

The Digital Astronaut (2/17/04)

The **Digital Astronaut** is an integrated modeling and database system that enables the efficient construction and utilization of a class of quantitative models of the whole human body in order to simulate the function of the normal human during and after a space voyage. This system will include appropriate computer-based simulation models that enable detailed study of the effects of weightless space flight and its Earth-based analogues, as well as the effects of the altered spacecraft environment (including the altered radiation field) on astronauts and cosmonauts.

The **Digital Astronaut** is a restricted version of the more general Digital Human. Like the Digital Human, the **Digital Astronaut** will be capable of appropriate structural integration, spanning the required multiple levels of biological organization, from the whole body through the organs, tissues, and cells to the genes and proteins. In addition, the **Digital Astronaut** will be capable of functional integration, integrating multiple coupled physiological subsystems and components of biological networks (circulatory, respiratory, musculoskeletal ...) into a consistent whole-body model. Finally, the **Digital Astronaut** will serve the important function of data integration, integrating the sparse set of space- and analogue-related empirical data, phenomenological observations and experimental studies with theoretical principles.

Developing the **Digital Astronaut** in the context of current biological knowledge will require the development of the infrastructure that will enable the community of biomedical scientists, medical personnel, engineers, and computer specialists involved with human space flight to share their work and build constructively and incrementally on each other's efforts. The resulting system will help biomedical researchers understand the human effects of space flight, to use this understanding to improve medical care for space voyagers and to design appropriate counter-measures that reduce the biomedical risks of space flight. The **Digital Astronaut** is a key element of a robust program of human space exploration.