

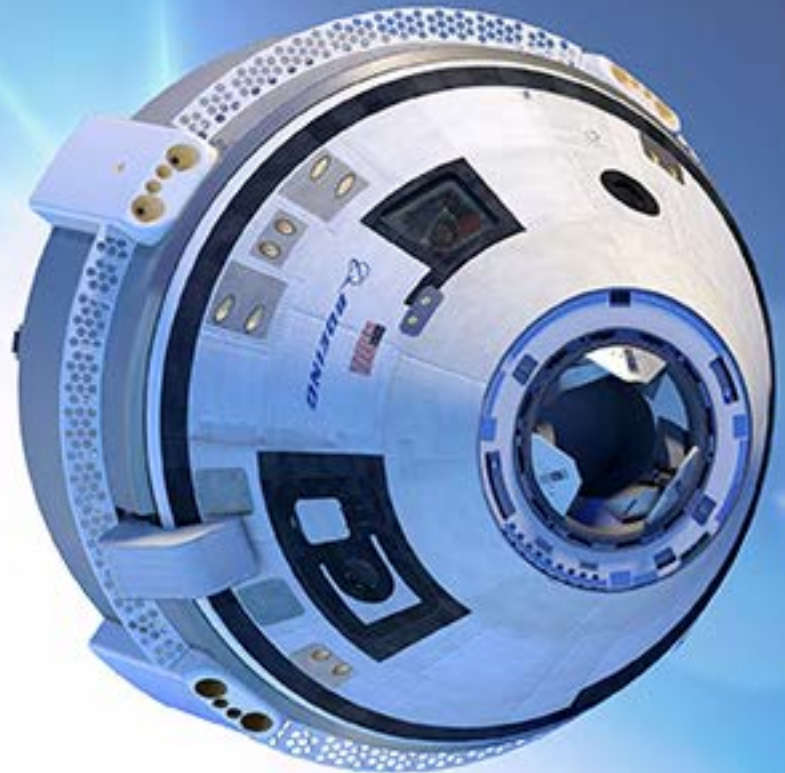


your window to space

capcom

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meet starliner



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space news roundup

Boeing Revamps Production Facility for Starliner Flights

By Steven Siceloff,
NASA's Kennedy Space Center, Florida

Cover Picture

A mural depicting on The Boeing Company's newly named CST-100 Starliner commercial crew transportation spacecraft is installed on the company's Commercial Crew and Cargo Processing Facility, or C3PF, at NASA's Kennedy Space Center in Florida. Photo credit: NASA/Kim Shiflett

Meet the CST-100 Starliner, the newly unveiled name of Boeing's commercial crew transportation spacecraft. It's been designed with a focus on automated flight, reliable operation and frequent flights carrying NASA astronauts to the space station. It also may take paying customers to the awe-inspiring heights of low-Earth orbit and the unique sensation of sustained weightlessness.

NASA last year awarded contracts to Boeing and SpaceX to each develop systems that will safely and cost effectively transport astronauts to the International Space Station from the United States.

The CST-100 will be assembled and processed for launch at the revitalized Commercial Crew and Cargo Processing Facility, or C3PF, at NASA's Kennedy Space Center in Florida. NASA had used the facility for 20 years as a shuttle processing hangar and for the extensive preps and testing of the space shuttle main engines in the engine shop.

"One hundred years ago we were on the dawn of the commercial aviation era and today, with the help of NASA, we're on the dawn of a new commercial space era," said Boeing's John Elbon, vice president and general manager of Space Exploration. "It's been such a pleasure to work hand-in-hand with NASA on this commercial crew development, and when we look back 100 years from this point, I'm really excited about what we will have discovered."

With the high bay of the C3PF expected to be complete in December 2015, engineers are building the structural test article for the Starliner in the remodeled engine shop. Though not scheduled to ever make it into space, the test version of the spacecraft will be put through a continuum of tests culminating with a pad abort test in 2017. It will be used as a pathfinder to prove the design Boeing and NASA's Commercial Crew Program worked together to develop is sound and can accomplish its missions.

For NASA, the main mission for Boeing's Starliner and the SpaceX Crew Dragon spacecraft is to re-establish an American launch capability for astronauts to use to reach the space station and make more use of its unique research environment. Experiments are conducted every day in orbit that will improve life on Earth and find answers to the challenges of deep space exploration so astronauts can undertake a successful journey to Mars in the future.

"Commercial crew is an essential component of our journey to Mars, and in 35 states, 350 American companies are working to make it possible for the greatest country on Earth to once again launch our own astronauts into space," said NASA Administrator Charles Bolden. "That's some impressive investment."

NASA expects to use the Starliner and Crew Dragon to take four crew members to the space station at a time, increasing the resident

crew on the orbiting laboratory to seven at a time instead of the current six. By adding the workweek of a single new crew member to the capabilities of the space station, the amount of research time available to astronauts in orbit will double to about 80 hours a week.

Kennedy will be the home of Boeing's Commercial Crew Program, with other buildings at the center to be used as Boeing's Launch Control Center and for mission support.

"Kennedy Space Center has transitioned more than 50 facilities for commercial use. We have made improvements and upgrades to well-known Kennedy workhorses such as the Vehicle Assembly Building, mobile launcher, crawler-transporter and Launch Pad 39B in support of Orion, the SLS and Advanced Exploration Systems," said Robert Cabana, Kennedy's center director. "I am proud of our success in transforming Kennedy Space Center to a 21st century, multi-user spaceport that is now capable of supporting the launch of all sizes and classes of vehicles, including horizontal launches from the Shuttle Landing Facility, and spacecraft processing and landing."

Boeing officials say Kennedy was a natural choice given its expertise along the full range of spacecraft and rocket processing to launch and operations.

"When Boeing was looking for the prime location for its program headquarters, we knew Florida had a lot to offer from the infrastructure to the supplier base to the skilled work force," said Chris Ferguson, a former shuttle commander who now is deputy manager of operations for Boeing's Commercial Crew Program.

The Starliner will launch from Cape Canaveral Air Force Station's Space Launch Complex-41 on a United Launch Alliance (ULA) Atlas V rocket. The crew access tower that will support astronauts and ground support teams before launch is being built a couple of miles away from the launch pad now and will be assembled adjacent to the current structures already at the pad. ULA will continue to operate the pad for Atlas V processing and launches during construction of the tower.

Although the infrastructure is coming together quickly, the first flight of the Starliner and Crew Dragon depends on a number of design and testing milestones for the entire space system before either one will be in a position to take its first flight test.

Working under contracts awarded last year, both Boeing and SpaceX agreed to conduct an orbital mission without a crew aboard for their respective spacecraft. Then each will launch a test flight, which includes astronauts, to demonstrate the spacecraft's ability to meet the demands of human-rated spaceflight. Following that mission, the spacecraft will be certified for operational missions carrying a full complement of crew to support the research work on the space station. And astronauts will once again will be taking regular flights from Florida's Space Coast.

NASA
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ISS MISSION UPDATE

By George Spiteri

Expedition Forty-Four is in its first month of operations aboard the International Space Station (ISS). The orbital outpost is crewed by its Russian Commander Gennady Padalka and Flight Engineers, Russians Mikhail Kornienko and Oleg Kononenko, Americans Scott Kelly and Kjell Lindgren and from Japan, Kimiya Yui.

There was a computer malfunction in the US segment of the ISS during the morning hours of 20th June. The crew were in no danger and power was later restored, having no impact on orbital operations. The following day, Padalka celebrated his 57th birthday and broke Sergei Krikalev's cumulative record time in space on 28th June of 803 days 9 hours 39 minutes, becoming the world's most experienced space traveller.

SpaceX launched their Dragon commercial cargo vehicle on the Commercial Resupply Services-7 (CRS-7) mission from Cape Canaveral at 1521 BST (1021 local time) on 28th June. Two minutes 19 seconds into flight and just before first stage shutdown the Falcon 9 rocket exploded in the skies above Florida. Initial reports indicated that the problem was with the rocket's second stage and SpaceX's CEO Elon Musk Tweeted that there "was an overpressure event in the upper stage liquid oxygen tank. Data suggests counterintuitive cause". The Dragon vehicle was carrying 4,300 pounds of supplies to the ISS including the critical International Docking Adapter-1 (IDA-1), the first of two instruments which would have allowed future commercial vehicles to dock at the Station. NASA said the Station has supplies till October and the crew were never in any danger.

Progress M-28M/60P was launched from Baikonur at 0555 BST (1055 local time) on 3rd July. Unlike the last Progress launch, everything went according to plan and the cargo ship docked at the Station's Pirs Module at 0811 BST on 5th July, using the two day rendezvous profile on this occasion, delivering more than three tons of food, fuel and supplies.

The first pair of a series of CubeSats were launched from Kibo's airlock on 13th July with the final pair being deployed three days later, in total 16 were launched included 14 Planet Lab Doves, 1 Arkyd-3 and 1 Centennial-1 Satellite.

The success of Progress 60 paved the way for the next manned launch. Soyuz TMA-17M/43S was launched from Baikonur at 2202 BST on 22nd July (0302 23rd July local time), carrying veteran Oleg Kononenko and rookies Kjell Lindgren and Kimiya Yui. Soyuz docked to the Rassvet Module at 0345 BST on 23rd July returning the ISS to a six person complement.

The crew continued with science experiments and maintenance work throughout the rest of July and early-mid August.

The mission's only planned EVA began at 1520 BST on 10th August when Padalka and Kornienko left the Pirs airlock. The cosmonauts rigged new equipment outside the Station's Russian segment and conducted a detailed photographic inspection of its exterior. Padalka and Kornienko also jettisoned a pair of used towels and an old antenna into retrograde orbits. The spacewalk ended after 5 hours 31 minutes at 2051 BST. It was the 188th EVA dedicated to ISS assembly and maintenance totalling 1177 hours or 49 days.

During the EVA, inside the European Columbus Module, Kelly, Lindgren and Yui participated in a piece of space history, consuming the first item of food grown in space. This was a sample of red romaine lettuce harvested as part of NASA's Veggie experiment. The aim being to grow food and make space travellers self sufficient during future long duration missions such as interplanetary trips to Mars. Inevitably, Kelly tweeted that "It was one small bite for man, one giant leap for NASA Veggie".

Progress M-26M/58P undocked from Zvezda at 1119 BST on 14th August and sent to an orbital demise over the Pacific Ocean later that same day. The next Progress vehicle is scheduled to arrive at the ISS in early October.

As of 14th August, Padalka, Kelly and Kornienko have been in space for nearly five months, whilst Kononenko, Lindgren and Yui have spent 24 days in orbit.

MSS

The International Docking Adapter

Engineers in the Space Station Processing Facility at NASA's Kennedy Space Center, Florida, recently tested the mechanisms that will connect future commercial crew spacecraft with the second International Docking Adapter. IDA-2, as it's called, will be taken to the space station on a future cargo resupply mission. It will be one of two connection points for commercial crew spacecraft visiting the orbiting laboratory. The systems and targets for IDA-2 are set to be put through extensive tests with both Boeing's CST-100 and SpaceX's Crew Dragon before the adapter is loaded for launch.

Two International Docking Adapters (IDA) will be the physical connecting point for spacecraft, but for NASA it will be a metaphorical gateway to a future in which crews go to the station aboard America's first new, human-rated spacecraft since the space shuttle.

The adapters are built to the International Docking System Standard, which features built-in systems for automated docking and uniform measurements. That means any destination or any spacecraft can use the adapters in the future – from the new commercial spacecraft to other international spacecraft yet to be designed. The adapters also include fittings so power and data can be transferred from the station to the visiting spacecraft. The work by private companies to take on low-Earth orbit missions is expected to free up NASA's resources for future missions into deep space with astronauts in the Orion crew capsule launching on the Space Launch System Rocket to prepare for future journeys to Mars.

Boeing's CST-100 Starliner and SpaceX's Crew Dragon spacecraft will dock at the adapters in the near future when bringing astronauts to the station as part of NASA's Commercial Crew Program.

An IDA will be placed on each of the station's two open Pressurized Mating Adapters (PMA), both of which will be connected to Harmony module. When each IDA arrives, the station's robotic arm would remove it from Dragon's trunk and move it to about 30 cm (1 ft) from the front of the PMA. Astronauts during an extravehicular activity would then attach tethers to the IDA and manually connect it to the PMA. The first spacewalks to prepare the station for the addition of the new adapters took place in early 2015.

It took international and national teams working together to construct the IDAs. Built by Boeing, parts from companies in 25 states were assembled to make the adapters, which measure about 42-inches tall and about 63-inches wide each. The Russian company RSC-Energia made the primary structures of the IDAs. Docking targets, laser retro-reflectors and related systems are arrayed around the outer perimeters to give them an outer diameter of about 94 inches.

The systems and targets for the IDA are much more sophisticated than previous docking systems and include lasers and sensors that allow the station and spacecraft to talk to each other digitally to share distance cues and enable automatic alignment and connection.

NASA
www.nasa.gov

ASTRONAUT NEWS

By Rob Wood



Opening comments

No sooner had I sent off my last Astronaut News to the editor when further news on astronauts came thick and fast. I already had some additional items to write including about a new ISS crew, Nicole Stott's retirement, changes at the top in NASA's Astronaut Office and a private spaceflight participant piece. Now, there is even more.

This is really going to be a busy Astronaut News. Within a day or so of completing the last one came details of potential commercial crew test astronauts, astronauts who are no longer active and ascans that are now active. July 2015 has been the busiest month for news about astronauts that I can remember.

The following list relates to July only and refers to the public first notice of the event and not necessarily the date of the change.

- 7 July 2015 – Cady Coleman, Rick Mastracchio and Steve Swanson joined the ranks of management astronauts.
- 8 July 2015 – New Chief of the Astronaut Office.
- 9 July 2015 – Commercial Crew Flight Crew Announcement.
- 9 July 2015 – Class of 2013 astronauts now eligible for flight assignment.
- 21 July 2015 – Tony Antonelli retires from NASA.
- 27 July 2015 – Stephen Frick retires from NASA.
- 30 July 2015 – ESA confirms assignment of Paolo Nespoli to ISS crew.
- 30 July 2015 – Michael Foreman retires from NASA.

The sheer volume of stories means that some will have to be held over into the next issue of Astronaut News.

All Change at the Top

From flight engineer on the ISS swapping food with his Russian colleagues to top dog in the Astronaut Corps in less than two years. With two spaceflight missions behind him Christopher Cassidy has taken over as Chief of the Astronaut Office at the Johnson Space Center (JSC).

I had been expecting a change in NASA's Chief Astronaut to occur at some point this year because the last few holders have served for three years and moved on. Robert Behnken was due to hit that milestone in August 2015 but prior to this, and quietly in March 2015, NASA's astronaut biographies were updated showing there was now a new Deputy Chief Astronaut.

Chris Cassidy had taken over from Eric Boe who was stepping down prior to taking up a new assignment. There was no fanfare or even a NASA news release. This was normal practice for the Deputy position and you just had to keep your ear to the ground to spot when this post changed hands. Chief Astronaut was a different matter however and a news release could confidently be expected when a change did occur.

The position of deputy would prove to be a stepping stone for Cassidy for on 8 July 2015 NASA released the news that that he was taking over from Behnken as Chief Astronaut. The following day we discovered that Behnken and Boe, along with Douglas Hurley and Sunita Williams were NASA's nominees for the first test flights of the new commercial crew vehicles (see the next story).

"Bob has provided outstanding leadership of our astronaut corps during the last three years," said NASA's Director of Flight Operations, Brian Kelly, speaking about Robert Behnken. "His selfless dedication and sound guidance has been top-notch as NASA ramped up research aboard the International Space Station and began laying the groundwork for human exploration missions beyond Earth orbit."

In his new role, Cassidy will be responsible for managing Astronaut Office resources, operations and safety programmes. He will be involved in choosing crews for upcoming space missions and developing training procedures. Cassidy had been a member of the Navy SEALs for 10 years before becoming an astronaut, a history that Kelly alluded to in speaking about the appointment.

"The Navy has a long history working with NASA and supporting astronauts – during the earliest US spaceflights, Frogmen helped return astronauts from a splashdown at sea," Kelly said. "Now, we are proud to have a Frogman leading the Astronaut Office. Chris has served this nation admirably in the most challenging of circumstances and he will be a great leader for the astronaut corps."

Christopher John 'Chris' Cassidy (Captain, USN) was born on 4 January 1970 in Salem, Massachusetts. In 1993 he received a Bachelor of Science degree from the US Naval Academy in Mathematics. Seven years later in 2000 he obtained a Master of Science degree in Ocean Engineering from the Massachusetts Institute of Technology.

Following graduation from the Naval Academy he married and then moved to San Diego where he underwent Navy SEAL training. He was the Honor graduate of Basic Underwater Demolition/SEAL Class 192. He was then assigned to SEAL Delivery Vehicle (SDV) Team TWO at the Naval Amphibious Base, Little Creek, Norfolk, Virginia, where he was based for about four years. He accumulated more than 200 hours underwater as pilot/navigator/mission commander of the two-man flooded SDV submersible.

After his two years at graduate school he was posted as a platoon commander in SEAL Team THREE based at the Naval Amphibious Base, Coronado, California. The team was preparing for a scheduled deployment when the September 11 (2001) attack occurred. They soon found themselves in Afghanistan. Cassidy was awarded the Bronze Star with combat 'V' and Presidential Unit Citation for leading a nine-day operation at the Zhawar Kili cave complex very close to the Pakistan border. He was awarded a second Bronze Star in 2004 for combat leadership service in Afghanistan.

In 2002 he was assigned back to Norfolk where he served as the Executive Officer and Operations Officer of Special Boat Unit TWENTY. He had already unsuccessfully applied for NASA's astronaut class of 2000 but decided to try again whilst based at Norfolk. He was interviewed by NASA in September 2003 and almost immediately afterwards deployed overseas again for a six-month tour. On the Monday after the weekend he returned home he received the telephone call from the then Astronaut Chief Kent Rominger asking if he was still interested in working for NASA. A month later, the Cassidy family had sold their house and were on the move to Houston.

He was selected as a mission specialist (MS) astronaut in 2004 (NASA Astronaut Group 19). He successfully completed basic training in February 2006 which made him eligible for technical duties in the Astronaut Office and flight assignment. He worked as a CapCom in Mission Control from 2006 to 2008.

NASA's news release of 12 February 2008 named Cassidy as a MS for STS-127, it was said to be targeted for launch in 2009. In July 2008 NASA said that the launch of STS-127 was due on 15 May 2009 but by 30 April 2009 this had been pushed further back to 13 June 2009.

The attempt to launch on 13 June 2009 was scrubbed due to a gaseous hydrogen leak and the same thing happened on 17 June 2009. In the event launch of his first spaceflight did not take place until 15 July 2009 and then only after three further scrubs due to weather conditions on consecutive days from 11 through 13 July 2009.

The mission of STS-127 Endeavour (15- 31 July 2009) delivered the Japanese-built Exposed Facility and Experiment Logistics Module Exposed Section to the ISS. With these, the crew were able to complete the construction of Kibo. Kibo is the Japan Aerospace Exploration Agency's ISS Experiment Module. Cassidy was MS-1 and conducted three spacewalks whilst the shuttle was docked to the station.

On 18 February 2011 NASA released the news that Cassidy would fly an expedition mission to the ISS. He was named to ISS Expeditions 35/36 with his flight due to commence in March 2013. From Russian sources, his name had been linked to this assignment in December 2010. Before his second spaceflight he would serve in a back-up flight engineer role for Soyuz TMA-06M/ISS33/34 which launched on 23 October 2012.

For his second spaceflight, Cassidy would serve as a flight engineer for both the Soyuz spacecraft and space station. The flight commenced on 29 March 2013 when he was launched aboard Soyuz TMA-08M from Baikonur. This was the first time the Soyuz used a new 6-hour fast rendezvous flight profile to the ISS. It had been tried on two unmanned Progress M resupply runs but this was its first use for a manned mission. The mission would last for 166 days before he returned to Earth in central Kazakhstan on 11 September 2011 in the descent module of the Soyuz.

During his time as an ISS35/36 crewmember he gained a taste for Russian food. "One of the Russian astronauts really liked our chocolate pudding," said Cassidy. "I would trade my pudding serving for their veal that I really liked." He also participated in three spacewalks but it was the third on 16 July 2013 that produced the most excitement and publicity.

The EVA began at 14:57 (Moscow Time). With Cassidy was Italian/ESA astronaut Luca Parmitano. 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. Parmitano suffered from impaired breathing and visibility, and had communication problems. Parmitano entered the airlock first but had to wait several minutes for Cassidy to join him and start closing the airlock hatch. Repressurization started but all the time Parmitano's situation was worsening. He had lost his audio communications and 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. 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.

Following his second spaceflight, Cassidy was assigned as Chief of Extravehicular Activity and Robotics for the Astronaut Office before in March 2015 moving into the role of a Deputy Chief of the Astronaut Office.

He is not the only SEAL to be admitted into NASA's astronaut corps. Bill Shepherd, who also served in Special Boat Unit TWENTY, joined the astronaut team in 1984. He made four spaceflights and was the first ISS commander.

Commercial Crew Vehicle Flight Crew

In the last issue I had a speculative piece about potential Commercial Crew Vehicle Flight Crew members. I wrote:-

"I have always said that the time to start taking real notice of the Commercial Crew Vehicle test flights is when we have some firm news of astronaut selection. By that I mean the naming of astronauts either on a crew or those who have been selected to train generically for these missions. It looks like we are closing in on the first such naming."

I noted that in January 2015, Ellen Ochoa, Director of the JSC and former astronaut, had indicated that a small cadre of astronauts would be named soon to commence generic training for the first flights. On 9 July 2015 NASA released the names of four astronauts selected to train for the test flights.

"I am pleased to announce four American space pioneers have been selected to be the first astronauts to train to fly to space on commercial crew vehicles, all part of our ambitious plan to return space launches to US soil, create good-paying American jobs and advance our goal of sending humans farther into the solar system than ever before," said NASA Administrator and former astronaut Charles Bolden. "These distinguished veteran astronauts are blazing a new trail -- a trail that will one day land them in the history books and Americans on the surface of Mars."

Pre-prepared hyperbole as we saw from the comments made by John Holdren, assistant to the President for Science and Technology and Director of the White House Office of Science and Technology Policy, who spoke along similar lines except for adding credits to his boss President Obama, "Their selection allows NASA to move forward with the training necessary to deliver on President Obama's ambitious plan for returning the launch of US astronauts to US soil, while creating good-paying American jobs, and moving us closer to the President's goal of sending astronauts to Mars in the 2030s." Now if only they can convince Congress to agree to sufficient and focused long-term funding.

The four named were all spaceflight veterans and have a military flight test background: Robert Behnken, Eric Boe, Douglas Hurley and Sunita Williams. They will work closely with The Boeing Company and SpaceX as they work towards the first commercial crew flights to the ISS. They will support the companies through their manned flight tests and certification activities.

The Commercial Crew Transportation Capability (CCtCap) contracts with the two companies require at least one manned flight test with at least one NASA astronaut on board. The NASA astronauts will verify that the fully-integrated rocket and spacecraft system can launch, maneuver in orbit, dock to the space station, land safely and validate that all systems perform as expected. The companies are required to provide the necessary training for the astronauts to operate their respective vehicles.

"Congratulations to Bob, Eric, Doug and Sunita and welcome to the Commercial Crew team," said John Elbon, Boeing Vice President and General Manager, Space Exploration. "We look forward to working with such a highly-skilled and experienced group of NASA astronauts as we carve a path forward to launch in 2017."

"Congratulations to Bob, Doug, Eric and Suni on being the first group of astronauts selected for flight training as part of NASA's Commercial Crew Program," said Gwynne Shotwell, President and COO of SpaceX. "We look forward to working with them even more closely as we prepare for the first human missions to the space station on Crew Dragon. Human spaceflight is why SpaceX was founded, and we look forward to supporting our nation's exploration efforts by launching astronauts from America again."

Once the test programme is completed successfully, a standard

mission to the station will carry four NASA or NASA-sponsored crew members and 220.5 pounds of pressurized cargo. The spacecraft will remain at the station for up to 210 days and serve as an emergency lifeboat during that time. Each company has a CcTcap contract that includes a minimum of two and a potential maximum of six crew rotation missions to the ISS.

Robert Louis Behnken (Colonel, USAF, Ph.D.) was born on 28 July 1970 in Creve Coeur, Missouri. In 1992 he received two Bachelor of Science degrees from Washington University in the subjects of Mechanical Engineering and Physics. These were followed by a Master of Science degree and a Doctor of Philosophy, both in Mechanical Engineering, from the California Institute of Technology in 1993 and 1997 respectively.

He was a United States Air Force (USAF) Reserve Officers' Training Corps student whilst he studied at Washington University and on completion of his time at the California Institute of Technology he entered active service with the USAF. He was assigned to Eglin Air Force Base (AFB), Florida, as a Development Engineer involved in munitions research in the USAF Research Laboratory.

He was a distinguished graduate from the USAF Test Pilot School, Flight Test Engineer's Course, at Edwards Air Force Base in 1999. After graduation, he was assigned to the fifth-generation super-maneuvrable jet fighter F-22 'Raptor' Combined Test Force at Edwards. During his flying career through to July 2015 he has accumulated over 1,500 flight hours in more than 25 different aircraft types.

He was selected as a MS astronaut in 2000 (NASA Astronaut Group 18). After two years basic training he was assigned technical duties in the Astronaut Office. In September 2006 he was an aquanaut during the NEEMO 18 undersea exploration mission. The aim of the NEEMO missions is to provide a convincing analog to space exploration. He made two spaceflights as a MS on the now retired US Space Shuttle.

His first was on STS-123 Endeavour (11-26 March 2008), which delivered the first component of the Japan Aerospace Exploration Agency's Kibo Laboratory and the final element of the ISS's Mobile Servicing System (the Canadian-built Special Purpose Dexterous Manipulator, known as Dextre). Behnken was MS-1 and conducted three spacewalks whilst the shuttle was docked to the space station. He operated both the station robotic arm and the Dextre robot. He was on the flight deck during launch and landing and helped the flight deck crew.

Not only did he make his first spaceflight in 2008 but he also got married. During the summer he married fellow astronaut Megan McArthur, who later flew on the 2009 Hubble repair mission. It was a busy year for him because during the autumn of 2008 he also trained as MS-1 for STS-400, the unused launch-on-need rescue flight for the last Hubble servicing mission. In the event, if the flight had been needed, he would not have flown as due to delays in the Hubble shuttle launch a new crew had been assigned.

His second spaceflight was on STS-130 Endeavour (8-21 February 2010) which delivered the Tranquility and Cupola modules to the ISS. Behnken was MS-4 and during the mission he operated the station's Canadarm and served as the lead spacewalker. He added three more spacewalks to his CV.

In January 2012 he was assigned as one of two Deputy Chiefs of the Astronaut Office. The Chief Astronaut at this time was Peggy Whitson, but he would serve as her deputy for only six months. She then stepped down and Behnken was named to replace her. His stint as Chief Astronaut lasted from July 2012 to July 2015.

Eric Allen Boe (Colonel, USAF, Ret.) was born on 1 October 1964 in Miami, Florida. In 1987 he received a Bachelor of Science degree in Astronautical Engineering from the USAF Academy. Ten years later he obtained a Master of Science degree in Electrical Engineering from the Georgia Institute of Technology.

He was commissioned into the USAF in 1987 and went to Sheppard AFB, Texas, for his pilot training. He graduated in 1988. The following

years saw a number of assignments and qualifications. He was an instructor pilot and test pilot, and flew several types of aircraft including the McDonnell Douglas F4-E Phantom, the Northrop T-38 Talon and the McDonnell Douglas F-15C Eagle. During his test career he even got to fly Huey helicopters (Bell UH-1 Iroquois).

In the mid-1990's he flew 55 combat missions over Iraq in support of Operation Southern Watch flying the F-15C. He graduated from the USAF Test Pilot School at Edwards AFB, California, in 1997. After graduation, he was assigned as the Director of Test, Air-to-Air Missile Test Division, 46th Test Wing, at Eglin AFB, Florida.

He was selected as a pilot astronaut in 2000 (NASA Astronaut Group 18). After two years basic training he was assigned technical duties in the Astronaut Office. From October 2005 to October 2006, he served as the Astronaut Office's Director of Operations at the Yuri Gagarin Cosmonaut Training Centre. He has made two spaceflights as pilot on the now retired US Space Shuttle.

His first spaceflight was on STS-126 Endeavour (14-30 November 2008), As well as being an ISS crew exchange mission it also delivered equipment to enable larger crews to reside aboard the complex. His second spaceflight was on STS-133 Discovery (24 February – 9 March 2011) which delivered the Leonardo Permanent Multipurpose Module to the ISS. The Italian built Leonardo was also on STS-126 when it was used in its original role as a logistics carrier.

From August 2011 to March 2015, he served as a Deputy Chief of the Astronaut Office. There were two deputies and his responsibilities included the Commercial Crew Programme. He retired from the USAF in February 2012. During his flying career he has accumulated more than 6,000 flight hours in more than 50 different aircraft.

Douglas Gerald Hurley (Colonel, USMC, Ret.) was born on 21 October 1966 in Endicott, New York. In 1988 he received a Bachelor of Science degree in Civil Engineering from Tulane University, Louisiana. Twelve years later in 2000 he obtained a Master of Science degree in Aviation Systems from the University of Tennessee Space Institute.

He studied at Tulane University under a United States Navy (USN) Reserve Officers' Training Corps scholarship and on completion of his time there was commissioned as a Second Lieutenant in the United States Marine Corps (USMC). He entered flight training in 1989 and was designated a Naval Aviator in 1991. He then trained to fly the McDonnell Douglas (now Boeing) F/A-18 Hornet. Flying this aircraft, he made several overseas deployments.

In 1997 he graduated from the United States Naval Test Pilot School at Naval Air Station Patuxent River, Maryland. He was then assigned to the Naval Strike Aircraft Test Squadron (VX-23) as an F/A-18 Project Officer and Test Pilot. During this assignment he became the first Marine pilot to fly the Boeing F/A-18E Super Hornet.

He was selected as a pilot astronaut in 2000 (NASA Astronaut Group 18). After two years basic training he was assigned technical duties in the Astronaut Office. His duties included lead of Astronaut Support Personnel and a tour as the Astronaut Office's Director of Operations at the Yuri Gagarin Cosmonaut Training Centre. He has made two spaceflights as pilot on the now retired US Space Shuttle.

His first spaceflight was on STS-127 Endeavour (15- 31 July 2009), which delivered the Japanese-built Exposed Facility and the Experiment Logistics Module Exposed Section to the ISS. With these, the crew were able to complete the construction of Kibo. His second spaceflight was the final flight of the Space Shuttle. STS-135 Atlantis (8-21 July 2011) delivered supplies to the ISS using the Italian built Raffaello Multi-Purpose Logistic Module and a Lightweight Multi-Purpose Carrier.

Following STS-135 he was assigned as Assistant Director, New Programs, for the Flight Crew Operations Directorate at the JSC. Following the merger of Flight Operations and Mission Operations in August, 2014, he became the Assistant Director for the Commercial Crew Program for the newly formed Flight Operations Directorate.

He retired from the USMC in September 2012. Similarly to Behnken,

Hurley is also married to a fellow astronaut, Karen Nyberg. She flew a near 14 day flight on STS-124 in 2008 and in 2013 spent over 160 days on the ISS. During his flying career Hurley has accumulated more than 5,000 flight hours in more than 25 aircraft.

Sunita Lyn 'Sunī' Williams (Captain, USN) was born on 19 September 1965 in Euclid, Ohio. In 1987 she received a Bachelor of Science degree in Physical Science from the US Naval Academy. In 1995 she graduated with a Master of Science degree in Engineering Management from the Florida Institute of Technology.

At the end of her time at the US Naval Academy she received a commission as an Ensign in the USN. She undertook a six-month basic diving officer course before reporting for flight training in November 1987. She was designated a Naval Aviator in 1989 and followed this by undertaking rotary-wing aircraft training. In 1993 she graduated from the United States Naval Test Pilot School at Naval Air Station Patuxent River.

During her operational and test flying career she has flown numerous helicopter types. She made overseas deployments in support of the US military campaigns against Iraq in the early 1990's. Following a period in test flying, she also had a spell as an instructor at the Naval Test Pilot School. She was deployed onboard the amphibious assault ship USS Saipan when she was selected as an astronaut.

She was selected as a MS astronaut in 1998 (NASA Astronaut Group 17). She successfully completed basic training and was assigned technical duties in the Astronaut Office. In May 2002 she was an aquanaut during the NEEMO 2 undersea exploration mission. She has made two long-duration spaceflights, accumulating over 320 days in space. Currently she holds the record for cumulative spacewalk time by a female astronaut and is ranked seventh on the all-time US time-in-space endurance list and in second place for a female astronaut of any nation.

Her first tour on the ISS was as a flight engineer for the ISS-14/15 mission (9 December 2006 – 22 June 2007). She travelled to and from the station on the US Space Shuttle's STS-116 Discovery and STS-117 Atlantis flights on which she was designated MS-5. Her second spaceflight was on the Soyuz TMA-05M/ISS32/33 mission (15 July – 19 November 2012). She was a flight engineer for the Soyuz and for the first part of her stay on the ISS before taking over command of the station for ISS-33. She conducted four spacewalks on her first mission and three on her second.

As well as her flown missions she was also appointed to the ISS/10 back-up crew in November 2002 but the loss of Columbia on 1 February 2003 led to a reshuffle of station crews and a reduction in crew numbers and Williams was dropped. A possible position as a flight engineer on ISS-12 was also ended by the delays in the Space Shuttle's return-to-flight. She was a back-up for Soyuz TMA-03M/ISS30/31 which launched on 21 December 2011.

In between her two spaceflights she spent time as a Deputy Chief of the Astronaut Office. During her flying career she has accumulated more than 3,000 flight hours in more than 30 different aircraft.

ISS Crewing Updates

The Interdepartmental Commission for the selection of cosmonauts and their appointment to space crews met at the Yuri Gagarin Cosmonaut Training Centre on 22 June 2015. They gave official confirmation of the first ISS expedition due to launch in 2017. The new crew is due to lift-off on 30 March 2017 on Soyuz MS-4 and will form part of the crews of ISS Expeditions 51/52.

Aleksandr Misurkin and Nikolay Tikhonov will represent the Russian Federal Space Agency. Representing NASA is Mark Vande Hei. Misurkin is the only one to have already flown in space. As early as March 2015 news had leaked onto Internet spaceflight message boards that the two Russians had been nominated for this crew and even Vande Hei's name had been linked before the official confirmation.

Aleksandr Aleksandrovich Misurkin (Lieutenant Colonel, Russian Federation Air Force Ret.) was born on 23 September 1977 in

Yershichi, Smolensk Region, Russia. In 1999 he graduated with honours as an engineer-pilot from the Armavir Higher Military Aviation Institute. Following graduation he worked as a flight instructor with the 627th Guards Pilot Training Regiment. He retired from the Air Force in 2012.

He was accepted for cosmonaut training in 2006. He received his basic cosmonaut training from February 2007 to June 2009 and was officially confirmed as a 'Test Cosmonaut' by the Interdepartmental Qualification Committee on 9 June 2009. He served as a back-up flight engineer for Soyuz TMA-06M/ISS-33/34 launched on 23 October 2012 before flying his own ISS residency.

His tour on the ISS was as a flight engineer for the Soyuz TMA-08M/ISS-35/36 mission (29 March – 11 September 2013). His second spaceflight in 2017 will see him fly as the commander of Soyuz MS-4. He will be a flight engineer for the initial part of his stay on the ISS before taking command of the space station for the second portion.

Nikolay Vladimirovich Tikhonov was born on 23 May 1982 in Novomoskovsk, Tula Region, Russia. In 2005 he graduated as an engineer from the Moscow Aviation Institute (MAI). The same year he started work with the S P Korolyov Rocket-Space Corporation Energiya. In 2004 whilst still a student at the MAI he passed the initial medical tests for the selection of cosmonauts.

He was formerly accepted for cosmonaut training in 2006. He received his basic cosmonaut training from February 2007 to June 2009 and was officially confirmed as a 'Test Cosmonaut' by the Interdepartmental Qualification Committee on 9 June 2009. He is designated a flight engineer for Soyuz MS-4/ISS-51/52. If the current schedule stays on plan he will be the last of the cosmonauts selected in 2006 to fly (excluding Maksim Ponomaryov who was eliminated from the cosmonaut corps before making a spaceflight).

Mark Thomas Vande Hei (Colonel, US Army) was born on 10 November 1966 in Falls Church, Virginia. He received a Bachelor of Science degree in Physics from St. Johns University, Collegeville, Minnesota, in 1989 and a Master of Science degree in Applied Physics from Stanford University, ten years later. He saw service as a combat engineer and space support team leader in the US Army during the US wars against Iraq.

Prior to his selection as an astronaut he was a CapCom flight controller for the ISS at the JSC as part of the US Army NASA Detachment. He was selected as an astronaut in 2009 (NASA Astronaut Group 20). He completed his Ascan training in June 2011. From June 2012 to May 2013, he served as the Astronaut Office's Director of Operations at the Yuri Gagarin Cosmonaut Training Centre. In 2014 he was an aquanaut during the NEEMO 18 undersea exploration mission. He is designated a flight engineer for Soyuz MS-4/ISS-51/52.

Private Spaceflight Participant Signs up for Flight

On 22 June 2015, Space Adventures, Ltd. announced that Satoshi Takamatsu, a Japanese entrepreneur, had signed a contract for a future orbital spaceflight mission. It was confirmed that he was stepping down from his back-up role as a private spaceflight participant for the Soyuz TMA-18M mission to the ISS but would continue his current training regimen in order to be fully certified as a flight eligible spaceflight participant.

When Sarah Brightman stood down from the Soyuz TMA-18M mission there was speculation that Takamatsu would take her place. In the event, Brightman was replaced by a Kazakh cosmonaut (see full story in last issue). Takamatsu explained why he did not take the opportunity.

"I have thoughtfully considered as to when I should realize my dream of spaceflight and have come to the conclusion that the art projects that I would like to perform in space require cutting-edge technology both in hardware and software. I need to dedicate myself to these projects and prepare diligently for them, and that cannot be satisfied before the next launch in September. Therefore, I will wait until the moment is right for me."

Tom Shelley, President of Space Adventures, Ltd., explained further. "Since January, Satoshi has been in spaceflight training as a member of the Soyuz TMA-18M backup crew and we are proud of the work that he has accomplished thus far. Based on his decision to plan for a future space mission, he has stepped down from the backup crew. He is continuing his training to be certified as a 'fully-trained spaceflight participant cosmonaut' that will convey toward his qualification for a future flight to the International Space Station. We hope that he realizes his dream of launching to space in the next 2-4 years."

It was back on 16 October 2014 when the Chief Medical Commission of the Russian space programme accepted Takamatsu for cosmonaut training. Exactly two months later the Interdepartmental Qualification Commission approved his appointment as the back-up to Sarah Brightman who was then due to fly a short visiting mission to the ISS in September 2015. On 15 January 2015 he arrived at the Yuri Gagarin Cosmonaut Training Centre to commence his cosmonaut training. He was joined by Sarah Brightman on 19 January 2015.

"I am delighted to be able to take advantage of this opportunity to train as a cosmonaut," he said at the time. "I am excited to prepare myself alongside professionals and to get their unique insight as to what it takes to train for a flight to space. I started dreaming of launching to space when I was 6 years-old when I watched the Apollo 11 lunar landing on TV. So this really is the fulfillment of a lifelong dream."

Satoshi Takamatsu was born on 5 May 1963. In 1979 he graduated from high school in the city of Utsunomiya in Japan before attending the University of Tsukuba. He graduated from there in 1983 with a Bachelor of Science degree in Solid State Physics. He worked as a Copywriter for Dentsu Incorporated, the largest advertising agency in Japan, from April 1983 to March 2002 and then as a Creative Director from April 2002 until September 2005.

In April 2002 (in conjunction with his work for Dentsu) he founded his own company, 'Space Films' based in Tokyo and took the position of Chief Executive Officer (CEO). The aim of the company was to provide end-to-end assistance for commercial space projects. The company has successfully helped complete three space projects on the ISS including a soft drink commercial (2001); a cup noodle commercial (2005) and the Olympus photography project (2009) with, for the latter, the help of Japanese astronaut Koichi Wakata who took photographs for the photographic exhibition from Kibo, Japan's ISS module.

In September 2005 he left Dentsu and founded his own creative agency 'Ground' where he was the Chief Creative Officer. In April 2012 and run concurrently with 'Space Films' and 'Ground' he founded 'Space Travel', a space travel agency. He is also the CEO. In July 2013 'Space Travel' entered into partnership with Space Adventures' to market the latter's space experiences in Japan.

Space Adventures, Ltd., is the only commercial company that has brokered spaceflight tourist trips to the ISS. Their HQ is in Washington DC and they also have an office in Moscow. They offer other spaceflight related experiences such as parabolic aircraft rides, spaceflight training and launch tours to Baikonur. They hope to be able to offer suborbital spaceflights at some point. And, if you really have a lot of spare cash, and I mean a lot - somewhere in the region of \$150 million, they offer a circumlunar mission with the Russians. If rumours are correct they have sold one ticket for the moon flight but need two sales to make the mission a GO.

"We have worked with Mr Takamatsu over the last decade and as we continue our efforts to expand private spaceflight opportunities, we look forward to work closely with him and his newly formed Space Travel firm in providing these opportunities to the people of Japan," said Tom Shelley at the time the two companies got together. "Mr Takamatsu is a big space fan, but also a very successful businessman and brings his own unique experience as the only person to direct a television broadcast commercial onboard the International Space Station. I am looking forward to a very fruitful partnership."

It was a fruitful partnership because it was Space Adventures' that brokered the deal for Satoshi Takamatsu to serve as back-up to Sarah

Brightman. The cost of the training is at least \$3 million but this can be offset against the cost of an actual spaceflight.

In addition to conventional advertising projects, Satoshi Takamatsu is known as a pioneer in the field of non-standard advertising, integrated campaigns, media and brand projects. He has won many major international awards in the field of advertising and has served on the jury of many competitions for advertisers.

After the announcement on 22 June 2015 that he would not continue as back-up for Soyuz TMA-18M he remained at the Yuri Gagarin Cosmonaut Training Centre and at the end of the month conducted his water survival training. His training took place over 29 to 30 June 2015 and the crew was made up of an instructor and Aaydin Aimbetov, the Kazakh cosmonaut who replaced Brightman.

Astronaut Leaves for her Art

When one thinks of artist astronauts, the names of the first spacewalker Alexei Leonov and the fourth moonwalker Alan Bean come to mind, but there have been others. Vladimir Dzanibekov who from 1978 to 1985 flew on five spaceflights took up the paint brush. Michael Collins who was the Command Module Pilot on Apollo 11 now paints watercolour landscapes of his Florida Everglades home. Their ranks have now been swelled by Nicole Stott whose last day at NASA was 31 May 2015.

Whilst on the ISS she had tried her hand at watercolours. She had taken with her a paintbrush of a friend who worked at the Kennedy Space Center (KSC) but later admitted her work would not win any prizes. However, it is the arena of 'Modern Art' that her sights are set on. Even that description may be too passé to fit with her intentions. Perhaps a good descriptor would be 'New Media Art' (it is called a "new media approach" in the Tampa Bay Times).

Stott talked about her plans in an interview with 'Spaceflight Insider' on 26 July 2015. She told the interviewer, Jason Rhian, that what she was doing was "mixed media" based on the photographs she took from space. She emphasised that it was not editing photographs on a computer or doing "PhotoShop-y" as she phrased it. She explained further, "What I'm really doing is taking the image and either layering it with multiple images or embellishing it with paint in some way or I got some larger format stuff that I have done. I've added some sea glass and things to them, so it's kind of a physical mixed-media kind of thing."

Although in early planning stages she hopes her work will be exhibited in galleries across the Tampa Bay area and other places. Her aim is that her works will be used to educate students about careers in the STEM disciplines as well as art.

Nicole Marie Passonno Stott was born on 19 November 1962 in Albany, New York. She was bitten by the flying bug in her early teens encouraged by her father. She helped him build small aerobatic biplanes in the family garage and at the local airport. Even the tragic accident that saw her father killed in an experimental aircraft when she was aged 16 failed to dim her enthusiasm for long.

She attended school in Clearwater, Florida, and following graduation in 1980 entered St Petersburg College also in Florida where she studied Aviation Administration. One thing that had attracted her to this course was that it also offered a private pilot's training programme through which she earned her pilot's license aged 18.

After a year at St Petersburg College she enrolled at Embry-Riddle Aeronautical University. On graduation in 1987 she received a Bachelor of Science degree in Aeronautical Engineering. Five years later in 1992 she obtained a Master of Science degree in Engineering Management from the University of Central Florida.

She had wanted to join NASA after she had completed her undergraduate degree course but NASA was on a hiring freeze. She therefore accepted an offer to join Pratt and Whitney Government Engines as a structural design engineer in West Palm Beach, Florida. She worked for a year with the Advanced Engines Group performing structural analyses of advanced jet engine component designs.

NASA began hiring again and in 1988 she accepted a position with them. Over the next ten years she held a number of posts related to the Space Shuttle and the ISS whilst based at the KSC. She was Operations Engineer in the Orbiter Processing Facility; Shuttle Flow Director for Endeavour; Orbiter Project Engineer for Columbia; NASA Convoy Commander for shuttle landings and a member of the Space Station Hardware Integration Office. For a short time she worked out of Huntington Beach, California, where she was the NASA Project Lead for the ISS truss elements under construction at the Boeing Space Station facility.

She had always thought being an astronaut was really 'cool' but she did not think it was a realistic prospect for herself. That changed during her time at the KSC. Several of her mentors there encouraged her to apply for astronaut selection. NASA called for applications for their 17th group of astronauts and Stott applied. She was one of 2618 to apply and when 121 finalists were called to the JSC for interviews and medical examinations Stott was one of them.

She did not make the final 25 when they were named on 4 June 1998 but she was offered a job at the JSC's NASA Aircraft Operations Division. She was a flight engineer on the highly modified Grumman Gulfstream-II Shuttle Training Aircraft (STA) and helped to train astronaut pilots to land the Space Shuttle. The STA mimics the cockpit configuration and flight characteristics of the Space Shuttle. It was not long before NASA started a new recruitment process for their 18th group of astronauts and she applied again.

Again she made the finalists and was one of 123 who were called to attend the interviews and examinations. This time, when those selected were announced on 26 July 2000, she was one of the 17 named as new astronauts. She was selected as a MS astronaut and after two years basic training she was assigned technical duties in the Astronaut Office. She was initially in the ISS Operations Branch. She was a crew support astronaut for ISS-10 which flew in 2004/2005 and served as a CapCom in mission control.

In April 2006 she was an aquanaut during the NEEMO 9 undersea exploration mission. This was the longest NEEMO mission to date. She lived and worked for 18 days on the Aquarius undersea research habitat. The NEEMO 9 mission served as an analog for future lunar operations – the crew tested advanced space suit design concepts, robotic devices for surface-based exploration, construction and communication techniques, and advanced telemedicine hardware and techniques. She holds the women's world record for saturation diving with this mission.

On 12 February 2007 NASA announced that Stott would serve as the back-up to Sandra Magnus for ISS-17 targeted for summer 2008. On 11 February 2008 NASA named her to ISS-20/21. At this time the plan was for Stott to travel to the ISS on the Space Shuttle (STS-128) and return to Earth on a Soyuz (TMA-15) but that would change when it came to the actual mission. A little later than planned Magnus was launched on STS-126 on 14 November 2008.

Whilst training for her first spaceflight she visited the main training sites of ISS partner states: Star City, in Russia; Tsukuba, Japan; Cologne, Germany; and Montreal, Canada. On 3 March 2009 NASA announced a change of plan for her return to Earth. She would exchange return vehicle with Canadian astronaut Robert Thirsk over concerns that the Space Shuttle would be unable to keep to schedule leaving Thirsk to fly longer than the nominal six-month duration (considering the normal operations of the Space Shuttle the only surprise is that NASA did not do this from the start).

STS-128 Discovery was launched from pad 39A at the KSC on 28 August 2009. Stott was MS-5 for her two day journey to the ISS. Whilst Discovery was still docked with the space station she performed a 6½ hour spacewalk with John 'Danny' Olivas to prepare for the replacement of an empty ammonia tank, and retrieve a materials processing experiment and a European science experiment. During her residency, the first Japanese cargo spacecraft, HTV-1 visited the station. It was Stott, using the station's robotic arm (Canadarm-2), that made the initial capture of the HTV prior to it being berthed to the station.

She would spend the best part of three months working as a flight engineer for ISS-20/21 expeditions before returning to the MS-5 position for her return to Earth on STS-129 Atlantis. During her stay on the ISS she helped maintain the US portion of the station and its payloads. Her duties included working with the station's international partners on the Japanese and European modules. STS-129 landed at the KSC on 27 November 2009. She was the last ISS crewmember to return to Earth on an STS spacecraft.

Even before she had completed her first spaceflight she knew that she would be making a second. The public announcement came on 18 September 2009 whilst she was still on the ISS. She was named as a MS for STS-133 targeted for launch in September 2010 and the mission was, at the time of the announcement, the last scheduled Space Shuttle spaceflight. In the event two more were flown although STS-133 would be the last one for Discovery.

As was usual for the Space Shuttle system the mission was delayed due to technical issues with various dates being set for October 2010, November 2010 and February 2011. STS-133 Discovery was finally launched from pad 39A on 24 February 2011. She was designated MS 4. The flight carried the Italian built Leonardo Permanent Multipurpose Module (PMM) and the fourth Express Logistics Carrier (ELC). Stott was one of the operators of the station's Canadarm for the installation of the PMM and ELC. She also served as the intra-vehicle crew member for the flights EVA operations.

When STS-133 docked with ISS it was the first and only time that all space station supply vehicles were docked to the station. The unmanned vehicles: Japan's HTV, the Russian Progress and ESA's ATV, and the manned spacecraft; two Soyuz ferry vehicles and the Space Shuttle. Discovery returned to Earth at the KSC on 9 March 2011. Stott was on the flight deck during both ascent and descent and performed the flight engineer role for the latter.

Following her second flight she was assigned to the KSC as the Astronaut Office representative to the Commercial Crew Program. In 2012, she returned to the JSC as the Astronaut Office Space Station Integration Branch Chief and then in 2014 became Chief of the Vehicle Integration Test Office. She was also the lead Astronaut representative to the Orion Landing and Recovery team.

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.

- Chris Hadfield: 19 January 2016 at the Symphony Hall, Birmingham.
- To be named at the end of October – a moonwalker: 8 – 9 April 2016 with Space Lectures events in Pontefract.

Although the Space Lectures guest has not been announced, two clues have been given – “we can confirm that our guest is a moonwalker and a first time visitor to Space Lectures”. There are only four living moonwalkers who have not attended a Space Lectures event: Eugene Cernan, Harrison Schmitt, David Scott and John Young. Young's health precludes him taking part and a previous attempt to bring Schmitt to Pontefract fell through so I would surmise that the new guest is either Cernan or Scott.

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 in the details shown.

Continued on back page ...

Mir – the end

By Andy Salmon

Continuing our series of articles by our late chairman Andy Salmon, we reproduce here an article published in the Federation of Astronomical Societies Newsletter Issue no 63 (Winter 2000)

www.fedastro.org.uk

After a false dawn in 2000 it seems that the Russian space station Mir will finally fall to Earth in 2001 after 15 years of activity. Everyone thought the end was nigh for Mir in the autumn of 1999. The Russian government declined to fund further operations because they couldn't keep Mir going at the same time as honouring their commitments to the new International Space Station (ISS).

There were various rumours of Mir being saved by western capitalists but everyone was surprised when the rumours turned out to be true. The Mircorp company was set-up with millions of dollars from two western investors. Launch of a repair crew was financed and they set to work. Mir was re-activated, its air-leak plugged and science activities started again. Several Progress robot logistics flights were also funded – to fire their engines and so keep Mir's 350-400 km high orbit from decaying.

But by the middle of the year 2000 Mir was unoccupied again and precious few sources of income to Mircorp had materialised - apart from the planned flight of two fee paying passengers in 2001 and 2002. The falls in the high-technology stock market meant that Mircorp's investors provided only promises of future cash rather than the much needed hard currency. Mir's owners (and builders) RKK Energia "paid for" a further Progress tanker flight in October 2000 – meaning that they took it from their production line of Progress tankers intended for ISS.

There were several Russian Space Agency meetings in October where it was said the final decision on Mir's future would be made. But no-one wanted to be the person that signed its "death warrant". Ultimately the issue was fudged. The council of chief designers said that Mir was capable of further operations. The head of the Russian Aviation & Space Agency (RAKA) said that Mir should be de-orbited unless further funds were provided from outside the government. And the government itself provided theoretical funding from the proceeds of R&D licences – though this amounted to almost nothing. Old time communists in the Duma (parliament) made lots of noise about government funding for Mir and motions were debated but they amounted to naught.

Push came to shove in November when the government finally got plans from RKK Energia for what to do with Mir in 2001. Government payment for one last tanker flight in February 2001 and then a controlled de-orbit in late February. Or just use the tanker still docked to Mir for the de-orbit engine burn – though this would be less controlled – with less propellant available to cope with any last minute perturbations to the controlled descent. And an "emergency" crew should be available (funded by the government) to take control of Mir or the tanker in the event of a failed tanker docking or any loss of Mir control before the final de-orbit burns.

Such a "salvage" crew has docked with a totally out of control space station before (Salyut-7) so it's not as impossible as it sounds. The Russian government is liable for any damage caused by Mir's return to Earth so they opted for the last tanker flight and agreed for the emergency crew to be placed ready.

Incidentally some of the other suggestions included destruction of Mir by a missile or dismantling Mir into its component modules for separate de-orbit – but these would generate even more uncertainties in the debris spread.

As if to confirm Mir's end, Mircorp made a press announcement on December 12 that "the board took a decision to cease the marketing

of the Mir space station" and was throwing in its lot with the Russian part of ISS.

In late January a Progress-M1 tanker with a double load of propellant will dock with Mir. Over several days it, along with another Progress-M tanker already docked to Mir, will make synchronised engine firings. Mir's orbit will be lowered to just 170 km high.

Then there is one last 800 second long firing by the Progress-M1, over Africa. A few minutes later, over Russian tracking stations, the orbit will be fine-tuned. As it passes over Australia, New Zealand and the Marquesas Islands (French Polynesia) on successive orbits, the thicker atmosphere rushes to meet Mir at just 80 km high.

On February 27 or February 28, a strip of sea far to the East of Australia, away from shipping lanes, 200 km wide and 6,000 km long will be showered with whatever survives the entry of the 130 tonne Mir into Earth's lower atmosphere.

A propaganda banner at Russia's spaceport in Kazakhstan, Baikonur Cosmodrome, reads "Russia has been, is, and always will be, a space power". Mir was the last visible manifestation of that for much of the world. But with ISS now up and running Russia can keep its space infrastructure going. Not as prolific as it used to be; and it's no longer in full control; but there is a need for Russian rockets, lifeboats, tanker craft, some flight control, cosmonaut/astronaut training and a spaceport to launch them from.

The sad part is that there are almost no funds for Russian science on ISS and that many tonnes of perfectly usable research hardware will be burnt up on Mir. Expect most of the hardware on the Russian side of ISS to be provided by countries like France and India or even commercial western companies.

Mir has been used for astronomy in the past but most fields of that science can be accomplished far easier from robotic satellites. What Mir, and ISS, is most useful for are the fields of materials science, life science, fundamental physics/biology/ chemistry and space technology (testing hardware for ultimate use on robotics spacecraft). And the often unspoken reason for Mir and ISS: to learn how to preserve human life in space ready for long duration spaceflight. We still have a lot to learn about the psychological and physiological effects of spaceflight and counter-measures for them.

Mir was built to last 5 or 6 years. It has lasted 15 years and is still usable. Please don't remember Mir just for its terrible year of 1997 (the fire; Progress freighter collision; life support and computer failures).

Remember instead the 62 successful robot dockings; the assembly of a space station from 6 add-on modules; the 70 spacewalks – including assembly of 3 solar panels to provide power and construction of a 14 metre high pylon to hold a thruster module; nearly 10 years of continuous occupation; 28 long duration stays by crew; and the 437 day long flight of Medical Doctor Valery Polyakov.

As a footnote to history, on December 8 the Russian Aviation and Space Agency hosted a meeting of the "Transnational Committee on mission support and operation of Mir space station".

The meeting reviewed the results of activities under the space station flight test program for the period of 1986 - 2000 - "It noted that:

- All the activities envisaged in the flight test program for modular space station Mir which was approved in 1986 had been fully completed;
- Technologies for creating, deploying and operating permanently manned space stations have passed developmental tests;
- The research program has been completed;
- Mir space station operational life in orbit has exceeded the originally specified 5-year life in orbit by a factor of three.

Taking into account the fact that the Mir space station was in a fully operational condition, the Committee confirmed that its operation could be further extended”.

Image below: This is a view of the Russian Mir Space Station photographed by a crewmember of the fifth Shuttle/Mir docking mission, STS-81. The image shows: upper center - Progress supply vehicle, Kvant-1 module, and Core module; center left - Priroda module; center right - Spektr module; bottom left - Kvant-2 module; bottom center - Soyuz; and bottom right - Kristall module and Docking module. The Progress was an unmaned, automated version of the Soyuz crew transfer vehicle, designed to resupply the Mir. The Kvant-1 provided research in the physics of galaxies, quasars, and neutron stars, by measuring electromagnetic spectra and x-ray emissions. The Core module served as the heart of the space station and contained the primary living and working areas, life support, and power, as well as the main computer, communications, and control equipment. Priroda's main purpose was Earth remote sensing. The Spektr module provided Earth observation. It also supported research into biotechnology, life sciences, materials science, and space technologies. American astronauts used the Spektr as their living quarters. Kvant-2 was a scientific and airlock module, providing biological research, Earth observations, and EVA (extravehicular activity) capability. The Soyuz typically ferried three crewmembers to and from the Mir. A main purpose of the Kristall module was to develop biological and materials production technologies in the space environment. The Docking module made it possible for the Space Shuttle to dock easily with the Mir. The journey of the 15-year-old Russian Mir Space Station ended March 23, 2001, as the Mir re-entered the Earth's atmosphere and fell into the south Pacific Ocean.

Source: Wikimedia Commons
<https://commons.wikimedia.org>



Astronaut News: Continued:

COMMENTS & UPCOMING IN THE NEXT ISSUE OF ASTRONAUT NEWS

Next time I will cover the items I ran out of time for (not helped by a computer breakdown).

Acknowledgements and sources:

Amazon; Astronaut.ru; Autographica; CapCom (previous issues); Collect Space; Dentsu Incorporated; ESA; Facebook; The Free Dictionary; Google; LinkedIn; Manned Spaceflight Log II 2006-2012 ©2013 by David J Shayler and Michael D Shayler; NASA and its various centres; NASA Astronaut Selections ©2003 AIS Publications; NASASpaceflight.com; Navyseals.com; NBC News; Novaspace; Novosti Kosmonavtika; The Red Circle ©2012 by Brandon Webb and John David Mann; Seals: The US Navy's Elite Fighting Force ©2008 by Mir Bahmanyar and Chris Osman; Space Adventures'; Spacefacts; Spaceflight Insider; SpaceNews.com; Spacetoday.net; Tampa Bay Times; Timeanddate.com; United States Navy official website; Wikipedia; Yuri Gagarin Cosmonaut Training Centre.

Fifth Mission for Ariane 5 This Year

On the evening of 30th September an Ariane 5 delivered two telecom satellites into their planned orbits after lifting off from Europe's Spaceport in Kourou, French Guiana.

The launch of flight VA226 occurred at 20:30 GMT.

Sky Muster, with a mass of 6440 kg and mounted in the upper position atop Ariane's Sylta dual-payload carrier inside the fairing, was the first to be released about 28 minutes into the mission.

Following a series of burns controlled by Ariane's computer, the Sylta structure encasing the 2977 kg Arsat-2 was then jettisoned. Arsat-2 was released into its own transfer orbit about four minutes after the first satellite.

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<http://www.esa.int>

Next-Up: Principia Mission

Principia is the name given to UK astronaut Tim Peake's six-month mission on the International Space Station to maintain the weightless research laboratory and run scientific experiments for hundreds of researchers on Earth.

Tim will leave our planet on 15 December 2015 from Baikonur cosmodrome in Kazakhstan on a Soyuz rocket with NASA astronaut Tim Kopra and commander-cosmonaut Yuri Malenchenko.

A former army helicopter pilot, Tim will travel in the left-hand seat of the capsule and act as co-pilot to Yuri. The crew will arrive at the Space Station with six other astronauts waiting for them. They will share the Station briefly with NASA astronaut Scott Kelly and Russia's Mikhail Kornienko, who will be finishing the last part of their 11-month stay in space.

Science is an important part of the mission. Tim will conduct a wide range of experiments on the Station, an out-of-this world research outpost that serves as a stepping stone for human exploration.

During Principia, Tim will perform more than 30 scientific experiments for ESA, and take part in a dozen research activities for the other Station partners.

Principia is the eighth long-duration mission for an ESA astronaut and was named after Isaac Newton's ground-breaking text on physics, *Naturalis Principia Mathematica*, describing the principal laws of motion and gravity physics. Tim is passionate about quantum physics and cosmology.

Education and inspiring youngsters is another core element of Principia. Tim is determined to make Principia an exciting adventure for the younger generation. As an ambassador for science- and space-based careers, he has an intensive programme to inspire children during his stay in space.

School activities running alongside Tim's mission have some element of science or technology in it, from computer coding, growing plants and maths demonstrations to fitness and nutrition.

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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.

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