

HUMAN SPACEFLIGHT SYMPOSIUM (B3)  
Utilization & Exploitation of Human Spaceflight Systems (3)

Author: Dr. Julie A. Robinson

National Aeronautics and Space Administration (NASA), Johnson Space Center, United States,  
julie.a.robinson@nasa.gov

Ms. Amelia Rai

National Aeronautics and Space Administration (NASA), Johnson Space Center, United States,  
amelia.e.rai@nasa.gov

Dr. Nicole Buckley

Canadian Space Agency, Canada, Nicole.buckley@asc-csa.gc.ca

Dr. Martin Zell

European Space Agency (ESA), The Netherlands, martin.zell@esa.int

Mr. Kazuyuki Tasaki

Japan Aerospace Exploration Agency (JAXA), Japan, tasaki.kazuyuki@jaxa.jp

Dr. Georgy Karabadzhak

TSNIIMASH, Russian Federation, gfk@tsniimash.ru

Dr. Salvatore Pignataro

Italian Space Agency (ASI), Italy, salvatore.pignataro@asi.it

EXPANDED BENEFITS FOR HUMANITY FROM THE INTERNATIONAL SPACE STATION

**Abstract**

In 2012, the International Space Station (ISS) partnership published the *International Space Station Benefits for Humanity*, a compilation of stories about the many benefits being realized in the areas of human health, Earth observations and disaster response, and global education. This compilation has recently been revised to include updated statistics on the impacts of the benefits, and new benefits that have developed since the first publication. Two new sections have also been added to the book, and this presentation will summarize the updates on behalf of the *ISS Program Science Forum*, made up of senior science representatives across the international partnership.

A new section on “Economic Development of Space” highlights case studies from public-private partnerships that are leading to a new economy in low earth orbit (LEO). Businesses provide both transportation to the ISS as well as some research facilities and services. These relationships promote a paradigm shift of government-funded, contractor-provided goods and services to commercially-provided goods purchased by government agencies. Other examples include commercial firms spending research and development dollars to conduct investigations on ISS and commercial service providers selling services directly to ISS users. This section provides examples of ISS as a testbed for new business relationships, and illustrates successful partnerships.

The second new section, “Innovative Technology,” merges technology demonstration and physical science findings that promise to return Earth benefits through continued research. Robotic refueling concepts for life extensions of costly satellites in geo-synchronous orbit have applications to robotics in industry on Earth. Flame behavior experiments reveal how fuel burns in microgravity leading to the possibility of improving engine efficiency on Earth. Nanostructures and smart fluids are examples of materials improvements that are being developed using data from ISS.

The publication also updates and expands the previously described benefits of research results in the areas of human health, environmental change and disaster response, and education activities. Applications

to human health of the knowledge gained on ISS continues to improve healthcare technologies and the understanding of human physiology. Distinct benefits return to Earth from the only orbiting multidisciplinary laboratory of its kind. The ISS is a stepping stone for future space exploration while also providing findings that develop LEO and improve life on our planet.