Yearlong ISS crew returns to Earth
By Derek Richardson

Blazing through the atmosphere and landing at the steppes of Kazakhstan, NASA astronaut Scott Kelly and Russian cosmonaut Mikhail Korniyenko returned to Earth on the morning of March 2, 2016, after spending nearly a year at the International Space Station (ISS).

Kelly and Korniyenko returned in the Soyuz TMA-18M with Sergey Volkov, who launched to the orbiting laboratory back in September and spent 181 days in space. The one-year duo were launched to the ISS on March 27, 2015, in Soyuz TMA-16M and subsequently spent 340 days in space—the longest single flight for an American and longest mission in the history of the ISS program (to date).

Over the course of their stay, they orbited Earth over 5,440 times and traveled more than 143 million miles (230 million kilometers). Additionally, nearly 400 experiments were performed in areas ranging from life sciences, robotics, biology and more.

Kelly, who had been the commander of the space station since Sept. 5, 2015, relinquished his post to fellow NASA astronaut Tim Kopra on Feb. 29.

“It’s kind of hard to believe that we’ve been here for two and a half months and it’s only a portion of Scott and [Mikhail’s] time here,” Kopra said after Kelly handed over command. “Special thank you to Scott. Thank you for your leadership. You’ve been such a great role model to us in every aspect—as a crew member and as a space station commander—so we’re very, very grateful.”

Expedition 46 officially ended and Expedition 47 began when the Soyuz undocked at 7:02 p.m. CST on March 1 (00:10 GMT on March 2) from the Poisk module. Hatches between the spacecraft had been closed a few hours prior at 3:43 p.m. CST (21:43 GMT).

Remaining on board the space station are Commander Kopra and Flight Engineers Tim Peake, from the European Space Agency (ESA), and Russian cosmonaut Yuri Malenchenko. All three have been in space for more than 77 days.

“We are very grateful to this crew, to you [Mikhail] and to you Scott,” Malenchenko said before hatch closure. “Thank you to the mission control centers in Moscow and Houston. Good luck guys and we’ll see you soon on the ground.”

After pulling away from the station, the first separation burn occurred when the Soyuz was 66 feet (20 meters) away. The spacecraft fired its thrusters again for a second burn just 90 seconds later.

About two and a half hours after undocking at 9:32 p.m. CST (3:32 GMT), while 7.5 miles (12 kilometers) from the ISS, the crew commanded the Soyuz’s SKD engine to fire for four minutes

and 49 seconds, slowing the spacecraft down by about 420 feet (128 meters) per second. With that, the vehicle and crew were on an intercept course with the upper atmosphere.

Shortly before Entry Interface, 27 minutes after the de-orbit burn, the three modules of the Soyuz—the Orbital Module, Descent Module and the Service Module—separated. Only the Descent Module with crew is intended to return to Earth safely.

The Soyuz began to skirt the atmosphere just after 10 p.m. CST (4:00 GMT) going 4.73 miles (7.62 kilometers) per second. They were about 62 miles (100 kilometers) above the Arabian peninsula.

Just under seven minutes later, slowing down to 1.41 miles (2.28 kilometers) per second while still 20.7 miles (33.4 kilometers) high, the crew experienced their maximum gravity load of about 4.57 times the force of Earth's gravity.

"Doing OK, feeling the pressure, feeling the G's," Volkov said during descent.

The spacecraft soared through the atmosphere, creating a trail of super-heated plasma around the capsule for nearly 10 minutes before slowing down enough for the first set of parachutes to deploy.

That deployment came with the release of pilot chutes to pull the drogue chute out. The spacecraft and crew were just over 6 miles (10 kilometers) in altitude at this point, still going 695 feet (212 meters) per second.

The drogue slowed the capsule to only 262 feet (80 meters) per second before the main parachute deployed. It's surface area of 10,764 square feet (1,000 square meters) slowed the vehicle to about 21 feet (6.5 meters) per second.

This slow descent lasted for about 10 minutes while the spacecraft and crew began to prepare for touchdown.

First, the heat shield was jettisoned, which revealed the Soft Landing engines. Next, the cabin pressure was equalized with the outside. Finally, the crew seats, called Kazbek, were moved slightly upward relative to the horizon in order to absorb the shock of landing.

As the spacecraft descended, the recovery team began to locate and track the capsule. Once the main parachute deployed, helicopters began a wide circle around the landing area.

About one second before touchdown, the Soft Landing engines ignited in a momentary burst to cushion the final three feet (about one meter) of the crew's journey. The official landing time was 10:26 p.m. CST (10:26 a.m. local Kazakh time, 4:26 GMT).

The spacecraft landed upright. To prevent the parachute from dragging the capsule around, the line connecting the two was automatically cut, as planned.

Once confirmation of touchdown occurred, the helicopters landed, and nearby all-terrain vehicles rushed to the capsule to begin the careful extraction of the crew. The first thing the search and rescue teams did was erect a ladder around the module. Then they opened the hatch at the top of the vehicle.

The first to be extracted was Volkov, then Kelly and Korniyenko. They were individually lowered and moved to lawn-chair like couches nearby and given a blanket. Temperatures at the landing area were around 32 degrees Fahrenheit (0 degrees Celsius).

“The air feels great out here,” Kelly said, “I don’t know why you guys are all bundled up.”

Kelly, who last flew in space five years ago as part of the Expedition 25/26 increment in 2010 and 2011, told a medical officer that he didn’t feel much different than he did when he landed then.

After the medical evaluations were complete, the crew was flown to nearby city Dzhezkazgan, where Kelly will part ways with Korniyenko and Volkov.

Kelly is scheduled to return to Houston around 9 p.m. CST on March 2 (3:00 GMT March 3). He will be welcomed home by the Second Lady of the United States Jill Biden, Assistant to the President for Science and Technology John Holdren, NASA Administrator Charles Bolden and Kelly’s identical twin brother and former NASA astronaut Mark Kelly.

At noon CST (18:00 GMT), Friday, March 4, a media briefing will be held by key members from NASA’s science community to discuss the research accomplishments and the next steps for the nearly 400 experiments that occurred while Kelly was in space.

Then at 1 p.m. CST (19:00 GMT), another media briefing will be held by Kelly where he will share his personal perspective on the one-year mission and answer questions about his stay aboard ISS. Both events will be streamed on NASA TV.

“Scott Kelly’s one-year mission aboard the International Space Station has helped to advance deep space exploration and America’s Journey to Mars,” said NASA Administrator Charles Bolden. “Scott has become the first American astronaut to spend a year in space, and in so doing, helped us take one giant leap toward putting boots on Mars.”