INTRODUCTION
The Prebreathe Reduction Program (PRP) employs exercise during oxygen prebreathe to reduce the prebreathe time necessary prior to depressurization (depress) to 4.3 psi extravehicular mobility unit (spacesuit) pressure during extravehicular activity (EVA).

Initial testing produced a two-hour protocol, the Phase II protocol, which incorporated two forms of exercise and a 30 min cycle of depress/repress to 10.2 psi where subjects breathed 26.5% oxygen/balance nitrogen. The depress/repress cycle simulated a break in prebreathe to allow for suit donning. Phase II exercise consisted of 10 min of cycle ergometry at an intensity of 75% peak oxygen consumption ($VO_2$ peak) followed by 40 min of intermittent light exercise (ILE) carried out while subject remained semi-recumbent in a cot equipped with attachments to simulate the effort associated with EVA. The mean $VO_2$ of the ILE was approximately 5.8 mL·kg$^{-1}$·min$^{-1}$. The ILE was followed by a 50-min period of rest and then depress to an ambient pressure equal to EVA spacesuit pressure.

The Phase II protocol was tested in 45 person-exposures. It produced 0 cases of decompression sickness (DCS) and 3 cases of Grade IV venous gas emboli (VGE; [1]). The protocol was approved for operations and has been used on 40 EVAs, providing significant time savings compared to the standard four-hour resting oxygen prebreathe. The Phase V effort focused on performing all light in-suit exercise which could eliminate the reliance on a cycle ergometer.

METHODS
Protocol V-5 was a 160 min prebreathe with 140 min of ILE - first 40 min at 14.7 psi and then 30 min at 10.2 psi (breathing 26.5% oxygen) after a 20 min depress period. Following the exercise at 10.2 psi, subjects were repressed to 14.7 psi at which time they performed another 50 min of lower body ILE. Subjects then remained at rest for 50 min before depress to 4.3 psi for a four-hour simulated EVA with ILE.

Protocol acceptance required a minimum of 50 person-trials: acceptance if DCS $\leq$15% and Grade IV VGE $\leq$20% at 95% confidence limits (c.l.); rejection at any time if DCS $\geq$15% and Grade IV VGE $\geq$20% at 70% c.l.

RESULTS
V-5 testing (ongoing) has produced 2 cases of DCS and 6 cases of Grade IV VGE in 34 person-exposures (6% and 17.6%, respectively). Fisher exact tests indicate no significant difference between Phase II and Phase V-5 for DCS (p=0.182). The difference in Grade IV VGE (p=0.09) is approaching significance.

CONCLUSIONS
The modest frequency of DCS in the trials to date favors the potential for V-5 to serve as a prebreathe protocol that is not reliant on an exercise ergometer. If the protocol is to be rejected, it will likely be due to a relatively high frequency of Grade IV VGE.

REFERENCES