Research Overview of the International Space Station Partnership

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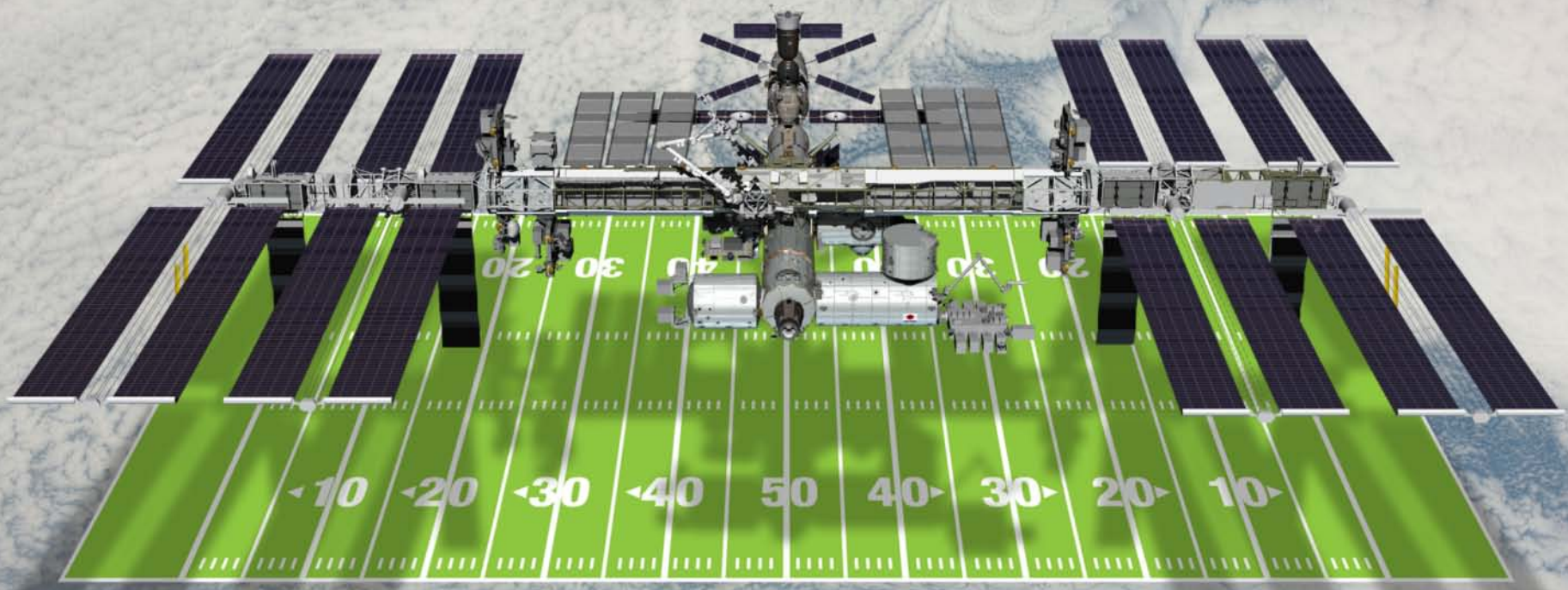
The Global Engineering Achievement

International Space Station



Spacecraft Mass: 799,046 lb (362,441 kg)

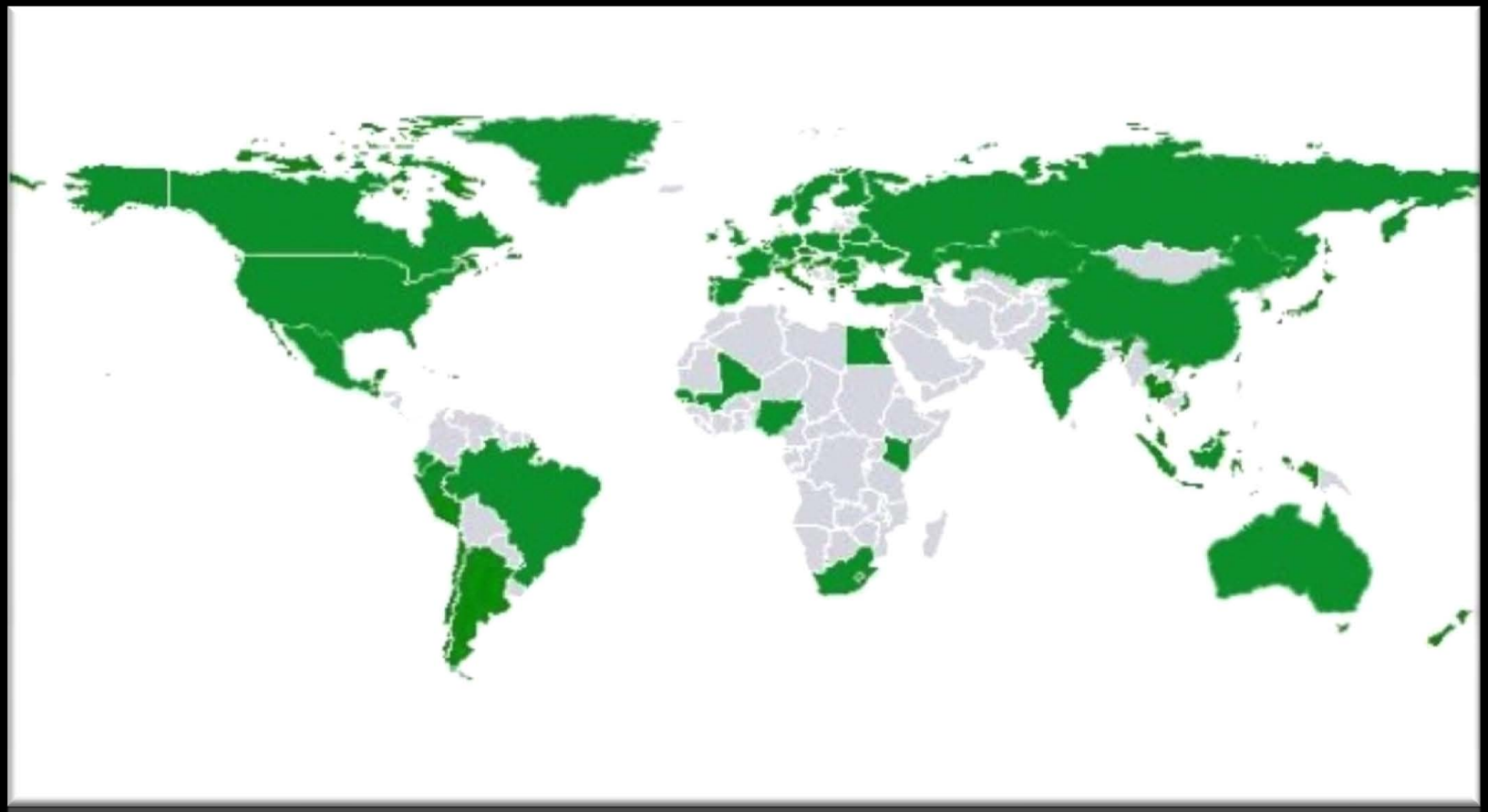
Spacecraft Pressurized Volume: 4 bedroom house

Velocity: 17,500 mph (28,200 kph)

Science Capability: Laboratories from four international space agencies – US, Europe, Japan, and Russia.

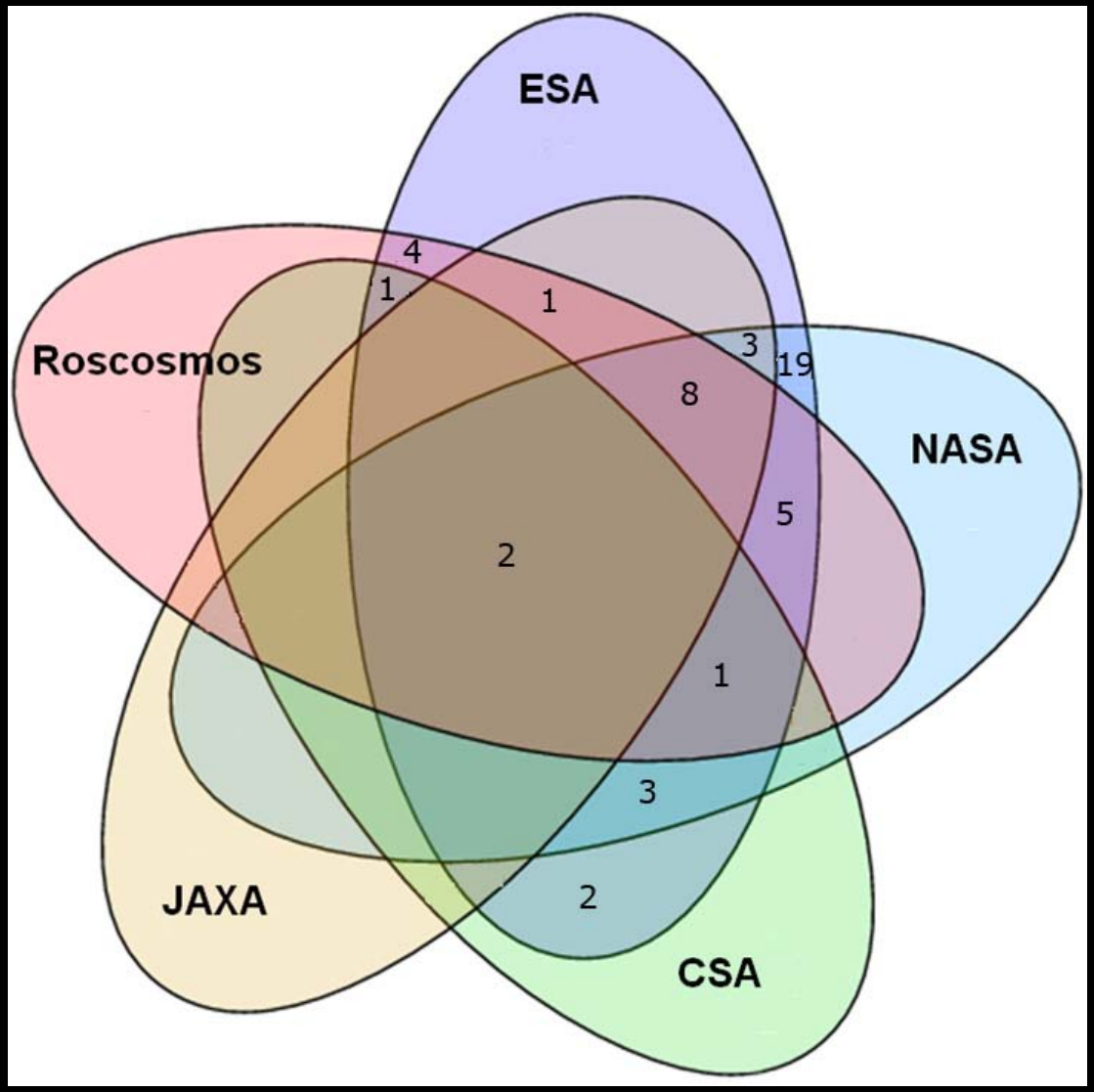

International Partnership

International Participation in Research and Education



63 countries

Example: European Collaboration in ISS Investigation Development over the next year

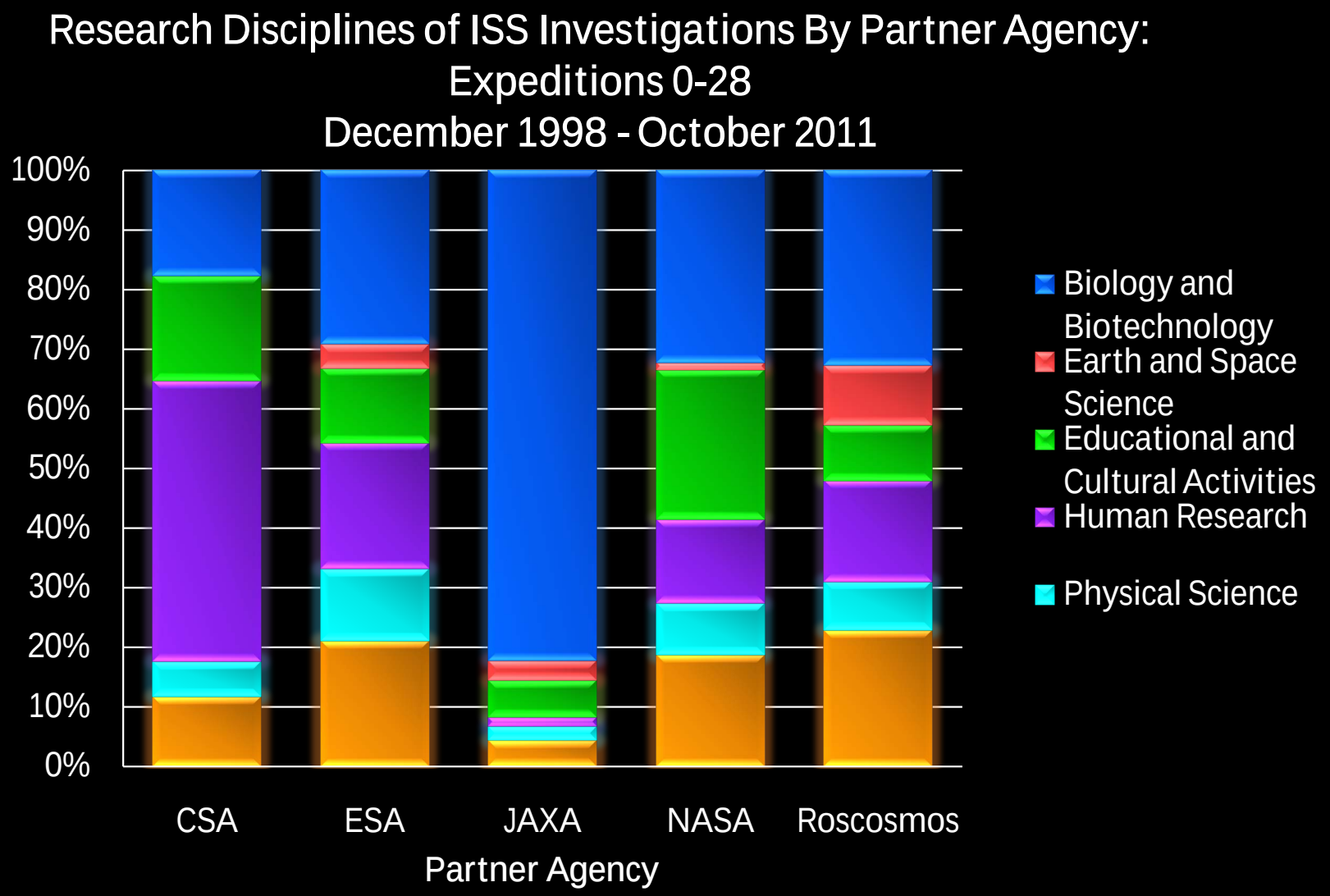


Collaborations among other ISS partner agencies are not shown

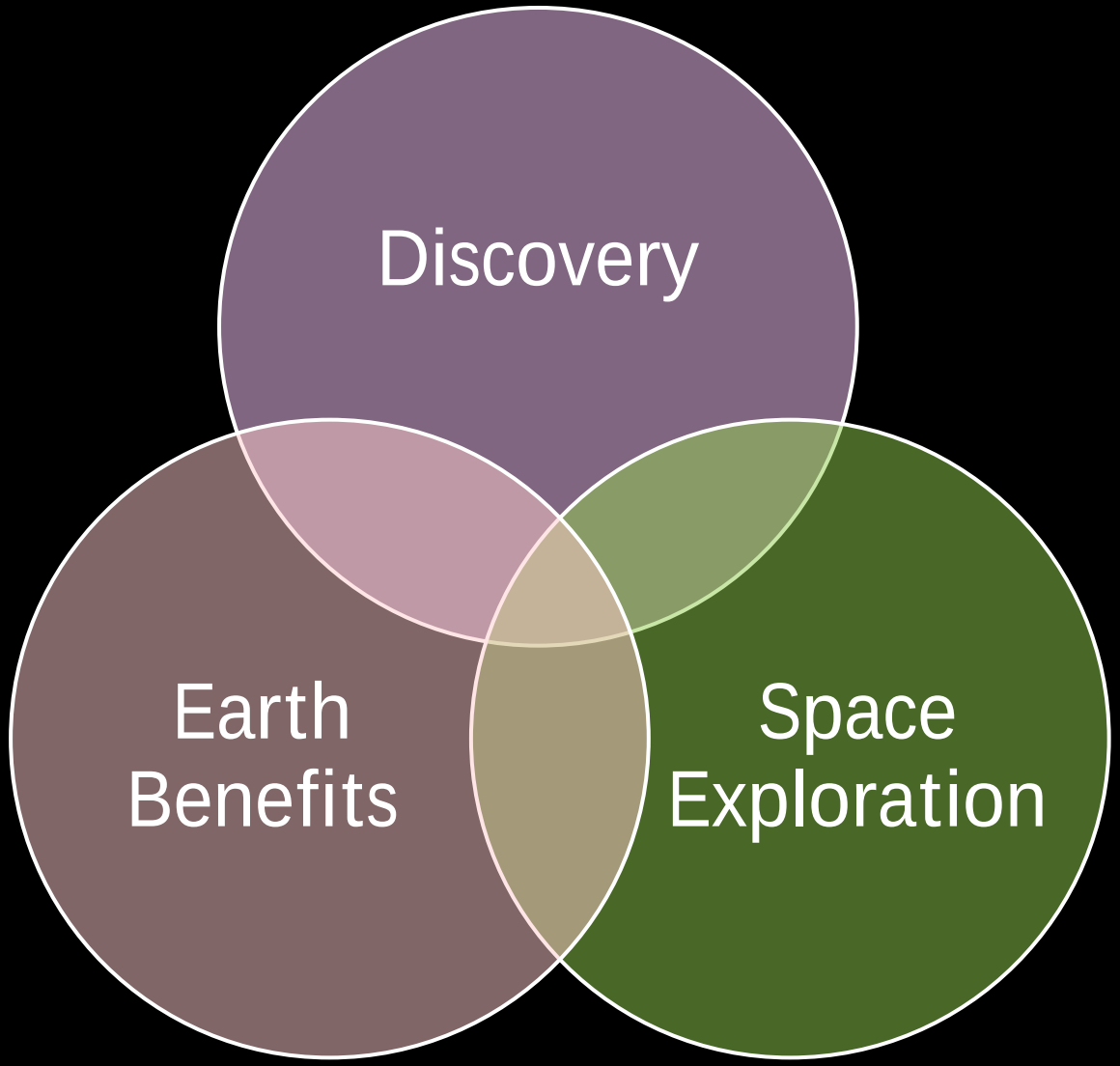
New Knowledge and Benefits

By the Numbers: ISS Research Accomplishments

- Expeditions 0 – 28
  - 1251 Investigations
  - > 1300 scientists served
  - >578 scientific publications



What kind of benefits come from research in space?



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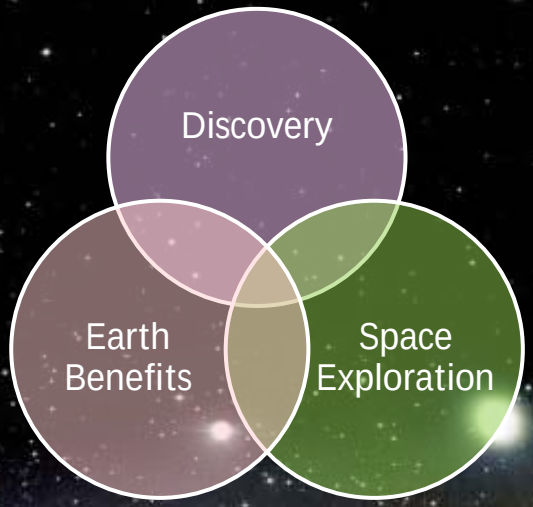
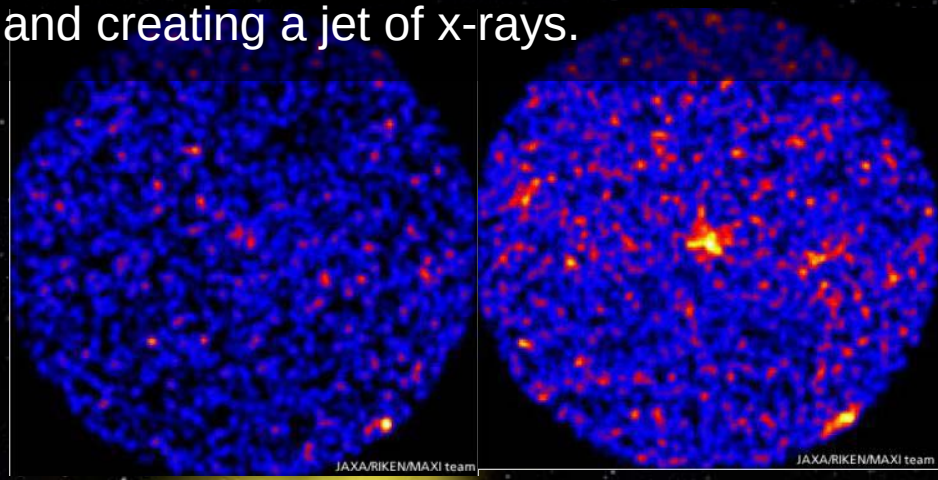


Discovery

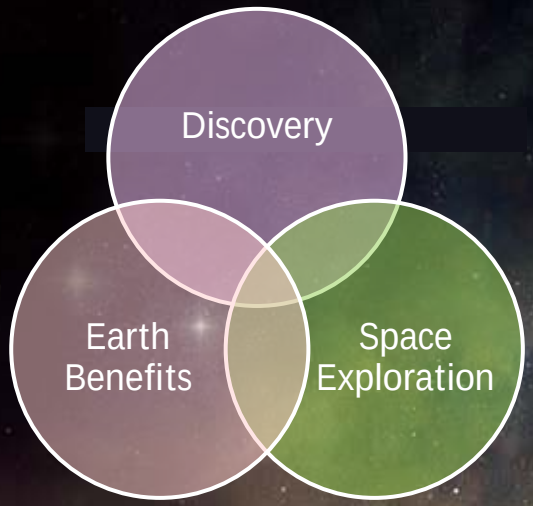
X-ray Monitoring – MAXI is a highly sensitive X-ray slit camera externally-mounted to the ***International Space Station*** for monitoring more than 1,000 X-ray sources in space, including black holes and neutron stars. In 2010, MAXI along with the SWIFT spacecraft found two new X-ray sources from its sky scans. Both instruments made the first observation of a relativistic x-ray burst from a supermassive black hole destroying a star and creating a jet of x-rays.



Nature, 476: 421-424 August 2011

Source: Goddard Simulation of the Event, JAXA/Rikken, ISS Program Scientist, NASA

Exploration

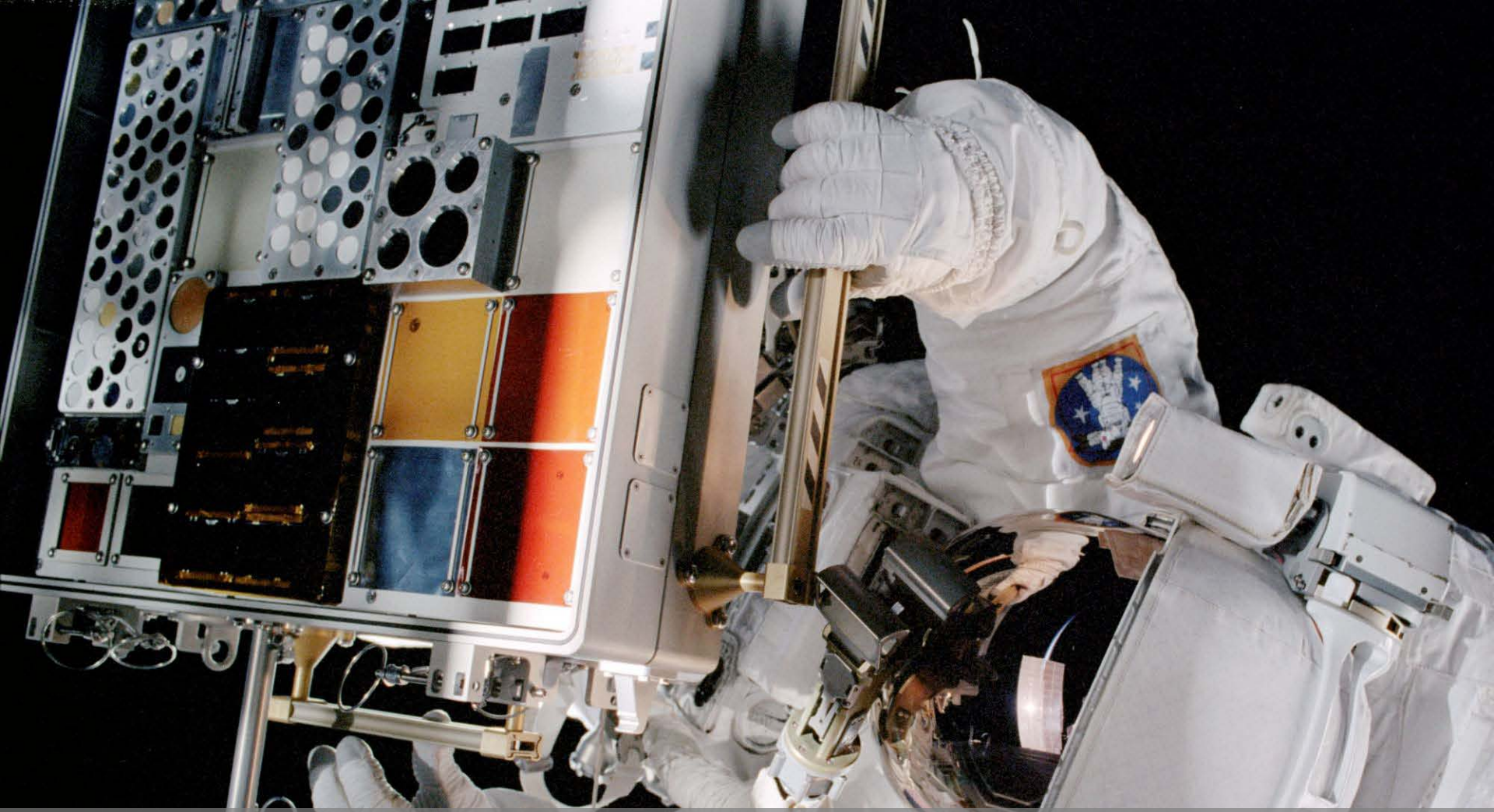


Mars

Asteroid

Moon

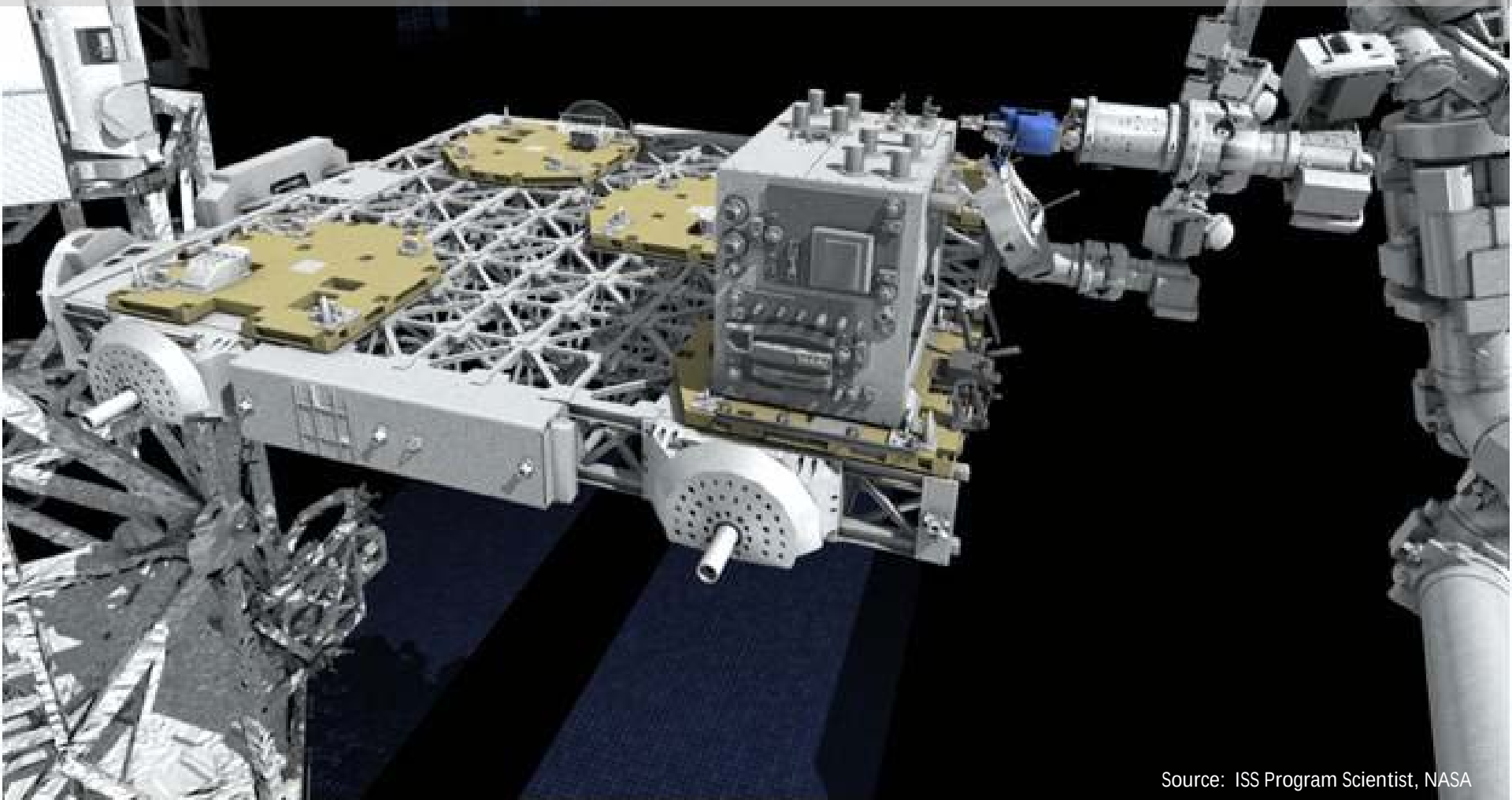
Orion



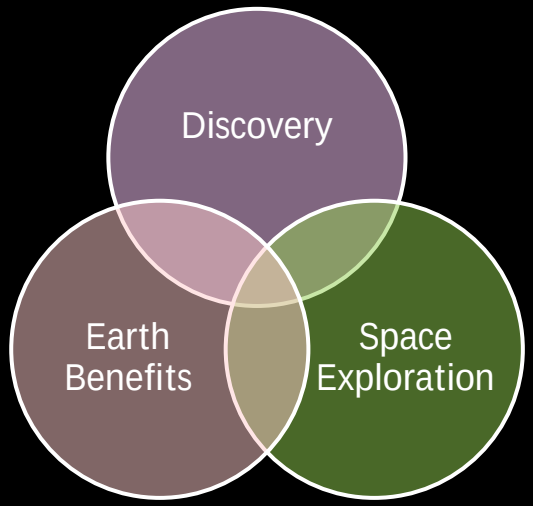
Space Materials Technology – Studies of how materials withstand the harsh space environment (atomic oxygen, direct sunlight, radiation and extremes of heat & cold) provide a better understanding of the durability of various materials with important applications in the design of future spacecraft. The Naval Research Laboratory and Boeing have used the ***International Space Station*** materials test bed to shorten development time for satellite hardware components by as much as 50%

Source: ISS Program Scientist, NASA

Robotic Refueling Mission (RRM) is an external *International Space Station* experiment that paves the way for future robotic refueling missions. It demonstrates robotic refueling tasks and servicing technologies in a zero-g environment. It uses of the ISS Special Purpose Dexterous Manipulator (also known as "Dextre") to validate tasks, tools, and techniques needed to repair "legacy" satellites not designed to be refueled in orbit. Robotic refueling extends the lifetime of satellites, allowing owners and operators to gain additional years of use from assets already operating in space.



Source: ISS Program Scientist, NASA



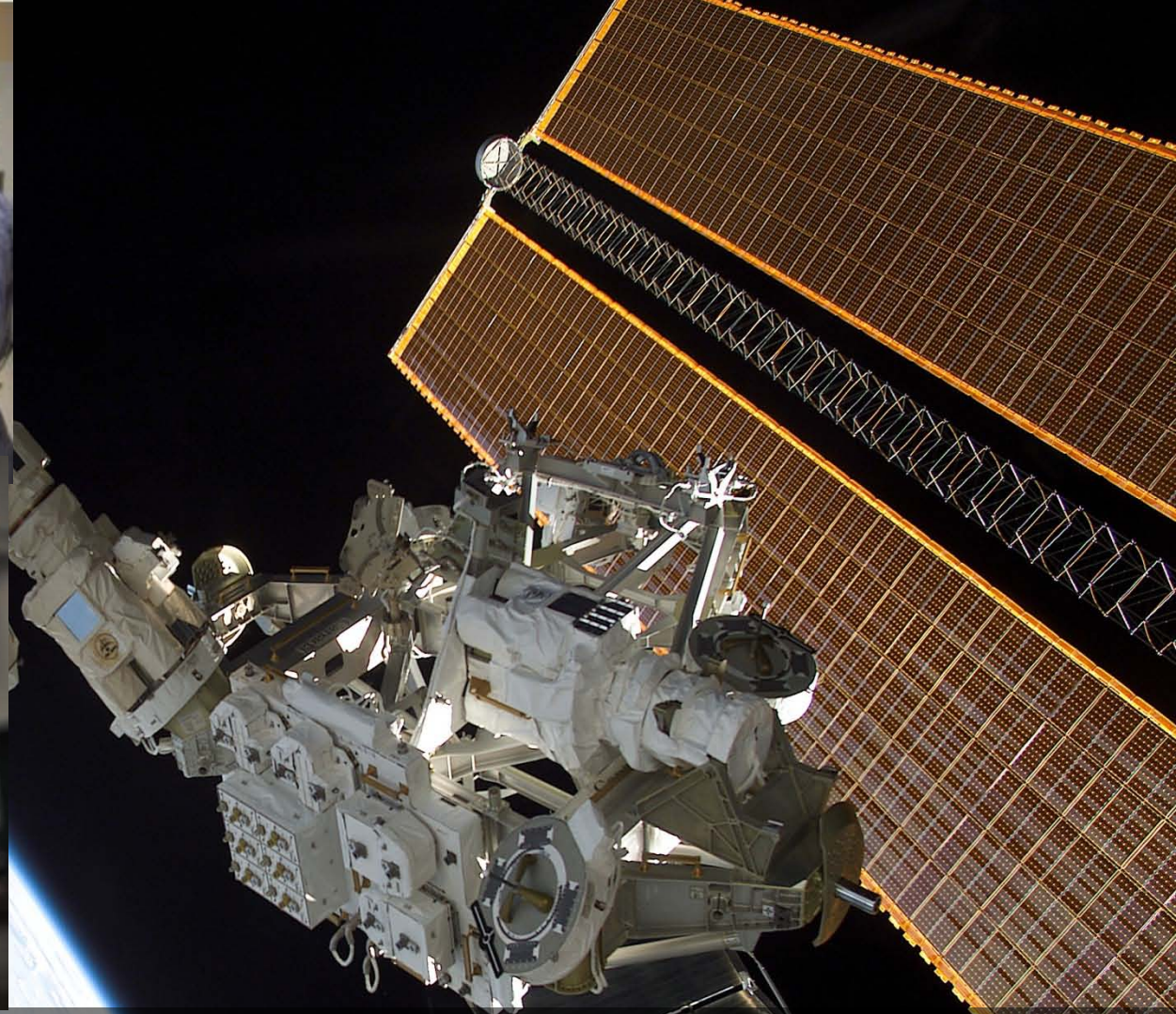
Earth Benefits

Three of the possible Earth benefits themes were developed in 2011

Health

Earth Observation & Disaster Response

Education



Medical Technology - The development and use of the robotic arm for space missions on the Space Shuttle and the ***International Space Station*** has led to the world's first MRI (Magnetic Resonance Imaging) compatible image-guided, computer-assisted device specifically designed for neurosurgery. The device now being used to augment surgeons' skills to perform neurosurgeries that are traditionally considered difficult or impossible, thus leading to better patient outcomes.

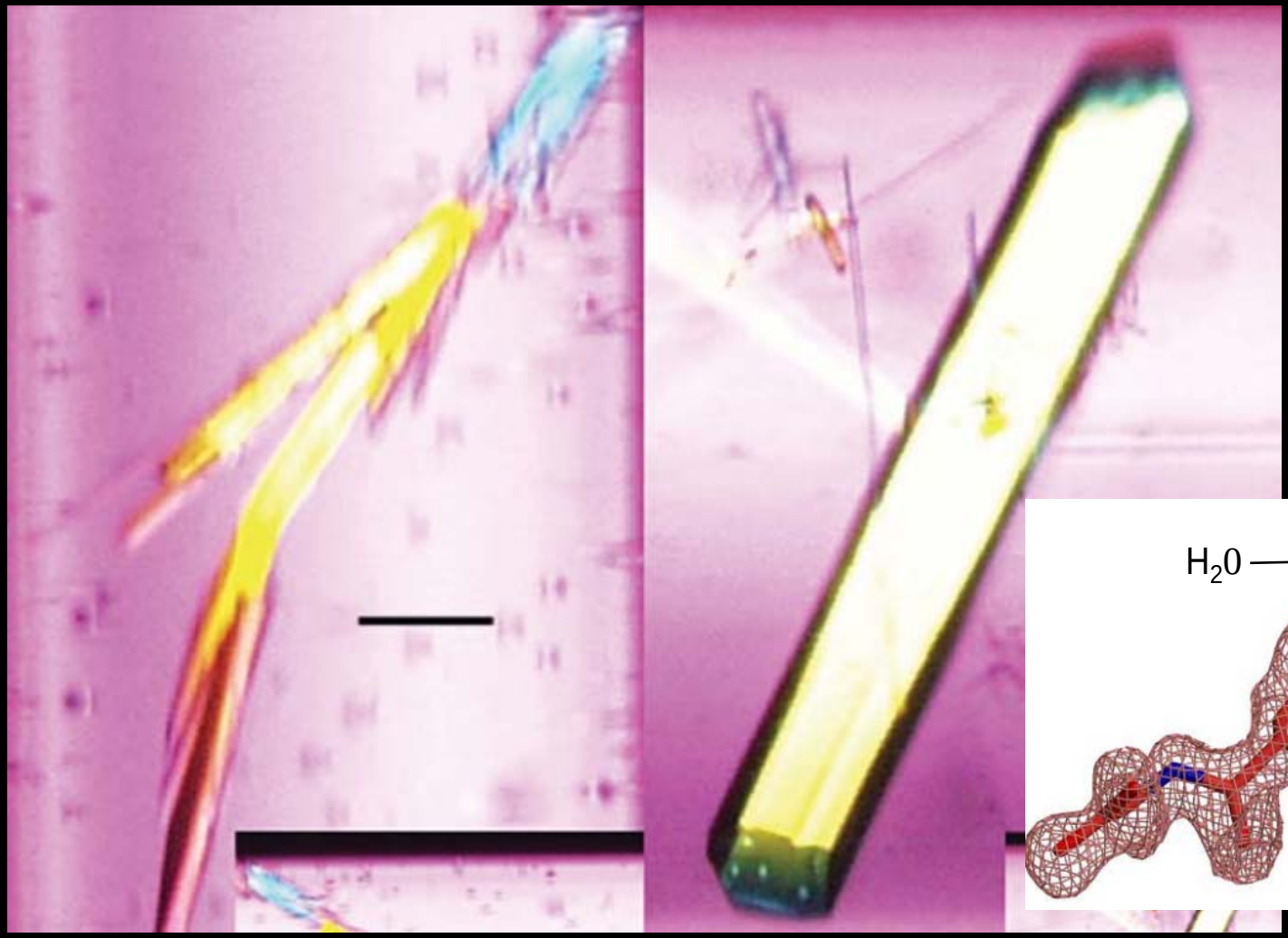
Source: Canadian Space Agency

Telemedicine Advancements - Ultrasound training methods developed for evaluating medical issues on the ***International Space*** Station have been used by the American College of Surgeons to teach ultrasound techniques to surgeons. Additional applications could include diagnosis of injuries and illnesses in remote locations on Earth, including rural areas, disaster areas and the battlefield.

Images courtesy of Scott A. Dulchavsky, Henry Ford Health System, Detroit, MI

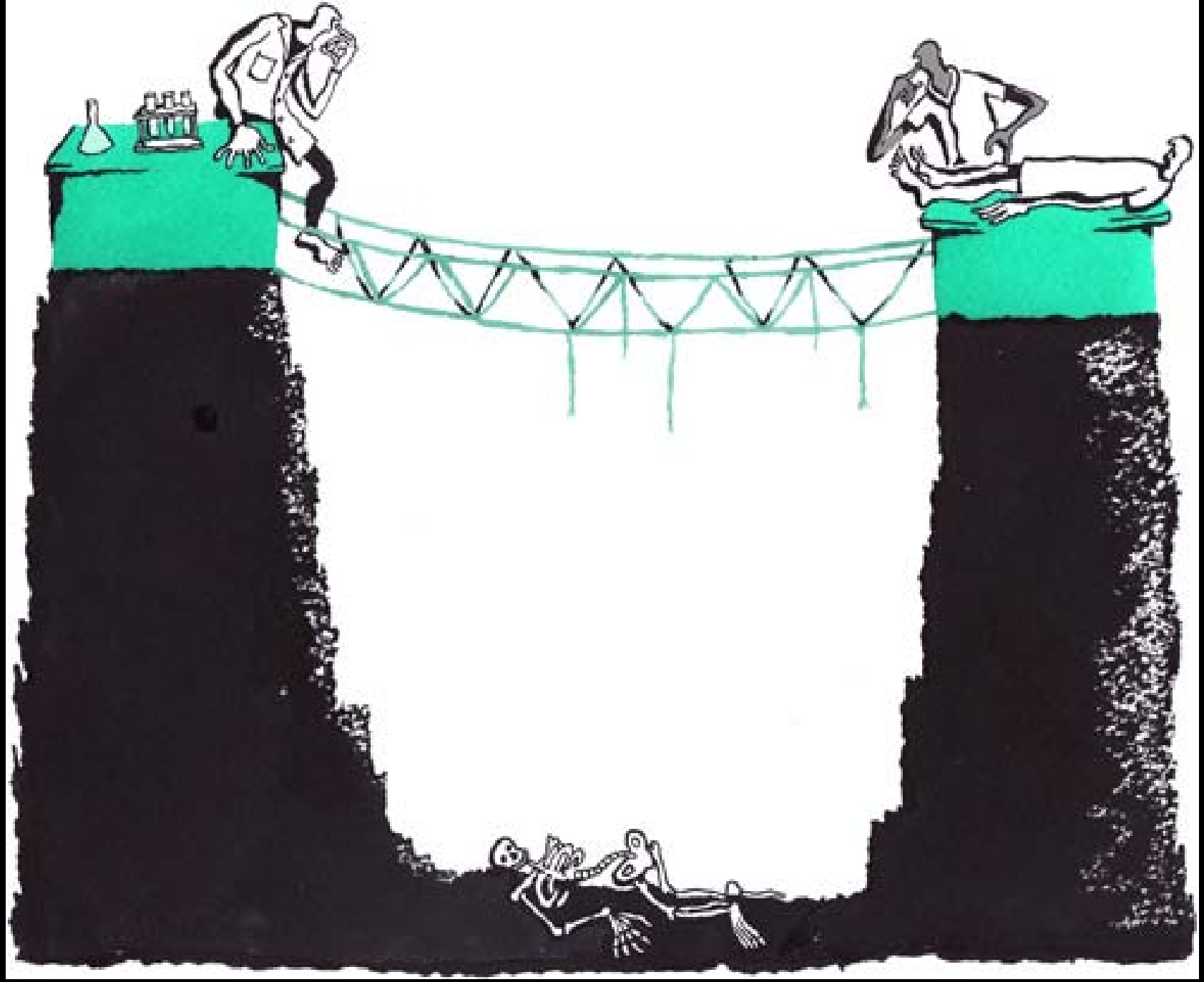
Source: ISS Program Scientist, NASA

Macromolecular Crystallization– Japanese scientists crystallized a human prostaglandin D2 synthase-inhibitor complex (H-PGDS/HQL-79 complex) on the ***International Space Station***, identifying an improved complex structure and an associated water molecule that was not previously known. The H-PGDS protein has shown to play a critical role in the formation of Duchenne's muscular dystrophy. Continuing work is investigating other proteins and viruses.



Acta Cryst. (2010). F66, 846–850

Source: ISS Program Scientist, NASA



B. Mellor/Nature, Used with permission

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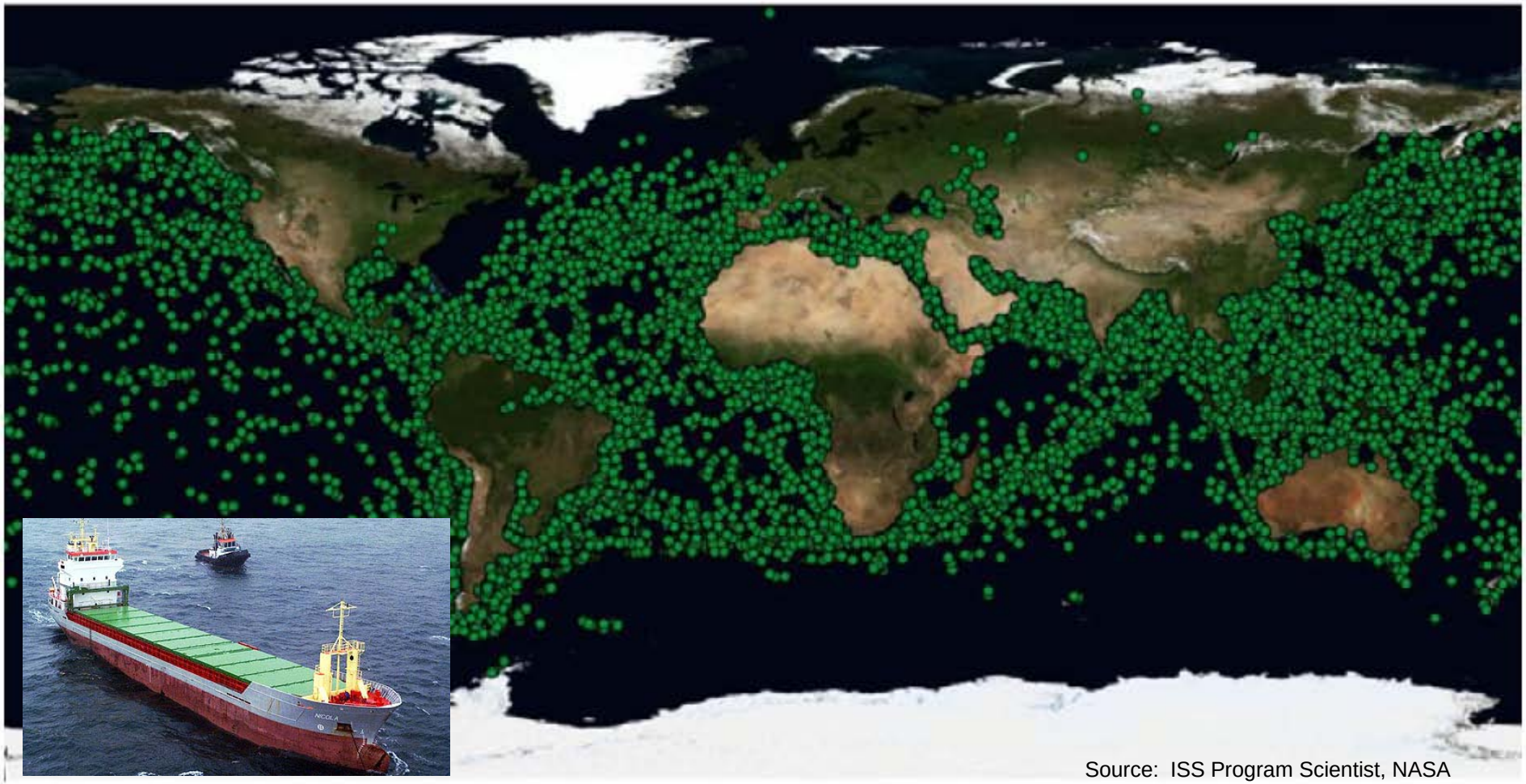
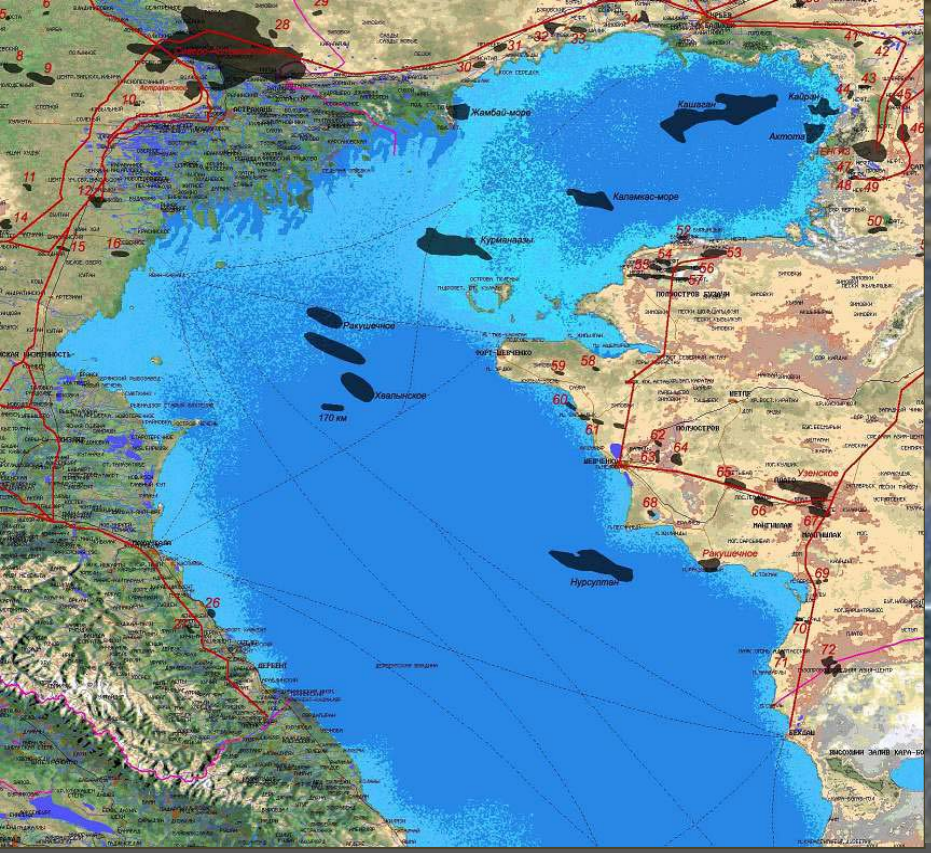
Global Maritime Traffic Tracking – This space-based method of tracking global maritime traffic is mounted outside the Columbus Laboratory on the *International Space Station.* It can track a ship's speed, position, course, cargo, and voyage information to and from other vessels and shore. This autonomous system can monitor traffic in open waters, whereas Earth-based systems can only monitor maritime vessels in coastal waters.



Source: ISS Program Scientist, NASA

First Summary Plot of Data from NORAIS Receiver (after first hours) (Image: FFI)



Images courtesy of Roscosmos

Natural and Human-made Disaster Observation – In the Caspian Sea, a Russian Earth observation program on the *International Space Station* observed oil pollution along the coastal areas. Three major sources of the pollution were determined through analysis of these images. Images before and after natural disasters, such as the ones taken of the Caucasus Mountains prior to a devastating avalanche, showed that glacial melting was the cause.

Education – Students from around the world talk to astronauts each week onboard the ISS through the "Amateur Radio on the International Space Station" program- a cooperative venture of NASA, the National Association for Amateur Radio, and AMSAT.

Source: ISS Program Scientist, NASA

Image courtesy of ARISS

ISS benefits for Humanity Document

based on the 3 themes

Direct Links to Agency Benefits Pages

www.nasa.gov/mission_pages/station/research/benefits/index.html

http://www.esa.int/SPECIALS/ISSBenefits

English : http://www.asc-csa.gc.ca/eng/iss/benefits.asp
Français : http://www.asc-csa.gc.ca/fra/iss/avantages.asp

Japanese: http://iss.jaxa.jp/iss/about/benefits/index.html
English: http://iss.jaxa.jp/en/iss/benefits/index.html

Russian: http://knts.tsniimash.ru/ru/site/Benefits.aspx
English: http://knts.tsniimash.ru/en/site/Benefits.aspx

English: http://www.asi.it/en/activity/habitability/iss_benefits_for_humanity
Italian: http://www.asi.it/it/attivita/abitabilita/benefici_per_lumanit_dalla_ricerca_sulla_iss