Is Radiation Exposure an Important Issue in Suborbital Human Spaceflight?

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Background: Within the next few years, it is very likely that commercial suborbital human spaceflight will become a reality. As the companies developing these new technologies approach their ambitious goals, there is an increased interest on the effects of suborbital spaceflight on the human body, with one particular focus being radiation exposure during flight. There are a number of potential sources of radiation during suborbital flight, such as galactic cosmic radiation (GCR), solar particle events (SPE), trapped radiation from the Van Allen belts, and terrestrial background radiation. Given the average altitudes of the currently proposed suborbital vehicles, the only two sources that are likely relevant are GCR and SPE.

Radiation Exposure: The average flight profile for suborbital vehicles is relatively short in duration, resulting in exposure to what is postulated to be a very low dose of GCR and SPE radiation [1]. This level of exposure is unlikely to result in any harm for individuals who fly once or twice (i.e. most passengers) but it may be of more importance to those who fly repeatedly into space (i.e. crew) [2]. However, the specific amount of radiation exposure on any given flight depends upon a number of factors, including vehicle radiation shielding, space weather disturbances, and the location and latitude of the launch site. In general, incorporating effective shielding into vehicle design, not flying during space weather disturbances, and choosing launch sites at low or middle latitudes can minimize radiation exposure.

Rationale for a Radiation Safety Program: While these measures will likely lower radiation exposure dramatically, they will not eliminate it entirely. As a result, a radiation safety program should be developed for all flight companies in order to define, track, and minimize the radiation exposure of both passengers and crew. The benefits of such a program are many, such as monitoring crew health over time, mitigating the potential for litigation, and verifying the safety of suborbital human spaceflight with respect to radiation exposure. The data from this type of program will also have research and scientific knowledge benefits, since the number of study subjects will increase substantially as the general public begins to access space more frequently.

Elements of a Radiation Safety Program: The elements of a radiation safety program will differ between passengers and crew. For passengers, the program will be focused primarily on monitoring radiation exposure during flight. The information gleaned from this monitoring will be of use not only to alleviate the potential concerns of individual passengers but may also be incorporated into longitudinal studies of human health with respect to suborbital spaceflight. For crew, the radiation safety program should be more robust, encompassing all stages of their career (selection, training, active duty, and retirement). It should incorporate all the usual tenets of occupational and preventative medicine, such as crew health maintenance activities, monitoring and tracking radiation exposures, and appropriate mission assignments for individual crewmembers.

Conclusion: Radiation exposure is one of the many issues in suborbital human spaceflight that warrants further consideration. Even though the radiation doses in suborbital flights are likely to be very low, it is still prudent for all suborbital human spaceflight companies to have a well-designed radiation safety program, in order to keep both passengers and crew healthy and informed. This presentation will outline how to create an effective and reasonable radiation safety program for suborbital human spaceflight.

References: