National Aeronautics and Space Administration

International Space Station

[MISSION SUMMARY]

EXPEDITION 47

Expedition 47 began March 1, 2016 and ends June 5, 2016. This expedition includes musculoskeletal research, chemistry research and a technology demonstration. No spacewalks are currently planned during Expedition 47.

THE CREW:

Soyuz TMA-19M Launch: December 15, 2015 (Note: Kelly and Kornienko launched on Soyuz TMA-16M on March 27, 2015) • Landing: June 1, 2016

Timothy Kopra (NASA) – Flight Engineer

Born: Austin, Texas
Interests: running, swimming, reading, home improvement projects, and spending time with family and friends
Spaceflights: STS-127, Expedition 20
Bio: http://go.nasa.gov/bgyJnW
Twitter: @astro_tim

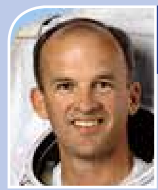
Timothy Peake (ESA) – Flight Engineer

Born: Chichester, England
Interests: skiing, scuba diving, cross-country running, climbing, and mountaineering
Spaceflights: Exps. 46/47 mark his first space station missions
Bio: http://go.nasa.gov/1MkB4Ja
Twitter: @astro_timpeake
Instagram: @astro_timpeake

Yuri Malenchenko (Roscosmos) – Flight Engineer

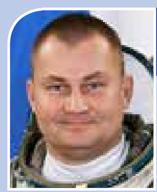
Born: Svetlovodsk, Kirovograd Region, Ukraine
Interests: sports, games and music
Spaceflights: STS-106, Exps. 7, 16, 32 and 33
Bio: http://go.nasa.gov/195yzKl

Soyuz TMA-20M Launch: March 18, 2016 • Landing: September 7, 2016



Jeffrey Williams (NASA) – Flight Engineer

Born: Superior, Wisconsin
Interests: running, fishing, camping, skiing, scuba diving and woodworking
Spaceflights: STS-101, Exps. 13, 21 and 22
Bio: http://go.nasa.gov/20p7kDFl
Twitter: @Astro_Jeff
Instagram: @astro_jeffw



Alexey Ovchinin (Roscomos) – Flight Engineer

Born: Rybinsk, Yaroslavl Region, Russia
Spaceflights: Exps. 47/48 mark his first space station missions
Bio: http://go.nasa.gov/20p7NFG

Oleg Skripochka (Roscomos) – Flight Engineer

Born: Nevinnomysk, Stavropol Region, Russia
Interests: parachute sport and bicycle tourism
Spaceflights: Exps. 25/26
Bio: http://go.nasa.gov/20p863z

THE SCIENCE:

What are some of the investigations the crew is operating?

During Expedition 47, researchers will investigate spaceflight's effect on the musculoskeletal system, the ability of tablets to dissolve in microgravity and how robotics can make exercise equipment smaller to minimize space dedicated to equipment and leave more room for crew during a long-duration mission. Investigations like these demonstrate how space station crews help advance NASA's journey to Mars while making discoveries that can benefit all of humanity.

Rodent Research-3-Eli Lilly

Spaceflight causes a rapid loss of bone and muscle mass especially in the legs and spine, with symptoms similar to those experienced by people with muscle-wasting diseases or with limited mobility on Earth. Assessment of Myostatin Inhibition to Prevent Skeletal Muscle Atrophy and Weakness in Mice Exposed to Long-duration Spaceflight (Rodent Research-3-Eli Lilly), a U.S. National Laboratory investigation sponsored by the Center for the Advancement of Science in Space (CASIS), studies molecular and physical changes in the musculoskeletal system that happen in space. Results expand scientists' understanding of muscle atrophy and bone loss in space, while testing an antibody that has been known to prevent muscle wasting in mice on Earth.

In addition to the primary research focus on musculoskeletal systems, other organ systems are also studied for molecular and morphological changes as a function of duration of spaceflight exposure, further supporting the use of mice to model harmful effects of spaceflight in astronauts. On Earth, numerous diseases or physical impairments cause bone and muscle loss, including muscular dystrophy, cancer, spinal cord injury and the aging process. Patients on extended bed rest also experience similar physical changes. Results from this investigation could lead to new treatments for bone- and muscle-wasting diseases such as these.

Eli Lilly-Hard to Wet Surfaces

Another investigation hopes to determine how microgravity affects the ability of materials to dissolve. In chemistry, wetting refers to spreading of a liquid over a solid material's surface, and is a key aspect of the material's ability to dissolve. While tablets and pills that do not dissolve easily might impede a drug's release into the body, how a product's wettability affects its performance is not well understood. The Hard to Wet Surfaces (Eli Lilly-Hard to Wet Surfaces) investigation, also a U.S. National Laboratory study sponsored by CASIS, examines how certain materials used in the pharmaceutical industry dissolve in water while in microgravity.

On Earth, the density differences between a hard-to-wet solid/tablet and the solution can result in the solid/tablet floating on top of the solution, thereby exacerbating the dissolution problem. In microgravity, the solid/liquid density differences are negligible, and other factors controlling dissolution rate such as wettability dominate. Investigators hope to determine how mini-tablets behave differently in microgravity (float vs. sink, wet out faster or slower, etc.), and whether simple mixing will have less impact in microgravity (whether the tablet/capsule moves less). Results from this investigation could help improve the design of tablets that dissolve in the body to deliver drugs, thereby improving drug design for medicines used in space and on Earth.

Miniature Exercise Device (MED-2)

Exercise countermeasures are required by crew members during spaceflight to maintain health and to counter the debilitating effects of microgravity, including bone and muscle loss, cardiovascular alterations, and neurovestibular disturbances during long duration missions in microgravity. They are also especially critical for exploration missions, which require the crew to be at optimum physical performance in order to conduct potentially physically demanding exploration tasks.

The current exercise equipment used on the International Space Station is large. Smaller exercise devices could make room for other critical spaceflight equipment while providing similar benefits. The Miniature Exercise Device (MED-2) technology demonstration exhibits key motion system technology required to reduce the volume and weight of countermeasure equipment that will be needed for long-term spaceflight. It demonstrates the use of robotic actuator technology to provide the motion and resistance needed to provide appropriate countermeasures for counteracting the effects of microgravity on the human body. This technology could lead to the next generation of exercise equipment that is lighter and smaller than existing systems and will be critical to longer duration spaceflight on journeys to Mars and beyond. Ground-based exercise equipment using the same robotic actuator technology could lead to improvements in rehabilitation and physical therapy, allowing physical therapists greater control over the prescriptions used in the exercises allowing for truly tailored rehabilitation programs.

THE MISSION **PATCH:**

The central depiction of the International Space Station (ISS) is in recognition of the international achievement of designing, building and maintaining a world-class space laboratory. The orientation of the ISS represents the view seen by the Soyuz crewmembers as they approach the station. The blackness of space in the background portrays the limitless area that humankind has yet to explore. The efforts of the Expedition 47 crew will contribute to the growing body of knowledge and expertise that will allow us to extend human exploration beyond low-Earth orbit. The three blue colors are from the flags of the Expedition 47 crew's home countries (United States, Russia and the United Kingdom), representing a fundamental commonality among each of the international partner countries whom the crewmembers serve.

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