

Space Life Sciences Innovation and Integration Successes



*Jeffrey R. Davis, Johnson Space Center and
The University of Texas Medical Branch*

The Space Life Sciences Directorate (SLSD) at the Johnson Space Center (JSC) is implementing exciting, new changes in the integration and innovation of a complex technical body of work. The SLSD is comprised of professionals with a wide variety of degrees from MDs and PhDs in life sciences, engineering, and business. Many technical disciplines are required to provide services to all of our customers, as is experienced with project and program management. In addition to the three major space flight programs (i.e., the Space Shuttle, International Space Station (ISS), and Constellation Programs), SLSD also hosts the Human Research Program (HRP). SLSD truly functions as a team with members from multiple NASA centers, Wyle Integrated Science and Engineering (and several subcontractors), Baylor College of Medicine (as host to the National Space Biomedical Research Institute), and the Universities Space Research Association. The team is comprised of approximately 160 civil servants and 900 contractors.

Short- and especially long-duration human space flights challenge the human system, and we are responsible for maintaining the health and well-being of space travelers. Maintaining health and well-being requires not only medical services but also biomedical research to mitigate the hazards of space flight and technologies and to provide services for environmental monitoring, habitability, and human factors.

Integration

To address these challenges, SLSD recently took steps to better integrate all of these professional services for human space flight and to focus our efforts on the highest-priority human health and performance risks for various missions. Our first step was to view the human in space flight as a human system that must be optimally integrated with vehicle systems. While the definition of the human system will vary with organizations outside NASA, for our purposes it means: risks to the human from a medical, a physiological, a performance, an environmental (including radiation, fractional gravity, toxicology, and microbiology), a human factors, and a habitability standpoint. We have developed a comprehensive, standards-driven, risk-based system that focuses all our work on the highest-priority human health and performance risks during space flight.

Our next step was to form an integrated Human System Risk Board (HSRB) and forum. The JSC Chief Medical Officer chairs the HSRB; and HRP managers and managers from all SLSD divisions serve as active voting members on this decision-making board. The board structure permits the integration of medicine and research as well as all technical disciplines. As the HSRB focuses on the risks of human space flight, many disciplines (including expertise from medicine and research) can take part in comprehensive board discussions. Since the board was formed in April 2008, its members have made several timely decisions to rebalance the research portfolio, accepted a risk with operational mitigation, and agreed to new risks based on recent evidence. The HSRB is open through teleconferences and WebEx support to many who cannot attend it in person.

Innovation

The SLSD leadership team recognizes the need to accelerate and diversify innovative strategies to solve both short- and long-duration space flight problems. Accordingly, the team recently renewed its emphasis on flying commercially available hardware that can be adapted to space flight (e.g., flying this year a commercial automatic external defibrillator), and flew a commercial treadmill for astronaut use and a gas chromatograph/differential mobility spectrometer to monitor vehicle air quality.

The SLSD is also exploring techniques of open or distributed innovation. In April 2008, we collaborated with the Rice Business Alliance to form the Rice Business Plan Competition, offering the first-ever NASA Earth/Space Life Sciences prize. This prize is awarded for a technology that was developed for terrestrial uses, but that may also have application in space flight. Teams that participate in the Rice Business Plan Competition must demonstrate a solid technology and business plan. The initial team submissions are culled down to 36 team finalists, who compete in Houston each spring. HeartSounds, the winner of the 2008 NASA prize, came from the University of Illinois, Chicago. The HeartSounds technology, as its name suggests, is a wireless patch that can diagnose heart sounds and pressures and transmit the data to a small storage device for later downloading. The HeartSounds team visited JSC to collaborate with our medical doctors and scientists. In the April 2009 competition, the JSC Engineering

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continued

Directorate joined with the SLSD to expand the prize offerings. The 2009 winner was Integrated Diagnostics, a team that designed the HemaScreen. The HemaScreen technology is a rapid clinical assay that uses integrated circuit technology to perform multiple immunoassay tests.

Another innovative technique that SLSD is exploring is an open source approach to further develop a computational physiological model of the human body – the digital astronaut (DA). The use of open source could accelerate the development of the DA in a cost-effective manner. It also allows for easier incorporation of previously developed sub-models from the broader national/international community of model developers, and facilitates participation of interested model developers from inside and outside the NASA community. This approach can potentially enrich the global knowledge base for computational physiological modeling. SLSD released the initial version of the DA in mid-2009.

Other initiatives in open or distributed innovation included sponsoring workshops on open innovation with professors and material from the Harvard Business School. As these workshops focused on community-based design, SLSD is now exploring various techniques to tap a larger community of expertise – perhaps by awarding national prizes.

These exciting changes in integration and innovation will truly position SLSD to be a valuable provider of services for the human system for the ISS as well as for future flights to the moon and Mars.

Websites

Space Life Sciences Website: <http://slsd.jsc.nasa.gov>

Rice Alliance Website: <http://alliance.rice.edu>