The Perfect Fit: Parabolic Flight Testing A Novel Biosensor Package

Ravi Komatireddy[1&2], Paddy Barrett[1&2], Sean C. Casey[3], Brian Shiro[4], Jason Reimuller[4], and Erik Seedhouse[4],

([1]West Wireless Health institute, La Jolla, CA;, [2]Scripps Translational Science Institute, La Jolla, CA; [3]Universities Space Research Association, Moffett Field, CA; [4]Astronauts for Hire, Ontario, FL, USA,)

Summary: As human travel aboard suborbital and orbital vehicles expands, it is clear that translating the guidelines and expert consensus for spaceflight participant (SP) medical assessment is a non trivial task. Although basic physiologic changes with exposure to the microgravity environment have been well documented in mostly healthy astronauts, factors such as repeated exposure of commercial crews to microgravity and the potential consequences of preexisting disease with the stresses of suborbital and orbital spaceflight among some SPs remain largely theoretical. Given the existing guidelines regarding medical assessment, training, and simulation methodology of SPs, it is expected that the complication rate from biomedical pathology will be low [1]. The growth of suborbital spaceflight, however, reflects a unique opportunity to capture and quantify the physiologic variables related to human performance in demanding environments. A longitudinal analysis of collected physiological data will offer significant insight in to preflight fitness, in-flight physiological alterations and post flight physiological recovery of general SPs.

Given the recent advancements in wireless medical devices, real time acquisition and monitoring of physiologic data from SPs is now possible. Here we describe a collaborative effort among the Vital Space project team in the assessment of a novel wireless sensor package within the confines of zero-G parabolic flight testing.

Methods: As an investigational medical device, the Visi from Sotera Wireless Inc. has the capability to reliably capture critical physiological metrics such as continuous noninvasive blood pressure, arterial oxygen saturation, heart rate, respiratory rate, skin temperature and multi-lead electrocardiogram. Additional data from integrated accelerometers and a display can be used to view and assess physiologic response. As proposed, our initial parabolic flight test will be used to collect performance and operational data on volunteers from the Astronauts For Hire (A4H) group, under direct supervision of members of the Vital Space Team.

Discussion: In this data poor field, accumulation of physiological metrics pertaining to these subjects will enhance our ability to assess preflight risks, anticipate certain in-flight physiological dynamics and potentially develop continuously self learning algorithms to predict physiological alterations in the future.

Flight Testing: Flights are scheduled for May 2012 under NASA's Flight Opportunities Program and will be flown from Ellington Field, Houston, Texas aboard the Zero Gravity Corporations, G-Force One. From a starting altitude of 24,000 feet, up to 40 parabolas encompassing a 1.8 positive Gx and approximately 25 seconds of near-zero-gravity will be experienced. All aforementioned physiological metrics will be collected live on the A4H subjects prior to, during and after the flight. Data will then be stored, processed and analyzed for integrity. Additionally, usability and the "fit and feel" of the Visi Sotera platform will be assessed during flight. Pre-flight operational testing of the Visi unit has demonstrated successful data capture and usability. The May 2012 flight opportunity is an initial step toward a continued program of using the novel wireless devices to acquire and interpret physiologic data captured from future SPs.

Summary: The frequency of exposure and demographics of spaceflight participants will undoubtedly change over time. The ability to accurately monitor and assess risk of all spaceflight candidates will be critical to the development of commercial space tourism sector. The Vital Space test program in conjunction with the Sotera Visi Mobile Biosensor Platform will offer significant insight in to the physiological dynamics of a growing number of spaceflight participants.

References: [1] Longnecker, D. E., *et al.* (Eds.). 2004. Review of NASA's Longitudinal Study of Astronaut Health, National Academics Press, Washington, 7