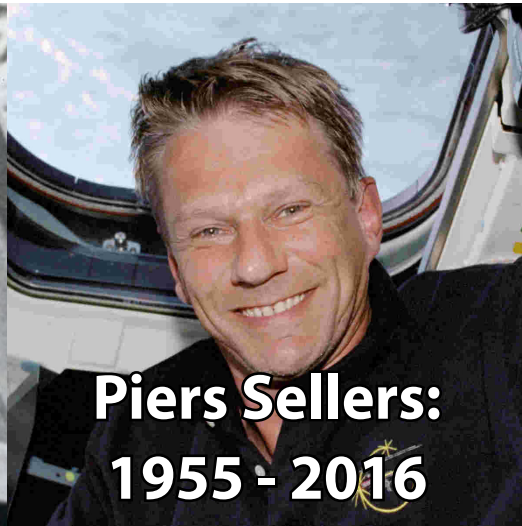




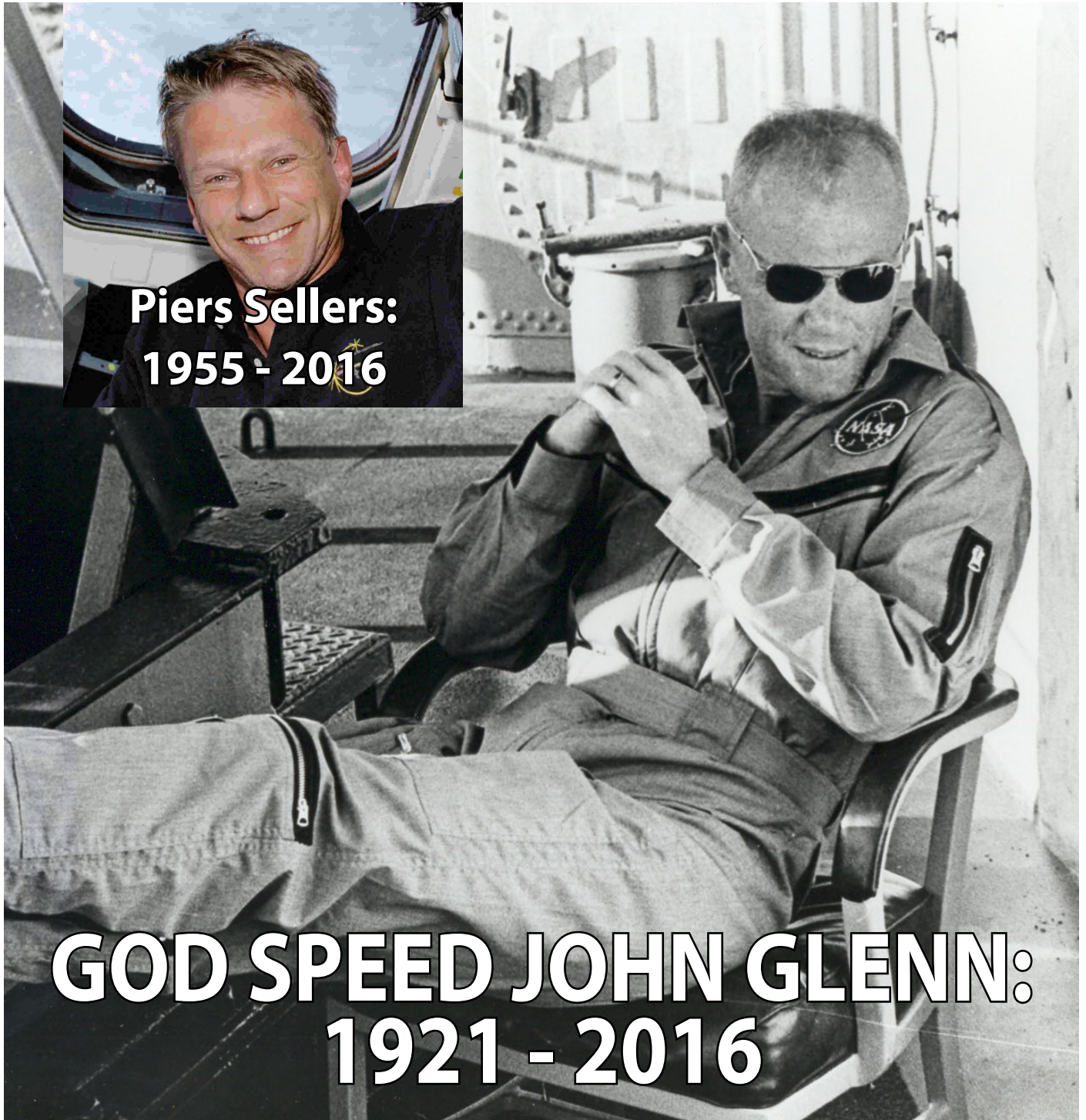
your window to space

capcom

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**Piers Sellers:
1955 - 2016**



**GOD SPEED JOHN GLENN:
1921 - 2016**

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space news roundup

Piers Sellers: 1955 - 2016

Astronaut Piers Sellers passed away on 23rd December in Houston of pancreatic cancer. For several years Dr. Sellers had served as acting director of the Earth Sciences Division at NASA's Goddard Space Flight Center in Greenbelt, Maryland. The following is a statement from Goddard Center Director Chris Scolese on Sellers' passing:

"Piers came to Goddard in 1982 from his native Britain and ultimately left a legacy that few can claim. His career path took him from scientist, to astronaut, and back to his roots as a leader in Goddard's Sciences and Exploration Directorate.

"After learning he had pancreatic cancer more than a year ago, Piers' optimistic take on life – well-known within the gates at Goddard – inspired people around the world. He spoke eloquently about his confidence in humanity's ability to confront the challenges of climate change, even as he faced his own terminal diagnosis.

"Piers' contributions to Earth science are beyond significant. His Simple Biosphere Model was the first to realistically simulate the interaction of global photosynthesis and Earth's climate. The focus of research throughout his career, his first-author papers on biosphere-climate interactions have been cited thousands of times. He led major field campaigns, FIFE and BOREAS, that combined ground, airborne, and satellite measurements at an unprecedented scale. He was the first project scientist of the Terra mission, which remains healthy in orbit today, 17 years after launch.

"When the opportunity arose, Piers made good on a childhood dream and was accepted to NASA's astronaut corps. On missions STS-112, 121, and 132, he helped complete construction of the International Space Station, and gained the perspective of seeing Earth from space that he would talk about for years to come.

"In 2011, we at Goddard were fortunate that Piers chose to return to help lead the Sciences and Exploration Directorate and Earth Sciences Division. With wit and humor, and yet a razor-sharp focus on the task at hand, Piers has helped energize Earth science at Goddard in recent years.

"We remember Piers as an exceptional scientist and leader, but most importantly as an inspiring human being. He could make you think anything was possible, was always up for the adventure, and would remind you along the way how lucky we are to do the work we do here at Goddard."

NASA Goddard Spaceflight Center
<http://www.nasa.gov/goddard>

UK space sector continues to grow, outlook bright

The Agency's latest survey of the UK space industry, carried out every two years, shows that the sector has continued to grow strongly.

Produced by London Economics, the 'Size and Health of the UK Space Industry 2016' report represents the definitive latest source of information on the UK space sector. This year's report shows that space continues to be a key infrastructure for the UK, supporting more than £250 billion of output across the economy with telecommunications, navigation, earth observation and meteorology services.

The sector is now estimated to directly employ 38,500 people. With output per worker almost three times the UK average, the sector is highly productive and has a workforce that is among the most highly

skilled in the economy, with three in four employees holding at least a primary degree.

Firms are also positive in their expectations for the future. 7 in 10 responding businesses expect their income to grow over the next few years, and over half expect export sales to grow. Exports are an important source of income for the sector, accounting for over a third of revenues in 2014/15.

With a range of improvements to method and more than twice as many companies responding, this year's report provides the most robust evidence yet on the main characteristics of the UK space industry and on perceived challenges and opportunities looking forward. Survey responses are supplemented with detailed secondary research and analysis to give the most accurate overview possible.

UK Space Agency

<https://www.gov.uk/government/organisations/uk-space-agency>

UK at the forefront of NASA's CYGNSS mission

A UK company is at the forefront of NASA's latest Earth observation mission to see inside tropical storms and hurricanes like never before.

Surrey Satellite Technology has developed the Space GNSS Receiver Remote Sensing Instrument (SGR-ReSI) for the Cyclone Global Navigation Satellite System (CYGNSS) mission providing scientists with innovative satellite technology.

The CYGNSS mission, which launched from Cape Canaveral Air Force Station in Florida on 15 December, is part of a NASA programme to improve extreme weather prediction by studying how tropical cyclones form.

CYGNSS will measure ocean surface winds in and near a hurricane's inner core, including regions previously could not be measured from space. CYGNSS will use both direct and reflected satellite navigation signals to obtain estimates of surface wind speed over the ocean.

Surrey Satellite Technology demonstrated the technology for the first time on its UK-DMC mission launched in 2003. It has subsequently developed the SGR-ReSI with sponsorship from the UK Space Agency, Innovate UK and the UK Centre for Earth Observation and Instrumentation and Space Technology. The first flight of the SGR-ReSI is on the UK TechDemoSat-1 mission, with exploitation support from the European Space Agency.

The UK is already a world-leader in satellite technology and Earth observation. In September the UK Space Agency unveiled new support to help the UK space sector maintain its leading position in Earth observation, helping to tackle global issues such as deforestation and disaster monitoring. This support included a new £2m joint programme for UK companies and academia to develop innovative technologies to observe the Earth from space.

Working together with the University of Leicester, Airbus Defence and Space UK, and RAL Space, the £2m funding from UK Space Agency will support UK companies and academia to develop their technologies and help them gain access to government funding worth up to £10 million.

UK Space Agency

<https://www.gov.uk/government/organisations/uk-space-agency>

ESA To Supply Service Module For First Crewed Orion Mission

ESA and NASA are extending their collaboration in human space exploration following confirmation that Europe will supply a second Service Module to support the first crewed mission of the Orion spacecraft.

The mission is set for launch from NASA's Kennedy Space Center in Florida, USA, as early as 2021 and will include up to four astronauts – the first time humans have left low orbit since 1972. Crew size and composition will be determined closer to launch.

The mission will see Orion follow three progressively elongated orbits to reach past the Moon and return to Earth, faster than any manned spacecraft has reentered our atmosphere before.

ESA's Director of Human Spaceflight, Dave Parker, says, "We are excited to be a part of this historic mission and appreciate NASA's trust in us to help extend humanity's exploration farther afield into our Solar System."

The first Orion with the service module will be launched in late 2018 on NASA's new Space Launch System. The month-long mission will be unmanned and will orbit the Moon before returning to Earth, testing the spacecraft and rocket before carrying astronauts.

Automated Transfer Vehicle

The European Service Module is designed, built and assembled by a team of companies from 11 countries led by Airbus Space & Defence, based on proven technology from ESA's Automated Transfer Vehicle that flew to the International Space Station five times with supplies.

The mission and collaboration with NASA is part of ESA's vision to prepare for future voyages of exploration further into the Solar System, and continues the spirit of international cooperation that forms the foundation of the International Space Station.

ESA
<http://www.esa.int>

Ariane 5's Seventh Launch This Year

An Ariane 5 lifted off on 21 December 2016 to deliver two telecom satellites, Star One-D1 and JCSat-15, into their planned orbits.

Arianespace announced liftoff at 20:30 GMT from Europe's Spaceport in Kourou, French Guiana for a dual payload mission lasting about 43 minutes.

Star One-D1, with a mass of 6433 kg at liftoff, was the first satellite to be released, about 29 minutes into the mission. The 3400 kg JCSat-15 was released 14 minutes later.

Star One-D1, owned by Embratel Star One, will handle broadcasting, broadband, Internet access and other digital applications over Brazil, Latin America, Central America, Mexico and the Caribbean.

JCSat-15, owned by SKY Perfect JSat, will offer a range of communications services for Japan, including broadcasting, data transfer, and maritime and aeronautical applications for the Oceania and Indian Ocean regions.

Both satellites are designed to last more than 15 years.

The payload mass for this launch was 10 722 kg. The satellites totalled about 9833 kg, with payload adapters and carrying structures making up the rest.

Flight VA234 was the 90th Ariane 5 launch, and the seventh this year.

European Space Agency
<http://www.esa.int>

Spacewalk For Thomas Pesquet

ESA astronaut Thomas Pesquet will be the 11th European to perform a spacewalk when he ventures outside the International Space Station in January 2017.

Lasting up to seven hours, its goal is to ensure the power supply of the International Space Station from the 2500 sq m of solar panels.

The Station commander, Shane Kimbrough, will lead the spacewalk, accompanied by Thomas.

At NASA's mission control in Houston, ESA astronaut Luca Parmitano will direct the duo as lead communicator – a recognition of ESA's expertise in Station operations.

Luca is an experienced spacewalker himself, undertaking two sorties during his six-month mission in 2013. Luca will guide the pair in space through their complex tasks, offering radio support.

Two January spacewalks are needed as part of an upgrade to replace older-technology batteries with newer lithium-ion designs. Batteries store power for supplying the Station as it flies through Earth's shadow.

Adapter plates that arrived on Japan's HTV cargo ferry in December will be moved to an external platform by the Station's robotic arm before the spacewalk.

When Shane and Thomas head outside, they will collect the adapters, install them, and reattach the batteries.

ESA
<http://www.esa.int>

SpaceX Falcon 9 failure probe complete; flights to resume from California

Spaceflight Now reports that after an exhaustive investigation, SpaceX engineers have identified the most likely cause of the spectacular explosion of a Falcon 9 rocket during a pre-launch test on 1st September that destroyed the booster and its \$195 million satellite payload, the company announced.

It is not yet known when SpaceX plans to resume flights from Cape Canaveral. Launch complex 40 at the Florida Air Force station was heavily damaged in the 1st September mishap, and the company plans to use a repurposed space shuttle launch pad at the nearby Kennedy Space Center for its next Falcon 9 flight from Florida.

Spaceflight Now
<http://www.spaceflightnow.com>

Lockheed Martin Successfully Launches EchoStar XIX Satellite To Power HughesNet Gen5 High-Speed Internet Service

Lockheed Martin Commercial Launch Services has successfully launched the EchoStar XIX communications satellite on 18th December 2016. An Atlas V 431 blasted off at 2:13 p.m. EST from Space Launch Complex 41, placing EchoStar XIX in orbit for customer Hughes Network Systems, LLC (HUGHES), an EchoStar company, and marking the 139th consecutive successful Atlas launch to date.

Lockheed Martin Commercial Launch Services launches EchoStar XIX aboard an Atlas V 431 rocket. The satellite will provide HughesNet

Gen5 high-speed satellite Internet service to rural areas across North America. Photo courtesy of Lockheed Martin and United Launch Alliance.

"The mighty Atlas has marked yet another successful launch as it placed EchoStar XIX into orbit," said Steve Skladanek, president of Lockheed Martin Commercial Launch Services. "This reliable rocket continues to bring unparalleled precision and schedule assurance to every mission it carries."

The rocket, a United Launch Alliance (ULA) Atlas V 431, was provided by Lockheed Martin Commercial Launch Services. For commercial missions, Lockheed Martin is responsible for contracts, licensing, marketing, sales and mission management of Atlas.

With an average slip date of less than two weeks and successful track record, the Atlas family of rockets provides the most reliable lift in the commercial market. Atlas also offers such precise delivery into orbit that customers can use the excess fuel to extend the life of a satellite and bringing more value to the mission.

EchoStar XIX will enable HughesNet Gen5, the next generation of HughesNet satellite Internet service, delivering more speed, more data, and more advanced features for U.S. consumers and small businesses coast to coast who are unserved or underserved by terrestrial broadband Internet services.

Lockheed Martin Corp
<http://www.lockheedmartin.com>

NASA Selects Two Missions to Explore the Early Solar System

NASA has selected two missions that have the potential to open new windows on one of the earliest eras in the history of our solar system - a time less than 10 million years after the birth of our sun. The missions, known as Lucy and Psyche, were chosen from five finalists and will proceed to mission formulation, with the goal of launching in 2021 and 2023, respectively.

"Lucy will visit a target-rich environment of Jupiter's mysterious Trojan asteroids, while Psyche will study a unique metal asteroid that's never been visited before," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate in Washington. "This is what Discovery Program missions are all about - boldly going to places we've never been to enable groundbreaking science."

The Psyche mission will explore one of the most intriguing targets in the main asteroid belt - a giant metal asteroid, known as 16 Psyche, about three times farther away from the sun than is the Earth. This asteroid measures about 130 miles (210 kilometers) in diameter and, unlike most other asteroids that are rocky or icy bodies, is thought to be comprised mostly of metallic iron and nickel, similar to Earth's core. Scientists wonder whether Psyche could be an exposed core of an early planet that could have been as large as Mars, but which lost its rocky outer layers due to a number of violent collisions billions of years ago.

NASA
<http://www.jpl.nasa.gov>

Mars Odyssey Mission Recovers from Safe Mode

NASA's Mars Odyssey orbiter, which has been in service at Mars since October 2001, put itself into safe mode -- a protective standby status -- on 26 December, while remaining in communication with Earth.

The Odyssey project team has diagnosed the cause -- an uncertainty aboard the spacecraft about its orientation with regard to Earth and the sun -- and is restoring the orbiter to full operations.

The mission experienced a similar fault and solution in December 2013.

Mars Odyssey left Earth on 7 April 2001, entered orbit around Mars on 24 October and began systematically examining Mars in February 2002. In December 2010, it surpassed the previous record for longevity of a robotic mission at Mars. The Mars Odyssey Project has been extending that record daily for more than six years.

In addition to its direct contributions to planetary science, Odyssey provides important support for other missions in NASA's Journey to Mars through communication-relay service and observations of candidate landing sites.

NASA
<http://mars.jpl.nasa.gov/odyssey>

NASA Assigns Upcoming Space Station Crew Members

NASA is assigning veteran astronaut Andrew Feustel and first-flight astronaut Jeanette Epps to missions aboard the International Space Station in 2018.

Feustel will launch in March 2018 for his first long-duration mission, serving as a flight engineer on Expedition 55, and later as commander of Expedition 56. Epps will become the first African American space station crew member when she launches on her first spaceflight in May 2018. She'll join Feustel as a flight engineer on Expedition 56, and remain on board for Expedition 57.

"Each space station crew brings something different to the table, and Drew and Jeanette both have a lot to offer," said Chris Cassidy, chief of the Astronaut Office at NASA's Johnson Space Center in Houston. "The space station will benefit from having them on board."

A native of Lake Orion, Michigan, Feustel was selected as part of the 2000 astronaut class and, in 2009, flew on the space shuttle Atlantis for the final servicing mission of NASA's Hubble Space Telescope. He made his first trip to the space station in 2011 as a member of the STS-134 crew on space shuttle Endeavour's final mission.

Feustel has a bachelor's degree in solid Earth sciences and a master's degree in geophysics from Purdue University in West Lafayette, Indiana. In 1995, he completed his doctorate in geological sciences, with a specialization in seismology, from Queen's University in Kingston, Ontario, Canada.

Epps earned a bachelor's degree in physics in 1992 at LeMoyne College in her hometown of Syracuse, New York. She went on to complete a master's of science in 1994 and a doctorate in 2000 in aerospace engineering from the University of Maryland.

While earning her doctorate, Epps was a NASA Graduate Student Researchers Project fellow, authoring several journal and conference articles on her research. After completing graduate school, she went on to work in a research laboratory for more than two years, co-authoring several patents, before being recruited by the Central Intelligence Agency. She spent seven years as a CIA technical intelligence officer before being selected as a member of the 2009 astronaut class.

Feustel and Epps will join a long and distinguished line of astronauts who have crewed the International Space Station since November 2000. With the help of the more than 200 astronauts who have visited, the space station enables us to demonstrate new technologies and make research breakthroughs not possible on Earth. Its convergence of science, technology and human innovation provide a springboard to NASA's next giant leap in exploration, including the Journey to Mars.

NASA
<http://www.nasa.gov>

GODSPEED, JOHN GLENN

By

Rob Wood

Al Shepard counted off the seconds to zero. Engine ignition. Glenn could hear the faint roar inside the capsule. The Atlas booster built up its thrust. The hold down clamps dropped away and lift-off. The capsule clock started on time and Glenn reported "The clock is operating, we're under way". It was 09 hours, 47 minutes and 39 seconds Eastern Standard Time on 20 February 1962 and John Glenn was on his way to space.

Main engines ignition sequence starts, T minus 6 seconds and counting. Glenn felt a shudder run through the shuttle as it swayed away from vertical before returning there for the exact moment of solid rocket booster ignition and lift-off. Glenn's second spaceflight had started. It was 14 hours, 19 minutes and 34 seconds Eastern Standard Time on 29 October 1998 and John Glenn was heading back to space after a gap of 36 years, 8 months, 8 days, 23 hours, 36 minutes and 32 seconds since the splashdown of his Mercury capsule in 1962.

With his second flight, Glenn aged 77 years, became the oldest person to fly in space. A record, and like the gap between spaceflights, one I suspect likely to remain in place for a very long time. Presently it is 18 years and counting.

He was not particularly crazy about flying, just showed a normal interest that one would expect from a boy; or at least that is what he said in the astronaut book 'We Seven' in 1962, but I am not sure his history backs this up. From playing mock dogfights with his neighbourhood friends when very young; then building model airplanes; to picking aviation as the programme theme for his high school Junior-Senior banquet and the theme continued as he grew older.

He enrolled in a government sponsored civilian pilot training programme shortly before the United States entered World War Two; he joined the United States Marine Corps in World War Two, yes you have guessed it, as a pilot; later he qualified as a test pilot; and to top it all off he became an astronaut. Perhaps he was, after all, just a little bit interested in flying.

Absent Without Leave

John Herschel Glenn Junior was born on 18 July 1921 in Cambridge, Ohio, the first of two children (the second was adopted) of Clara Sproat and John Herschel Glenn Senior. Two years later the family moved a short distance to New Concord, Ohio where Glenn Senior opened his own plumbing and heating business.

Following Japan's attack on Pearl Harbor on 7 December 1941, Glenn and a college friend volunteered for the Army Air Corps. They passed the medical exam, signed the appropriate documents and took the Oath of Allegiance. They were then told to go home and await orders. Naturally they were champing at the bit to get started and patience did not abound in great quantities so after weeks dragged into months and with no sign of any orders from the army Glenn decided to try again. This time he would give the Navy a go. The same process was followed but with one important difference; the orders came almost immediately. Glenn speculates in the book 'We Seven' as to whether he has been AWOL (absent without leave), normally a serious military offence, from the Army ever since.

Whilst training, Glenn discovered that he had a choice of whether to receive his commission in the Navy or Marine Corps. He chose the latter. He completed his flight training in March 1943 and then married

his long-time sweetheart Annie on 6 April 1943. Her name was actually Anna but he always referred to her as Annie.

He saw action in both World War Two and Korea, flying just shy of 150 combat missions and earning more than 20 gallantry medals in the process. He was involved in ground attack roles until the last few months of the Korean War. Whilst flying in Korea he earned a new nickname from his squadron colleagues 'Old Magnet Ass'. The Chinese and North Koreans were known to be pretty good at shooting down aircraft from the ground and his aircraft was frequently hit by anti-aircraft fire.

He had already flown over 60 ground attack combat missions in Korea before his chance at air-to-air combat came. On 1 June 1953 he was assigned to the 25th Fighter Interceptor Squadron of the Air Force as a Marine exchange pilot. On the afternoon of 12 July 1953 he was leading a patrol near the Yalu River when he spotted enemy aircraft. The Mikoyan-Gurevich MIG-15 was a formidable opponent and Glenn chased after his prey.

He followed it into Manchuria. As the MIG approached an airfield it slowed allowing Glenn the opportunity to line up his .50 calibre machine guns and open fire. The bullets impacted onto the MIG's fuselage and right wing. The MIG burst into flames and went down. It hit the ground and exploded into a fireball, spreading wreckage over at least 100 yards of ground. Glenn would shot down two more MIG-15's before a cease-fire came into effect on 27 July 1953.

With the end of Glenn's second war, he had to decide what to do next. He wanted to stay in the Marines but also to move forward and have his abilities further challenged. The obvious solution was to move into test flying and so he applied for test pilot school.

In February 1954, he reported to the huge Naval Test Center at Patuxent River Maryland. The base was more often referred to as Pax River or just Pax. A period of intense training followed and in July 1954 he received his test pilot diploma. He would remain at Pax for the next couple of years, serving as a project officer of the Patuxent Armament Test Division.

In November 1956, Glenn received a new assignment as a project officer at the Fighter Design Branch of the Bureau of Aeronautics in Washington DC. At this time, the Air Force held the cross-country, coast to coast, speed record but Glenn knew the Navy's Chance Vought F8U-1 'Crusader' could better the current time. He had test flown the aircraft during his time at Pax River.

He lobbied long and hard to be allowed to take the idea forward and eventually got the go-ahead. His service record put him in the frame to be named the chief test pilot for the project and he received the assignment. He was also able to name the project and selected 'Operation Bullet'. When he told an engineer at the Chance Vought plant in Dallas of the name, the engineer said to him "Well that fits. Pointed head and no sense. Fits both of you".

The record attempt took place on 16 July 1957. It was time for the engineers to get out their slide rules. There was an anxious wait before confirmation came that Glenn had bettered the previous record. In fact he smashed the record by 21 minutes. Glenn had completed the flight in 3 hours, 23 min and 8.4 seconds. His flight had been conducted at supersonic speed averaging 723.52 mph. The flight

turned Glenn into a bit of a celebrity. He even appeared as a guest on the TV quiz show 'Name That Tune'.

He began to think of his future career. He was a test pilot and wanted to test at the frontier of his profession; to fly higher and faster. His position in Washington DC allowed him to keep up with what was new in research and development. He was aware of the embryonic plans for a manned space programme and read everything he could find on the subject, also keeping his eyes and ears open.

When Glenn's section was asked to provide a test pilot for spaceflight related projects he volunteered himself. His first stop was at the National Advisory Committee on Aeronautics (NACA) laboratory at Langley Air Force Base, Virginia, where he spent a few days working on orbital mechanics. Next he spent over a week at the Naval Air Development Center at Johnsville, Pennsylvania, where he worked on a centrifuge project. He spent time at the McDonnell Aircraft Corporation's plant in St. Louis, where he was the Navy's representative in talks on manned space capsule design.

The Mercury Seven

In July 1958, NACA was replaced by the National Aeronautics and Space Administration (NASA). In December 1958, Project Mercury officially came into being. Glenn wanted to be an astronaut and volunteered early in 1959. It looked likely that his lack of a higher education degree would see him eliminated but the selection board was persuaded that his work experience more than made up for it.

He underwent a series of written tests, technical interviews and medical reviews before he was one of 32 pilots invited to the Lovelace Clinic in Albuquerque, New Mexico, for detailed medical tests. They were divided into groups, five of six men and one of two men. Tests were conducted in many medical fields:

- Cardiology (the study of the function of the heart and circulation)
- Haematology (blood)
- Myology (muscles)
- Neurology (nervous system)
- Ophthalmology (eyes)
- Otorhinolaryngology (ears, nose and throat)
- Pathology (tissues and cells)
- Radiology (X-rays and ultrasound)

There were also general internal checks and any linked laboratory tests that anyone could think of!

For seven days and not forgetting three evenings, the prospective astronauts underwent one of the toughest physical examinations in history. There were 17 separate eye examinations, their brain waves were measured, they were dunked in water for specific gravity tests, they pedalled fixed bicycles with increasing break loads to test lung function, water was dropped into their ears to see if they were susceptible to motion sickness. There were numerous blood, tissue and urine checks, samples and studies. The 'piece-de-resistance' must have been the barium enemas to enhance intestinal X-rays. Speaking of the overall testing regime, Deke Slayton later said "It was your worst nightmare." Glenn said of them "I didn't know the human body had so many openings to explore."

Only one candidate failed at this point, a navy test pilot named James Lovell who was rejected due to a minor liver anomaly. However, that did not stop him becoming one of America's best known and experienced astronauts from the Apollo era as he was later selected as part of NASA's second group of astronauts, but that is a story for another day.

The 31 remaining candidates' next series of tortures were the stress tests at the Aeromedical Laboratory at Wright-Patterson Air Force Base in Dayton, Ohio. Glenn must have felt almost at home in his home state but probably soon wished he was in Alaska, Siberia, probably anywhere. Again the candidates reported in groups, five of five men and one of six.

The next series of tests were designed to test physical and psychological capabilities to respond effectively to the stresses

associated with space travel. Five days of gruelling tests followed. General psychological questions were interspersed with periods in which they were baked, froze, isolated, pressurised and vibrated. Few have ever undergone such an intensive series of physical and mental tests as the Mercury candidates undertook at Lovelace and Wright-Patterson.

Following completion of the tests, Glenn reported back to his desk in Washington DC. Two weeks had passed when he received a telephone call from Charles Donlan, a senior NASA engineer who was the Deputy Director of Project Mercury and unofficial chairman of the astronaut selection committee. Donlan asked him if he was still interested in the programme. Glenn's reply was "Yes I am, very much." He then held his breath and waited. Donlan said "Well, congratulations. You've made it." It was 6 April 1959, his wedding anniversary. He was one of seven astronauts who became known as the 'Mercury Seven'.

The astronauts were announced to the world at a press conference at 2pm on Thursday 9 April 1959. About 150 reporters and cameramen had gathered in the auditorium at NASA Headquarters in Washington DC. Thomas Glennan, NASA's first administrator, opened the briefing by introducing "the nation's Mercury astronauts." They were sat in alphabetical order on the stage:

- Navy Lieutenant **Malcolm Scott Carpenter**
- Air Force Captain **Leroy Gordon 'Gordo' Cooper**
- A Marine Lieutenant Colonel by the name of **Glenn**
- Air Force Captain **Virgil 'Gus' Grissom**
- Navy Lieutenant **Walter Marty 'Wally' Schirra**
- Navy Lieutenant **Alan Bartlett Shepard**
- Air Force Captain **Donald Kent 'Deke' Slayton**

All hell broke loose, questions and camera flashes hit the astronauts from all directions, the press corps stood, applauded and cheered the nation's new heroes. Whilst most of the would be astronauts were taken aback by the reception, Glenn handled the situation with a cool professionalism which surprised some of the other astronaut candidates but was perhaps an indication of a future career direction for Marine pilot Glenn. Many years later Slayton wrote, "He ate this stuff up".

The astronauts were given just over two weeks to report to the NASA centre based at Langley AFB, near Norfolk, Virginia. Glenn was currently living nearby in Arlington, Virginia, just outside of Washington DC. He decided to move into bachelor officer quarters at Langley and commute home for weekends. Carpenter and Cooper were already assigned to Langley and Shepard was also close by. Only three had to uproot their families, Grissom, Schirra and Slayton.

On Monday 27 April 1959, the Mercury astronauts started work. About three weeks into their training they were taken to see their first rocket launch. Even Wally Schirra, who normally could be relied on for a joke or two, stood in stunned silence after the rocket blew up a minute after lift-off.

As well as their general training, the astronauts made trips together to the various plants and centres involved in Project Mercury but it was soon realised that it was just not practical for all of them to make each trip as a group. In July 1959, it was decided that each astronaut would be assigned to a specific area and Glenn got Cockpit design.

The public image of the astronauts painted them in glowing terms but they were only human. There were temptations and some succumbed. Glenn did not and thought the others should keep to his high standards. He was not shy in telling this to them in the strongest terms. This brought him into conflict with some. During one meeting he told them that, "we had worked too hard to get into the programme and that it meant too much to the country to see it jeopardised by anyone who couldn't keep his pants zipped." Shepard told Glenn that the personal lives of his fellow astronauts were none of his business and he was out of line.

Glenn had the support of Carpenter but the others were in the Shepard camp. The meeting was fractious enough to create wounds that would take many years to heal. Glenn even thought that this meeting might have cost him a place on the first manned mission. Shortly after this the astronauts were asked to give a peer rating on

whom should fly first from one to six excluding themselves. Glenn doubted he scored highly and was fairly sure that some importance must have been given to the ratings.

Any News on the Weather

On 19 January 1961, Robert Gilruth, Project Mercury Director, called all the astronauts into his office at Langley and informed them that Shepard and Grissom would fly the first two sub-orbital spaceflights. Glenn was named as the back-up to both flights. Glenn was naturally disappointed, like all the astronauts he had wanted to be first. There was some consolation in that he was in prime position to make the third flight. At this time this was to be another sub-orbital launch.

There was no immediate public announcement so Glenn felt the assignments could be changed. He lobbied for this. He felt the earlier peer ratings were unfair and pointed this out. He had tried to do the right thing for the space programme and felt he was being penalised for it. He had some support and it was said that Shepard did not have the right image to be the first American in space. In the end Gilruth stepped in. "I want this backbiting stopped right now," he warned. "Shepard is my choice. That's it."

On 31 January 1961, a four year old chimpanzee named Ham flew a successful sub-orbital flight. However, Wernher von Braun and his senior engineers were not satisfied with the performance of the Redstone booster and wanted more tests. A further successful launch was carried out on 24 March 1961, a flight which could easily have carried Alan Shepard and made him the first man in space. As it transpired, America had lost the race to put the first human in space.

On 12 April 1961, Soviet Air Force pilot, Senior Lieutenant (promoted to Major during the flight) Yuri Gagarin became the first human to fly in space. And, on an orbital mission unlike the sub-orbital flights planned by the Americans.

Shepard and Grissom flew their sub-orbital flights on 5 May 1961 and 21 July 1961 respectively with Glenn carrying out his role as back-up. Everyone agreed that there was no need for a third sub-orbital flight and it was cancelled. The next US manned flight would be orbital and Glenn was the prime candidate although no public announcement was made until 29 November 1961, the day after astrochimp 'Enos' flew a two-orbit mission on Mercury-Atlas 5. NASA announced that Glenn's flight would take place on 20 December 1961. The sub-orbital flights had used the Redstone rocket as the launch vehicle but the more powerful Atlas rocket would be needed for orbital flights.

Each astronaut got to name his Mercury spacecraft. Al Shepard called his Freedom and added a 7 because it was the seventh spacecraft made. The other astronauts decided to keep the 7 number going but this was in reference to themselves as in, 'The Mercury Seven'. Glenn chose Friendship 7. Friendship because, as he noted in his memoir, "... the name should represent our country and the way we feel about the rest of the world."

It was soon apparent that a 20 December 1961 launch date for Glenn was too optimistic and the flight was rescheduled for 16 January 1962. Problems with the Atlas launch vehicle's fuel tank system led to further delay and launch was re-set for 23 January 1962. Things began to look more promising. On 21 January 1962, 24 US Navy ships sailed towards various recovery zones to await Glenn. The area around the launch site at Cape Canaveral began to fill with media and the public, all eager to be part of America's first orbital manned shot, but they would have to wait, again and again and again and

On 22 January 1962, malfunctions in the oxygen supply system made necessary a 24 to 48 hour hold; then the gyroscopes were discovered not to be performing to their optimum. By the 23 January 1962 the oxygen system was still causing problems and it was announced that the launch attempt was off until 27 January 1962.

By the evening of 26 January 1962 it was looking promising again. Glenn went to bed knowing he was in for an early wake up call. At 02:33 hours on 27 January 1962 Glenn was awakened. He showered and shaved, had breakfast and underwent the pre-flight medical. Sensors were attached to his body and he was helped into his spacesuit.

By 05:12 Glenn was climbing into the Mercury capsule. There was a problem with the hatch gasket but eventually the hatch was secured. At 07:00 the countdown was put on hold for technical problems. By 08:45 the technical issues were solved but the weather was closing in with low cloud putting the launch in doubt. Nevertheless, the countdown was resumed with the launch due at 09:30. With 19 minutes to go the weather had the final word on the day. With the weather showing no signs of clearing the launch was scrubbed. At 10:39 Glenn was helped out of the capsule. By now 75,000 disappointed spectators were heading back to their bars, motels, trailers etc.

The next attempt was scheduled for 1 February 1962, but by 30 January 1962 high seas in a possible recovery area should Glenn have to return after one or two orbits instead of the planned three were making the launch doubtful again. The weather became quite academic however when fuelling problems with the booster well and truly scrubbed this latest launch attempt. NASA announced a two week delay to 13 February 1962.

With the latest hold in place Glenn took the opportunity to spend a few days with his family in Arlington. He then paid a visit to President Kennedy in Washington DC to brief him on the present position of the launch. On 7 February 1962, NASA announced that a further day was required for repairs.

By the evening of 13 February 1962, the technical side of things were looking up but almost on cue, in came the weather again. Storm clouds were gathering in some of the recovery areas. In the early hours of 14 February 1962 Glenn was woken up by astronaut doctor Lieutenant Colonel Bill Douglas to be given the bad news. Storms had indeed developed and launch was on hold again for another 24 hours. The next day Douglas gave Glenn the same message. On 16 February 1962 the message changed a little but not for the better. Launch was now off until at least 20 February 1962.

By the time Glenn went to bed on 19 February 1962 a local storm front was moving across the cape and the forecasters gave only a 50 per cent chance of it clearing by the scheduled launch time. Based on recent experience Glenn was not particularly hopeful.

Glenn woke up early on 20 February 1962, about 01:30. Did he think 'here we go again' when Douglas told him the weather was still playing up. The 27 January 1962 routine was followed again. Glenn showered and shaved; joined Deke Slayton, Douglas and others for breakfast, then the pre-flight medical. The biomedical sensors were attached to his body and he was helped into his spacesuit by the astronaut suit technician Joe Schmitt.

The four mile trip to the pad took 17 minutes; then they waited in the van. At 05:59 Glenn was on his way up the elevator. But, what about the weather? It still did not look too promising. At 06:03 Glenn entered the Mercury capsule. The countdown had been on hold since 05:30 because of a faulty transponder in the Atlas guidance system. As this problem was solved another popped up with Glenn's helmet microphone which added another ten minute delay. Finally at 06:25 the countdown was resumed.

Although launch was scheduled for 07:30 there was some lee-way. Launching by around about 09:30 would still allow for the planned three orbit mission and give recovery forces three hours of daylight to find Glenn after splashdown. A much later timed launch would have NASA officials thinking of a two orbit flight only.

But, what was the weather doing? By 06:30 the clouds were still low and heavy overhead but there were some signs of brightness to the east. Glenn was finally seated in the capsule at 06:59. Yes, but the weather? Winds coming from the west were beginning to break the clouds up and a few minutes later the Sun began to shine. Go for launch then? No, a broken hatch cover bolt. Another hold, Glenn was not going anywhere at 07:30.

T minus 60 minutes and counting, it was 08:05 and the countdown had resumed. T minus 35 minutes and another hold, this time planned. The final liquid oxygen load for the Atlas took place. Glenn knew this was a good sign, getting close now. Another hold; a valve had stuck in the liquid oxygen equipment.

Any news on the weather? The weather was 'GO' for lift-off. The countdown clock was running again. 09:35, T minus ten minutes and everything seemed set for launch. Alas not quite, the Bermuda Tracking Station was reporting a power loss in their computer system. The countdown was allowed to run down to T-minus six minutes and 30 seconds then held, awaiting clearance from Bermuda. Glenn could not launch until Bermuda was fully operational. It was a key tracking station, not only because it acted as a back-up control centre for Cape Canaveral but it lay close to the point where Glenn would enter orbit. 09:42, the all clear from Bermuda came and the countdown was resumed.

T minus 5, 4, 3 minutes and counting. The tension built to a crescendo amongst those watching. Was everything really 'GO' for launch? Over the radio Glenn was hearing the various systems reports. "Communications 'GO'", "ASCS 'GO'", "Aeromed 'GO'", "Range 'GO'". Towards the end of the check list it was Glenn's turn. He simply said "Ready". Just a few minutes more, then down to seconds. Scott Carpenter was in the blockhouse nearby. He spoke into his microphone. "Godspeed, John Glenn". Then it was Alan Shepard's turn, he gave the final ten second countdown.

Shepard counted off the seconds to zero. Would there be a last second hitch that would end today's countdown? No. Engine ignition. Glenn could hear the faint roar inside the capsule. The Atlas built up its thrust. The hold down clamps dropped away and lift-off. The capsule clock started on time and Glenn reported "The clock is operating, we're under way". It was 09 hours, 47 minutes and 39 seconds Eastern Standard Time.

The silver Atlas rocket left the pad and at 20 seconds Glenn started the back-up watch on his wrist and began to check the spacecraft's systems. All seemed perfect and Shepard confirmed telemetry indicated a good flight pattern. At 45 seconds Glenn hit the point where the aerodynamic forces were at their highest. This starts at about 35,000 feet, lasts for about 20 seconds and is known as the maximum-Q or more usually Max-Q. Years later the astronauts named their rock group 'Max-Q'.

Glenn did not expect any problems but he was aware of past difficulties at Max-Q. One unmanned launch had seen the booster blow up. Of some comfort was the fact that the abort procedures had brought the Mercury capsule down in good shape. At one minute and six seconds Shepard confirmed that Glenn was through Max-Q. Glenn felt good and reported that the flight was "smoothing out real fine" despite the fact that 'G' forces had built up to about 7.

At two minutes 11 seconds, the two outboard booster engines shut down and dropped away, followed 23 seconds later by the escape tower. The booster's sustainer engine continued the push to orbit. Orbital insertion was pretty much perfect and at five minutes and 1.4 seconds after lift-off the sustainer engine was shut down. Next, explosive bolts were fired to separate the capsule from the launch vehicle and the posigrade rockets fired to push the capsule away from the booster. Glenn was now 100 miles up and travelling at a velocity of 25,730 feet per second. The G forces dropped away and Glenn was weightless. He reported, "Zero G and I feel fine."

That View is tremendous

The capsule automatically turned to its normal orbital position, rear end facing forward and for the first time Glenn could get a proper view of where he had just come from. He could not help saying over the radio, "Oh! That view is tremendous." However, Glenn knew there was a lot of work to do and quickly got on with it. Telemetry was showing that everything was good for the continuation of the flight. Shepard confirmed that the mission was 'GO'.

The early minutes of the flight saw a lot of system checks with Glenn giving reports on the data to the ground. Glenn then began some Earth observations. He could make out the layers of the clouds and concluded that with the right sighting equipment astronauts could make a telling contribution to weather forecasting. Glenn had no problems working in weightlessness; he found it very pleasant and had no side effects. He tried to induce some dizziness by moving his head around quickly but even then he was fine. The time he had spent in aeroplanes being thrown around was obviously good training for spaceflight.

During the flight Glenn would encounter three night periods. Astronomical and Earth observations and attitude control tests were on the flight plan for the night periods. During the first 'night' he was over Australia. Gordon Cooper was Cap-Com at the Mucnea Tracking Station in Western Australia and suggested Glenn look to the right. Perth and other towns on the West Coast and turned their lights on for Glenn. Glenn saw them and asked Cooper to say thank you to everyone.

Glenn's flight continued. Over the Pacific he had the first of two planned meal breaks – a tube of applesauce. Glenn found that he had no trouble eating and swallowing. He wrote after the flight that he considered normal food could be eaten in space although anything crumbly might be a nuisance.

As Glenn moved back into daylight he looked back and saw all around the capsule many thousands of small, luminous particles of various sizes up to about three eighths of an inch. Glenn reported his sightings to the ground causing some consternation but he confirmed there were no signs of impact or damage to the capsule. The particles seemed to disappear in the glare as the Sun came up. The particles reappeared at about the same time on Glenn's next two orbits.

Although there was no obvious link, it was shortly after the first particle pass that Glenn began to experience problems with the control of the capsule. He was nearing the Californian coast when the capsule began to stray to the right. The automatic control system (Attitude Stabilisation and Control System or ASCS for short) kicked in after a drift of about 20 degrees and brought the capsule back to the correct position. This kept repeating until Glenn took over the controls manually. If the cycle had been allowed to keep repeating the hydrogen peroxide fuel would have been used too quickly.

Glenn was able to control the capsule without too many difficulties but it did curtail and even halt some of the other activities planned for the rest of the mission. This included the second planned meal (a tube of mashed up roast beef, which I am sure was no great hardship for Glenn); tests relating to the Sun's corona and various observations and photography. Glenn though, felt that the loss of these experiments was more than made up for by the confirmation of how important it is to have man in space. It is likely that the Mercury spacecraft would not have completed its planned duration of mission or even returned safely to Earth if Glenn had not been aboard.

Unknown to Glenn at this time an even greater drama was unfolding. The Mission Control Center (MCC) was reading telemetry that the heat shield on the capsule had come loose. This had potentially catastrophic consequences. The heat shield was designed to come loose but only as part of the final drop to the sea where it would form part of the impact bag to take up some of the shock of splashdown. It was possible that the signal was erroneous but MCC could not rely on that. If the telemetry was correct Glenn could burn up on re-entry. Was there anything that could be done to alleviate the situation? That was the question that focused everybody's minds.

The retro-rockets were held in place beneath the heat shield by heavy metal straps which were attached to the main part of the capsule. Normally the retro-rockets would be jettisoned after they had been used to commence re-entry. Heads on the ground came up with the idea that they could prove a useful buffer zone against the heat of re-entry if they were kept attached. Also, they may help keep the heat shield in place long enough for a successful re-entry.

It was decided not to tell Glenn of the problem at present, after all, so the thinking went, there was nothing he could do about it. The tracking stations were informed and were asked to relay some subtle questions and instructions to Glenn which would help them further assess the problem. The Cap-Com on the ship in the Indian Ocean told Glenn to keep the landing bag switch in the OFF position. Soon, he was in touch with Gordon Cooper in Australia. Cooper asked him to confirm the switch was in the OFF position and then asked if he heard any unusual banging noises.

I do not know who thought that these questions and instructions were subtle and perhaps if there was another chimpanzee on the spacecraft they might not have worked it out but it certainly did wring alarm bells in Glenn's mind. His first thought was that telemetry was

showing up something to the ground. He thought that the people on the ground were really worried about something and he correctly guessed it was to do with the heat shield being loose. So much for keeping it from him!

He was understandably a little concerned, after all a dodgy heat shield was something you did not want to have when re-entering the atmosphere. He gave it some thought and based upon his own observations decided everything was probably all right. What with the capsule drifting back and forth he was sure he would have heard of felt the shield banging against the edge of the capsule if it was loose.

When the luminous particles re-appeared Glenn turned the capsule 180 degrees so he could study them from a different direction and take photographs. They did not appear to be emanating from the capsule and he could not work out what they were. He hoped the photographs would help.

As the mission continued other problems appeared. A warning light told Glenn that there was an excess of water in the environmental control system. He was able to control this by turning down the water supply. Readings indicated a leak in the secondary oxygen tank. Although Glenn did not need this supply, it was a potentially serious matter. The manual controls were not operating as smoothly as earlier and he was getting concerned that he would not get a 'GO' for the third orbit. He wanted to continue and was very happy when MCC gave their recommendation to go on. Glenn quickly gave his assent.

Glenn checked out the recovery area where he would be landing next time around. The weather looked good and he reported this to Gus Grissom as he passed over the Bermuda Station for the last time. Grissom relayed a message from MCC recommending that he used ASCS during re-entry backed up by the manual controls. Glenn pointed out that the automatic system had been erratic for some time and he had not yet identified the cause. It was playing up in pitch, yaw and roll and Glenn preferred the decision be left until retro-fire time.

As the flight continued, Glenn told the doctor at the Canary Station that he had still not experienced any nausea and had felt fine throughout the flight. Shortly afterwards he was in touch with the Atlantic ship and gave them a detailed report on the status of the ASCS. Glenn had concluded that the gyros in the automatic system were not keeping up with the actual attitude of the capsule. If ASCS was operating incorrectly at retro-fire time it could put the capsule at the wrong attitude and thus effect the angle of re-entry or as Glenn later wrote in 'We Seven', "I might have trouble getting down."

As Glenn passed the tip of Africa into the Indian Ocean he saw a huge storm front stretching out as far as he could see. Lightning flashes showed up brilliantly from within the clouds. At 3 hours, 59 minutes and 15 seconds after launch Glenn came into contact with Cooper again and for the last time from orbit. Cooper was given an update on the ASCS and Glenn said that he would stay on manual for the re-entry sequence should the problems continue.

It was Hawaii Station who brought up the heat shield question again. Glenn was told that telemetry indicated landing bag deployment and although the consensus was that it was an erroneous signal MCC wanted Glenn to turn the landing bag switch to the automatic position to see if he got the green light that would indicate the landing bag had deployed. Glenn switched to automatic. There was no green light and he switched back to the off position and reported what happened to the ground. It did look like an erroneous signal was at work. Glenn was still satisfied that everything was all right and Hawaii indicated it was looking good for a normal re-entry. However, not everyone at MCC was sure.

Despite all the problems that Glenn had had with the ASCS so far it choose this moment to start working properly so Glenn allowed it to take over control of the spaceship. He knew he could quickly revert to manual control if it became necessary. The retro rockets fired on schedule. Five minutes later Texas Station was in touch and they confirmed that Glenn should leave the retro pack attached through re-entry. Certain automatic functions could not be carried out because of this and these tasks fell to Glenn to carry out manually including retracting the periscope.

The next voice Glenn heard was that of Al Shepard at the Cape, "recommend that you go to re-entry attitude and retract the scope manually at this time." By now Glenn was back in manual mode with ASCS as it was again causing difficulties. However, manual was down to 15% fuel. He switched to fly-by-wire mode, which allowed him to stay in control but draw fuel from the automatic system.

Things were warming up now. Glenn felt a considerable thump that he thought might have been the retro-pack breaking away. Glenn tried to pass this on to Shepard but it was too late. The capsule had heated up to the point where a barrier of ionisation had built up causing a communication blackout. This was a known phenomenon of re-entry.

Glenn saw large flaming chunks flying past the window. He heard them hit the capsule at the rear and wondered if indeed this was the heat shield breaking up after all. This was the worst part of the flight for him but there was nothing he could do about it. If the heat shield was breaking up it would be all over soon. So Glenn did what Glenn did best, he kept doing his job and waited for the heat that never came. The heat shield performed perfectly and the signal was indeed erroneous.

On the ground the communications blackout lasted a very long 4 minutes 20 seconds. Shepard spoke into the microphone, "Seven this is Cape. How do you read? Over." It was 4 hours, 47 minutes and 11 seconds after launch. "Loud and clear." came the reply. Glenn was about eight minutes from splashdown and G forces had built up to about eight but he felt fine. He had almost exhausted his fuel supply but he did not need anymore.

The small drogue chute deployed at 30,000 feet and began to smooth out the descent. At 20,000 feet the snorkels opened to let in the outside air. The main chute was next at 10,000 feet, not long to splashdown now. The destroyer 'Noa' was about six miles away and Shepard recommended that Glenn remain inside the capsule unless he had "an overriding reason for getting out."

Seconds left and Glenn braced himself for splashdown. The capsule hit the water solidly, taking it a little underwater, but it soon righted itself. The flight had lasted for four hours, 55 minutes and 23 seconds. Glenn checked around, everything seemed watertight. It was very warm and uncomfortable in the capsule. The outside air coming in did not help because it was extremely humid there also.

Glenn watched as the destroyer drew up alongside. Soon he was on the deck. He warned the crew to stand clear and then blew the hatch. It was with some relief when he was helped out of his spacesuit after being led to the captain's cabin. A shower and a large glass of iced tea followed then a quick medical once-over.

Glenn received radio calls from President Kennedy and a very relieved Annie. He also had a chance to talk to some of the crew of the destroyer. They made him a honorary member of the crew and voted him sailor of the month. A \$15 cheque came with the award which he promptly handed over to the ship's welfare fund.

Glenn's fourth sundown of the day was nearing when a helicopter arrived to take him to the aircraft-carrier 'Randolph'. He had a bite to eat and a more thorough medical examination on the carrier before being flown to Grand Turk Island. Fellow astronauts Slayton and Carpenter and a number of NASA officials greeted him. There was also an army of doctors awaiting their guinea pig and they had a whole array of tests ready for him.

Glenn knew he would be the centre of attention when he returned to the States but even he was not prepared for the tremendous reception he received wherever he went. He had arrived back in Florida at Patrick Air Force Base where his family met him. Most of the population of Florida seemed to have lined the route back to the Cape, waving and cheering. President Kennedy would shortly arrive and present Glenn with the NASA Distinguished Service Medal. Three days later Glenn was in Washington DC. Despite the pouring rain a quarter of a million people had gathered to welcome their new American hero as he rode up Pennsylvania Avenue to the Capitol.

A Political Interlude

Glenn would soon be before a joint meeting of Congress where the

senators and representatives plus any officials who could squeeze in were awaiting Glenn to address them. He was met by an ovation the like of which could not be recalled by living memory. His 17-minute speech was often interrupted by applause as he spoke of his flight, the work of the people who had made it possible and the pride he felt in his country. He confirmed the importance of the space programme and looked forward to the future. A few days later he was in New York City where four million people welcomed him.

Following all the travelling and celebrations it was time to return to work, to act as a Cap-Com and hopefully to prepare for his next flight assignment. However, unknown to Glenn until many years later, President Kennedy had instructed NASA that Glenn was not to be risked on another spaceflight. President Kennedy also saw Glenn as a potential political ally and hoped to persuade him to run for office. The idea did appeal to Glenn but at that point he still wanted to be an astronaut.

Glenn kept asking NASA about another flight assignment but kept getting stonewalled and told not yet. He continued to work in an ambassadorial role for NASA but was becoming increasingly frustrated. Then on 22 November 1963, President Kennedy was assassinated in Dallas. Glenn decided it was an important time for good people to enter public office.

On 16 January 1964, he officially retired as an active astronaut. His aspirations for an Ohio Senate seat suffered a setback on 26 February 1964 when, whilst fixing a bathroom mirror, he fell on to some tiles resulting in head injuries. He suffered disabling dizzy spells and nausea and spent two months in hospital. After about a month in hospital he was uncertain about his recovery and whether he would be well enough to run a vigorous election campaign. He decided to withdraw from the race. He announced this via a press conference held from his hospital room on 30 March 1964.

Technically he was still a serving officer in the Marine Corps and in October 1964 he was promoted to full Colonel. It was only at this time that he felt fully recovered from his accident. Medical tests confirmed this and he took a short jet refresher course. He flew 26 hours during 15 flights over 11 days conducting aerial manoeuvres and never felt better.

He officially left the Corps on 1 January 1965. He would spend the next decade working in private industry, serving on the boards of several corporations and making a few appearances for NASA. In February 1965 he was named as a consultant to the NASA administrator. He served as an executive with the Royal Crown Cola Company based in Atlanta, Georgia, and invested in hotel development. These interests helped him to become a millionaire. He continued to live in Houston.

Politics continued to beckon Glenn. In 1970 he made another unsuccessful bid for the Senate, being defeated by Howard Metzenbaum in the Democratic Primary race. The general view was that Glenn's campaign was poorly organised and under-funded. But Glenn was learning and disinclined to give up. Four years later he was back again and ran a much improved bid. In an increasingly fractious campaign, Metzenbaum did not help himself by attacking Glenn for, "Never having held a job." Glenn pointed out in the final debate that he had held jobs "where it wasn't my chequebook, it was my life that was on the line." Glenn won the Democratic candidate nomination and in November 1974 defeated the Republican candidate in the general election. It had taken him 11 years but he had finally made it to the Senate.

In 1983, Glenn announced a Presidential bid and ran for the Democratic nomination. By his own words, good early fund raising and polls "created a false sense of security and pushed me toward organisational mistakes." Results from the early primaries in February and March 1984 were not encouraging and he withdrew from the race on 16 March 1984. This was not the lowest point in his political career however. In 1990 he was publically charged with improperly interfering in the Federal investigation of Lincoln Savings and Loan owner Charles Keating.

If Glenn was found guilty then he could have been impeached and lost his Senate seat. In 1991 a Senate panel found him not guilty but

to some there was 'no smoke without fire'. Despite this the people of Ohio continued to support him, albeit only just in the 1992 elections, and he remained their Senator for two more terms.

He decided to retire from the Senate and announced this in February 1997. His grounds were that there were still some things he wanted to do. He confirmed he would continue to work hard for the remainder of his term of office and then serve his country in other ways.

They Owed Him One

Glenn had never lost touch with spaceflight and NASA, and always supported the space programme as best he could. He had wanted to fly in space again following his Mercury flight but circumstances had prevented that and he had long since realised his astronaut career was over... but hold on a moment... maybe there was still a chance.

In early 1995, he was preparing for a debate on NASA's budget. Amongst his research materials was a NASA doctors' authored book 'Space Physiology and Medicine'. He noted that many of the changes that take place in the body during an astronaut's adaptation to weightlessness were mirrored by changes that occur in people as they get older.

Glenn concluded that a lot could be learned by sending an older person up into space with a balanced and focussed mission plan for study on the effects of weightlessness and he had a pretty shrewd idea on who that elderly person should be. It was no good running off 'half-cocked'; the wheels of bureaucracy had to be turned carefully. Glenn knew that NASA would need careful persuading if they were to accept the proposal as viable. Glenn informally discussed the weightless/ ageing correlation with a number of NASA doctors who agreed that research should be conducted.

He introduced NASA Administrator Dan Goldin to the subject, also informally and took every opportunity to bring it up again. He even said at one point that if NASA decided to do it then, "I'd like to volunteer." The National Institute on Ageing (NIA) discussed the subject at two special meetings and collected much information. At a reception in December 1995, Glenn raised the subject with Goldin again. He talked about how interested the NIA was to obtain more information. Goldin turned to him and said, "You're serious about this, aren't you." Glenn replied, "Serious as I can be."

Glenn also knew that Presidential approval would be necessary for the flight to go ahead. Fortunately, he was on good terms with President Clinton and accompanied him on a number of election trail trips during the 1996 presidential election campaign. He took the opportunity to discuss the subject. What Clinton said reassured Glenn that he would not stand in his way.

In mid-1996, Glenn formally approached Dan Goldin and made his sales pitch. Goldin quickly weighed up the pro's and con's and agreed to take it further but he cautioned Glenn. Before NASA could seriously consider the proposal Glenn would have to pass the NASA physical, and the science and experiments would have to be sound enough to justify the mission. What he left unsaid, but also needed careful consideration, was what would the fall-out be if anything went wrong. Glenn was a national hero and the American public would want their 'pound of flesh' if anything happened to him.

The science stood up to review and Glenn passed the physical with flying colours. It was now down to Goldin and on 15 January 1998 he telephoned Glenn and said, "You're the most persistent man I've ever met." He gave him the news that he would okay the flight. He asked Glenn to keep this to himself until a press conference the next day. Rumours however had been circulating since the previous summer and the stories started up again. The morning press on 16 January 1998 proclaimed that NASA was about to confirm Glenn's return to space.

The press conference announced that Glenn would fly on the Space Shuttle Discovery in October 1998 on the designated STS-95 flight. Glenn would be payload specialist number two. Glenn said, "This is a great adventure and I'm very excited about it."

There was a mixed reaction to the news and controversy throughout

the lead up to the flight. In general, the general public greeted the news positively but even many of them were not entirely convinced that it was for purely scientific purposes. The scientists, professionals and politicians discussed and argued the merits of the mission. One scientist argued it was poor use of NASA's scarce resources. Some people accused NASA of a publicity stunt. Republican politicians said it was a blatant political payoff that rewards Glenn for his defence of the administration (some called it obstructionism) during the Senate hearings on campaign finances.

The White House insisted it was NASA's decision. On the day of the launch President Clinton actually denied publically that there was anything political about Glenn's flight, noting that he would have preferred Glenn to have remained in the Senate. Whatever the truth of the reasons for the flight there is no doubt the American people became excited by spaceflight again and that can be no bad thing. The same was true throughout the world. Glenn's flight sparked people's interest and those who remembered the early days of the space programme were reminded of Glenn's first flight. Even the world's press showed an interest and perhaps just for once forgot their normal attitude of concentrating on the negative aspects of man in space.

Perhaps the simplest way of looking at it is that NASA owed him one. After all, if NASA had not bowed to political pressure, Glenn would almost certainly have flown on Gemini.

STS-95 had already listed experiments on sleep patterns and the breakdown of muscle tissue which involve similar responses in astronauts in Zero G and elderly people. Glenn was assigned to work on these. Other age related experiments were added to the manifest to take advantage of Glenn's presence.

As the flight neared, NASA confirmed they had reviewed medical protocols and had extensively consulted with the medical profession. The conclusion was if Glenn had a medical emergency during the flight, the medical kit normally carried was quite sufficient. Even the US Congress got a little carried away. They renamed NASA's Lewis Research Centre in honour of Glenn. Henceforth it would be known as NASA's John H Glenn Research Centre at Lewis Field.

Perhaps Glenn had a feeling of 'déjà vu' a few days before the launch date. The weather forecast gave only a 50% chance of the weather being within acceptable limits. Would history repeat itself? Would it be like his Mercury flight when the weather conditions kept postponing the launch? In the event, the weather was perfect.

The interest in STS-95 was immense. Huge crowds flocked into the area around the Cape and media representation was well above normal. It was almost like the old days, a throwback to the time of the Mercury and Apollo launches. Even the British TV shopping channel QVC got in on the act. They had one of their English presenters over at the Cape with his US counterparts taking a live feed which was shown on both sides of the 'pond'. During what was a two and a half hour programme they covered not only the launch but sold official NASA merchandise.

Smiling From Ear to Ear

Glenn was seated in the middeck between Japanese astronaut/payload specialist number 1 Chiaki Mukai and mission specialist/payload commander Stephen Robinson. Glenn was on his back with the wall lockers less than three feet from his face. On the flight deck was shuttle commander Curt Brown, shuttle pilot Steven Lindsey, flight engineer/mission specialist Scott Parazynski and Spain's European Space Agency astronaut and mission specialist Pedro Duque.

During the built in hold at T minus 9 minutes an erroneous master alarm delayed countdown resumption for about 8 minutes. With 5 minutes to go, there was an unplanned hold when aircraft strayed into the air exclusion zone. It was only a few minutes before the clock started again. The launch window was over two hours long and these short delays never really put the launch in doubt but it did serve to add to the tension for those of us sat in front of our television screens waiting for it and wanting to breathe again.

At T minus 6 seconds the main engines ignition sequence started. At T minus 4 seconds part of the landing drag parachute door fell off. This excepted, launch proceeded normally. Lift-off of STS-95 'Discovery' at 14 hours, 19 minutes and 34 seconds Eastern Standard Time on 29 October 1998. After 8½ minutes Glenn was experiencing Zero-G from space for the first time in more than 36 years.

When Glenn was able to go up to the flight deck, he was able to look at Earth. He realised how much he had missed being in space. Curt Brown radioed Houston, "Let the record show that John has a smile on his face and it goes from one ear to the other and we haven't been able to remove it yet."

Just over three hours into the flight and Glenn's first communication to the ground was "Zero G and I feel fine," mirroring the quote he had given on his Mercury flight. In another throw-back to Mercury, the citizens of Perth in Australia again switched on their lights. Glenn noted that Perth had grown since 1962 and it was brighter now. Glenn once again asked for his thanks to be passed on to the people of Perth.

The flight proceeded as planned with Glenn involved in many experiments. NASA flight surgeons reported they were extremely pleased with Glenn's adaptation to space. He had no ill effects, no vomiting or nausea and sleeping fine. Glenn achieved the normal level of sleep on a shuttle flight of five to seven hours per night.

Media attention focussed on Glenn and at one point he commented, "I do wish they'd centre on some of the rest of the people on this flight. These are brilliant people doing wonderful work and research up here."

After analysis, NASA stated that the only potential problem from the loss of the drag parachute door that had occurred during the launch sequence was at the chute deployment time after landing. As 45 landings had been carried out, all successfully, before the chute system had been fitted, NASA saw no problem in making it 46. NASA told the crew to deploy the chute only in an emergency.

Discovery landed on runway 33 at the Kennedy Space Center on 7 November 1998. The flight had lasted for 8 days, 21 hours, 44 minutes and 56 seconds and Glenn had added another 134 orbits to his previous score of three. Curt Brown told Glenn he should make a homecoming statement and he said, "Houston, this is PS 2, otherwise known as John. One G and I feel fine." This was not strictly true.

Although speculation that he would find the return to normal gravity difficult due to his age proved unfounded he was finding his high-salt fluid intake uncomfortable. This lemon-lime flavoured fluid was supposed to counteract the effects of returning to normal gravity loads. He was supposed to down five of the eight ounce bags but by the time he had drank three it tasted awful.

He was able to walk unaided after he left the shuttle although he was a little more unsteady than the rest of the crew. He made it to the crew transport vehicle and got out of his spacesuit before the "salt-loaded lemon-lime gunk" as Glenn described it in his memoirs made a return journey. He reckoned it all came back and that his body had absorbed none.

He was determined to walk out of the transport vehicle under his own power and joined his crewmates on the traditional walk around the shuttle. He then drank some water and began to feel better. The post flight medical examination in general produced no anomalous results and soon he was reunited with his family. The next several months would see further tests and observations.

On 3 January 1999, Glenn formerly retired from the Senate. As for the ageing experiments, well the scientists were enjoying their study and analysis time and pronounced it would be several months, perhaps even a year before the results were made public. But for us, the spaceflight enthusiast, the flight was about John Glenn, now a twice flown astronaut. Glenn thanked NASA for the flight and promised to promote the space programme in any way he can.

Was there more to come? I am sure deep down Glenn would have loved to fly again but I think he knew STS-95 was a one-off. He

was actually asked the question during the flight but referred the questioner to his wife. Annie wanted her husband to wind down and spend more time with her and the family and when she was asked the specific question she replied in no uncertain terms, ".... There are going to be no more flights."

He was still flying his own aircraft, a twin piston engine Beechcraft Baron, until January 2012 when he sold the aircraft citing aging knees making it difficult for him and his wife to climb on the wing to get into the cabin. He continued to make public appearances promoting the space programme and remained very active until 2014 when he suffered a minor stroke, affecting his vision, after undergoing heart-valve replacement surgery. He would still make occasional appearances into 2016. He made one of his final public appearances in June 2016, when the Columbus airport in Ohio was renamed the John Glenn Columbus International Airport in his honour.

Glenn was the last surviving member of 'The Mercury Seven'. Gus Grissom had died in the Apollo 1 fire in 1967 whilst training to command the first manned Apollo mission. He was the only one to die whilst a serving astronaut. All the others died of natural causes; Deke Slayton in 1993 as a result of a brain tumour; Al Shepard in 1998 from complications of leukaemia; Gordo Cooper in 2004 of heart failure; Wally Schirra in 2007 following a heart attack; and Scott Carpenter in 2013 subsequent to a stroke.

NASA's Commercial Crew Program Target Test Flight Dates and secures Crew Rotation flights

The next generation of American spacecraft and rockets that will launch astronauts to the International Space Station are nearing the final stages of development and evaluation. NASA's Commercial Crew Program will return human spaceflight launches to U.S. soil, providing reliable and cost-effective access to low-Earth orbit on systems that meet our safety and mission requirements. To meet NASA's requirements, the commercial providers must demonstrate that their systems are ready to begin regular flights to the space station. Two of those demonstrations are uncrewed flight tests, known as Orbital Flight Test for Boeing, and Demonstration Mission 1 for SpaceX. After the uncrewed flight tests, both companies will execute a flight test with crew prior to being certified by NASA for crew rotation mission.

Targeted Flight Dates:

Boeing Orbital Flight Test: June 2018
Boeing Crew Flight Test: August 2018
SpaceX Demonstration Mission 1: November 2017
SpaceX Demonstration Mission 2: May 2018

NASA's Commercial Crew Program secured eight crew rotation missions from Boeing and SpaceX – four from each company. The missions will carry astronauts to the International Space Station through 2024. The four additional missions will fly following NASA certification. They fall under the current Commercial Crew Transportation Capability contracts, and bring the total number of crew rotation missions awarded to each provider to six.

The additional flights will allow the commercial partners to plan for all aspects of these missions while fulfilling space station transportation needs. The awards do not include payments at this time.

The two commercial spacecraft also will provide a lifeboat capability to allow the astronauts aboard the station to return safely to Earth in an emergency, if necessary.

Returning human launch capabilities to U.S. soil underscores NASA's commitment to the station and the research that the orbiting laboratory makes possible including the advancement of scientific

It was reported on 7 December 2016 that he had been admitted to hospital. He died on 8 December 2016 at the Wexner Medical Center at The Ohio State University in Columbus. No cause of death has been reported. He is survived by his wife Annie; two children, Carolyn Ann Glenn and John David Glenn; and two grandsons, Daniel and Zach Glenn. As for the last word, I think I will leave that to Scott Carpenter, Glenn's Mercury back-up, "Godspeed John Glenn."

Acknowledgements and sources:

In 1998/1999 I wrote a three part article for CapCom commemorating Glenn's second spaceflight. This obituary is in part based upon that work although extensively reworked and updated. It is interesting comparing the research used then with now and I will be writing about this in the next issue of CapCom when I will give a full listing of sources. I should however note the importance to this work of two books, 'John Glenn: A Memoir' ©1999 by John Glenn and secondly the Mercury Seven astronaut authored book 'We Seven' ©1962. The former had not been around when I wrote my earlier work and I referred to it frequently when researching the latest article. 'We Seven' was used extensively in preparing the earlier piece.

Rob Wood

knowledge off the Earth, for the benefit of those on the Earth and to prepare for future deep space exploration.

The Commercial Crew Program will help NASA get full operational use from the national laboratory for scientific research by increasing the number of astronauts on the space station, and allowing the crew members to dedicate more time to research.

NASA
<http://www.nasa.gov>

Virgin Galactic Completes Successful First Glide Flight Test

Virgin Galactic's new space ship, VSS Unity, has successfully completed its first free flight! This important test flight marks the first time that a vehicle built by the company's sister organisation, The Spaceship Company, has flown fully under its own control.

For this flight, VSS Unity was piloted by Mark Stucky and Dave Mackay, with pilots Mike Masucci and Todd Ericsson as well as flight test engineer Dustin Mosher in WhiteKnightTwo. Over the course of the 1 hour 20 minute flight—particularly the 10 minutes of free flight for SpaceShipTwo—our pilots, mission controllers, and ground crew collected valuable data.

This test flight was the fifth flight of VSS Unity (and the 218th flight of WhiteKnightTwo), following several recent Captive Carry flights.

As referenced earlier, this glide flight was the first of many. We have not yet reached the rocket powered phase of the test flight program—first we need to gather test flight data to confirm our analyses and calculations about how VSS Unity will perform in a wide variety of real-world flight conditions.

As expected, for this first gliding test flight, VSS Unity was flying light and slow, achieving a maximum speed of approximately Mach 0.6 while gliding home from an altitude of 50,000 feet. An initial look at the data as well as feedback from our two pilots indicate that today's flight went extremely well, but we'll take the time to properly and thoroughly analyze the vehicle's performance before clearing the vehicle for our next test. We're looking forward to getting back into the skies as soon as the engineers say we are ready to do so.

Virgin Galactic
<http://www.virgingalactic.com>



ISS MISSION UPDATE

By *George Spiteri*



Expedition Fifty is about one month into orbital operations aboard the International Space Station (ISS). Following the safe return to Earth in late-October of Russian Anatoli Ivanishin, American Kate Rubins and Japan's Takuya Onishi, the complex is manned by its latest Commander, American Shane Kimbrough, who is joined by Flight Engineers, American Peggy Whitson, Russians Andrei Borisenko, Sergei Ryzhikov and Oleg Novitsky and Frenchman Thomas Pesquet.

At 0045 BST on 18th October (1945 17th October local time) Orbital ATK launched the Cygnus unmanned vehicle atop an upgraded Antares 230 rocket from Wallops, Virginia on the Commercial Resupply Services-5 (CRS-5) OA-5 mission. Named in honour of astronaut Alan Poindexter, who died in 2012, this was the first flight of Cygnus from its mid-Atlantic launch pad since the launch explosion that destroyed the vehicle and damaged the pad in October 2014.

Following several weeks of delays due to technical problems, Soyuz MS-02/48S was launched from Baikonur at 0905 BST on 19th October (1405 local time) carrying veterans Andrei Borisenko and Shane Kimbrough and rookie Sergei Ryzhikov. Soyuz docked at the Station's Poisk Module seven minutes ahead of schedule at 1052 BST on 21st October and the new arrivals floated into their new orbital home two and a half hours later to return the ISS to a six person complement.

Carrying approximately 5100 pounds of supplies, Cygnus was grappled by the Station's robotic Canadarm2 at 1228 BST on 23rd October and installed onto the nadir or Earth facing port of the Unity Module nearly three and a half hours later at 1553 BST. The crew opened the hatch to Cygnus the following day and began unloading its supplies three days ahead of schedule.

The traditional Change of Command ceremony took place on 28th October with Ivanishin relinquishing Command to Kimbrough. Ivanishin, Rubins and Onishi floated into Soyuz MS-01/47S the following day and undocked their spacecraft from Rassvet at 0135 BST on 30th October to signal the official start of Expedition 50. Soyuz landed near the remote Kazakh town of Dzhezkazgan a few hours later at 0358 GMT (0958 local time) to complete a mission of 115 days 2 hours 22 minutes. Rubins and Onishi were flown by NASA private jet back to Houston whilst Ivanishin returned to Star City outside Moscow.

31st October witnessed the 16th anniversary of continual human occupancy in space since the launch of Expedition One in 2000, which docked to the ISS two days later.

8th November was US election day and Kimbrough voted from orbit as have space fliers before him. Asked by a journalist from Russia TV before his flight who he'd vote for? Kimbrough smiled and gave a diplomatic response that he was "pretty much apolitical".

The ISS remained under temporary three person operations with the crew conducting routine maintenance and scientific experiments in early-mid November.

At 2020 GMT on 17th November (0220 18th November local time) Soyuz MS-03/49S was launched from Baikonur's Site 1 carrying veterans, Commander Oleg Novitsky and Peggy Whitson and rookie Thomas Pesquet. Soyuz docked to the Station's vacated Rassvet Module at 2158 GMT on 19th November and nearly three hours later the new arrivals floated into the Station to return it once again to its usual six person complement.

One of the first jobs for the six person crew was to detach Cygnus using Canadarm2 from the Station at 1322 GMT on 21st November, the vehicle eventually re-entered the Earth's atmosphere six days later on 27th November when it was de-orbited over the Pacific Ocean but not before it carried out further scientific and flammability experiments under NASA's Saffire-II study and deployed four Lemur-2 CubeSats.

24th November was US Thanksgiving Day and the Russian and French crewmen joined their American counterparts to celebrate according to Kimbrough with turkey in a pouch, candy yams, cornbread dressing, green beans, mushrooms, mashed potatoes, cherry and blueberry pie cobbler and sweet tea with lemon.

Progress MS-04/65P was launched from Baikonur's Site 1 at 1451 GMT on 1st December (2051 local time). Initially the launch went well but the Soyuz-U rocket's third stage single engine shut down early causing the spacecraft to separate and re-enter the Earth's atmosphere and burn up, resulting in the loss of 2.6 tons of crew supplies, including fuel for the ISS, the first of a new generation of the Russian Orlan EVA space suit and the Lada-2 greenhouse which would have attempted to grow sweet pepper, wheat and salad once in orbit. The crew were informed of the anomaly and despite the accident have enough supplies for four to six months.

The next unmanned cargo ship launched successfully to the ISS was JAXA's Kounotori (White Stork) HTV-6 which lifted-off from Japan's Tanegashima launch site at 1326 GMT on 9th December (2226 local time) atop a H-II/B rocket carrying approximately six tons of cargo including six Orbital Replacement Units (ORUs) and twelve CubeSats for future deployment. Kounotori was due to arrive at the ISS on 13th December when it would be grappled by Canadarm2.

As of 9th December, Kimbrough, Borisenko and Ryzhikov have been in space for 52 days, whilst Whitson, Novitsky and Pesquet have logged 23 days in orbit.

Igor Volk: 1937 - 2017

The Russian web site Zhukovsky City as reported that Soviet-era Cosmonaut Igor Volk, who trained to fly Buran Space Shuttle, died on 3 January at the age of 79.

Volk, Igor Petrovich, was a cosmonaut-researcher on "Soyuz T-12" and orbital station "Salyut-7" station, pilot-cosmonaut, Hero of the Soviet Union, Honoured Test Pilot of the USSR, President of the International Association "Earth and space exploration," and an honorary citizen of Zhukovsky city, near Moscow.

Zhukovsky City
<http://zhukovskiy.ru>



Come and meet astronaut Dr Don Thomas

Dr Thomas has flown aboard four space shuttle missions; he flew in space for more than 44 days and travelling over 17 million miles

Wednesday 22 March 2017

Join Dr Thomas for an evening event at the Calderfields Golf and Country Club, Walsall.

Dr Thomas will give a lecture "Living in Space" followed by a Q&A session and one autograph per person

Saturday 25th March 2017

Join Dr Thomas for a full day of activities at the National Space Centre Leicester including: Breakfast with an astronaut, planetarium lecture, professional photo sessions and autograph opportunities

For full details visit:

www.astronautevent.co.uk

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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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Copy Deadline

All contributions intended for the March - April 2017 issue should be emailed to the editor by

Friday 10 February 2017