your window to space





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## CapCom is published by Midlands Spaceflight Society www.midspace.org.uk Editor: Mike Bryce | President: David J Shayler | Secretary: Dave Evetts

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# space news roundup

### Arianespace's Ariane 5 launches two multi-mission satellites for fixed and mobile services

The 80th consecutive success for Arianespace's heavy-lift Ariane 5 lofted two satellites on 28 June, delivering new capacity for use in the distribution of TV and video content, telecommunications services, mobile satellite services, data relay, along with coverage of search and rescue missions.

Orbited by Arianespace Flight VA238 from the Spaceport in French Guiana were a so-called "condosat" composed of two payloads for Hellas Sat and Inmarsat, along with a spacecraft for the Indian Space Research Organisation.

On its fourth mission at the service of Arianespace this year, the Ariane 5 had a payload lift performance estimated at 10,136 kg. to geostationary transfer orbit, maintaining the company's sustained launch pace in 2017.

# Hellas Sat 3-Inmarsat S EAN deployed first in the mission

Riding as the upper passenger on Flight VA238 was Hellas Sat 3-Inmarsat S EAN, which integrated two relay payloads.

The payload for Hellas Sat 3 will expand this company's business reach by providing direct-to-home (DTH) TV broadcast and telecommunications services, as well as the distribution of highdefinition (HD) and ultra-high definition (UHD) video content in Europe, the Middle East and sub-Saharan Africa. These fixed satellite services (FSS) and broadcast satellite services (BSS) include a crossstrap service between Europe and South Africa.

#### Keeping airline passengers connected while aloft

Also integrated on the Hellas Sat 3-Inmarsat S EAN satellite is a relay payload for a system developed by Inmarsat with Deutsche Telekom to offer high-speed, high-capacity Wi-Fi connections for airline passengers.

Inmarsat is specialized in mobile satellite communications, and the first customer for this airborne connectivity is the International Airlines Group (AIG), which has begun equipping its aircraft and aims to have 90 percent of its short-haul fleet complete by early 2019.

Inmarsat Chief Technology Officer Michele Franci thanked Arianespace as part of the European effort that will bring cabin connectivity to passengers across Europe. "This satellite was riding on one of Europe's best successes – Ariane," he added.

#### Hellas Sat 3-Inmarsat S EAN, built by Thales Alenia Space

Weighing an estimated 5,780 kg. at liftoff, Hellas Sat 3-Inmarsat S EAN was produced by Thales Alenia Space using its Spacebus 4000C4 platform. With the satellite's successful launch today, Arianespace has now orbited a total of 149 spacecraft built by the company – continuing a long-time partnership.

Flight VA238 – which successfully delivered Hellas Sat 3-Inmarsat S EAN and GSAT-17 to geostationary transfer orbit – marked Arianespace's seventh mission in 2017 with its three-member launch vehicle family.

Hellas Sat 3-Inmarsat S EAN also marks key milestones between Arianespace and the two operators: it is the ninth satellite launched at the service of Inmarsat, and the first orbited for Hellas Sat.

#### 21 satellites launched by Arianespace for ISRO

GSAT-17 was the 21st spacecraft orbited by Arianespace for the Indian Space Research Organisation, extending a relationship that dates back to 1981 with launch of the APPLE experimental satellite.

#### Next up for Arianespace: Vega Flight VV10

Arianespace's next mission is set for August 1, utilizing the lightweight vehicle Vega on a mission to Sun-synchronous orbit. Its two passengers will be OPTsat-3000 for the Italian Ministry of Defense, along with VenµS for the French and Israeli space agencies.

> Arianespace http://www.arianespace.com

#### Long March 5 launch fails

The second launch of China's most powerful rocket, the Long March 5, ended in failure on 2 July, the second incident involving a Chinese launch vehicle in as many weeks.

The Long March 5 lifted off from the Wenchang Satellite Launch Center on the island of Hainan at 7:23 a.m. Eastern. The launch, broadcast live by Chinese media, appeared to go as planned, but those broadcasts ended prior to any announcement of separation of the rocket's payload, the Shijian-18 communications satellite.

China's state-run Xinhua news service announced about 45 minutes after liftoff that the launch had failed. Xinhua only said that an "anomaly" occurred during the launch, and that an investigation would take place.

The launch was the second for the Long March 5, China's most powerful rocket, able to place 25,000 kilograms into low Earth orbit and 14,000 kilograms into geostationary transfer orbit. The rocket's first launch, in November 2016, was declared a success although issues with the rocket placed the payload, the Shijian-17 satellite, into not quite the planned orbit. An upper stage attached to the satellite was later able to correct the orbit.

> Full story at Spacenews.com http://www.spacenews.com

# SSTL closing US factory, brings manufacturing back in UK

British small satellite manufacturer Surrey Satellite Technology Ltd. (SSTL) is closing down a Denver factory in favor of centralizing spacecraft production back in the United Kingdom.

SSTL formed its U.S. subsidiary, Surrey Satellite Technology-US, in 2008, and opened a factory in the Denver suburb of Englewood, Colorado, to specifically focus on the vibrant U.S. small satellite market. At one time, the company had ambitions of growing that office to upwards of 200 people, but growing competition in small satellite manufacturing scuttled those plans.

"There has been an explosion in commercial smallsat constellations that has created a whole new business area, which very aligns with what we want to do," Sarah Parker, SSTL's managing director, told SpaceNews. "The U.S. is still a key market, but we've reached a conclusion that we need a different organizational set up than we've had in the previous years."

SST-US's Denver facility is capable of fully manufacturing and integrating satellites. Parker said SSTL will keep a sales team in the U.S. and will complete all U.S. projects, but future work will be done back in the U.K.

## Tim Peake excited to return to space

The future's looking bright for British astronaut Tim Peake, writes Nick Spall, reporting from the 2017 UK Space Conference in Manchester., in the Sky at Night Magazine.

Just a year after his return to Earth following six months on the ISS, UK astronaut Tim Peake has told the UK Space Conference in Manchester he is excited about his next space assignment.

The conference took place 30 May - 1 June 2017 at the Manchester Central Convention Complex.

If all goes well, Tim will most likely experience his second spaceflight post 2019. This summer Peake will re-join the European Astronaut Centre (EAC) in Cologne and become Head of Crew Operations Support for the European Space Agency (ESA).

In this role he will work with Paolo Nespoli on the Italian astronaut's six-month Vita mission (currently scheduled for late July 2017). In 2018 Alexander Gerst, a fellow 2009 ESA astronaut selection group member, will make his second flight to become an ISS commander. Luca Parmitano will then launch in 2018/19, possibly at a time when crewed Space-X Dragon and Boeing CST Starliner commercial spacecraft will be resupplying the ISS.

Tim seems to be on-track to achieve his second mission post 2019, assuming the UK government continues to be part of ISS science research.

Tim Peake's Principia mission on Expedition 46/47 was not only a science research success; it had a major and lasting importance in terms of young people's engagement. Over 1.6 million children were involved during its 30 educational projects, with 10,000 schools signing up and following Tim's activities on the ISS during 2015/16.

Sky at Night Magazine http://www.skyatnightmagazine.com

# Booster segments readying for opening SLS launches

In an article by Philip Sloss, NASASpaceflight.com reports that Orbital ATK recently provided a peek at current production of Space Launch System (SLS) booster segments at their Promontory Propulsion Systems facility in Northern Utah. Work on the segments for the first two SLS launches continues and is on track to ship hardware to the launch site when needed. The last segment for the first launch, Exploration Mission-1 (EM-1), was recently loaded with solid fuel in mid-June and work on all the EM-1 segments should be complete by the beginning of November.

Full story at NASA Spaceflight http://www.nasaspaceflight.com

### Airbus Safran promotes launch record ahead of Ariane 6 entering production

Another report in NASASpaceflight.com, this time by Chris Bergin, says that Airbus Safran Launchers, which now owns the majority stake in Arianespace, has issued a statement of intent, promoting Ariane 5's track record as it prepares to enter the production phase of its next-generation launcher, the Ariane 6. The new rocket is set to become operational in 2020.

Airbus Safran Launchers is looking towards the future, as Arianespace fights for its place in an increasingly competitive launch services market.

Arianespace's current workhorse, the Ariane 5, is performing flawlessly and – via its successful 2016 campaign – broke Ariane 4's record of

74 successful launches in a row. The company also noted the rocket also broke a number of other records: performance, the number of satellites placed in orbit and mission duration.

Due to the increase in competition, launch companies are evolving their rockets to fine-tune the aim of ensuring reliability with cost.

Full story at NASA Spaceflight http://www.nasaspaceflight.com

### SpaceX's final Falcon 9 design coming this year, two Falcon Heavy launches next year

SpaceX intends to launch a final upgrade to the Falcon 9 rocket, known as the Block 5, later this year, and has three Falcon Heavy launches planned for the next 18 months.

Gwynne Shotwell, president and chief operating officer of SpaceX, confirmed in a June 22 appearance on "The Space Show" online radio show that the Block 5 version of the Falcon 9 will be the "final design spin," following just a few months after an "incremental" Block 4 version that will be more of a transition model.

"We are flying Block 3s right now," Shotwell said. "Block 4s start flying shortly, and then Block 5 at the end of this year. We definitely have gotten better [at] more smooth introducing of change. You don't see the big impacts to production we've had before when we've changed vehicle designs."

SpaceX Chief Executive Elon Musk had previously stated in an online question-and-answer session in October 2016 that Block 5 would be the final upgrade to the Falcon 9 design. The Falcon 9 Block 5 is expected to be far more reusable than the Block 3. Shotwell said a Block 5 booster could relaunch " a dozen or so times." The Block 3, by comparison, has an estimated life of two or three missions.

### President Trump reestablishes National Space Council

At an event in the White House, flanked by several members of Congress and industry officials as well as Apollo 11 astronaut Buzz Aldrin, Trump signed the executive order that re-establishes the council, last active at the end of the administration of President George H.W. Bush in 1993.

"Today's announcement sends a clear signal to the world that we are restoring America's proud legacy of leadership in space," Trump said during the ten-minute signing ceremony. The White House did not broadcast the event live, and provided scant advance notice of the event, taking place shortly before the president left for the 4 July holiday weekend. The White House posted a transcript and video of the event later in the day.

Trump had previously announced that Vice President Mike Pence would serve as the head of the space council once it is reestablished. Pence stated on several occasions, dating back to the signing of a NASA authorization bill in March, that the president would soon sign the order re-establishing the council, with Pence as chairman.

Pence also spoke at the signing ceremony prior to Trump's arrival, reiterating past statements that the council will be key to ensuring American leadership in space. "With the action he takes today, President Trump will bring a renewed sense of purpose to America's space policy that will benefit literally every facet of our national life," Pence said.

> above two news items from Spacenews.com http://www.spacenews.com

# Astronaut News Rob Wood

#### ISS Crewing Updates – From the Russian Perspective

When Russia decided to drop its crew numbers from three to two cosmonauts in October 2016, Sergey Prokopyev lost his preliminary position on Soyuz MS-8/ISS Expeditions 55/56 that at the time was due to launch in March 2018. Over a six month period his placement on crews changed that often it was almost difficult to keep up. He was on crews and off crews at various points. At the end of this period he was back on a crew just one flight later than his placement at the end of September 2016. He was not alone.

As of the end on September 2016, the schedule for manned Soyuz launches to the ISS from 2017 read as follows:

- March 2017 Soyuz MS-04 Aleksandr Misurkin, Nikolay Tikhonov and Mark Vande Hei
- May 2017 Soyuz MS-05 Fyodor Yurchikhin, Jack Fischer and Paolo Nespoli
- September 2017- Soyuz MS-06 Aleksandr Skvortsov, Ivan Vagner and Scott Tingle
- November 2017- Soyuz MS-07 Sergey Ryazansky, Norishige Kanai and Randy Bresnik
- March 2018 Soyuz MS-08 Sergey Prokopyev, Oleg Artemyev and Andrew Feustel
- May 2018 Soyuz MS-09 Aleksandr Samokutyayev, Jeanette Epps and Alexander Gerst
- September 2018 Soyuz MS-10 Gennady Padalka, Andrey Babkin and Serena Auñón-Chancellor
- November 2018 Soyuz MS-11 Oleg Kononenko, David Saint-Jacques and a NASA astronaut
- March 2019 Soyuz MS-12 Sergey Volkov, with Sergey Kud-Sverchkov or Denis Matveev (both had been nominated) and a NASA astronaut.

The crews from March 2018 had a mixture of preliminary assignments and those officially confirmed by their respective space agencies. Alexander Gerst and David Saint-Jacques had both been named to their positions by their respective space agencies. Neither Andrew Feustel nor Jeanette Epps had been announced by NASA on public news releases but Feustel's official NASA astronaut biography was updated in March 2016 to show he was assigned to the March 2018 launch and Epps had spoken publicly about flying on a Soyuz in May 2018. All of the Russian cosmonauts were preliminary and named by Russian sources as was Serena Auñón-Chancellor.

Then in October 2016, Russia decided to reduce its crew complement for the ISS from three to two pending the arrival of a new Russian ISS module, the Multipurpose Laboratory Module or Nauka. At this point, Nauka was scheduled to launch in late December 2017.

Almost immediately, the Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews confirmed a new line-up for missions in 2017.

- March 2017 Soyuz MS-04 Fyodor Yurchikhin and Jack Fischer
- May 2017 Soyuz MS-05 Sergey Ryazansky, Randy Bresnik and Paolo Nespoli

- September 2017- Soyuz MS-06 Aleksandr Misurkin and Mark Vande Hei
- October 2017- Soyuz MS-07 Aleksandr Skvortsov, Scott Tingle and Norishige Kanai

#### They also named back-ups for the four missions:

- March 2017 Soyuz MS-04 Sergey Ryazansky and Randy Bresnik
- May 2017 Soyuz MS-05 Aleksandr Misurkin, Mark Vande Hei and Norishige Kanai
- September 2017- Soyuz MS-06 Aleksandr Skvortsov and Scott Tingle
- October 2017- Soyuz MS-07 Anton Shkaplerov, Alexander Gerst and Jeannette Epps

In early November 2016, it was noted on the Novosti Kosmonavtika forum that a tourist astronaut was being considered for the vacant seat on Soyuz MS-06 with a return on Soyuz MS-04. The problem was the launch and landing schedule did not seem to allow for that but it was possible the Russians were considering changing in order to facilitate the fitting in of a tourist. More preliminary planning information out of Russia suggested a line-up for 2018 as follows.

- March 2018 Soyuz MS-08 Russian cosmonaut, NASA astronaut and tourist
- May 2018 Soyuz MS-09 Anton Shkaplerov, Jeanette Epps and Alexander Gerst
- September 2018 Soyuz MS-10 Sergey Prokopyev, Oleg Artemyev and Andrew Feustel
- November 2018 Soyuz MS-11 Russian cosmonaut, NASA astronaut and David Saint-Jacques

By the middle of November the Soyuz MS-10 crew was now Oleg Kononenko and Nikolay Tikhonov. Andrew Feustel had moved back to Soyuz MS-08 with Soyuz MS-10 open for another NASA astronaut. The movement of Feustel does not appear to make sense as he had always been linked to Soyuz MS-08 and his position on Soyuz MS-10 only lasted a few weeks. It might have something to do with Sergey Prokopyev and Oleg Artemyev's movements and indeed in January 2017, Feustel was with Prokopyev and Artemyev for survival training. Overall, I do not believe that Feustel was ever in serious contention for a place on Soyuz MS-10. Also in January 2017, the launch of Soyuz MS-05 slipped to July 2017.

In early February 2017 the Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews accepted the following assignments for 2018. Although there had been previous talk of tourist flights, in the end there had been no takers because of the price tag (apparently – I am not clear this is accurate but neither do I reject it out of hand).

- March 2018 Soyuz MS-08 Russian cosmonaut and Andrew Feustel
- May 2018 Soyuz MS-09 Anton Shkaplerov, Jeanette Epps and Alexander Gerst
- September 2018 Soyuz MS-10 Russian cosmonaut, Nikolay Tikhonov and Nick Hague

 November 2018 - Soyuz MS-11 Oleg Kononenko, Serena Auñón-Chancellor and David Saint-Jacques

Over the period February 2017 to April 2017 there were further complications for the selection of Russian cosmonauts for crews in 2018 and 2019. Firstly, Sergey Volkov decided to retire from the active list. Then Aleksandr Skvortsov was injured whilst exercising and temporarily off the active list. Three more were quickly lost from the cosmonaut team. Gennady Padalka retired of his own volition but Sergei Revin and Aleksandr Samokutyayev were removed for medical reasons.

On 28 March 2017, NASA's news release named Joseph Acaba as an addition to the crew of Soyuz MS-6 and Ricky Arnold to Soyuz MS-8. NASA also announced some normal ISS crew rotation places for 2018. Nick Hague had been assigned to Soyuz MS-10 and Serena Auñón-Chancellor to Soyuz MS-11. We already knew of the latter two from the Interdepartmental Commission of early February 2017.

During March 2017, Anton Shkaplerov provisionally took the place of the injured Aleksandr Skvortsov on Soyuz MS-07, opening up the commander position on Soyuz MS-09. Still in the frame for selection were Oleg Artemyev and Sergey Prokopyev. They were linked to command positions on Soyuz MS-08 and Soyuz MS-09. During April 2017, they both arrived at the Johnson Space Center for training on the American segment of ISS.

On 21 April 2017, the Interdepartmental Commission for the selection of cosmonauts and their appointments to flight crews met again. It approved Anton Shkaplerov as the replacement for Aleksandr Skvortsov; Oleg Artemyev's assignment to Soyuz MS-08; and Sergey Prokopyev for Soyuz MS-09. We now have officially confirmed full crews for the remaining three missions of 2017 and the first two of 2018. We can also add details for the last two crews of 2018 with some officially confirmed assignments and some preliminary placements:

- July 2017 Soyuz MS-05 Sergey Ryazansky, Randy Bresnik and Paolo Nespoli
- September 2017- Soyuz MS-06 Aleksandr Misurkin, Mark Vande Hei and Joseph Acaba
- October 2017- Soyuz MS-07 Anton Shkaplerov, Scott Tingle and Norishige Kanai
- March 2018 Soyuz MS-08 Oleg Artemyev, Andrew Feustel and Ricky Arnold
- May 2018 Soyuz MS-09 Sergey Prokopyev, Jeanette Epps and Alexander Gerst
- September 2018 Soyuz MS-10 Aleksey Ovchinin, Nikolay Tikhonov and Nick Hague
- November 2018 Soyuz MS-11 Oleg Kononenko, Serena Auñón-Chancellor and David Saint-Jacques

Aleksey Ovchinin had been provisionally agreed for Soyuz MS-10 by the Interdepartmental Commission on 21 April 2017. Nikolay Tikhonov had been linked to the crew for some time but his slot was precarious indeed. His place was probably dependent on the new Russian ISS module (Nauka) being at the ISS and at this time it was expected to launch no earlier than mid-Summer 2018. With expectations of further delays to Nauka, space watchers believed it was more likely a NASA astronaut would fly in his place. By the time another month had elapsed, Nauka's launch was pushed back to October 2018.

Oleg Kononenko's position on Soyuz MS-11, although previously confirmed by the Interdepartmental Commission, was again being described as provisional. As previously noted, Nick Hague, Serena Auñón-Chancellor and David Saint-Jacques had all been confirmed by their respective space agencies.

The story will not end here. By the time this edition reaches the MSS membership I am sure there will be more changes and updates but that is for a future issue. Watch this space (pun intended).

#### **New Astronaut Selections Update**

#### **United States of America**

Not so much an update as a home run to use a US sports analogy. On 7 June 2017, NASA named its 22nd class of astronauts. NASA whittled down a record 18,354 applicants to 12 who were named at a ceremony at the Johnson Space Center. Vice President Mike Pence joined NASA leaders as they introduced the astronaut candidates or ascans in NASA speak.

The ascans will report to the Johnson Space Center in August to start two years of basic training. The exact date is 21 August 2017 but no doubt some will filter into the Astronaut Office in the days preceding the deadline. The twelve represent the largest astronaut selection (all nations) since NASA's class of 2000. NASA has now selected 350 astronauts since the first, the Mercury 7, in 1959. As of 2 July 2017, NASA lists 44 active astronauts.

Their basic training will include scientific and technical briefings, intensive instruction in ISS systems, simulated extravehicular activities, robotics, physiological training, flight training, Russian language courses, and sea and wilderness survival training.

Within the NASA news release was the comment that on completion of their training, "they could be assigned to any of a variety of missions, including: performing research on the International Space Station, launching from American soil on spacecraft built by commercial companies, and departing for deep space missions on NASA's new Orion spacecraft and Space Launch System rocket." NASA does like its hyperbole.

One noticeable point with the new selection is how many of them have experience of operating in extreme environments and dangerous situations and not just the obvious military personal. More than one has worked in Antarctica. Another has extensive experience with wilderness search and rescue efforts and one lists spelunking (caving) as a hobby.

"We look forward to the energy and talent of these astronauts fueling our exciting future of discovery," acting NASA Administrator Robert Lightfoot said. "Between expanding the crew on board the space station to conduct more research than ever before, and making preparations to send humans farther into space than we've ever been, we are going to keep them busy. These candidates are an important addition to the NASA family and the nation's human spaceflight team."

"These women and men deserve our enthusiastic congratulations," said Johnson Space Center Director (and management astronaut) Ellen Ochoa. "Children all across the United States right now dream of being in their shoes someday. We here at NASA are excited to welcome them to the team and look forward to working with them to inspire the next generation of explorers."

Kayla Sax Barron (Lieutenant, US Navy) was born on 19 September 1987 in Pocatello, Idaho. She has degrees in Systems Engineering and Nuclear Engineering. The latter from the University of Cambridge, UK, where she was a Gates Cambridge Scholar. She was commissioned as a Navy officer in 2010 and was a member of the first class of women commissioned into the submarine community. She served on the USS Maine, an Ohio-class ballistic missile submarine. As a submarine warfare officer she completed three strategic deterrent patrols as a division officer aboard the Maine. At the time of her selection, she was serving as the Flag Aide to the Superintendent of the US Naval Academy.

Zena Maria Cardman was born on 26 October 1988 in Urbana, Illinois. She has degrees in Biology and Marine Sciences. Her research has focused on microorganisms in subsurface environments, ranging from caves to deep sea sediments. Her field experience includes multiple Antarctic expeditions, work aboard research vessels as both scientist and crew. She has served on NASA analogue missions in British Columbia, Idaho and Hawaii, including the Pavilion Lake Research Project (2008-2015) and BASALT (2016-2017). At the time of her selection, she was a National Science Foundation Graduate Research Fellow working on her doctorate at Pennsylvania State University.

Raja Jon Vurputoor 'Grinder' Chari (Lieutenant Colonel, US Air Force)

was born on 24 June 1977 in Milwaukee, Wisconsin. His father is of Indian origin who emigrated from Hyderabad, India, following his graduation from University. He has degrees in Astronautical Engineering, Engineering Science and Aeronautics/Astronautics. His master's degree in Aeronautics/Astronautics was from MIT. He has flown combat missions in support of America's wars in the Middle East and is a graduate of the US Naval Test Pilot School. At the time of his selection, he was a Colonel select in the USAF, serving as the Commander of the 461st Flight Test Squadron and the Director of the F-35 Integrated Test Force at Edwards Air Force Base in California.

Matthew Stuart Dominick (Lieutenant Commander, US Navy) was born on 7 December 1981 in Wheat Ridge, Colorado. He has degrees in Electrical Engineering and Systems Engineering. He was commissioned through the Reserve Officers' Training Corps in 2005 and was designated as a Naval Aviator in 2007. He has flown combat missions in support of America's wars in the Middle East and is a graduate of the US Naval Test Pilot School. He was at sea on the USS Ronald Reagan serving as Department Head for Strike Fighter Squadron 115 when he got the call saying he'd been selected as an astronaut candidate.

Robert Thomas 'Bob' Hines (Lieutenant Colonel, US Air Force, Ret) was born on 11 January 1975 in Fayetteville, North Carolina. He clearly prefers to be called Bob as even his official NASA biography only refers to that name. He has degrees in Aerospace Engineering and Flight Test Engineering. He received his commission from the USAF Officer Training School in 1999. He has combat experience, and has participated in multiple deployments in support of operations in the Middle East and throughout Europe. He is a graduate of the USAF Test Pilot School. He transitioned to reserve service in 2011. During his air force career he spent time stationed at RAF Lakenheath in the UK. For the last five years he has served as a NASA research pilot in the Aircraft Operations Division of the Flight Operations Directorate at the Johnson Space Center.

Warren Woodrow 'Woody' Hoburg (Ph.D.) was born on 16 September 1985 in Pittsburgh, Pennsylvania. He has a degree in Aeronautics and Astronautics from MIT and a doctorate in Electrical Engineering and Computer Science from the University of California, Berkley. He is a private pilot and has extensive experience with wilderness search and rescue efforts. At the time of his selection, he was at MIT as an assistant professor of Aeronautics and Astronautics. He was conducting research and taught undergraduate courses on Dynamics and Flight Vehicle Engineering.

Jonathan Yong 'Jonny' Kim (M.D. Lieutenant, US Navy) was born on 5 February 1984 in Los Angeles, California. He enlisted in the navy following graduation from high school in 2002. He qualified as a Navy SEAL and was assigned to SEAL Team 3. He served as a combat medic, sniper, navigator and point man on more than 100 combat operations spanning two deployments to the Middle East. He has received a Silver Star and Bronze Star with Combat V. He then joined the Navy's commissioning programme in 2009. He was commissioned through the Naval Reserve Officers Training Corps into the Medical Corps in 2012. Most astronauts earn their degrees before they get practical experience but Kim took the opposite route. His bachelor degree in Mathematics came in 2012 and a medical doctorate from Harvard Medical School in 2016. At the time of his selection, he was a resident physician in emergency medicine in Massachusetts.

Robb Michael Kulin (Ph.D.) was born on 7 December 1983 in Anchorage, Alaska. He has degrees in Mechanical Engineering and Materials Science, and a doctorate in Engineering. He has experience as an ice driller in Antarctica on the West Antarctic Ice Sheet and Taylor Glaciers, and as a commercial fisherman in Chignik, Alaska. In 2011, he joined SpaceX in Hawthorne, California, as a structures and integration engineer. At the time of his selection, he was their Senior Manager, Flight Reliability, leading the Launch Chief Engineering group. He has a private pilot license.

Jasmin 'Jaws' Moghbeli (Major, US Marine Corps) was born on 24 June 1983 in Bad Nauheim, Germany but considers Baldwin, New York, her hometown. Her parents are of Iranian origin. She has degrees in Aerospace Engineering with Information Technology from MIT and Aerospace Engineering. She was commissioned in the US Marine Corps and learned to fly military helicopters. She is a distinguished graduate of the US Navy Test Pilot School and has accumulated more than 1,600 hours of flight time and flown 150 combat missions. At the time of her selection, she was serving as a H-1 helicopter test pilot and as the Quality Assurance and Avionics Officer for Marine Operational Test and Evaluation Squadron 1 in Yuma, Arizona.

Loral Ashley O'Hara was born on 3 May 1983 in Houston, Texas. She has degrees in Aerospace Engineering and Aeronautics/Astronautics. As a student, she participated in NASA's KC-135 Reduced Gravity Student Flight Opportunities Program, the NASA Academy at the agency's Goddard Space Flight Center, and the internship programme at NASA's Jet Propulsion Laboratory. In 2006 to 2007 she was a project engineer for Rocketplane Limited who were trying to develop a reusable spaceplane for suborbital commercial flights. They went bankrupt in 2010. She has extensive experience working with remotely controlled and manned underwater systems. At the time of her selection, she was a research engineer at Woods Hole Oceanographic Institution in Woods Hole, Massachusetts. She has a private pilot license and is a certified Emergency Medical Technician and Wilderness First Responder.

Francisco Carlos 'Frank' Rubio (M.D., Major, US Army) was born on 11 December 1976 in Los Angeles, California. He has a degree in International Relations from the US Military Academy at West Point and a medical doctorate from the Uniformed Services University of the Health Sciences in Bethesda. Prior to attending medical school, he served as a UH-60 Blackhawk helicopter pilot and accumulated more than 1,100 flight hours, including more than 600 hours of combat and imminent danger time during deployments to Bosnia, Afghanistan, and Iraq. He is a board certified family physician and flight surgeon. At the time of his selection, he was serving as a surgeon for the 3rd Battalion of the Army's 10th Special Forces Group (Airborne) at Fort Carson.

Jessica Andrea Watkins (Ph.D.) was born in Gaithersburg, Maryland. She is 29 years old (stated in the initial NASA news release). She has a degree in Geological/Environmental Sciences and from UCLA a doctorate in Geology. While at UCLA, she was a teaching assistant for various courses in earth and planetary science. For her Ph.D. research, she studied the emplacement mechanisms of large landslides on Mars and Earth through orbital data analysis and field work. She already has experience of working at various NASA centres with time at Ames Research Center, Jet Propulsion Laboratory and Johnson Space Center. At the time of her selection, she was a postdoctoral fellow in the Division of Geological and Planetary Sciences at Caltech, where she collaborated on the Curiosity Mars Science Laboratory rover. She participated in daily planning of rover activities and investigated the geologic history of Gale Crater. Whilst at college she was a member of the USA Rugby Women's Sevens National Team and also lists soccer as one of her interests.

#### Canada

On 1 July 2017, Canada announced their new ascans who will join NASA's 22nd class for their basic training. Just over a year after applications opened Joshua Kutryk and Jennifer Sidey were named as the two newest Canadian astronaut recruits. Prime Minister Justin Trudeau introduced them in Ottawa during celebrations for the 150th anniversary of the Canadian Confederation. The final two were chosen from 3,722 applicants. In August 2017, they will relocate to Houston for the start of their ascan training at the Johnson Space Center.

Unlike NASA's total of 350 astronauts, Canada has selected somewhat fewer. There have been fifteen over four groups. The official number, according to the Canadian Space Agency, is fourteen, but there is another selectee who is not listed by the agency as an official astronaut. Robert Stewart was announced as part of the four strong second group in 1992. However, he withdrew two weeks later over uncertainty about flight assignments and was replaced.

Joshua Kutryk (Lieutenant Colonel, Royal Canadian Air Force) was born on 21 March 1982 in Fort Saskatchewan, Alberta. He has degrees in Mechanical Engineering, Space Studies, Flight Test Engineering and Defence Studies. As a McDonnell Douglas CF-18 fighter pilot he has flown combat missions in Libya and Afghanistan. In 2012, he graduated from the USAF Test Pilot School and received the prestigious Liethen-Tittle Award for being their top test pilot graduate. At the time of his selection, he was working as an experimental test pilot and a fighter pilot at Canadian Forces Base Cold Lake, Alberta, where he led the unit responsible for the operational flight-testing of fighter aircraft in Canada. He was one of the 16 final candidates during Canada's last astronaut recruitment campaign in 2009. His brother, Matthew, is also in the air force and was named as the pilot for the 2017 CF-18 Demonstration Team.

Jennifer Anne MacKinnon 'Jenni' Sidey (Ph.D.) was born on 3 August 1988 in Calgary, Alberta. She has a degree in Mechanical Engineering from McGill University (2011). Whilst at McGill she conducted research on flame propagation in microgravity in collaboration with the Canadian Space Agency. Following graduation from McGill she relocated to the UK where she received a doctorate in Engineering from the University of Cambridge (2015). At the time of her selection, she worked as an assistant professor in internal combustion engines at the Department of Engineering of the University of Cambridge. She also taught undergraduate and graduate students in the Energy, Fluid Mechanics and Turbomachinery Division on topics ranging from conventional and alternative energy production to introductory thermodynamics and flame physics.

#### And Then There Were Sixteen

Over the period February to May 2017 the Russian Cosmonaut Team saw two experienced space flyers resign of their own volition and two permanently grounded for health reasons. Following these departures there are now just 16 active cosmonauts who have experience of travelling in space. In addition to the veterans there are also 13 rookie cosmonauts who have yet to fly. Two of these rookies are currently assigned to crews through to the end of 2018 but one of those places is in considerable doubt because of almost certain further delays in the new Russian ISS module.

Of the 16 experienced cosmonauts still officially active two are already past 60 years of age, Pavel Vinogradov (born 1953) and Aleksandr Kaleri (1956), and one, currently in space, Fyodor Yurchikhin (1959), is fast approaching that milestone. The next oldest are Mikhail Korniyenko (1960), Andrey Borisenko (1964) and Oleg Kononenko (1964).

Oleg Kononenko has been nominated to a crew in 2018 and there are no other places available until 2019 (health warning – crewing is never written in stone especially where the Russians are concerned). Assuming the next appointments will be the 2019 crews, it is not unreasonable to conclude that Pavel Vinogradov and Aleksandr Kaleri will not be appearing on anymore flight crews. There does seem a reluctance to appoint rookies to crews at present but I am not sure whether this suggests anything other than that is how it is working out at present.

#### **The Russian Retirees**

Sergey Volkov was the first to call time on his cosmonaut career. As far as I can ascertain this appears to be his own decision although I have not found an exact explanation of why he decided to step down. His resignation was confirmed by the Chief of the Yuri Gagarin Cosmonaut Training Centre on 28 February 2017. Gennady Padalka also stepped down voluntarily and he himself gave his last day of active service as 28 April 2017.

Padalka wanted to fly again and in the Summer of 2016 had been preliminarily assigned to Soyuz MS-10, then due to launch in September 2018. Following the adjustments for the reduction in Russian crew size he no longer appeared on that crew and this appears to have been the catalyst for his resignation. This had also happened to Sergey Volkov with regard to Soyuz MS-12 due to fly from March 2019 but there is no mention of this as being a reason he retired.

In May 2017, two cosmonauts were removed from the Cosmonaut Team for medical reasons. The previous month it had become known that Sergey Revin and Aleksandr Samokutyayev had failed their medicals but their official dates of release i.e. when the orders came from the Chief of the Yuri Gagarin Cosmonaut Training Centre were 10 May 2017 for Revin and 22 May 2017 for Samokutyayev. According to unofficial sources Revin failed the annual cosmonaut physical in 2016 but there had been concerns for some time before this. up management or specialist roles at the Yuri Gagarin Cosmonaut Training Centre but Gennady Padalka appears to have left the training centre altogether.

Sergey Aleksandrovich Volkov (Colonel, Russian Federation Air Force Ret.) is a second generation cosmonaut. His father is Aleksandr Volkov who made three spaceflights in the 1985 to 1992 period. Sergey Volkov was born on 1 April 1973 in Chuguyev, then part of the Soviet Republic of Ukraine. Whilst his father was an active cosmonaut, Sergey went to High School in Zvezdny Gorodok (Star City) where the Yuri Gagarin Cosmonaut Training Centre is based.

He is a graduate of the Tambov Higher Military Aviation School and went on to fly the Ilyushin IL-76 four-engine turbofan strategic airlifter for the Russian Air Force. He left the air force in 2012.

He was selected as a cosmonaut in 1997 and following basic training received the qualification of test-cosmonaut on 1 December 1999. This made him eligible for advanced training, taking on ground positions associated with actual space missions and eventual assignment to a space crew. He went on to make three spaceflights: Soyuz TMA-12/ISS-17 (8 April 2008 – 24 October 2008), Soyuz TMA-02M/ISS-28/29 (8 June 2011 – 22 November 2011) and Soyuz TMA-18M/ISS45/46 (2 September 2015 – 2 March 2016). He completed four EVS's during his spaceflights.

Gennady Ivanovich Padalka (Colonel, Russian Federation Air Force Ret.) is the current world record holder for the most time spent in space with 878 days of flight time over five missions. He was born on 21 June 1958 in Krasnodar, Russia. He served as a fighter-pilot in the Soviet Air Force flying several Mikoyan-Gurevich and Sukhoi aircraft including the MiG-17 high subsonic jet fighter aircraft, the Su-7 swept wing supersonic fighter aircraft and the Su-24 supersonic all weather attack aircraft.

He was selected for cosmonaut training in 1989 and following basic training received the qualification of test-cosmonaut on 1 February 1991. His career includes numerous assignments including several as back-up and five spaceflights. He has flown once to the Mir space station and four times to the ISS on missions lasting between 124 days and 198 days. He has also trained to fly a rescue mission involving the ISS.

The rescue mission was during the early days of ISS assembly. The Zvezda Service Module was to be the third module launched to the station. If its automatic docking systems failed, Padalka and his flight engineer Nikolay Budarin would fly a Soyuz to Zvezda to try and facilitate a manual docking with the other two modules. Zvezda launched on 12 July 2000 and successfully docked with the rest of the ISS on 25 July 2000. Padalka's contingency crew was therefore stood down.

His spaceflights were: Soyuz TM-28/Mir-26 (13 August 1998 – 28 February 1999), Soyuz TMA-4/ISS-9 (19 April 2004 – 24 October 2004), Soyuz TMA-14/ISS-19/20 (26 March 2009 – 11 October 2009), Soyuz TMA-04M/ISS-31/32 (15 May 2012 – 17 September 2012) and Soyuz TMA-16M/ISS43/44 (27 March 2015 – 12 September 2015). He completed nine EVS's during his spaceflights.

In addition to his pilot-engineer qualifications from his early days in the air force he also has degrees in Engineering-Ecology (1994) and Public Administration and National Security (2009). He said of the latter degree that, "maybe it will help me after being retired, I hope." He retired from the Russian Air Force in March 2009 but there was little sign of a wind down in his cosmonaut career. Even before his fifth spaceflight started he hinted he would seek yet another mission. However, in the end, his fifth spaceflight was his last.

Aleksandr Mikhailovich Samokutyayev (Colonel, Russian Air Force, Ret.) ended his second spaceflight on 12 March 2015. At the press conference shortly after he was asked about the situation between the Russian and American governments over the Ukraine and if it affected the astronauts, "We do our work that we love and we respect each other," he said. "Whatever the politicians want to get up to, that is their business."

He was born on 13 March 1970 in Penza, Russia. In 1992 he graduated from the Chernigov Higher Military Aviation School as an engineer pilot. He served as a fighter-pilot flying the Sukhoi Su-24M supersonic

Sergey Volkov, Sergey Revin and Aleksandr Samokutyayev took

all weather attack aircraft and also spent time as an air force instructor. In 1998 he attended the Gagarin Air Force Academy in Monino, Moscow, from where he graduated in 2000. He retired from the Armed Forces of the Russian Federation in 2012.

He was selected for cosmonaut training in 2003 and following basic training received the qualification of test-cosmonaut on 5 July 2005. He went on to make two spaceflights: Soyuz TMA-21/ISS Expeditions 27/28 (5 April 2011 – 16 September 2011) and Soyuz TMA-14M/ISS Expeditions 41/42 (26 September 2014 - 12 March 2015).

He conducted two spacewalks, one on each spaceflight. After his first, he described it as, "hard physical work," and of the beginning of the walk, "It was such an experience, so I wanted to cling to the station because you feel like you're about to be blown off the surface".

Sergey Nikolayevich Revin was born on 12 January 1966 in Moscow. After graduating from High School in 1983 he carried out his National Service. He then entered the National Research University of Electronic Technology from where he graduated in 1989 with a degree in Electrical Engineering.

From 1989 to 1993 he worked for the Scientific Production Association of Measuring Technology in Kaliningrad, Moscow Region. In 1993 he joined NPO Energiya (S P Korolyov Rocket-Space Corporation Energiya from 1994).

He was selected for cosmonaut training in 1996 and following basic training received the qualification of test-cosmonaut on 17 June 1998. He only made one spaceflight on Soyuz TMA-04M/ISS-31/32 (15 May 2012 – 17 September 2012). He also served on the back-up crew for Soyuz TMA-22/ISS-29/30 (launched on 14 November 2011). During his time as a cosmonaut, he undertook post-graduate studies at the Moscow University for the Humanities. His main area of research was space education. In 2013, he graduated with a Candidate of Sciences degree in Pedagogy.

# Where Are They Now - Ex-Astronaut Movements in the Private and Public Sector

Last time out I reported that Michael Fossum had retired from NASA to enter private industry. I can now confirm that from 1 March 2017 he has taken up the posts of Vice President and Chief Operating Officer of Texas A&M University-Galveston Campus, and Executive Professor. "I'm excited about going from one dream job to another serving the university I love." Mike said on Facebook. A NASA Group 17 Astronaut (1998), he made three spaceflights: STS-121 (2006), STS-124 (2008) and Soyuz TMA-02M/ISS-28/29 (2011).

On 20 March 2017, the University of Arizona (UA) announced that former NASA astronaut Ron Garan is to lead new UA online class 'The Orbital Perspective' (this is also the title of his book released in 2015). The class aims to increase global access to science education and provide students with the opportunity to present their work to the United Nations. He is currently an affiliate professor in the UA's Department of Astronomy and Steward Observatory as well as Chief Pilot for World View Enterprises Inc.'s high altitude Stratollite balloon project. Garan was a NASA astronaut from 2000 to 2013 and made two spaceflights including one ISS residency. He was MS-2 on STS-124 (2008) and completed an ISS tour with Soyuz TMA-21/ISS-27/28 (2011).

Having mentioned World View Enterprises Inc. in connection with Ron Garan above, the company also has another ex-NASA astronaut on its team. Mark Kelly is Director of Flight Crew Operations for their high-altitude balloon flights. The news of his appointment was released on 9 December 2013 (and mentioned in the March/ April 2014 edition of CapCom). He was selected as a NASA astronaut in 1996. He flew four Space Shuttle missions, two as pilot STS-108 (2001) and STS-121 (2006) and two as commander STS-124 (2008) and STS-134 (2011). Although he left the Astronaut Corps in 2011 he agreed to be a ground based test subject for NASA's 'The Twins Study' experiment. His twin brother Scott flew a nearly year-long spaceflight mission over 2015/2016.

#### **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.

- Charles Duke: 9 September 2017 through Armchair Astronaut events in Milton Keynes.
- James Lovell: 19 September 2017 through Royal Aeronautical Society Cabin Air Conference in London (the website asks nicely that attendees do not make autograph requests to Captain Lovell).
- Anousheh Ansari: 23 September 2017 at Iranian American Women Foundation's Women's Leadership Conference in London.
- Bruce McCandless: 3-4 November 2017 with Space Lectures events in Pontefract.

An additional non-astronaut sighting but one of interest is Jerry Bostick, a Flight Dynamics Officer in Mission Control during the early days of manned spaceflight including the moon landings. He is appearing at Llanwddyn Community Centre in Wales on 26 August 2017 and the National Space Centre in Leicester on 28 August 2017 (full details on Collect Space – the same spot as the astronaut sightings).

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.

#### **Bits & Pieces**

1/ On 9 March 2017, at the Penguin Random House conference at The Barbican, London, ESA's British astronaut Tim Peake presented a cheque for £250,000 to The Prince's Trust. This was the royalties from the sale of his book 'Hello, is this planet Earth'. The Prince's Trust is a charity supporting disadvantaged young people. It was set up by His Royal Highness The Prince of Wales, in 1976.

**2**/ NASA astronaut Sunita Williams retired from the United States Navy on 20 May 2017. She is a veteran of two spaceflights and is currently assigned to the cadre of astronauts training to fly the initial test flights for America's first commercially built and operated spacecraft - the Boeing CST-100 Starliner and SpaceX Dragon V2.

**3**/ Actress Gwyneth Paltrow's lifestyle and wellness website Goop.com (she is CEO) is advertising 'Wearable Stickers that Promote Healing'. They are named 'Body Vibes' and I quote from the website, "that rebalance the energy frequency in our bodies." They say the stickers are "made with the same conductive carbon material NASA uses to line space suits so they can monitor an astronaut's vitals during wear." Not according to NASA who say they "do not have any conductive carbon material lining the spacesuits." Mark Shelhamer, a former Chief Scientist at NASA's Human Research Division, went a little further as he told Gizmodo, a design, technology and science blog on the net, his thoughts on Body Vibes "What a load of BS this is." Goop have now retracted and apologized saying "We regret not doing our due diligence," but they still stand by the product.

#### **CORRECTIONS & APOLOGIES**

In the last issue of CapCom was my Die Astronautin article and if you are going to make a mistake make it at the beginning so you can recover later. Unfortunately, that did not quite pan out in this case.

I opened the article with "Die Astronautin translates from German into English as 'The Female Astronaut". NO IT DOES NOT. It translates from German into English as 'The Astronaut'. What I should have said was that in the context of its use for this astronaut programme it should be 'The Female Astronaut' and in German this would be 'Die Wiebliche Astronautin'.

However, I should explain that my German language skills are very limited and I might be missing some subtleties of language use but from my vantage point it does seem odd that the actual name does not refer to what the project is about.

# COMMENTS & UPCOMING IN THE NEXT ISSUE OF ASTRONAUT NEWS

Due to time constraints and the need to cover the new astronaut selections I have held over a report on 1978 astronaut selectee Anna Fisher who departed NASA on 28 April 2017. Another recent astronaut departure is Rick Mastracchio who left NASA on effective 16 June 2017. NASA also has a new Chief Astronaut. On 2 June 2017, NASA announced that Patrick Forrester is taking over the position of Chief Astronaut from Christopher Cassidy who will resume his candidacy for a flight assignment.

#### Acknowledgements and sources:

Astroaddies; Astronaut.ru; Boston University; CapCom (previous issues); Collect Space; Gizmodo.com; Google; Goop.com; India.com; Manned Spaceflight Log II 2006-2012 ©2013 by David J Shayler and Michael D Shayler; Msn.com; NASA and its various centres; NASASpaceflight.com; Novosti Kosmonavtika; Praxis Manned Spaceflight Log 1961-2006 ©2007 by Tim Furniss and David J Shayler with Michael D Shayler; The Prince's Trust; Rockets and People: Creating a Rocket Industry volume two ©1999 by Boris Chertok (as translated for NASA History Series ©2006 edited by Asif A Siddiqi; Royal Canadian Air Force; RussianSpaceWeb.com; The Soviet Space Race With Apollo ©2000 by Asif A Siddiqi; Spacefacts; Space Lectures; S P Korolyov Rocket-Space Corporation Energiya; Timeanddate.com; University of Arizona; US Naval Institute; Who's Who in Space ©1999 by Michael Cassutt; Wikipedia; World View Enterprises Inc.; Yuri Gagarin Cosmonaut Training Centre.

# Preparing For Mercury: Bepicolombo Stack Completes Testing

In early July, ESA's Mercury spacecraft passed its final test in launch configuration, the last time it will be stacked like this before being reassembled at the launch site next year.

BepiColombo's two orbiters, Japan's Mercury Magnetospheric Orbiter and ESA's Mercury Planetary Orbiter, will be carried together by the Mercury Transport Module. The carrier will use a combination of electric propulsion and multiple gravity-assists at Earth, Venus and Mercury to complete the 7.2 year journey to the Solar System's mysterious innermost planet

Once at Mercury, the orbiters will separate and move into their own orbits to make complementary measurements of Mercury's interior, surface, exosphere and magnetosphere. The information will tell us more about the origin and evolution of a planet close to its parent star, providing a better understanding of the overall evolution of our own Solar System.

To prepare for the harsh conditions close to the Sun, the spacecraft have undergone extensive testing both as separate units, and in the 6 m-high launch and cruise configuration.

One set of tests carried out earlier this year at ESA's technical centre in the Netherlands focused on deploying the solar wings, and the mechanisms that lock each panel in place. The 7.5 m-long array of the Mercury Planetary Orbiter and the two 12 m-long array of the Mercury Transport Module will be folded while inside the Ariane 5 rocket.

In June, the full spacecraft stack was tested inside the acoustic chamber, where the walls are fitted with powerful speakers that reproduce the noise of launch.

Just recently, tests mimicked the intense vibrations experienced by a satellite during launch. The complete stack was shaken at a range of frequencies, both in up-down and side-to-side motions.

These were the final tests to be completed with BepiColombo in mechanical launch configuration, before it is reassembled again at the launch site.

dDuring July and August the assembly will be dismantled to prepare the transfer module for its last test in the thermal–vacuum chamber. This will check it will withstand the extremes of temperatures en route to Mercury.

The final 'qualification and acceptance review' of the mission is foreseen for early March 2018. Then BepiColombo will be flown to Europe's Spaceport in Kourou, French Guiana, in preparation for the October 2018 departure window. The date will be confirmed later this year.

> ESA http://www.esa.int



Artist's impression of the BepiColombo spacecraft at Mercury. The mission comprises ESA's Mercury Planetary Orbiter (foreground) and JAXA's Mercury Magnetospheric Orbiter (background).

Midlands Spaceflight Society: CapCom: Volume 27 No 6 July - August 2017

# **ISS Mission Digest** Compiled by Mike Bryce

#### 3 June to 5 July 2017

On 3 June the SpaceX Falcon 9 rocket lifted off and Dragon began its journey to the International Space Station.

Before Dragon arrived at the space station, Expedition 52 Flight Engineer Jack Fischer of NASA commanded the International Space Station's Candadarm2 robotic arm to release the Cygnus spacecraft on 4 June, while the space station was flying above the south Atlantic Ocean. Earlier, ground controllers detached Cygnus from the station and maneuvered it into place for its departure.

Dubbed the "SS John Glenn" after the iconic Mercury and shuttle astronaut and U.S. Senator from Ohio, Cygnus will remain in orbit for a week in support of the SAFFIRE experiment and the deployment of four small Nanoracks satellites before Orbital ATK flight controllers send commands 11 June to deorbit the spacecraft for its reentry into the Earth's atmosphere, where it will burn up over the Pacific Ocean.

On 5 June, while the ISS was traveling about 250 miles over the south Atlantic ocean east of the coast of Argentina, Flight Engineers Jack Fischer and Peggy Whitson of NASA captured Dragon a few minutes ahead of schedule.

A little over two hours after it was captured, the unpiloted SpaceX Dragon cargo craft was attached to the Earth-facing side of the Harmony module of the ISS. The three-member Expedition 52 crew settled down to science and cargo transfers since the arrival of Dragon.

NASA astronaut Peggy Whitson then looked after a student experiment that is exploring how molds and bacteria adapt to microgravity. Afterward, she measured the lighting in the Destiny and Kibo lab modules to help engineers understand how light affects the habitability of spacecraft.

Flight Engineer Jack Fischer installed and activated new science hardware. Fischer also joined Commander Fyodor Yurchikhin to prepare the station for the departure and arrival of a pair of Russian cargo ships on the following week.

On Monday 12 June Flight Engineer Peggy Whitson started measuring her shoulders, back, chest and hips for the Body Measures experiment. Scientists are researching how living in space changes body shape and size which may influence the design of future crew suits.

Jack Fischer of NASA studied how plants sense light and grow in space for the Seedling Growth-3 experiment. He also worked on removing and replacing a bolt that jammed after the last SpaceX Dragon cargo craft left the station back in March. The maintenance work is being done ahead of the departure of the newest Dragon.

The Orbital ATK Cygnus cargo craft deorbited into Earth's atmosphere on Sunday 11 June after its release from the station a week earlier. The same day, Russia's Progress 67 (67P) cargo ship rolled out to its launch pad in Kazakhstan.

On 13 June, Two external experiments were extracted from the trunk of the SpaceX Dragon resupply ship and attached to the outside of the ISS. Ground controllers commanded the Canadarm2 to reach inside Dragon, grapple both experiments and install them on EXPRESS logistics carriers.

The first experiment, MUSES, or Multiple User System for Earth Sensing, was removed June 6 the day after Dragon's arrival. It was installed two days later on the starboard side of the station's truss structure. MUSES is an Earth-imaging platform that may improve navigation, agriculture and benefit emergency responders and the petroleum industry.

NICER, or Neutron Star Interior Composition Explorer, was installed. It will search for new insights into the physics of neutron stars and help scientists develop a pulsar-based, space navigation system.

On 14 June, carrying more than three tons of food, fuel, and supplies for the ISS crew, the unpiloted ISS Progress 67 cargo craft launched from the Baikonur Cosmodrome in Kazakhstan on a 2-day flight.

On 15 June Fischer spent the morning photographing mold and bacteria samples on petri dishes as part of six student-led biology experiments that are taking place inside a NanoRacks module. In the afternoon, he removed protein crystal samples from a science freezer, let them thaw and observed the samples using a specialized microscope.

The following day, traveling about 250 miles over the Philippine Sea, the unpiloted ISS Progress 67 Russian cargo ship docked at to the aft port of the Zvezda Service Module of the ISS.

Robotics controllers completed the unloading and set up of the third and final external experiment delivered aboard the SpaceX Dragon resupply ship. Inside the ISS, the Expedition 52 crew studied a variety of life science including plant growth, bone loss and cardiac biology.

Engineers on the ground remotely operated the Canadarm2 to extract the Roll Out Solar Array from Dragon. The experiment, also known as ROSA, remained attached to the Canadarm2 over seven days to test the effectiveness of the advanced, flexible solar array that rolls out like a tape measure.

On 20 June, The Expedition 52 crew loaded the SpaceX Dragon with cargo for return back to Earth. BEAM, the experimental habitat, also received a new radiation shield that was 3D printed aboard the ISS.

Flight Engineer Jack Fischer opened up BEAM and entered the expandable activity module for a regular checkup. He replaced an older radiation shield with a thicker shield that covers a radiation sensor inside BEAM. Fischer also sampled BEAM's air and surfaces for microbes.

The three crew-members also carried on the science research projects including microgravity studies on mice, to a new drug therapy that may keep humans healthier in space and cardiac research.

On 23 June Three-time station crew member Peggy Whitson retrieved stem cell samples for observation to determine if living in space speeds up the aging process. Whitson also set up the SPHERES Halo experiment that is exploring the possibility of using satellites to clean up space debris and assemble objects such as space telescopes and habitats.

Commander Fyodor Yurchikhin worked in the station's Russian segment maintaining life support systems. The veteran cosmonaut also explored pain sensation in space then wrapped up the work day with Earth photography documenting human and natural impacts across the globe.

On 26 June the experimental solar array demonstration was jettisoned while the Expedition 52 crew continued preparing the SpaceX Dragon for its release. The three crew members also studied how microgravity impacts their bodies.

Following a week of successful science operations on the experiment

for the Roll-Out Solar Array (ROSA), attempts to retract the array were unsuccessful. The ISS Mission Management Team made the decision to jettison ROSA directly from its location at the end of the space station's robotic arm, where it remained fully deployed in a normal configuration.

The original plan called for ROSA to be stored back inside the trunk of SpaceX's Dragon which is detached and burned up in the atmosphere during Dragon reentry. The Operations team executed the jettison procedure that was developed as part of the pre-flight planning process that covered various scenarios. Once jettisoned, ROSA will not present any risk to the ISS and will not impact any upcoming visiting vehicle traffic.

On 27 June, Expedition 52 explored the aging process in space and measured the lighting conditions on the ISS. The crew also prepared spacesuits ready for an upcoming Russian spacewalk.

Flight Engineer Peggy Whitson swapped out stem cell samples today inside the Microgravity Science Glovebox for the Cardiac Stem Cells study. The experiment is researching spaceflight's effect on accelerated aging and may provide a treatment for heart disease on Earth. Scientists are observing the stem cells in space to determine their role in cardiac biology and effectiveness in tissue regeneration.

Whitson also set up light meters to measure the intensity and color of new LED (light-emitting diode) light bulbs installed in the station. The data is being collected for the Lighting Effects study to determine how the new lights affect crew sleep, circadian rhythms and cognitive performance.

The SpaceX Dragon was prepared for a weekend departure on Sunday 2 July, however, due to a forecast of unacceptable sea states in the Pacific Ocean in the prime opportunity splashdown zone, SpaceX and NASA elected to delay the return of the SpaceX Dragon cargo craft.

The spacecraft splashed down in the Pacific Ocean on the morning of 3 July west of Baja California, marking the end of the company's eleventh contracted cargo resupply mission to the ISS for NASA.

A variety of technological and biological studies are returning in Dragon. The Fruit Fly Lab-02 experiment seeks to better understand the effects of prolonged exposure to microgravity on the heart. Flies are small, with a well-known genetic make-up, and age rapidly, making them good models for heart function studies. This experiment could significantly advance understanding of how spaceflight affects the cardiovascular system and could help develop countermeasures to help astronauts.

On 5 July, a pair of Expedition 52 astronauts from NASA aboard the ISS explored how microgravity causes bone loss in space. The commander from Roscosmos also worked on life support maintenance tasks.

NASA astronauts Peggy Whitson and Jack Fischer studied a new drug therapy to determine its potential to prevent bone loss. The duo worked inside the Destiny lab module and used a bone densitometer to measure bone minerals in mice living in the Rodent Research habitat. The new drug may slow or reverse bone loss in astronauts during spaceflight and possibly help patients on Earth suffering bone loss syndromes.

Commander Fyodor Yurchikhin was on the opposite side of the station doing plumbing work and transferring water from the new Progress 67 cargo craft into the Zvezda service module. The veteran cosmonaut also replaced water hoses and worked on air purification gear.

> Report compiled fom NASA ISS Status Updates https://blogs.nasa.gov/spacestation/

## Visit to RAF Spadeadam with the British Interplanetary Society By Mike Bryce

## Between the 26 and 28 June 2017 I joined BIS visit to RAF Spadeadam in Cumbria. I decided to rejoin the BIS a couple of years ago after years of absence.

RAF Spadeadam was the home of the launcher testing facility of the de Havilland Propellers Blue Streak rocket.

Originally designed and built in Britain as a Medium Range Ballistic Missile (MRBM) with the support of the United States. After its cancellation as a military project, there was reluctance to cancel the Blue Streak project because of the huge cost incurred. Blue Streak would have become the first stage of a projected all British satellite launcher known as "Black Prince".

Blue Streak became the first stage of a European Rocket to be known as Europa, independant of the United States. However, Black Prince proved too expensive for the UK, and the European Launcher Development Organisation (ELDO) was set up comprising of the UK, France, Germany and Australia. The Blue Streak first stage was successfully tested three times at the Woomera Test Range in Australia as part of the ELDO programme.

During our visit to Spadeadam the weather couldn't have been much worse with driving rain. But we were greeted by station staff with such professionalism and enthusiasm which made the visit even more worth while. We were taken around the site on our coach under the drection of the Station Commander who gave an overview of the facililities.

The highlight of the tour was a visit to Greymare East, the name given to one of the two testing stands (along with Greymare West). Again in pouring rain we were encouranged to leave the coach to take pictures of the historic monument.

Photograph of Greymare East by Mike Bryce Text by Mike BrycewWith Acknowledgements to RAF Spadeadam and Wikipedia

![](_page_10_Picture_21.jpeg)

### Introduction of Space Industry Bill shows UK's commitment to commercial spaceflight

The Space Industry Bill has been introduced into the House of Lords, marking the first step in the process to create new laws and a regulatory framework to enable exciting new technologies to operate safely from the UK.

The Bill, which was outlined in the Queen's Speech, is a clear signal of the UK's commitment to enabling commercial spaceflight from UK spaceports, and a key part of the Government's Industrial Strategy to ensure the UK businesses capture a share of this emerging global market.

Lord Callanan, Parliamentary under Secretary of State for Transport introduced the Space Industry Bill, which is a joint initiative by the Department for Transport, UK Space Agency and Civil Aviation Authority supported by the Health and Safety Executive.

Universities and Science Minister Jo Johnson said:

"The Space Industry Bill will ensure the UK remains a leading player in the commercial space age by enabling small satellite launch from UK spaceports. The measures in the Bill will help make the UK the most attractive place in Europe for commercial launch and enable UK businesses to capture a growing share of this emerging global market."

The emerging markets for small satellite launch and sub-orbital flight are forecast to be worth over £25 billion globally over the next 20 years. They offer exciting opportunities to grow the UK space sector, create local jobs and inspire the next generation of British scientists and engineers.

The main elements of the Bill are:

- new powers to license a wide range of spaceflight activities, including vertically-launched rockets, spaceplanes, satellite operation, spaceports and other technologies
- a comprehensive and proportionate regulatory framework to manage risk, ensuring that commercial spaceflight in the UK remains safe
- measures to regulate unauthorised access and interference with spacecraft, spaceports and associated infrastructure, drawing on the UK's extensive expertise – particularly in aviation security
- measures to promote public safety by providing a regulatory framework to cover operational insurance, indemnity and liability

This legislation will ensure the UK can take advantage of new markets, overcome dependence on foreign launch services and benefit from the development of new spaceports and supply chains.

UK Space Agency https://www.gov.uk/government/organisations/uk-space-agency

## **Successful Intelsat 35E Mission**

SpaceX's Falcon 9 rocket successfully delivered Intelsat 35e, a commercial communications satellite, to a Geostationary Transfer Orbit (GTO). Falcon 9 lifted off from Launch Complex 39A (LC-39A) at NASA's Kennedy Space Center in Florida on Wednesday 5 July. The satellite was deployed approximately 32 minutes after launch and the customer has confirmed signal acquisition.

SpaceX http://www.spacex.com

![](_page_11_Picture_18.jpeg)

# Midlands Spaceflight Society

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### Contributions to CapCom

The Editor welcomes contributions for CapCom. Articles on any aspect of space exploration are considered. Articles in Word format or text files should be sent by email to **capcom.editor**@ **midspace.org.uk**.

The Society is not responsible for individual opinions expressed in articles, reviews or reports of any kind. Such opinions are solely those of the author. Material published in CapCom does not necessarily reflect the views of the Society. Any comments directly concerning the magazine should be addressed to the Editor via the email address above.

# **Copy Deadline**

All contributions intended for the September - October 2017 issue should be emailed to the editor by

Friday 11 August 2017