

COMPARISON OF V-4 AND V-5 EXERCISE/OXYGEN PREBREATHE PROTOCOLS TO SUPPORT EXTRAVEHICULAR ACTIVITY IN MICROGRAVITY

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INTRODUCTION: The Prebreathe Reduction Program (PRP) used exercise during oxygen prebreathe to reduce necessary prebreathe time prior to depressurizing to work in a 4.3 psi suit during extravehicular activity (EVA). Initial testing produced a two-hour protocol incorporating ergometry exercise and a 30 min cycle of depress/repress to 10.2 psi where subjects breathed 26.5% oxygen/balance nitrogen (Phase II - 10 min at 75% peak oxygen consumption [$\text{VO}_{2\text{ peak}}$] followed by 40 min intermittent light exercise [ILE] [$\sim 5.8 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$], then 50 min of rest). The Phase II protocol (0/45 DCS) was approved for operations and has been used on 40 EVAs, providing significant time savings compared to the standard 4 h resting oxygen prebreathe. The Phase V effort focused on performing all light in-suit exercise.

METHODS: Two oxygen prebreathe protocols were tested sequentially: **V-4**) 160 min prebreathe with 150 min of continuous ILE. The entire protocol was completed at 14.7 psi. All exercise involved upper body effort. Exercise continued until decompression. **V-5**) 160 min prebreathe with 140 min of ILE - first 40 min at 14.7 psi, then 30 min at 10.2 psi (breathing 26.5% oxygen) after a 20 min depress, simulating a suit donning period. Subjects were then repressed to 14.7 psi and performed another 50 min of lower body ILE, followed by 50 min rest before decompression.

RESULTS: The V-4 protocol was rejected with 3 DCS/6 person-exposures. Initial V-5 testing has produced 0 DCS/11 person-exposures (ongoing trials). The difference in DCS rate was significant (Fisher Exact $p=0.029$).

CONCLUSIONS: The observations of DCS were significantly lower in early V-5 trials than in V-4 trials. Additional studies are required to evaluate the relative contribution of the variables in exercise distribution, the 10.2 psi depress/repress component, pre-decompression rest, or possible variation in total oxygen consumption.

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The material described in this abstract lends itself to oral delivery. The evolution and data can be most efficiently delivered as a graphic-supported timeline annotated by the speaker. This would optimize sharing the results, saving poster time for those with specific questions.

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Attach brief CV of presenting author