 4
- Visual-Manual
  - Task Review
  - Blocks 1 – 4
  - Reconfigure for Manual alignment (via maintenance script)

    - Return to Visual-Manual sub-session and perform Blocks 1 – 4
    - Reconfigure for Chest Marker alignment (via maintenance scripts)
    - Blocks 1 – 4
- Manual-Manual
    - Task Review
    - Reconfigure for "best method" alignment (via maintenance script)
    - Return to Visual-Manual sub-session and perform Blocks 1 – 4

GRASP Commissioning protocol – free floating

- Alignment
- Reconfigure for Coda head alignment (via maintenance scripts)
- Visual-Visual
    - Task Review
    - Blocks 1 – 4
- Visual-Manual
    - Task Review
    - Blocks 1 – 4
    - Reconfigure for Manual alignment (via maintenance script)
    - Return to Visual-Manual sub-session and perform Blocks 1 – 4
    - Reconfigure for Chest Marker alignment (via maintenance scripts)
    - Return to Visual-Manual sub-session and perform Blocks 1 – 4
- Reconfigure for "best method" alignment (via maintenance script)
- Manual-Manual
    - Task Review
    - Blocks 1 – 4

Q4 CADMOS: Are we allowed to reshuffle the tasks to minimize back and forth for the crew? Especially in quasi free floating where the crew ask for support for donning the equipment, we have to minimize the number of time where the crew has to doff and don its equipment between each sub-task.

A4: We are open to suggestions, but the order has been chosen with such optimization in mind already plus other criteria as follows:

- The three paradigms (visual-visual, visual-manual and manual-manual) should be performed in the order described, as it is in general easiest to "warm up" using the visual-visual paradigm, while manual-manual is the most difficult and most time consuming.
- The three alignment methods should be performed using the visual-manual or manual-manual paradigms because these include raising and lowering the arm. Visual-manual is preferred because it is shorter than manual-manual.

It is possible to navigate the menus using only the VR Remote, so it is possible to go through the above steps without exiting the restraint systems. The operator need only lift the VR helmet to see the laptop screen.

Note that if it would be possible to change two files on the Perspectives laptop, the above steps could be integrated into a single sub-session definition, including the reconfiguration steps, to minimize the amount of navigating in the menus.

Q5 CADMOS: What is the criterion for "Best method"? Do we need data download of some files for that?

A5: It should be possible to make this decision based on telemetry data that is sent in real time, provided that the tests are performed during AOS. If this is not the case, we will consider choosing a single method in advance (e.g. the coda alignment method) for the manual-manual trials. We will then make the decision about the method to be used for future subjects based on off-line analysis of down-linked files after the commissioning session has been completed.

Q6 CADMOS: In the "GRASP success criteria" section, it is mentioned that "*On certain trials we will ask the commissioning crewmember to purposely exaggerate movements so as to sweep out the working volume with the hand marker structure. To ensure safety, the crewmember can lift the Virtual Reality Helmet to allow visual feedback of the real movement.*"

On how many trials? Are some trials preferred?

A6: Block 3 in the visual-manual paradigm, only for the coda head alignment method, i.e. one block of trials out of the 12 blocks performed in each protocol (seated and floating).