



your window to space

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Crew Dragon Successfully Splashes down in Atlantic Ocean after completing SpaceX's Demo-1 mission to the ISS



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space news roundup

SpaceX Crew Dragon Splashdown Marks Success of First NASA Commercial Crew Flight Test

NASA passed a major milestone in its goal to restore America's human spaceflight capability when SpaceX's Crew Dragon returned to Earth after a five-day mission docked to the International Space Station.

About 6 hours after departing the space station, Crew Dragon splashed down at 8:45 a.m. EST on Friday 8 March approximately 230 miles off the coast of Cape Canaveral, Florida. SpaceX retrieved the spacecraft from the Atlantic Ocean and is transporting it back to port on the company's recovery ship.

"Today's successful re-entry and recovery of the Crew Dragon capsule after its first mission to the International Space Station marked another important milestone in the future of human spaceflight," said NASA Administrator Jim Bridenstine. "I want to once again congratulate the NASA and SpaceX teams on an incredible week. Our Commercial Crew Program is one step closer to launching American astronauts on American rockets from American soil. I am proud of the great work that has been done to get us to this point."

Demonstration Mission-1 (Demo-1) was an uncrewed flight test designed to demonstrate a new commercial capability developed under NASA's Commercial Crew Program. The mission began March 2, when the Crew Dragon launched from NASA's Kennedy Space Center in Florida, and racked up a number of "firsts" in less than a week.

- First commercially-built and operated American crew spacecraft and rocket to launch from American soil on a mission to the space station.
- First commercially-built and operated American crew spacecraft to dock with the space station.
- First autonomous docking of a US spacecraft to the International Space Station.
- First use of a new, global design standard for the adapters that connect the space station and Crew Dragon, and also will be used for the Orion spacecraft for NASA's future mission to the Moon.

NASA and SpaceX teams gathered in the early morning hours at the company's headquarters in Hawthorne, California, to follow the spacecraft's return journey and ocean splashdown.

"We were all very excited to see re-entry, parachute and drogue deploy, main deploy, splashdown – everything happened just perfectly. It was right on time, the way that we expected it to be. It was beautiful," said Benji Reed, director of crew mission management at SpaceX.

A critical step in validating the performance of SpaceX's systems, Demo-1 brings the nation a significant step closer to the return of human launches to the space station from U.S. soil for the first time since 2011, when NASA flew its last space shuttle mission. However, NASA and SpaceX still have work to do to validate the spacecraft's performance and prepare it to fly astronauts.

"If you just think about the enormity of this flight and all of the prep that went into it – getting the pad refurbished, getting the flight control room set up, getting the vehicle built, getting the Falcon 9 ready, all of the analysis and mission support that went into it – it's just been a tremendous job. Our NASA and SpaceX teams worked seamlessly not only in the lead-up to the flight but in how we managed the flight," said Steve Stich, deputy manager of NASA's Commercial Crew Program.

Crew Dragon carried a passenger on this flight test – a lifelike test device named Ripley, which was outfitted with sensors to provide data about potential effects on humans traveling in the spacecraft. After SpaceX processes data from this mission,

teams will begin refurbishing Crew Dragon for its next mission, an in-flight abort test targeted to take place this summer. Demo-2, the first crewed test flight, will carry NASA astronauts Bob Behnken and Doug Hurley on the spacecraft's final flight to certify Crew Dragon for routine operational missions.

"For the first time, we've gotten to see an end-to-end test, and so now we've brought together the people, the hardware and all the processes and procedures, and we've gotten to see how they all work together, and that's very important as we move toward putting people onboard," said NASA astronaut Mike Hopkins, who will crew SpaceX's first operational mission to the space station following Demo-2. "I'm, personally, very anxious to hear how Ripley is feeling after they pull her out of the capsule and get her onto the recovery vehicle."



SpaceX Crew Dragon about to dock with International Space Station

NASA
<http://nasa.gov>

Learn more about NASA's Commercial Crew program at:
<https://www.nasa.gov/commercialcrew>

NASA to accelerate plans to Return to Moon by 2024

The following is a statement from NASA Administrator Jim Bridenstine on the 26 March announcement by Vice President Mike Pence, at the fifth meeting of the National Space Council, about putting American astronauts back on the Moon in the next five years:

"Today, I joined leaders from across the country as Vice President Mike Pence chaired the fifth meeting of the National Space Council. Vice President Pence lauded President Donald J. Trump's bold vision for space exploration and spoke to NASA's progress on key elements to accomplish the President's Space Policy Directives.

"Among the many topics discussed during our meeting at the US Space and Rocket Center in Huntsville, Alabama, was to accelerate our return to the Moon:

- NASA is charged to get American astronauts to the Moon in the next five years.
- We are tasked with landing on the Moon's South Pole by 2024.
- Stay on schedule for flying Exploration Mission-1 with Orion on the Space Launch System (SLS) rocket next year, and for sending the first crewed mission to the lunar vicinity by 2022.
- NASA will continue to 'use all means necessary' to ensure mission success in moving us forward to the Moon.

"It is the right time for this challenge, and I assured the Vice President that we, the people of NASA, are up to the challenge.

"We will take action in the days and weeks ahead to accomplish these goals. We have laid out a clear plan for NASA's exploration campaign that cuts across three strategic areas: low-Earth orbit, the Moon, and Mars and deeper into space.

"I have already directed a new alignment within NASA to ensure we effectively support this effort, which includes establishing a new mission directorate to focus on the formulation and execution of exploration development activities. We are calling it the Moon to Mars Mission Directorate.

"Earlier today I was also at Marshall Space Flight Center for an all-hands to reinforce our



NASA's Orion capsule and ESA's European Service Module (above) and the mighty Space Launch System (SLS) is shown on the left.

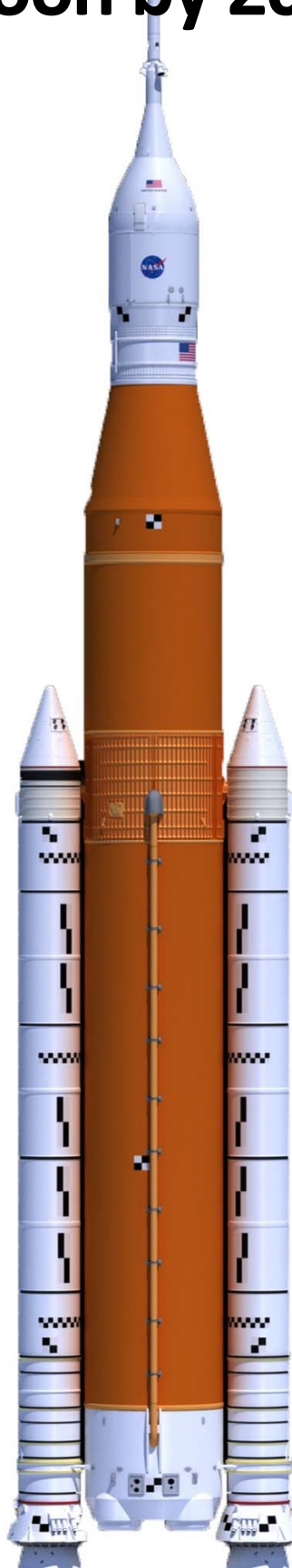
NASA

commitment to SLS with the workforce. We discussed my recent announcement that NASA would consider all options to fly Orion around the Moon on schedule. I shared the analysis we conducted to assess flying the Orion on different commercial options. While some of these alternative vehicles could work, none was capable of achieving our goals to orbit around the Moon for Exploration Mission-1 within our timeline and on budget. The results of this two-week study reaffirmed our commitment to the SLS. More details will be released in the future.

"There's a lot of excitement about our plans and also a lot of hard work and challenges ahead, but I know the NASA workforce and our partners are up to it. We are now looking at creative approaches to advance SLS manufacturing and testing to ensure Exploration Mission-1 launches in 2020. We will work to ensure we have a safe and reliable launch system that keeps its promise to the American people.

"I know NASA is ready for the challenge of moving forward to the Moon, this time to stay."

To learn more about NASA's Moon to Mars plans, visit:
<https://www.nasa.gov/moon2mars>



Moon to Mars Overview

Working with US companies and international partners, NASA will push the boundaries of human exploration forward to the Moon and on to Mars. NASA is working to establish a permanent human presence on the Moon within the next decade to uncover new scientific discoveries and lay the foundation for private companies to build a lunar economy.

Right now, NASA is taking steps to begin this next era of exploration.

It all starts with delivery services to the lunar surface from US companies for scientific instruments and technology demonstrations as well as a spaceship, called the Gateway, in orbit around the Moon that will support human missions to the surface with reusable lander elements for decades to come. The Gateway will, for the first time, give NASA and its partners access to more of the lunar surface than ever before, supporting both human and robotic missions. The agency's powerful Space Launch System rocket and Orion spacecraft will be the backbone to build the Gateway and transport astronauts to and from Earth.

Groundbreaking Science

The Moon is a treasure chest of science that holds many fascinating mysteries to explore – many that will advance our understanding of our home planet and solar system, as well as the cosmos beyond. NASA wants to use the Moon's unique perspective as a science platform to look back at the Earth, observe the Sun, and view the vast universe. The discovery of water on the Moon and possible deposits of rare Earth metals also hold promise for both scientific and human exploration.

Surface Exploration

NASA is working to build and identify scientific instruments and technology demonstrations for Moon deliveries by US companies as soon as 2019. These deliveries will help us learn more about the Moon, and provide opportunities to test new lander technologies. At the same time, NASA will begin to develop increasingly larger, more capable, and reusable landers for humans that can carry more cargo and land more precisely. Future landers also will carry large roving instrument kits to locate life-sustaining and mission-enabling resources on the Moon, and collecting and returning samples to the Gateway.

Lunar Outpost

The Gateway will enable months-long crew expeditions with multiple trips down to the lunar surface, enabling exploration of new locations across the Moon. The first part of the Gateway is targeted to launch on a private rocket in 2022 and will provide power and propulsion as well as communications for the spaceship. After it reaches orbit, and demonstrates its capabilities in space for about a year, NASA will launch astronauts in Orion on an SLS rocket carrying two new sections for the Gateway that will add a small living space and initial science and operational capabilities. Over time, the Gateway will become a way station for the development of refueling depots, servicing platforms, and a facility for processing samples from the Moon and other bodies in support of science and commerce.

Getting There: SLS and Orion

SLS and Orion are critical to the NASA's exploration plans at the Moon and beyond. NASA designed the Space Launch System as the world's most powerful rocket for safely sending humans on missions to deep space, and Orion is specifically designed to keep humans alive hundreds of thousands of miles from home, where getting back to Earth takes days rather than hours.

The first mission in 2020 will test the new spacecraft systems flying together for the first time, without crew, and the second flight is targeted for 2022 to take people for a flight test around the Moon. The third flight of SLS and Orion will kick-off delivery of new Gateway parts, with missions flying about once per year thereafter. SLS will launch the larger components for the Gateway on flights along with Orion, and Orion will be used as a tug to deliver those components to the required orbit for assembly. Together, Orion, SLS and the Gateway represent the core of NASA's sustainable infrastructure for human exploration.

Looking to Mars

NASA also continues to work with companies to address the challenges of living in space, such as using existing resources, options for disposing of trash, and more. Missions to the Moon are about 1,000 times farther from Earth than missions to the International Space Station, requiring systems that can reliably operate far from home, support the needs of human life, and still be light enough to launch. These technologies will become increasingly more important for the 34 million mile trip to Mars.

Exploration of the Moon and Mars is intertwined. The Moon provides an opportunity to test new tools, instruments and equipment that could be used on Mars, including human habitats, life support systems, and technologies and practices that could help us build self-sustaining outposts away from Earth. Living on the Gateway for months at a time will also allow researchers to understand how the human body responds in a true deep space environment before committing to the years-long journey to Mars.

All these efforts will build on NASA's 60 years of exploration experience, including the success of more than 18 years of continuous human presence aboard the International Space Station. With the work underway, the agency will move deeper into the solar system with its partners to achieve the ambitious exploration goals set forth by Space Policy Directive-1 and to develop a permanent presence at the Moon that generates new markets and opportunities, both scientific and economic, and prepares humanity for future exploration to Mars.

NASA
www.nasa.gov

Meet Blue Moon

Amazon Founder Jeff Bezos Unveils New Lunar Lander



Blue Moon is a flexible lander delivering a wide variety of small, medium and large payloads to the lunar surface. Its capability to provide precise and soft landings will enable a sustained human presence on the Moon.

Blue Moon can deliver payloads to the lunar surface, host payloads and even deploy payloads during its journey to the Moon. Its technology builds on our experience with New Shepard with respect to LH2/LOX propulsion, precision guidance, vertical landing and landing gear systems.

It's been years in development.

Large Lunar Landing Payload Capability

Blue Moon can land multiple metric tons of payload on the lunar surface.

The top deck and lower bays easily accommodate a wide variety of payloads, including large payloads and ESPA-class payloads with standard ring port interfaces. There are lower mounting locations for payloads, useful for closer access to the lunar surface and off-loading.

Ample Power for Payloads

The Blue Moon lander provides kilowatts of power to payloads using its fuel cells, allowing for long mission durations and the ability to last through the lunar night.

Precision Landing

Blue Moon's precision guidance and descent sensors utilize machine learning technology to accurately land anywhere on the lunar surface, starting with its first mission.

Versatility

The Blue Moon lander can deliver large infrastructure payloads with high accuracy to pre-position systems for future missions. The larger variant of Blue Moon has been designed to land an ascent vehicle that will allow us to return Americans to the Moon by 2024.

Artists Impression of Blue Moon with Astronauts module on lunar surface



For more information please visit Blue Origin
<https://www.blueorigin.com/blue-moon>

Flying to the Moon without taking off – SIRIUS-19

Isolation experiment begins in Moscow

19 March 2019 marked the start of the SIRIUS-19 isolation study with three female and three male 'cosmonauts' in the habitat at the Institute for Biomedical Problems in Moscow.

For 122 days, they will simulate a mission to an orbital lunar station, during which they will conduct six German-developed experiments, and even land on a simulated lunar surface.

Focus: Spaceflight, health, robotics, social benefits

A special experiment will begin at the Institute of Biomedical Problems of the Russian Academy of Sciences (IBMP RAS) in Moscow on 19 March 2019 at 14:00 local time. Just four months before the celebrations for the fiftieth anniversary of the first Moon landing by the Apollo 11 astronauts, three female and three male 'cosmonauts' will embark on a simulated journey to our terrestrial neighbour. Closed off from the outside world, they will live, work and research in conditions of complete isolation in the Moscow NEK Habitat.

"Only biomedical research of this nature will make future journeys to other celestial bodies possible. Six of these experiments have been developed in Germany," notes Christian Rogon, SIRIUS Project Manager at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) Space Administration. DLR is participating in the SIRIUS-19 isolation study together with the French space agency CNES under the leadership of the Russian space agency Roscosmos and the US space agency NASA.

Three women and three men on board

In recent times, the Moon has again become a focus of attention for all the major space agencies. "However, before any meaningful research can be conducted on the Moon, crews must be trained to successfully complete such a mission. For this, as in SIRIUS-19, they must be able to live for a long time under conditions in which they will be subjected to a mixture of psychological stress, due to total isolation, and a high degree of pressure to perform well. Only in this way can we learn more about the interaction of body and mind in isolation," Rogon explains. These insights are best gained when a simulated lunar mission takes place in a setting that is as realistic as possible. The SIRIUS-19 experiment is being conducted under the command of 44-year-old Russian cosmonaut Evgeny Tarelkin, who has already carried out one space mission. During the experiment, Tarelkin will embark on a 122-day lunar journey together with his crew – Reinhold Povilaitis, Allen Mirkadyrov (both US Americans), Daria Zhidova, Anastasia Stepanova and Stephania Fedeye (all Russian).

"The interesting thing for SIRIUS-19 is that the crew is composed of an equal number of men and women. How does a mixed-sex crew cope with the challenges of isolation? How does it deal with potential mishaps? How does it react to increased performance pressure? These are all fascinating questions, and we are very curious to find out the answers," says an enthusiastic Christian Rogon as the study begins.

The daily work routine on an orbital lunar station

After travelling for three days, the crew will enter lunar orbit and approach an orbital Moon station; their small capsule will finally dock on the 10th day. The 'cosmonauts' will then be able to move into their new living quarters and use the entire station, which from this point on will be their home and their workplace for 100 days. They will undergo daily health and fitness checks, engage in sporting activities, complete safety training, keep the station germ-free, and dock and undock spacecraft. Numerous experiments will complete their eight-hour workday. In the morning, they will eat breakfast together. All other meal times will vary, depending on the daily schedule of the 'cosmonauts'. Every 30 days, a space freighter will deliver food and consumables to the orbital lunar station. Sleeping and waking periods will remain, as far as possible, the same as on Earth. "Since the monotony of working in a very limited space can become a major challenge, the crew will also have to respond to unexpected technical failures and malfunctions, such as a five-day break in communications with 'ground control'," Rogon explains. Radio communication with Earth is generally delayed by five minutes in each direction.

Docking manoeuvres in the isolation trial

During their stay on the orbital lunar station, the cosmonauts must carry out a total of 70 experiments. Six of these have been developed in Germany and are for the most part funded by the Federal Ministry for Economic Affairs and Energy (BMWi) via the DLR Space Administration. For example, researchers at the DLR Institute of Aerospace Medicine in Cologne are testing a new training programme that allows astronauts to practise docking spacecraft with space stations. In this way they can independently learn the mental and motor skills they need to manually control objects with six degrees of freedom. The Institute of Space Systems at the University of Stuttgart is also focusing on docking manoeuvres. In a project devised by former German astronaut Reinhold Ewald, the six 'cosmonauts' have to simulate steering the brand-new Russian spacecraft PTK Federatsiya and docking at a Moon station, the Lunar Orbital Platform-Gateway (LOP-G).

Training and sleeping for space exploration

Two experiments developed by the German Sport University Cologne are investigating the most effective training methods for astronauts, meant to counteract the reduction in muscle and bone mass as well as impairment of the cardiovascular system and risks to psychological wellbeing that occur on space missions. Sleep doctors from the Berlin Charité hospital are testing whether and how healthy, well-trained 'cosmonauts' in isolation, who do not get enough (or any) sleep, find that this affects their performance the next day, and their autonomous nervous systems. In addition, the Beuth University of Applied Sciences in Berlin would like to find out how crews on long-term missions can remove bacterial contamination or prevent it altogether in the first place, thus

Continued on page 7 ...

ExoMars Landing Platform Arrives in Europe with a name

21 March 2019

The platform destined to land on the Red Planet as part of the next ExoMars mission has arrived in Europe for final assembly and testing – and been given a name.

An announcement was made by the Russian State Space Corporation Roscosmos of its new name: 'Kazachok'.

The ExoMars programme is a joint endeavour between ESA and Roscosmos and comprises two missions. The Trace Gas Orbiter is already circling Mars examining the planet's atmosphere, while the second mission – comprising a surface science platform and a rover – is foreseen for launch in 2020.

ExoMars rover

In February, the rover was named 'Rosalind Franklin' after the prominent scientist behind the discovery of the structure of DNA. Now the surface platform also has a name. Kazachok literally means little Cossack, and it is a lively folk dance.

Once on the Martian surface, Rosalind the rover will drive off the Kazachok platform to perform scientific investigations. Kazachok will remain stationary to investigate the climate, atmosphere, radiation and possible presence of subsurface water in the landing site.

Welcome to Europe

Kazachok left Russia after being carefully packed to meet planetary protection requirements, making sure to not bring terrestrial biological contamination to Mars. It was shipped to Turin, Italy, on an Antonov plane along with ground support equipment and other structural elements.

Packed for Europe

The Italian division of Thales Alenia Space will perform final assembly and testing of the mission in close cooperation with ESA and the Russian Lavochkin Association, the developer and manufacturer of the descent module including the landing platform.

There will be more components arriving to Italy throughout the year, including avionics equipment, the carrier and rover modules and thermal protection systems for the landing platform.

Several test campaigns with ExoMars models are running in parallel in preparation for launch and landing.

Recent shock tests in Russia have successfully proved the mechanical compatibility between the spacecraft and the adapter for the Proton -M rocket that will set ExoMars on its way to Mars.

The ExoMars teams have also just completed the egress and locomotion tests with a full-sized model of the rover in Zurich, Switzerland.

There the rover drove off ramps and through all the terrain conditions that it might encounter on Mars: different types of soil, various obstacle shapes and sizes and all kind of slopes.

"We have now a very challenging schedule of deliveries and tests both in Italy and France. The coordination between the Russian and European teams is key to timely reach the Baikonur Cosmodrome in 2020," says François Spoto, ESA's ExoMars team leader.

European Space Agency (ESA)

http://www.esa.int/Our_Activities/Space_Science/ExoMars

Robotic exploration of Mars

<http://exploration.esa.int>

...from page 6

avoiding risk of infection and damage to the technical equipment. For this purpose, they are testing surfaces of structured and refined silver (AGXX) and chemically modified graphite surfaces (GOXX).

At the halfway point – an excursion to the lunar surface

In addition to the numerous experiments and the many everyday challenges, one very special highlight awaits the crew – a visit to the Moon. "Exactly halfway through the SIRIUS isolation study, four 'cosmonauts' will land on the lunar surface in a small capsule. Once there, they will carry out several 'Moon walks' while wearing spacesuits, collect samples and prepare a 'settlement' on the Moon – a very special experience," Christian Rogon emphasises.

Two 'cosmonauts' will stay behind in the orbital lunar station and monitor the excursion. After the return and successful docking of the lander with the station, the whole crew will orbit the Moon together for another 30 days. During this time, they will remotely control rovers on the lunar surface, dock more spaceships with the orbital station, and carry out numerous experiments before returning to Moscow.

DLR—German Aerospace Centre
<http://www.dlr.de>

Dragon arrives at the International Space Station

The SpaceX Dragon arrived at the International Space Station on 6 May 2019 and was captured at 10:01 hrs BST while flying about 257 statute miles over the North Atlantic Ocean. The spacecraft was then installed on the Harmony module for the duration of its four-week stay at the orbiting laboratory.

Filled with more than 5,500 pounds of supplies and payloads, Dragon launched aboard a Falcon 9 rocket on Saturday 4 May 2019 at 03:48 BST from Cape Canaveral Air Force Station in Florida. The Dragon spacecraft flown on this mission previously visited the space station during SpaceX's CRS-12 mission in August 2017. Dragon is the only spacecraft currently flying that is capable of returning significant amounts of cargo to Earth.

Astronaut News

Rob Wood

Official ISS Crews Approved for 2019 – Partially –Then Fully

In the last issue of Astronaut News, I commented on the reluctance of NASA and Roscosmos to confirm upcoming crews, I wrote, “probably because they were unsure of what they would be themselves.” Well, finally on 26 February 2019, Roscosmos released the news that the Russian State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews had approved the ISS flight programme for the launch of Soyuz MS spacecraft for 2019. But, hang on a moment, not quite. There are three manned flights but there were still no named astronauts or cosmonauts for the third mission.

The reluctance to name crews was probably the result of the Soyuz MS-10 launch abort in October 2018, and the trying to work out how to fit the two Soyuz MS-10 astronauts and the Emirati astronaut into the flight schedule for 2019. As noted in the last issue, NASA had announced on 3 December 2018 that Aleksei Ovchinin and Nick Hague would be recycled to Soyuz MS-12 following their launch abort on Soyuz MS-10 and that they would be joined by Christina Hammock-Koch who had been previously assigned to that flight. The Russian State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews confirmed this in their 26 February 2019 announcement as well as naming the crew for the next mission and providing launch dates.

The details released by Roscosmos on 26 February 2019 showed:-

- Soyuz MS-12/ISS-59/60: with a crew of Aleksei Ovchinin, Nick Hague and Christina Hammock-Koch with a planned launch date of 14 March 2019
- Soyuz MS-13/ISS-60/61: with a crew of Aleksandr Skvortsov, Luca Parmitano and Andrew Morgan with a planned launch date of 6 July 2019
- Soyuz MS-14: an unmanned cargo version of the Soyuz MS spacecraft with a planned launch date of 22 August 2019
- Soyuz MS-15: with a crew including one Roscosmos, one NASA and one UAE astronaut with a planned launch date of 25 September 2019

Oddly, no ISS Expedition numbers were given to the Soyuz MS-15 crew.

According to the Spacefacts and NASASpaceflight.com websites at the time of the Roscosmos release, the Soyuz MS-15 crew was to compose of Oleg Skripochka, Christopher Cassidy and Hazza Al Mansouri. With Skripochka and Cassidy linked to ISS Expeditions 61/62. NASASpaceflight.com indicated that the Cassidy position was to be confirmed. I have to say that it did appear odd that Hazza Al Mansouri was noted as the prime crew member for the United Arab Emirates (UAE) flight when even the UAE did not appear to be aware of this (Update:- by 10 March 2019, NASASpaceflight.com had

changed their listings to show either Hazza Al Mansouri or Sultan Al Niyadi as the prime crew member – by now, the indication was that the actual selection of the prime crew member would take place in May 2019 but in the event, the announcement came earlier).

As I noted in the last two issues of Astronaut News, there was some uncertainty as to the return to Earth dates of certain astronauts and amazingly, at the time of launch, the Soyuz MS-12 astronauts did not know either. In the pre-launch press conference on 13 March 2019, Aleksei Ovchinin said, “This question is currently being decided. There are some options available, but after our launch, the issue will be resolved and we will have final information about who of us is going to stay there for longer than expected.”

The day before the pre-launch press conference, Rob Navias, a NASA public affairs officer, did give his or was it NASA’s take on the subject to the AmericaSpace online blog, saying, “Hague returns to Earth in October and, as of now, Morgan returns to Earth in December”, but then hedged his bets by adding, “Regardless of when he returns, Hague will serve as the left-seat Flight Engineer-1 aboard the Soyuz.” Navias also said that Hammock-Koch was expected to remain on the ISS after October 2019 but that, “the Flight Programme is under review.” Navias’s comments about Hague serving as flight engineer confirmed my opinion that the Russians would not allow their Soyuz spacecraft to be commanded by a non-Russian cosmonaut (I discussed this point in the November/December issue of CapCom – under the heading of ‘When Will the Emirati Astronaut Fly.

Soyuz MS-12 was launched on 14 March 2019. On the same day, but after the launch, the CollectSpace website reported that Bill Gerstenmaier, NASA’s Associate Administrator for Human Exploration and Operations, had confirmed that Hammock-Koch will stay on the ISS longer and Andrew Morgan will also stay longer than the normal duration of an ISS tour. He said, “We’re working with Roscosmos to finalize the flight plan for this year and in that flight plan our crews will end up staying a bit longer, the US crews will, and that will allow the UAE expedition in the fall.”

By 28 March 2019, it had become known that NASA had requested a postponement of the Soyuz MS-13 launch date from 6 July 2019 to 20 July 2019 and to extend the mission from December 2019 to February 2020. On 11 April 2019, these changes were approved by Russia.

On 14 April 2019, the Mohammed bin Rashid Space Centre (MBRSC) confirmed the assignment of Hazza Al Mansouri as their prime candidate for Soyuz MS-15 with Sultan Al Niyadi as the back-up. The MBRSC release showed the already given launch date of 25 September 2019. A few days later, on 17 April 2019, NASA announced that it would be Jessica Meir flying on the Soyuz MS-15 flight and not Christopher Cassidy as previously suggested.

The line-ups for 2019 now show:

- Soyuz MS-12/ISS-59/60: actual launch date of 14 March 2019 with a crew of Aleksei Ovchinin, Nick Hague and Christina Hammock-Koch
- Soyuz MS-13/ISS-60/61: with a crew of Aleksandr Skvortsov, Luca Parmitano and Andrew Morgan with a planned launch date of 20 July 2019
- Soyuz MS-14: an unmanned cargo version of the Soyuz MS spacecraft with a planned launch date of 22 August 2019
- Soyuz MS-15: with a crew of Oleg Skripochka, Jessica Meir and Hazza Al Mansouri with a planned launch date of 25 September 2019

Based upon the various announcements from the space agencies involved and what we have from Internet/semi-official sources (shown in brackets) we have return to Earth timings: for the crew launched on 3 December 2018 on Soyuz MS-11, Oleg Kononenko, Anne McClain and David Saint-Jacques, of 24 June 2019; Aleksey Ovchinin, Nick Hague and Hazza Al Mansouri of 3 October 2019; Aleksandr Skvortsov, Luca Parmitano and Christina Hammock-Koch in February 2020 (6 February 2020) and Oleg Skripochka, Jessica Meir and Andrew Morgan in spring 2020 (29 March 2020).

Both Christina Hammock-Koch and Andrew Morgan will be pulling longer shifts on the ISS than normal. If there are no changes, Hammock-Koch will set a record for the longest single spaceflight by a female astronaut, beating Peggy Whitson's 289 day record from 2016/2017; she will place second for the longest single spaceflight by a NASA astronaut (Scott Kelly's 340 day mission from 2015/2016 is in first place); and she will place fifth in the all nationalities records for a single spaceflight. She will also place second for the longest spaceflight on a first mission (Musa Manarov's 365 day flight from 1987/1988 is in first place) and first place for the longest debutant mission for a female.

For Andrew Morgan, taking into account Christina Hammock-Koch's likely flight, he will place third for the longest spaceflight on a first mission; fourth for the longest single spaceflight by a NASA astronaut; and ninth in the all nationalities records for a single spaceflight.

Soyuz MS-12 crew biographies

Although these were in the January/February 2019 issue of CapCom, a number of errors and omissions crept in. I have corrected these, updated and added to the biographies.

Aleksey Nikolaevich Ovchinin (Lieutenant Colonel, Russian Air Force, Ret.) was born on 28 September 1971 in Rybinsk, Yaroslavl Oblast, Russia. He was in the Soviet then Russian air forces from 1988 to 2012. In 1992, he graduated from a Higher Military Aviation School for pilots as an engineer-pilot. He was immediately assigned as an instructor-pilot and later took command positions at pilot training centres.

He was selected as a cosmonaut candidate by the State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews on 11 October 2006. He commenced his basic training in February 2007 and took his final exams in June 2009. He was officially confirmed as a 'Test Cosmonaut' by the Interdepartmental Qualification Committee on 9 June 2009 and was given the designation 'Test Cosmonaut' making him eligible for advanced training and flight assignment.

In 2012 the Yuri Gagarin Cosmonaut Training Centre was put under civilian control and it was no longer considered a posting for serving military personal (this policy appears to be no longer in place). The military cosmonauts were given the option of resigning from the military or re-assignment to another place. Those military cosmonauts who chose to resign were given an option of joining the cosmonaut team as civilian specialists. Ovchinin chose to remain a cosmonaut and in the summer of 2012 he retired from the Armed Forces of the Russian Federation.

He took part in the European Space Agency (ESA) CAVES 2013 (15-28 September 2013) space analogue mission exploring caves on the Mediterranean island of Sardinia. On 27 January 2014, the State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews approved his assignment as a prime crewmember for Soyuz TMA-20M/ISS-47/48. He would first serve a back-up role. He was a back-up for Soyuz TMA-16M/ISS-43/44 (flew 27 March – 12 September 2015).

His first spaceflight was Soyuz TMA-20M/ISS-47/48 (flew 18 March – 7 September 2016), on which he was Soyuz commander and a flight engineer for the two ISS expeditions. During the 172 day mission, several unmanned resupply spacecraft visited the ISS including two Russian Progress spacecraft and three USA commercial resupply spacecraft (two SpaceX Dragon spacecraft and an Orbital Sciences Cygnus). He also took part in a test of a newly installed manual docking system from inside the Russian segment of ISS with a re-dock under manual control of a Progress vehicle.

In April 2017, he was assigned to train for a second spaceflight. As per normal, this included a back-up role. He was a back-up for Soyuz MS-8/ISS-55/56 (flew 21 March – 4 October 2018). He was then due to fly Soyuz MS-10/ISS-57/58. Unfortunately what was supposed to be his second spaceflight did not go according to plan.

His second mission to ISS came to a premature end when his Soyuz MS-10 launch vehicle failed about two minutes after lift-off on 11 October 2018 and he was unable to complete his ISS-57/58 assignment. He was the Soyuz commander and was accompanied by NASA astronaut Nick Hague as his flight engineer. Soyuz MS-10 flew for 19 minutes, 41 seconds and reached an apogee of 57.8 miles (93 kilometres). Despite a lot of discussion on the Internet that this was a spaceflight, it was not.

The Fédération Aéronautique Internationale (FAI) is the governing body for air sports, aeronautical and astronautical world records, and uses the Karman Line boundary for where space starts. The Karman Line is 100 kilometres or 62.137 miles above sea level. The FAI's current code for astronautic records states that, "All flights must exceed an altitude of 100 km in order to qualify for records."

On 3 December 2018, NASA announced that Ovchinin and Hague would be recycled to Soyuz MS-12. They were to be joined by NASA's Christina Hammock-Koch who had been previously assigned to that mission. Soyuz MS-12 was successfully launched on 14 March 2019 and docked with ISS after a just under six hour flight. Soyuz MS-12 is Ovchinin's second spaceflight. He is the commander of the Soyuz and flight engineer for ISS-59. He will take command of the station for ISS-60.

Tyler Nicholas 'Nick' Hague (Lieutenant Colonel, USAF) was born on 25 September 1975 in Belleville, Kansas but considers Hoxie, Kansas, to be his hometown. His academic achievements include a bachelor's degree in Aeronautical Engineering from the United

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States Air Force (USAF) Academy (1998) and a master's degree in Astronautical Engineering from the Massachusetts Institute of Technology (MIT) (2000).

He was commissioned as a Second Lieutenant in the USAF in May 1998. From 2000 to 2002 he was assigned to the Space Vehicles Directorate of the USAF Research Laboratory at Kirtland Air Force Base (AFB), Albuquerque, New Mexico, where he worked on solar panels for spacecraft and advanced systems for missile interception.

In 2003, he attended the flight test engineering course at the USAF Test Pilot School at Edwards AFB, California. On graduation as top flight test engineer for his class he was assigned to the 416th Flight Test Squadron of Edwards' 412th Test Wing where he was involved in the testing of several aircraft. He also helped adapt a Beechcraft C-12 Huron twin-engine turboprop aircraft to carry thermal sensors and ground penetrating radar.

He then deployed to Iraq with the Beechcraft aircraft between November 2004 and April 2005 where he flew 139 combat missions on the C-12 during the US occupation. He was part of Operation Horned Owl, where he conducted experimental counter-IED (Improvised Explosive Device) operations.

At the time of his deployment to Iraq he was technically still based at Edwards. His assignment there ended in June 2006, when he was assigned as an instructor at the USAF Academy. He was Assistant Professor of Astronautics there until July 2009 and was then posted as an Air Force Legislative Fellow in Washington DC. At the time of his selection as an astronaut he was supporting the Department of Defense as Deputy Division Chief of the Joint Improvised Explosive Device Defeat Organization.

On 15 November 2011, NASA announced that they were accepting applications for its 21st class of astronauts from that date until 27 January 2012. He applied as one of 6,372 applicants. This was the second largest number of applications in NASA's history. These numbers had only been beaten by the 1978 class which had seen 8,079 (the 2017 selection saw a new record for applicants with 18,354). The 1978 class was the first of the space shuttle era and a total of 35 astronaut candidates were selected. This time only eight would be chosen. The public announcement came on 17 June 2013 but those selected were told on 6 June 2013.

He was selected as an astronaut in 2013 (NASA Astronaut Group 21). It was a case of 'third time lucky' for Hague because he had applied for astronaut selection for both the previous classes. He got as far as the interview stage for the 2009 selection but was not interviewed for the 2004 group.

After two years basic training he was assigned technical duties in the Astronaut Office with the ISS Operations Branch. He commenced training at the Yuri Gagarin Cosmonaut Training Centre in January 2017, prior to his formal appointment to Soyuz/ISS crews. NASA Johnson Space Center's (JSC) news release of 28 March 2017 named him to the ISS-57/58 crews.

He was a back-up for Soyuz MS-8/ISS-55/56 (flew 21 March – 4 October 2018) before making final preparations for his prime assignment on Soyuz MS-10/ISS-57/58. He was the flight engineer for Soyuz MS-10 during its aborted launch on 11 October 2018 (see Ovchinin's biography above for further details). Soyuz MS-12 is his first flight into space. He is a flight engineer for Soyuz and ISS-59/60.

Christina Marie Hammock-Koch was born on 2 February 1979 in Grand Rapids, Michigan, but considers Jacksonville, North Carolina, to be her hometown. Her academic achievements include two bachelor degrees from North Carolina State University, firstly in

Electrical Engineering (2001) and secondly in Physics (2002). Also in 2002 she earned her master's degree in Electrical Engineering from the same University.

She received funding for her education from the Astronaut Scholarship Foundation (ASF). The ASF is a charity organisation originally founded by the Mercury astronauts in 1984. Now, over one hundred astronauts participate in fundraising for the charity together with the support of corporate and individual donors. She is the first of their scholars to be selected as an astronaut although many others have worked within the space industry.

She joined NASA's Goddard Space Flight Center in 2002 and spent two years as an electrical engineer. Between 2004 and 2007, she worked as a research associate for Raytheon Polar Services and this included a winter-over at Amundsen-Scott South Pole Station in Antarctica for the 2005/6 season as well as time working at Palmer Station, which is also located in Antarctica.

From 2007 to 2009, she worked for the Space Department's Space Science Instrumentation Group at the Johns Hopkins Applied Physics Laboratory. During her time there her main focus was on three particle detector instruments: the Jupiter Energetic-particle Detector Instrument, launched on the Juno deep space mission to Jupiter in 2011; the Van Allen Probes' Ion Composition Instrument, which was launched in 2012 to study the Van Allen radiation belts that surround our planet; and similar devices for the Magnetospheric Multiscale mission launched in March 2015 to study Earth's magnetosphere.

In January 2010, she returned to Raytheon Polar Services as an electronics technician and worked under contract to the National Oceanic and Atmospheric Administration (NOAA). She spent part of the 2011/12 winter at Summit Observatory in Greenland, a NOAA Baseline Observatory and in January 2012, moved to the Alaska Observatory near Barrow. From August 2012, she continued her work as an electronics technician at the American Samoa Observatory before taking over as Station Chief in October 2012.

She was selected in the same group of astronauts as Nick Hague. She would later say that, "I don't even remember a time when I didn't want to be an astronaut. I've always been into things like exploring and science on the frontiers. I had pictures of space up in my room way back in middle school, right next to the boy band posters!"

She was selected as an astronaut in 2013 (NASA Astronaut Group 21) and completed two years of basic training in 2015. In January 2018, she commenced winter survival training in Russia, prior to her formal appointment to Soyuz/ISS crews. The following month she was assigned to the back-up crew for Soyuz MS-12, but in May 2018, she moved up to the prime crew replacing Shannon Walker who was removed from the crew. Soyuz MS-12 is her first spaceflight. She is a flight engineer for Soyuz and ISS-59/60/61.

Soyuz MS-13 crew biographies

Aleksandr Aleksandrovich Skvortsov (Colonel, Russian Air Force, Ret.) was born on 6 May 1966 in Schyolkovo, Moscow Region, Russia. He comes from a family of military pilots. His father, who was also named Aleksandr Skvortsov, served in the Soviet air force from 1961 to 1987 including a stint as a cosmonaut candidate (1965-1968) but did not fly in space as his status to train for spaceflight was rescinded due to medical reasons. Aleksandr Skvortsov Jr's younger brother Yuri has also served as a military pilot.

Coming from a military family, meant that he moved around a lot and so does not identify with one single place but he has the fondest memories of the town of Morshansk, so he calls that his hometown.

He noted that, “It was a very quiet, provincial, Russian town with a beautiful river running through it, with beautiful nature.”

In 1983, following graduation from high school, he was drafted into the Soviet military and was accepted into flight school. In 1987, he graduated from the Stavropol Higher Military Aviation School as a pilot-engineer and served as a fighter pilot in the Soviet then Russian Air Forces flying the Mikoyan-Gurevich MiG-23 and the Sukhoi Su-27 fighter aircraft.

Following graduation from the Air Defence Academy in 1997 he was selected as a cosmonaut candidate by the State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews on 28 July 1997. He commenced his basic training in January 1998 and took his final exams in November 1999. He was officially confirmed as a ‘Test Cosmonaut’ by the Interdepartmental Qualification Committee ON 1 December 1999 making him eligible for advanced training and flight assignment.

He commenced advanced training for the ISS in January 2000 but it was not until 2007/2008 that he was associated with specific crews and these formed the basis of his first back-up and prime assignments. He was back-up for Soyuz TMA-16/ISS-21/22 (flew 30 September 2009 – 18 March 2010).

His first spaceflight was Soyuz TMA-18/ISS-23/24 (flew 2 April – 25 September 2010), for which he was Soyuz commander, a flight engineer for ISS-23 and commander for ISS-24. During the 176 day mission, he was involved in multiple experiments and helped oversee the arrival of the Russian ‘Rassvet’ Mini-Research Module 1 via STS-132 Atlantis (flew 14-26 May 2010). He also saw the visit of STS-131 Atlantis (flew 5-20 April 2010) and the arrival of three Russian Progress resupply spacecraft.

Also in 2010, he graduated from the Russian Presidential Academy of National Economy and Public Administration with a Law degree. In 2011, he returned to active training for further spaceflight and received assignments to back-up and prime crews.

In 2012 the Yuri Gagarin Cosmonaut Training Centre was put under civilian control and it was no longer considered a posting for serving military personal (this policy appears to be no longer in place). The military cosmonauts were given the option of resigning from the military or re-assignment to another place. Those military cosmonauts who chose to resign were given an option of joining the cosmonaut team as civilian specialists. Skvortsov chose to remain a cosmonaut and in the summer of 2012 he retired from the Armed Forces of the Russian Federation.

In July 2011, on the website of Novosti Kosmonavtika (Russia’s premier space magazine), it was reported that he had been assigned for a further spaceflight. He served as a back-up for Soyuz TMA-10M/ISS-37/38 (flew 25 September 2013 – 11 March 2014). With the successful launch of Soyuz TMA-10M, he was able to step up his training for his own flight.

His second spaceflight was Soyuz TMA-12M/ISS-39/40 (flew 25 March – 11 September 2014), for which he was Soyuz commander and a flight engineer for ISS-39/40. On this 169 day spaceflight, he conducted two spacewalks. By now, the US Space Shuttle was retired but other spacecraft were visiting the ISS, albeit unmanned. During his mission, seven unmanned resupply spacecraft spent time at the ISS and this included four different types of spacecraft. Four Russian Progress spacecraft; one ESA Automated Transfer Vehicle (ATV) and two USA commercial resupply spacecraft – a SpaceX Dragon and an Orbital Sciences Cygnus.

In 2015, the news out of Russia was that his third spaceflight would

be the Soyuz MS-06 flight to the ISS in 2017 and this was confirmed by a NASA news release in May 2016. However, four months later, he was reassigned to Soyuz MS-07 before in March 2017, being removed from the crew because of a temporary medical issue. He had been injured whilst exercising.

In October 2017, he was returned to flight status and on 30 November 2017, the Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews approved his assignment to the back-up crew for Soyuz MS-11. This put him in line for the flight of Soyuz MS-13. He served as a back-up for Soyuz MS-11/ISS-57/58 (launched on 3 December 2018).

The previous mission to Soyuz MS-11, Soyuz MS-10, had not gone according to plan. About two minutes after lift-off on 11 October 2018, Soyuz MS-10’s launch rocket malfunctioned leading to a launch abort and an emergency return to Earth for the crew of Aleksey Ovchinin and Nick Hague. This led to some reshuffling of crews and Ovchinin and Hague were recycled to Soyuz MS-12. In January 2019, Skvortsov was given another back-up assignment. He covered for Ovchinin on Soyuz MS-12/ISS-59/60 (launched on 14 March 2019).

He is now prime for Soyuz MS-13/ISS-60/61, currently scheduled for a 20 July 2019 lift-off. He is the Soyuz commander and a flight engineer for the ISS expeditions. For many years we have been used to getting official confirmation of upcoming crews from Russia. Unusually in this case, and probably as a consequence of the Soyuz MS-10 abort, it was NASA who confirmed Skvortsov’s prime assignment in their news release of 17 April 2019.

Luca Salvo Parmitano (Lieutenant Colonel, Italian Air Force) was born on 27 September 1976 in Paternò, Italy. His parents were both teachers but he had no ambitions to join them. “I grew up with the dream of being an astronaut,” he told a NASA interviewer. He describes an early memory, “about three or four-years-old, no older than that,” telling a swimming pool instructor that he wanted to be an astronaut. He graduated from high school in 1995 and then attended Accademia Aeronautica (Italian Air Force Academy) in Pozzuoli and the University of Naples Federico II.

He received a bachelor’s degree in Political Sciences from the University of Naples Federico II, with a thesis on international law in 1999 and the following year graduated from the Accademia Aeronautica. He then attended Euro-NATO Joint Jet Pilot Training at Sheppard Air Force Base, Texas, USA, which he successfully completed in 2001.

He was posted to the 13th Fighter-Bomber Squadron, of the 32nd Wing at Amendola Air Base, Italy, where he flew the AMX International AM-X single-engine jet ground attack aircraft from 2001 to 2007. In 2007, he was selected by the Italian Air Force to become a test pilot. He attended the French Test Pilot School, Ecole du Personnel Navigant d’Essai et Réception (EPNER) at Istres-Le Tubé Air Base, France, where he trained as an experimental test pilot. In 2009, he received a master’s degree in Experimental Flight Test Engineering at the Institute Supérieure de l’Aéronautique et de l’Espace in Toulouse, France.

On 10 April 2008, ESA announced a new astronaut recruitment round and he was one of almost 10,000 people who registered as candidates through the ESA website prior to the closing date of 18 June 2008. Of these 8,413 fulfilled the initial application criteria. Based upon the initial announcements they were competing for four

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vacancies, although ultimately six would be chosen with a seventh activated in 2016. On 20 May 2009, ESA named the original six including Parmitano. He officially joined ESA in September 2009 to commence basic training. This was successfully completed in November 2010.

On 18 February 2011, ESA announced his assignment to his first spaceflight. He was the first of his group to be assigned and fly in space. Before making his first spaceflight he served in back-up roles for Soyuz TMA-07M/ISS34-35 (flew 19 December 2012 – 14 May 2013). His flight was Soyuz TMA-09M/ISS36-37 (flew 28 May – 11 November 2013). He served as a flight engineer for both the Soyuz spacecraft and the ISS. During the mission four different unmanned resupply spacecraft arrived at the station: ESA's ATV-4, Progress M-20M, a Japan Aerospace Exploration Agency (JAXA) H-II Transfer Vehicle (also known as 'Kaunotori') and the first Orbital Sciences Cygnus to supply the ISS.

He spent 166 days in space, conducting over 20 experiments and took part in two spacewalks. However, the second spacewalk did not go according to plan. The EVA began at 14:57 on 16 July 2013 (Moscow Time). His partner was NASA astronaut Chris Cassidy. Their main tasks were to prepare the ISS for a new Russian module and perform additional installations and replacements on the station's exterior. About 44 minutes into the spacewalk Parmitano reported water inside his helmet.

As the amount of water increased the EVA was terminated but as Parmitano made his way back to the airlock the situation got worse. He suffered from impaired breathing and visibility, and had communication problems. The water covered his nose and, as the sun was setting, his vision, already compromised by the water, went almost completely. He used his tether to feel his way towards the airlock.

As he moved, he thought about how to eliminate the water if it reached his mouth. In his own words he said, "The only idea I can think of is to open the safety valve by my left ear. If I create controlled depressurisation, I should manage to let out some of the water, at least until it freezes through sublimation, which would stop the flow. But making a 'hole' in my spacesuit really would be a last resort."

He reached the airlock but had to wait for Cassidy. Once inside he initially can hear Karen Nyberg, a NASA astronaut inside the space station, but she cannot hear him. Cassidy joined him but as repressurization began his situation worsened. The water was now inside his ears and he lost all communication. He would later write that with the start of repressurization, "I know that if the water does overwhelm me I can always open the helmet. I'll probably lose consciousness, but in any case that would be better than drowning inside the helmet." Having lost his audio communications he had to signal to Cassidy by hand. Cassidy reported that, "He looks fine. He looks miserable - but OK."

With repressurization complete the internal hatch was opened and the rest of the ISS crew of US and Russian astronauts helped expedite Parmitano's progress out of the airlock and quickly started to remove his helmet. Once inside, Karen Nyberg got his helmet off and Fyodor Yurchikhin and Pavel Vinogradov, two Russians cosmonauts, who were ready to do whatever they could to help, handed him towels. Cassidy who was now unable to assist further waited calmly in the airlock. Capcom Shane Kimbrough said, "Hey Chris, just hang tight for a bit." Cassidy replied, "No problem. I'm in no rush. I've got a ring side seat."

An hour and 41 minutes after the EVA had begun, Parmitano's

helmet was off. NASA's PAO said, "...neither astronaut was in serious danger..." on the live TV broadcast as the astronauts continued to help Parmitano out of his spacesuit. The PAO was wrong or making some strange usage of the phrase 'neither astronaut was in serious danger' that I had been previously unaware of. In fact it was a close call for Parmitano who was at genuine risk of drowning.

In his blog, Parmitano said, "Space is a harsh, inhospitable frontier and we are explorers, not colonisers. The skills of our engineers and the technology surrounding us make things appear simple when they are not, and perhaps we forget this sometimes. Better not to forget."

He was the commander of NASA's NEEMO 20 (20 July – 2 August 2015) space analogue mission. NEEMO (NASA Extreme Environment Mission Operations) missions involve living and working underwater on the Aquarius undersea research habitat off the coast of Florida. The aim of these activities is to provide a convincing analogue to space exploration. They provide astronauts with some of the same challenges underwater as they would face in space. International crews representing various space agencies test technologies and research crew behaviour in what is an extreme environment.

On 18 January 2017, ESA Director General Jan Woerner spoke to the media at ESA Headquarters in Paris. He said that "Luca Parmitano will fly in 2019." He did not give any details of the actual mission. On 16 May 2017, the Yuri Gagarin Cosmonaut Training Centre confirmed that he had started training for a future mission but it was not until 31 May 2018, that an ESA news release actually gave details that he would be part of ISS-60/61 expeditions and that he would take over command of the space station for the second part of his mission.

As part of his preparations for his second flight he undertook a further back-up assignment for Soyuz MS-11/ISS-57/58 (launched on 3 December 2018). Because of the Soyuz MS-10 abort he was also given a back-up assignment for Soyuz MS-12/ISS-59/60 (launched on 14 March 2019).

Andrew 'Drew' Richard Morgan (Lieutenant Colonel, US Army, M.D.) was born on 5 February 1976 in Morgantown, West Virginia. He is from a military family, with his grandfathers, his father and his brother having spent time in service. His father served for 24 years in the air force and retired with the rank of Colonel. With this family history, is it really that surprising to find reading military history listed as one of his hobbies and that he chose the military for a career.

His academic achievements include a bachelor's degree in Environmental Engineering from the US Military Academy at West Point, New York (1998) and a doctorate in Medicine from the Uniformed Services University of the Health Sciences, Bethesda, Maryland (2002). In 2005 he completed a residency in Emergency Medicine, University of Washington and in 2013 he completed a fellowship in Primary Care Sports Medicine, Virginia Commonwealth University, Fairfax, Virginia.

Whilst at West Point, he was a member of the cadet demonstration and competitive parachute team. He would later jump with the Golden Knights, the army parachute team and was a team physician. He has undertaken high-level military training, including Ranger School and multiple high threat environment survivability courses. He is a trained parachutist, scuba diver and rescue diver.

After he completed his residency in emergency medicine, he linked up with the US Army special-forces community, gaining experience as an emergency combat physician and flight surgeon. His initial

assignment was as an attending physician at Womack Army Medical Center, Fort Bragg, North Carolina. He next spent three years as Battalion Surgeon for 1st Battalion, 3rd Special Forces Group (Airborne) 'Desert Eagles' (homebase - Fort Bragg). After his time with the Desert Eagles, he was selected for a strategic special operations assignment in the Washington, DC area. Overall, he spent seven years involved with US Special Forces and in that time served in Iraq, Afghanistan and Africa, and has treated soldiers in combat situations. He said, "I've taken care of many brave soldiers in combat, unfortunately not all of them made it."

He completed his fellowship in Primary Care Sports Medicine in 2013 and was preparing to move his family to Stuttgart for a three-year posting when he received a telephone call that changed his destination to Houston, Texas. The process that led to the change had actually started two years earlier. In 2011, he saw an announcement that NASA was selecting another astronaut class. "I had always been interested in space exploration, but figured I didn't have the right background," he explained. "But I decided to give it a shot anyway."

Military personnel have to apply through their respective services and they decide whether it can go forward to NASA. Morgan had started on what would be an about 18 month process. The US Army forwarded Morgan's application to NASA and he passed the initial sift. There were then extensive interviews, medical testing and language aptitude testing. NASA eventually narrowed the group to eight. The eight successful candidates received telephone calls from the Chair of the Selection Board Janet Kavandi (a former astronaut who was then serving as Director of Flight Crew Operations at the JSC).

Morgan was the recipient of one of Kavandi's telephone calls. "Her first question in the phone call was, 'We wanted to know if you'd like to come to Houston and join our team?'" Morgan recalled in a 2013 Army.mil website article. "I couldn't believe it; the thought that I had been chosen choked me up. It was surreal."

He was selected as an astronaut in 2013 (NASA Astronaut Group 21) and completed two years of basic training in 2015. He was then assigned to the EVA/Robotics Branch where he worked on spacesuit development and researching injuries caused by spacesuits. Another assignment he received was with the Crew Operations Branch of the Astronaut Office.

In February 2018, the Yuri Gagarin Cosmonaut Training Centre reported that he had arrived at their centre to commence training. The same month he took part in winter survival training. On 24 May 2018, NASA announced his assignment to ISS-60/61. Although not specifically stated in the NASA release, this would use the Russian Soyuz MS-13 spacecraft. As part of his preparations for spaceflight he was a back-up for Soyuz MS-11/ISS-57/58 (launched on 3 December 2018) and because of the Soyuz MS-10 abort he was also given a back-up assignment for Soyuz MS-12/ISS-59/60 (launched on 14 March 2019).

Soyuz MS-15 crew biographies

Oleg Ivanovich Skripochka was born on 24 December 1969 in Nevinnomyssk, Stavropol Krai, Russia. As part of a military family, he had several homes including time in the wilds of the Kamchatka Peninsula which is in the easternmost part of Russia but he did spend a lot of time in the city of Zaporozhye, Ukraine, where he attended secondary school and where he became interested in space studies.

He originally considered a career in the military as his father was in

service but as he approached his mid-teens he began thinking of a career in engineering within the space programme. He took classes on cosmonautics, including on the hardware and technologies that are used in space.

He attended the Bauman State Technical University, Moscow and graduated with a degree in Mechanical Engineering, specialising on spacecraft (1993). Whilst studying at Bauman he had work experience at the S P Korolev Rocket and Space Corporation Energiya (RSC Energiya) design bureau before joining them full time from 1993.

He was selected as a cosmonaut candidate by the State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews on 28 July 1997. He commenced his basic training in January 1998 and took his final exams in November 1999. He was officially confirmed as a 'Test Cosmonaut' by the Interdepartmental Qualification Committee **on 1 December 1999** making him eligible for advanced training and flight assignment.

He commenced advanced training for the ISS in February 2000 and was assigned to specific mission training in December 2002. But, on 1 February 2003, the Columbia Space Shuttle broke up on re-entry, killing all the crew. With shuttle missions suspended, there were alterations to ISS flights and crews, and his mission was cancelled. He had to wait several years before he was again linked to crews.

Over the 2006 to 2008 period, he was linked to several back-up and prime crews and did complete a back-up assignment for Soyuz TMA-12/ISS-17 (flew 8 April – 24 October 2008). On 21 November 2008, a NASA news release confirmed his appointment for upcoming missions. It noted that he was prime for ISS-25/26 due to launch in September 2010. There were still some changes as befitted his cosmonaut career to date but he was pretty close to making it into space on this schedule.

He was originally due to fly on Soyuz TMA-19 but delays with a new Soyuz variant led to his placement on the new Soyuz. There were no changes to his ISS expeditions and launch took place just a little after the original schedule. Since it made its first manned spaceflight in 1967, the Soyuz has continued to be modified. Soyuz TMA-01M was the first manned flight of a further modified version. The main change was in a new on-board computer system.

His first spaceflight was Soyuz TMA-01M/ISS-25/26 (flew 7 October 2010 – 16 March 2011), for which he was a Soyuz and ISS flight engineer. He completed 159 days in space and made three spacewalks. During his mission the ISS was visited by STS-133 Discovery (flew 24 February – 9 March 2011) and he saw the arrival of several international unmanned re-supply missions: two Russian Progress spacecraft, one JAXA Kaunotori and one ESA ATV.

Up to this time he had been part of the cosmonaut detachment of RSC Energiya but as part of a consolidation of various cosmonaut groupings his home base became the Yuri Gagarin Cosmonaut Centre in 2011. On 27 January 2014, the State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews approved his assignment for upcoming missions.

He was back-up for Soyuz TMA-18M/ISS-45/46 (flew 2 September 2015 – 2 March 2016) before making his second spaceflight on Soyuz TMA-20M/ISS-47/48 (flew 18 March – 7 September 2016). During his 172 day flight, he saw the delivery of the Bigelow Expandable

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Activity Module (BEAM), an experimental expandable space station module developed by Bigelow Aerospace, via the commercial resupply spacecraft, Dragon CRS-8. This was one of two SpaceX Dragon's to arrive at the ISS during Skripochka's flight. There were also the arrivals of an Orbital Sciences Cygnus commercial resupply spacecraft and two Russian Progress spacecraft.

On 30 November 2017, the State Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews approved his assignment as a back-up for Soyuz MS-10/ISS-57/58 and as prime for Soyuz MS-12/ISS-59/60. In June 2018, he was replaced on the Soyuz MS-10 back-up crew for unknown reasons but remained as prime for Soyuz MS-12 until after the launch abort of Soyuz MS-10 and the subsequent reshuffle of crews that put him on Soyuz MS-15.

Jessica Ulrika Meir (Ph.D.) was born on 15 July 1977 in Caribou, Maine. She has a Bachelor of Arts degree in Biology from Brown University, Providence, Rhode Island, in 1999. Whilst at Brown she was part of a student team that submitted a proposal under NASA's Reduced Gravity Student Flight Opportunities Program. Her team was successful and she got her first taste of microgravity when she flew on NASA's Boeing KC-135 Stratotanker aircraft (nicknamed the 'vomit comet'), during parabolic arc manoeuvres.

She then attended the International Space University (ISU) in Strasbourg, France, where she graduated from the ISU Master of Space Studies Programme in 2000. At the ISU she worked on a team project on the use of an Autonomous Lunar Transport Vehicle that would operate between two lunar craters. During her time at ISU she also got her second taste of microgravity, this time on the French space agency's (Centre national d'études spatiales) version of the vomit comet the Airbus A-300 aircraft.

Between the end of her studies at the ISU in 2000 and the start of her doctorate in 2003, she worked for Lockheed Martin Space Systems Company as a support scientist at the JSC. She was involved in human physiology space experiments for the Space Shuttle and the ISS, science liaison, astronaut crewmember training, and ground support in NASA's Mission Control Center. Again, she added to her time spent in microgravity with further parabolic flights on NASA's aircraft.

She was one of the aquanauts on NEEMO 4 (23-27 September 2002), a NASA undersea mission to test exploration concepts whilst living and working underwater on the Aquarius undersea research habitat off the coast of Florida. She helped coordinate the life sciences experiments.

She applied to join NASA's 20th class of astronauts in 2008 and was interviewed by the astronaut selection board in January 2009. However, she was not one of the finalists when the group (number 20) was announced in June 2009.

She received her doctorate in Marine Biology from the Scripps Institution of Oceanography, University of California, San Diego, in 2009. From 2009 to 2012 she was a post-doctoral researcher at the University of British Columbia in Canada. In September 2012 she was appointed as an Assistant Professor at Harvard Medical School, Massachusetts General Hospital, Boston. Over the years she has conducted considerable research on animals in extreme environments.

As with the other three NASA astronauts due to fly in 2019, she was in the same astronaut group. She was selected as an astronaut candidate in June 2013 (NASA Group 21). She reported to the JSC in August 2013 to begin basic training. Basic training included Russian

language learning, scientific and technical briefings, instruction about ISS systems, tutoring on EVA operations, robotics guidance, physiological schooling, T-38 flight training, and water and wilderness survival training. She successfully completed basic training in July 2015 making her eligible for technical duties in the Astronaut Office and eventual flight assignment.

She has said she has dreamt about flying in space since she was five and was looking forward to her training especially the part about flying in jets, "I have my private pilot's license," she said, "but I'm really excited about going to Pensacola for real flight training in jets." She has about 180 hours of flight time but is clearly eager for more.

She took part ESA's CAVES 2016 (1-7 July 2016) space analogue mission exploring caves on the Mediterranean island of Sardinia. This was the fifth ESA CAVES mission and a truly international team with astronauts representing Europe, Japan, Russia, United States of America and for the first time on an ESA caving programme, China. They were Richard Arnold (NASA), Pedro Duque (ESA), Ye Guangfu (China National Space Administration), Akihiko Hoshide (JAXA), Sergey Korsakov (Roscosmos) and Jessica Meir (NASA).

ESA, JAXA, NASA, Russian and Chinese astronauts working together side-by-side! "There were no borders in this team, said Loredana Bessone, head of ESA's Human Behaviour and Performance training. "The variety of organisational, professional and national cultures enriched the team with a multitude of skills and fresh perspectives." Bessone noted that, "We will make space history," citing the first woman astronaut (Meir) to join them, which she described as, "It was about time," and the first taikonaut. She added, "We have a really fantastic crew and we are sooo looking forward to start."

On 22 January 2018, the Yuri Gagarin Cosmonaut Training Centre reported that she had arrived at the centre to commence training for the back-up crew of ISS-60/61. The prime crew would launch on Soyuz MS-13. This should have put her in line to be prime for Soyuz MS-15, which is exactly as it has turned out but not without some twists and turns since then including a possible reassignment as a back-up for Soyuz MS-12 (I have not verified this but it was apparently on the website of the Yuri Gagarin Cosmonaut Training Centre), the Cassidy rumours about him flying on Soyuz MS-15 and the Soyuz MS-10 launch abort causing a reshuffle of crews.

Hazza Al Mansouri

See following report

UAE Astronaut Flight

On 14 April 2019, the Mohammed bin Rashid Space Centre (MBRSC) confirmed the assignment of Hazza Al Mansouri as their prime candidate with Sultan Al Niyadi as the back-up. Al Mansouri is due to launch on 25 September 2019 onboard Soyuz MS-15. He should return to Earth on Soyuz MS-12 on 3 October 2019.

Hazza Ali Abdan Khalfan Al Mansouri was born on 13 December 1983 in Abu Dhabi, UAE. His academic achievements include a bachelor's degree in Aviation Science and Military Aviation from the Khalifa bin Zayed Air College, Al Ayn International Airport, near Al Ayn, UAE. In 2016, he qualified as a pilot on the Lockheed Martin F-16 Block 60 Desert Falcon, single-engine supersonic multirole fighter aircraft.

He has 14 years of military aviation experience and has completed training programmes both in the UAE and internationally, including, advanced courses on rescuing people from drowning, rotation training on acceleration acclimatization up to 9Gs and Exercise Red Flag (two-week advanced aerial combat training exercises held

several times a year in the USA).

Although not stated in any reports that I have seen, his probable journey in the UAE Air Force would have included the advanced strike-fighter course at Al Minhad Air Base, UAE and training on the F-16 Block 60 Desert Falcon at both the Al Dhafra Air Base near Abu Dhabi and at the Tucson Air National Guard Base in Arizona, USA.

The launch of the UAE Astronaut Programme was announced in April 2017. Al Mansouri was one of 4022 applications. In July 2018, he was one of nine finalists sent to Russia for further evaluation. On 3 September 2018, he was one of two finalists announced. He was selected as an UAE astronaut in September 2019 (UAE Group One).

Originally, the UAE flight was planned to start with the launch of Soyuz MS-12 in April 2019 but the Soyuz MS-10 launch abort led to a delay. There remained a wish to fly the mission in 2019 and there was a reshuffle of crews to facilitate this.

Sultan Saif Muftah Hamad Al Niyadi (Ph.D.) was born on 23 May 1981 in Al Ayn, Emirate of Abu Dhabi, UAE. His academic achievements include a bachelor's degree in Electronics and Communication Engineering from Brighton University, UK (2004), a master's degree in Information and Networks Security from Griffith University, Australia (date not known), and a doctorate in Information Technology (Data Leakage Prevention) also from Griffith University (2016).

Since 1999, he has worked as a communications engineer and electronics and information security researcher for the UAE armed forces. He has had a number of papers published in international journals. He was selected as an UAE astronaut in September 2019 (UAE Group One).

Record Breaker Departs NASA

On 15 June 2018, Collect Space reported that "NASA's most experienced astronaut has hung up her space boots." NASA indeed confirmed this on the same day. NASA released the news that record breaking astronaut, Peggy Whitson, was retiring from NASA, effective that day. She was bringing to an end over 20 years as a serving NASA astronaut. Various senior managers chipped in with comments on her departure.

"Peggy Whitson is a testament to the American spirit," said NASA Administrator Jim Bridenstine. "Her determination, strength of mind, character, and dedication to science, exploration, and discovery are an inspiration to NASA and America. We owe her a great debt for her service and she will be missed. We thank her for her service to our agency and country."

"It has been the utmost honour to have Peggy Whitson represent our entire NASA Flight Operations team," said Brian Kelly, Director of Flight Operations at JSC. "She set the highest standards for human spaceflight operations, as well as being an outstanding role model for women and men in America and across the globe. Godspeed, Peg."

"Peggy is a classmate and a friend, and she will be deeply missed," said Pat Forrester, current Chief of the Astronaut Office. "Along with her record setting career, she leaves behind a legacy of her passion for space."

"It's been the greatest honour to live out my lifelong dream of being a NASA astronaut," Whitson posted on Twitter on her final day. "Thank you to the 'NASA Village' and all who have supported me along the way. As I reminisce on my many treasured memories, it's safe to say my journey at NASA has been out of this world!"

Records are made to be broken and Peggy Whitson has broken or set more than her fair share. From most time in space for a female astronaut (cumulative and individual spaceflight time), to most time in space by any US astronaut (cumulative), to most EVA's for a female, to most time spent on EVA for a female, to most EVA's by a female on an individual spaceflight, to equal record holder for number of EVA's by a US astronaut, to most time on ISS by a female, to most time on ISS by any US astronaut. She was the first female commander of the ISS and first female to command the station for a second time. She was the first female to make two and then three long duration spaceflights and she became the first and thus far only female Chief of the Astronaut Office and so far the only non-military Chief of the Astronaut Office. There is also one record that she is probably not so keen on in that she is the oldest female to fly in space.

Peggy Annette Whitson (Ph.D.) was born on 9 February 1960 in Mt. Ayr, Iowa but considers Beaconsfield, also in Iowa to be her hometown. She grew up on a farm owned by her parents near the small town of Beaconsfield. "It was a very rural area. I saw a lot more hogs growing up than I saw people." She later said. "The closest town had only 32 people living in it." The town was named after the Earl of Beaconsfield who is better known to us as Benjamin Disraeli, a British Prime Minister of the 19th Century.

Beaconsfield did not have its own high school, it did at one time but it was closed in 1958, so she attended Mt. Ayr Community High School. She graduated in 1978, the year NASA selected its first female astronauts and when she first set herself the goal of becoming an astronaut. She admits to knowing "very little about the whole process or what it would take to get in." But, she knew she wanted to join NASA, "and so I chose my goals in education to be consistent with working at NASA even as a scientist."

As an undergraduate she majored in both Biology and Chemistry and received a bachelor's degree (summa cum laude) from Iowa Wesleyan University, Mount Pleasant, Iowa, in those subjects (1981). She then attended Rice University, Houston, Texas, as a Robert A Welch Predoctoral Fellow. She received a doctorate in Biochemistry from Rice (1985).

She conducted post-doctoral work at Rice as a Robert A Welch Postdoctoral Fellow until October 1986 and then joined the JSC as a National Research Council Resident Research Associate. From 1988 to 1989 she was Supervisor for the Biochemistry Research Group at KRUG International, a medical sciences contractor at JSC. From 1989 to 1993, she worked as a Research Biochemist in the Biomedical Operations and Research Branch at JSC. She made her first trip to Russia in 1989 conducting joint biomedical research with the Russians. In 1991 to 1992 she was the Payload Element Developer for the Bone Cell Research Experiment (E10) aboard STS-47 Endeavour (flew 12 to 20 September 1992) and a member of the US-USSR Joint Working Group in Space Medicine and Biology.

In 1992, she was named the Project Scientist of the Shuttle-Mir Programme and served in that capacity for several manned missions, STS-60-Discovery (flew 3-11 February 1994), STS-63-Discovery (flew 3-11 February 1995) and Soyuz TM-21/Mir-18/STS71-Atlantis (flew 14 March – 7 July 1995). From 1993 to 1996, she held the additional responsibilities of the Deputy Division Chief of the Medical Sciences Division at the JSC. From 1995 to 1996, she served as Co-Chair of the US-Russian Mission Science Working Group.

Continued overleaf . . .

During the 1990's she also spent time as an Adjunct Assistant Professor in the Department of Internal Medicine and Department of Human Biological Chemistry and Genetics at the University of Texas Medical Branch, Galveston, Texas (from 1991 to 1997) and as Adjunct Assistant Professor at Rice University in the Maybee Laboratory for Biochemical and Genetic Engineering (from 1997).

She was selected as a mission specialist astronaut in 1996 (NASA Astronaut Group 16). She completed two years of basic training and was assigned technical duties in the Astronaut Office Operations Planning Branch. She had two patents approved (1997 and 1998). From 1998 to 1999, she served as the lead for the Crew Test Support Team in Russia.

In July 1999, she was assigned to ISS expedition training. She was a back-up for STS-105-Discovery/ISS-03 (launched on 10 August 2001) and then made her first spaceflight on STS-111/ISS-5/STS-113 (flew 5 June – 7 December 2002). She launched on the Endeavour Space Shuttle on its STS-111 mission and docked with the space station two days later.

In between her own Space Shuttle ferry flights, two other manned spacecraft saw time docked to the station, STS-112 Atlantis (flew 7-18 October 2002) and Soyuz TMA-1 (flew 30 October – 3 May 2003). Soyuz TMA-1 was a taxi flight to swap out Soyuz spacecraft and leave a fresher Soyuz for the use of the resident crew of the space station as required. She also saw the arrival of two Russian Progress resupply spacecraft.

During her tour of duty on the ISS, she performed numerous robotic arm operations in support of the installation of the Mobile Base System, the S1 truss segment and the P1 truss segment. She was NASA's first ISS Science Officer and was involved in numerous experiments involving human life sciences and microgravity sciences. She also made one spacewalk. She returned to Earth at the Kennedy Space Centre on the STS-113 mission which like her journey to the station also used the shuttle Endeavour. She was numbered Mission Specialist 4 for both her shuttle ferry flights. In completing her first flight, she logged nearly 185 days in space.

She was the commander for NEEMO 5 (16-29 June 2003), a space analogue mission involving living and working on the Aquarius undersea research habitat off the coast of Florida. She was the first female to command a NEEMO mission but has been followed by four others. From November 2003 to March 2005, she served as Deputy Chief of the Astronaut Office. During this time she was a member of the 2004 Astronaut Selection Board. From March 2005 to November 2005 she served as Chief of the Station Operations Branch within the Astronaut Office.

She returned to ISS expedition training and was a back-up for Soyuz TMA-9/ISS-14 (flew 18 September 2006 -21 April 2007). On 2 May 2006, NASA had named her as back-up commander for the ISS-14 back-up crew. This was the first time a female astronaut had been put into the command position for a space station expedition. On 13 February 2007, NASA released the news that she was prime commander for ISS-16.

Up to and including the ISS, there had been nine manned space stations, Skylab, Salyut's 1,3,4,5, 6 and 7 (Salyut 2 was unmanned), Mir and the ISS. They had been manned by 64 expeditions through to ISS 15 (*see notes 1 and 2*). Number 65, ISS-16, would be the first under the command of a female astronaut.

Her second spaceflight was Soyuz TMA-11/ISS-16 (10 October 2007 – 19 April 2008). She was the flight engineer for Soyuz, which docked to the ISS on 12 October 2007. The official ISS change of command

ceremony took place on 19 October 2007 when she took over command from Russian cosmonaut Fyodor Yurchikhin. It would be a busy mission which would see significant additions to the ISS.

As commander, she oversaw the first expansion of the station's living and working space in more than six years. The expedition crew and visiting Space Shuttle astronauts added the Harmony module, ESA's Columbus laboratory, JAXA's Kibo logistics pressurized module and the Canadian Space Agency's Dextre robotics system to the station. Whitson also performed five spacewalks to conduct assembly and maintenance tasks, the most EVA's made by a female astronaut on an individual spaceflight. She took part in numerous experiments during her almost 192 day flight.

Several Space Shuttle missions visited the ISS during her time on the ISS: STS-120 Discovery (flew 23 October – 7 November 2007), which delivered the 'Harmony' or Node 2 space station module; STS-122 Atlantis (flew 7-20 February 2008), which delivered ESA's 'Columbus' space station module; and STS-123 Endeavour (flew 11-27 March 2008), which delivered the first part of the Japanese Experiment Module, named 'Kibo' and the Dextre robot. In addition, the first ESA ATV, named 'Jules Verne' and the ubiquitous Russian Progress vehicles (two) arrived at the space station.

The end of the mission did not quite go according to plan. Soyuz TMA-11 undocked from ISS at just after 5am on 19 April 2008. During the return to Earth the Soyuz service module failed to separate normally from the descent module as a result of one of five pyro-bolts malfunctioning leading to a ballistic re-entry (steeper than normal). Whitson pulled 8.2 G's (eight and a bit times the force of normal Earth gravity) rather than the 4 to 5 G's pulled on a nominal re-entry. It was a pretty rough landing and the descent module was over 250 miles off target. She described the landing as like a "car crash." Although Whitson escaped significant injury, one of her fellow astronauts was not so lucky. Soyeon Yi, the first and so far only space flown South Korean astronaut, suffered from mild dislocation and bruising of the vertebrae, and although it was described as not serious, she still had severe pain and required hospital treatment at the Aerospace Medical Centre in Cheongju, South Korea.

By the end of her second flight Whitson held more time both in space and on EVA operations than any other female astronaut. Her spacewalk record was broken by Sunita Williams in early September 2012 but later she would take it back. In 2009 she was Chairman of the Astronaut Selection Board and in October of that year was named Chief Astronaut. She relinquished the role of Chief Astronaut in July 2012 in order to return to ISS expedition training. "She voluntarily stepped down to refocus on her International Space Station training and to become eligible for future crew assignments," said Janet Kavandi, NASA's then Director of Flight Crew Operations.

At the time, it was believed she had stepped down as Chief Astronaut in order to put herself in-line to be NASA's participant in a year-long flight to the ISS that was planned to begin in Spring 2015. There is no doubt from comments she subsequently made that she wanted the mission. Unfortunately, a problem for any female wanting to fly on long flights is that their allowed radiation exposure limits are less than for men. She was ruled out because her cumulative exposure level would have exceeded her allowance. I think it would be reasonable to say she was not best pleased by the decision. In speaking about this she said, "I think that the current standards are too confining for exposure limits based on my personal experience and because it limits careers more than it is necessary." She continued, "In my case, if I had a Y chromosome, I would be qualified but because I have two X's, I'm not"

The Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews met at the Yuri Gagarin Cosmonaut Training Centre on 16 December 2014 and authorised the crews due for launch in 2016. On 9 February 2015 NASA also named the crews in a press release. The fourth and final crew was Soyuz MS-3/ISS-50/51, which included Whitson. As part of the preparations for her flight she served as a back-up for Soyuz MS-01/ISS-48/49 (flew 7 July – 30 October 2016).

It had been rumoured for some months that Russia intended to reduce its crew numbers on the ISS from three to two for a temporary period. A number of reasons were cited including: to increase efficiency; to reduce the number of Progress resupply ships required; delays with a new Russian ISS module; and to facilitate tourist flights. The bottom line was of course money, whether in reducing costs or bringing some additional revenue in.

On 28 October 2016, a news release from Roscosmos confirmed Russian changes to ISS crewing. This left some empty space (pun intended) to be filled. In the meantime, Whitson continued preparing for her next spaceflight. She launched on 17 November 2016 in Soyuz MS-03 from the Baikonur Cosmodrome. In space for a cumulative total of 500 days and ending in May 2017 with a return to Earth in Soyuz MS-03. That is what she was looking at when she commenced her third spaceflight but by the end of the mission the 500 days had reached over 650.

On 8 February 2017, it became known from Russian sources that NASA had discussed with Russia the possibility of Dr Whitson extending her stay on the ISS until the return of the Soyuz MS-4 spacecraft in September 2017. This would add another three months plus to her mission. The word was that Whitson had already agreed (I suspect with no or very little hesitation). Russia was apparently happy to accommodate NASA (I have no idea if there was any financial consideration in favour of the Russians in this but it is reasonable to presume there was).

On 17 February 2017, at a pre-launch press conference for SpaceX's tenth commercial resupply services mission, Dan Hartman, Deputy Manager for the ISS Programme at the JSC, fielded questions on the extension of Whitson's mission. He said that they were just starting to have some discussions with the Russians on extending a United States Orbital Segment (USOS) crew member's stay but no agreement has been made at present or a decision on which crew member it will be. NASA appeared to be dragging its feet on making a decision.

Finally, on 5 April 2017, NASA confirmed the extension of Whitson's flight. She was now to return to Earth in Soyuz MS-4 in September 2017. Her third spaceflight became Soyuz MS-03/ISS-50/51/52/ Soyuz MS-04 (17 November 2016 – 3 September 2017). She was a flight engineer for her Soyuz spacecraft and for ISS-50/52 but she took command of the station for ISS-51. This was her second time as commander of the ISS. Only one other female has actually commanded the ISS, Sunita Williams for ISS-33 in 2012.

During her flight, she contributed to hundreds of experiments in biology, biotechnology, physical science and Earth science, welcomed several unmanned cargo spacecraft (including Cygnus, Dragon, Kaunotori and Progress) delivering tons of supplies and research experiments, and conducted a combined four spacewalks to perform maintenance and upgrades to the station. She broke record after record as indicated earlier in this piece including regaining the EVA records from Sunita Williams.

Towards the end of her final flight, she was asked, "what have you missed most about Earth?" She replied with, "Flush toilets. Trust me,

you don't want to know the details." The word 'yuk' comes to mind. When she returned to Earth, she had completed another 289 days in space.

Regarding her setting of spaceflight records, she commented that, *"I am not overly comfortable with the praise about the records. I honestly do think that it is critical that we are continuously breaking records, because that represents us moving forward in exploration."* She continued, *"I feel lucky to have been in a position to take advantage of the opportunities that I have had, and yet I do acknowledge that my dedication and work ethic helped put me in those positions. Recognizing all that, it is still difficult for me to come to grips with the fact that I have the potential to be a role model. I am working on paying forward some of the advice and mentoring that I received on my journey, in hopes that one day those young people will do the same, and look back on a life in which they leapt at the opportunities and broke their own records."*

At the end of her third spaceflight, she was not sure what would follow, "I am not sure what the future holds for me personally, but I envision myself continuing to work on spaceflight programmes. My desire to contribute to the spaceflight team as we move forward in our exploration of space has only increased over the years." But for a finish I like her quote from a few weeks before she left NASA, "I'm trying to decide now what I want to do when I grow up!"

Note 1: I have used the Spacefacts website to help me with the statistics on the number of space station expeditions. They do not include visiting flights such as when the US Space Shuttle docked with Mir and the ISS, and the Soyuz swap/taxi flights to Salyut, Mir and ISS. Spacefacts also do not include the Soyuz T-3 mission to Salyut 6 but there is an argument it should be despite the short duration (flight lasted just under 13 days) and so I have included this flight. In addition, Soyuz T-15 spent time at both Salyut 7 and Mir and is counted twice; as expedition 6 to Salyut 7 and expedition 1 to Mir.

Note 2: Amongst the visiting missions which are not counted as ISS expeditions were two US Space Shuttle flights that were commanded by female astronauts: STS -114 Discovery (flew 26 July – 9 August 2005) by Eileen Collins and STS-120 Discovery (flew 23 October – 7 November 2007) by Pamela Melroy. STS-120 visited the ISS during Whitson's first stint as commander and this was the first time that two space vehicles in orbit at the same time had female commanders.

UK Astronaut Sightings

Brief details on UK astronaut sightings follow. For full details see Collect Space and their Sightings section - <http://www.collectspace.com/sightings/sightings-unitedkingdom.html> This is kept updated by many in the space community and is always more up to date than any printed material.

Helen Sharman is at a number of venues in June and July 2019: Liverpool Cathedral (2 June), Birmingham Town Hall (22 June) and Jodrell Bank Observatory, Cheshire (noted as 18-21 July 2019).

Jack Lousma: 4-5 October 2019 with Space Lectures events in Pontefract.

NB: If anyone wants to know more about these or other sightings and they do not have access to Collect Space on the Internet please contact me either through the Midlands Spaceflight Society or by email at - RobandJill@blueyonder.co.uk - I often find out about visits at too short notice to put in CapCom. But, a word of warning. It is always best to check in advance of travelling that an event is taking place as planned. I travelled all the way to London a number of years ago to meet a cosmonaut only to discover he had cancelled because of work commitments. I had not phoned before travelling. I have no involvement in the organisation of the above astronaut events and therefore no liability is accepted for any changes that occur.

Continued overleaf...

10 Years Ago, Hubble's Final Servicing Mission Made It Better Than Ever

A window on the space shuttle Atlantis frames Hubble as astronaut Megan McArthur uses the shuttle's robot arm to grab the telescope in preparation for the final servicing mission. From its perch 340 miles above Earth, the famed space telescope has tracked celestial objects across the universe.

Astronaut Mike Massimino floated next to the Hubble Space Telescope's cylindrical body and began to remove the screws that fastened a handrail to one of the telescope's instrument panels. The first three screws came out easily, but when he put his power tool to the final screw, the bit began to spin.

He had stripped the bottom right screw. It wouldn't budge.

"I saw what I had done and my heart just sank," Massimino recalled.

That day, Massimino and fellow astronaut Mike Good were tasked with replacing the power supply of one of Hubble's critical instruments: the Space Telescope Imaging Spectrograph (STIS). The instrument provides scientists with information about the temperature, chemical composition, density and motion of celestial objects. Its power supply wasn't initially designed to be replaced, so the team had practiced for months with hundreds of carefully crafted tools to perfect the maneuvers.

"I quickly did the deduction," Massimino quipped. "If that screw doesn't come off, the handrail doesn't come off, and then 111 screws don't come off the panel. That means the power supply doesn't come out; a new one doesn't go back in, and STIS doesn't come back to life. We'll never find out if there's life in the universe and everyone's going to blame me."

Ten years ago (11 May 2009), Massimino, Good and five other astronauts aboard the space shuttle Atlantis launched into space to visit Hubble one last time. During this mission, they would integrate new instruments, repair broken equipment and replace critical components of the famed telescope.

At the time of the fifth servicing mission, scientists expected that Hubble, which launched in the spring of 1990, would have roughly five serviceable years left, as was typical after servicing missions. But the telescope has far surpassed expectations, already doubling that time and showing no signs of calling it quits.



Above: Hubble as seen from space shuttle

A window on the space shuttle Atlantis frames Hubble as astronaut Megan McArthur uses the shuttle's robot arm to grab the telescope in preparation for the final servicing mission. From its perch 340 miles above Earth, the famed space telescope has tracked celestial objects across the universe.

Right: In the foreground, the space shuttle Atlantis stands ready for launch. A backup space shuttle (shown behind Atlantis) was also prepared for launch at NASA's Kennedy Space Center in Florida, in the event that the STS-125 crew experienced an emergency.

Credits: NASA



"It shows that people — engineers, technicians, scientists, astronauts — can do just about anything," said three-time Hubble servicing astronaut John Grunsfeld. "Our abilities in space are really quite limitless."

NASA

<http://www.nasa.gov>

...Continued from previous page

APOLOGIES, COMMENTS & UPCOMING IN THE NEXT ISSUE OF ASTRONAUT NEWS

All dates for lift-off and landing are given in GMT for this issue of Astronaut News.

Circumstances have precluded my keeping up with some of the news items I would have liked to have covered and I hope to catch up shortly. As well as Peggy Whitson detailed in this issue, several other astronauts have retired from NASA over the past year including Daniel Burbank in June 2018, Gregory C 'Ray' Johnson in August 2018, Tim Kopra in October 2018 and Kathryn Hire in March 2019. There is also sad news as I have to catch-up on several astronauts and cosmonauts that have died.

Acknowledgements and sources:

Americaspace.com; Army.mil; Astronaut.ru; CapCom (previous issues); Collect Space; ESA; Google; Gulfnews.com; Manned Spaceflight Log II 2006-2012 ©2013 by David J Shayler and Michael D Shayler; NASASpaceflight.com; Novosti Kosmonavtika; Praxis Manned Spaceflight Log 1961-2006 ©2007 by Tim Furniss and David J Shayler with Michael D Shayler; RSC Energiya; RussianSpaceWeb.com; Spacefacts; Space Lectures; Space Shuttle Developing an Icon 1972-2013 ©2016 by Dennis R Jenkins; Teenvogue.com; Who's Who in Space ©1999 by Michael Cassutt; Wikipedia; Women Spacefarers ©2017 author Umberto Cavallaro; Yuri Gagarin Cosmonaut Training Centre.

Rob Wood

Michael Bryce, Go Space Watch, Presents:

Celebrating Apollo

Join us as we celebrate the 50th Anniversary of Man's first landing on the Moon with a day of lectures and exhibition area commemorating the Apollo missions and the Space Programme.

Saturday 20th July 2019

At

SUTTON ARTS THEATRE

SOUTH PARADE

SUTTON COLDFIELD

B72 1QU

This event is organised by Go Space Watch.
Entrance will be by ticket only for lectures (£2.50 per lecture or £10.00 for all lectures).
Exhibition Area will be open to all.

For more information please visit: www.gospacewatch.co.uk.

Email: michael@gospacewatch.co.uk

Telephone Michael Bryce on 07821 896 304 or

Pauline Bryce on 07593 650053.

Note: Pay and Display Car Park at corner of South Parade and Upper Holland Road. The venue is within easy walking distance from Sutton Coldfield Railway Station.

Celebrating Apollo

Lecture Programme:

09:45	Introduction	
10:00	Dr Steve Barrett (University of Liverpool)	"The Great Moon Hoax" (Proving NASA did go to the Moon)
11:15	David J Shayler (Astro Info Services)	"The Gemini Project" (Space Techniques to Support Apollo)
12:30	Lunch	
13:00	Michael Bryce (Go Space Watch)	"The Apollo Missions"
14:15	David A Hardy (Astro Art)	"To the Stars On a Paint Brush"
15:30	David J Shayler (Astro Info Services)	"Apollo: the Lost and Forgotten Missions"
16:45	David Shayler and David Hardy Book Signing	
17:30	Close of Meeting	

programme subject to change

NASA Awards \$106 Million to US Small Businesses for Technology Development

Managing pilotless aircraft and solar panels that could help humans live on the Moon and Mars are among the technologies NASA is looking to develop with small business awards totaling \$106 million. In all, NASA has selected 142 proposals from 129 U.S. small businesses from 28 states and the District of Columbia to receive Phase II contracts as part the agency's Small Business Innovation Research (SBIR) program.

"Small businesses play an important role in our science and exploration endeavors," said Jim Reuter, acting associate administrator of NASA's Space Technology Mission Directorate. "NASA's diverse community of partners, including small businesses across the country, helps us achieve our mission and cultivate the U.S. economy. Their innovations will help America land the first woman and the next man on the Moon in 2024, establish a sustainable presence on the lunar surface a few years later, and pursue exciting opportunities for going to Mars and beyond."

NASA selected the proposals based on a range of criteria, including technical merit and feasibility, as well as the organizations' experience, qualifications, and facilities. Additional criteria included effectiveness of proposed work plans and the commercial potential of the technologies.

The selected proposals will support the development of technologies in the areas of human exploration and operations, space technology, science, and aeronautics. The proposals offer a breadth of applications, including:

- *Solar panels that deploy like venetian blinds. The technology behind these panels can be used as a surface power source for crewed missions on the Moon and Mars. It offers benefits such as efficient power generation, lower procurement costs and reduced mass and stowed volume.*
- *Sensor technology for autonomous entry, descent and precision landing on planetary surfaces — a critical advancement for next generation human lunar landers.*
- *A type of permanent magnet that creates a bonding force between two halves with no moving parts, enabling in-space assembly of large platforms.*
- *A high-resolution X-ray instrument to analyze surface rocks and core samples on planets and asteroids. This*

technology could advance our understanding of the Moon, Mars and even Earth by providing unique analysis and reconstruction of samples.

- *A suite of technologies for managing autonomous aircraft. The proposed solution aims to have a single dispatcher simultaneously monitor multiple flights, leading the way for future airspace and vehicle concepts.*

Only small businesses awarded a Phase I contract are eligible to submit a proposal for a Phase II funding agreement. Phase II is focused on the development, demonstration, and delivery of the innovations previously selected during Phase I. These projects are chosen as a result of competitive evaluations and based on selection criteria provided in the solicitation. Phase II contracts last for 24 months, with a maximum funding of \$750,000.

The SBIR program is a three-phase program. Phase I work and results provide a sound basis for the continued development, demonstration and delivery of the proposed innovation in Phase II and follow-on efforts. Phase III is the commercialization of innovative technologies, products and services resulting from either a Phase I or Phase II contract.

The SBIR and Small Business Technology Transfer (STTR) programs encourage small businesses and research institutions to develop innovative ideas that meet the specific research and development needs of the federal government. The programs are intended to stimulate technological innovation in the private sector, increase the commercial application of research results, and encourage participation of socially and economically disadvantaged companies and women-owned small businesses. Since the 1970s, small businesses have created approximately 55 percent of all jobs in the United States.

NASA's Ames Research Center in California's Silicon Valley manages the SBIR and STTR programs for NASA's Space Technology Mission Directorate (STMD). STMD is responsible for developing the cross-cutting, pioneering new technologies and capabilities needed by the agency to achieve its current and future missions.

For more information about the SBIR and STTR programs, including the selection list, visit NASA:
<https://sbir.nasa.gov/>

UK campaign marks 50 years since the first Moon landings

The UK Space Agency are asking people across the UK to share their memories of one of the seminal moments of the 20th century - the 1969 Apollo 11 Moon landing - and to tell their stories about how this moment in history has inspired them.

A selection of the submissions to this crowd-sourced history campaign, led by the UK Space Agency and Arts and Humanities Research Council (AHRC), will be curated and shared with the public on 20 July 2019, marking 50 years since Neil Armstrong and Buzz Aldrin landed on the Moon.

The campaign is intended not only to unearth fascinating first-hand

memories but to explore how the Moon landings touched almost every aspect of popular culture, from cinema and art, to literature and music.

For anyone who may not have watched the footage live, there is an opportunity to get involved by sharing their stories about how space exploration has inspired them or led to a career in the sector.

Entries could include a grainy photograph of a family huddled around an early television to watch this iconic moment; a scrapbook of newspaper cuttings from July 1969; or a personal account of how the Moon landing has shaped a work of art or led to a lifelong passion for science fiction.

For full story please visit UK Space Agency:
<https://www.gov.uk/government/news/uk-crowd-sourced-history-campaign-marks-50-years-since-the-first-moon-landings>

NASA Taps 11 American Companies to Advance Human Lunar Landers

NASA has selected 11 companies to conduct studies and produce prototypes of human landers for its Artemis lunar exploration program. This effort will help put American astronauts — the first woman and next man — on the Moon's south pole by 2024 and establish sustainable missions by 2028.

"To accelerate our return to the Moon, we are challenging our traditional ways of doing business. We will streamline everything from procurement to partnerships to hardware development and even operations," said Marshall Smith, director for human lunar exploration programs at NASA Headquarters. "Our team is excited to get back to the Moon quickly as possible, and our public/private partnerships to study human landing systems are an important step in that process."

Through Next Space Technologies for Exploration Partnerships (NextSTEP) Appendix E contracts, the selected companies will study and/or develop prototypes during the next six months that reduce schedule risk for the descent, transfer, and refueling elements of a potential human landing system.

NASA's proposed plan is to transport astronauts in a human landing system that includes a transfer element for the journey from the lunar Gateway to low-lunar orbit, a descent element to carry them to the surface, and an ascent element to return them to the Gateway. The agency also is looking at refueling capabilities to make these systems reusable.

The total award amount for all companies is \$45.5 million. As NextSTEP is a public/private partnership program, companies are required to contribute at least 20% of the total project cost. This partnership will reduce costs to taxpayers and encourage early private investments in the lunar economy.

The awardees, from eight states across the country, are:

- *Aerojet Rocketdyne – Canoga Park, California*
- *One transfer vehicle study*
- *Blue Origin – Kent, Washington*
- *One descent element study, one transfer vehicle study, and one transfer vehicle prototype*
- *Boeing – Houston*
- *One descent element study, two descent element prototypes, one transfer vehicle study, one transfer vehicle prototype, one refueling element study, and one refueling element prototype*
- *Dynetics – Huntsville, Alabama*
- *One descent element study and five descent element prototypes*
- *Lockheed Martin – Littleton, Colorado*
- *One descent element study, four descent element prototypes, one transfer vehicle study, and one refueling element study*
- *Masten Space Systems – Mojave, California*

- *One descent element prototype*
- *Northrop Grumman Innovation Systems – Dulles, Virginia*
- *One descent element study, four descent element prototypes, one refueling element study, and one refueling element prototype*
- *OrbitBeyond – Edison, New Jersey*
- *Two refueling element prototypes*
- *Sierra Nevada Corporation, Louisville, Colorado, and Madison, Wisconsin*
- *One descent element study, one descent element prototype, one transfer vehicle study, one transfer vehicle prototype, and one refueling element study*
- *SpaceX – Hawthorne, California*
- *One descent element study*
- *SSL – Palo Alto, California*
- *One refueling element study and one refueling element prototype*

To expedite the work, NASA is invoking undefinitized contract actions, which allow the agency to authorize partners to start a portion of the work, while negotiations toward contract award continue in parallel.

"We're taking major steps to begin development as quickly as possible, including invoking a NextSTEP option that allows our partners to begin work while we're still negotiating," said Greg Chavers, human landing system formulation manager at NASA's Marshall Space Flight Center in Huntsville, Alabama. "We're keen to collect early industry feedback about our human landing system requirements, and the undefinitized contract action will help us do that."

NASA gave industry its first heads up in April, with the issuance of a pre-solicitation, of its intention to partner with American companies on the development of an integrated lander. The formal solicitation, to be issued this summer, will provide the requirements for a 2024 human landing, and leave it to U.S. industry to propose innovative concepts, hardware development and integration.

"This new approach doesn't prescribe a specific design or number of elements for the human landing system," Chavers said. "NASA needs the system to get our astronauts on the surface and return them home safely, and we're leaving a lot of the specifics to our commercial partners."

NASA is sending astronauts to the Moon and then on to Mars, in a measured and sustainable way. The direction from Space Policy Directive-1 builds on the hard work NASA is doing on its Space Launch System rocket and Orion spacecraft, agency efforts to enable commercial partners, its work with international partners, and what NASA learns from its current robotic missions at the Moon and Mars. Learn more at:

NASA
<https://www.nasa.gov/moontomars>

NASA Invites Public to Submit Names to Fly Aboard Next Mars Rover



Although it will be years before the first humans set foot on Mars, NASA is giving the public an opportunity to send their names — stenciled on chips — to the Red Planet with NASA's Mars 2020 rover, which represents the initial leg of humanity's first round trip to another planet. The rover is scheduled to launch as early as July 2020, with the spacecraft expected to touch down on Mars in February 2021.

The rover, a robotic scientist weighing more than 2,300 pounds (1,000 kilograms), will search for signs of past microbial life, characterize the planet's climate and geology, collect samples for future return to Earth, and pave the way for human exploration of the Red Planet.

"As we get ready to launch this historic Mars mission, we want everyone to share in this journey of exploration," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate (SMD) in Washington. "It's an exciting time for NASA, as we embark on this voyage to answer profound questions about our neighboring planet, and even the origins of life itself."

The opportunity to send your name to Mars comes with a souvenir boarding pass and "frequent flyer" points. This is part of a public engagement campaign to highlight missions involved with NASA's journey from the Moon to Mars. Miles (or kilometers) are awarded for each "flight," with corresponding digital mission patches available for download. More than 2 million names flew on NASA's InSight mission to Mars, giving each "flyer" about 300 million frequent flyer miles.

From now until 30 September, you can add your name to the list and obtain a souvenir boarding pass to Mars here:

<https://go.nasa.gov/Mars2020Pass>

The Microdevices Laboratory at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, will use an electron beam to stencil the submitted names onto a silicon chip with lines of text smaller

than one-thousandth the width of a human hair (75 nanometers). At that size, more than a million names can be written on a single dime-size chip. The chip (or chips) will ride on the rover under a glass cover.

NASA will use Mars 2020 and other missions to prepare for human exploration of the Red Planet. As another step toward that goal, NASA is returning American astronauts to the Moon in 2024. Government, industry and international partners will join NASA in a global effort to build and test the systems needed for human missions to Mars and beyond.

The Mars 2020 Project at JPL manages rover development for SMD. NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida, is responsible for launch management. Mars 2020 will launch from Cape Canaveral Air Force Station in Florida.

For more information on Mars 2020, visit NASA at:
<https://www.nasa.gov/mars2020>

Below: an artists illustration of NASA's Mars 2020 rover on the surface of Mars.

NASA



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Contributions to CapCom

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Copy Deadline

All contributions intended for the July—August 2019 issue should be emailed to the editor by
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