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SUBORBITAL SPACEFLIGHT PRE-LAUNCH PHYSIOLOGICAL PRIMING FOR ENHANCED +G to 0-G SWITCHING TOLERANCE

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ABSTRACT

Suborbital spaceflight passengers will experience a cycle of extreme gravitational loading-unloading-reloading for which no simulation can completely prepare them for. Put simply, down-gearing from 4-G to 0-G & then 0-G to 6-G is not merely a delta-G of 4-G & 6-G, respectively, because passing in & out of 0-G results in unique sensations that few ever experience let alone get to practice for. As pointed-out by Anne Fisher, professional astronaut-physician, *"Your first moments in space are not always your best. The switch from 3-Gs of acceleration to sudden weightlessness can be abrupt enough to induce vomiting. I could feel the blood rushing & in 30 seconds I was going 'uh oh', I am going to be one of the ones who is not going to feel good."* [1] The real world possibility that such *"sudden"* switching &, moreover, from significantly more hostile +G-position, i.e., +4-G_x & +4-G_z may result in a higher-than-expected incidence of passengers actually vomiting probably shouldn't be underestimated, especially because most passenger will be passed their physical prime & under the stress of being strapped to a real-world rocket may mess up their anti-G straining manoeuvers; Fisher experienced less than 2-G_z & was exceptionally well trained. In addition, a *bystander vomiting ripple effect* could ensue in such a close confines, completely ruining the experience & resulting in some major public relations disaster. In response, outlined here, two new & novel anti-G countermeasures that might substantially mitigate such untoward ill-effects & possibly even allow expanding the passenger pool since it would also reduce the risk of G-LOC. Specifically, the technical approach involves off-setting otherwise unprepared & disadvantaged physiological systems by manipulating peripheral blood flow-volume & core-temperature to effect a more favorable, say, primed position & retard-offset G-related adverse effects. The strategy simply involves triggering & accentuating the diver's response, by means of modified pre-launch breath-holding manoeuvers to ensure a lingering diver's response on launch. The on-demand priming effects include prompt, substantial & largely lingering: cephalo-thoracic *blood-shift*; extensive body-cooling, including brain & visceral cooling of several degrees; cold-induced peripheral vasoconstriction; increased time-dose hypoxia tolerance; &, increased tolerance of G_x *chest-crushing*.[2] Indeed, one notes, that human +G_z tolerance, a poorly tolerated force, is decreased by as much as 30-40% per degree increase in core-body temperature.[3] Though the technique requires a minimum of 5 minutes to effect, pre-launch, maximum advantage requires a *warm-up* time of some 20-30 minutes. Once learned the technique permits i-limited self-practice & a considerable conditioning improvement potential; biofeedback is possible via novel non-invasive physiological gadgetry. Although the two priming techniques require some specialized training beyond what is taught in technical freediving courses they can be learned in a gradual, stepwise-personalized manner & do not involve extremely prolonged breath-holding nor deep-diving. Considering the stakes & the amount of money invested by both service-providers & customer alike, reducing the risk of untoward events seems warranted. The technique has yet to be tested under actual suborbital spaceflight conditions.

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(3) Weis, J. Murat*, S., &* Ortiz-Nieto, F. *et al.* (2014). Breath-holding cools the human brain. *ISMRM-ESMRMB Meeting, 10-16 May, Milan, Italy.* Accessed: 14/03/2019. https://cds.ismrm.org/protected/14MProceedings/files/3683.pdf