2010 001A (36287)
Name: Beidou 2-G1
Country: China
Launch date: 16 January 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ 3C
Orbit: geostationary at 144.5°E

Navigational satellite in the Compass system as described for 2007 011A.
2010 002A (36358)
Name: Raduga 1M-2
Country: Russia
Launch date: 28 January 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/Briz M
Orbit: geostationary at 55°E

Globus M military communications satellite as described for 2007 058A.
<table>
<thead>
<tr>
<th>Name</th>
<th>Kavoshgar-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>Iran</td>
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<tr>
<td>Launch date</td>
<td>3 February 2010</td>
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<tr>
<td>Re-entry</td>
<td>n.a.</td>
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<tr>
<td>Launch site</td>
<td>Semnan</td>
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<tr>
<td>Launch vehicle</td>
<td>Nazeat 6 (?)</td>
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<tr>
<td>Orbit</td>
<td>sub-orbital to 55 km</td>
</tr>
</tbody>
</table>

Sub-orbital flight to test the recovery of a Capsule type B that carried turtles and mice.
Cargo transfer spacecraft as described for 2008 060A. Progress M-04M docked at the Zvezda rear port of ISS (1998 067A) on 4 February 2010. The flight was also known as ISS-36P. The spacecraft undocked on 10 May 2010 but remained in orbit to take part in the Reflection geophysical experiment to study reflective characteristics of the freighter's hull and the transparency of the Earth's atmosphere.
Crewed spaceflight with astronauts G. Zamka (Cmdr.), T. Virts (Pilot), R. Behnken, N. Patrick, K. Hire and S. Robinson (all Mission Specialists), using the orbiter Endeavour as described for 1981 034A. The objective was to undertake the International Space Station (ISS)-20A mission. The payload included Tranquility (Node-3) and the Cupola, a dome-shaped module that was attached to Tranquility.

Other experiments that were carried by the orbiter were:

1. Mycological Evaluation of Crew Exposure to ISS Ambient Air (Myco), a Japanese experiment to evaluate the risk of inhalation of microorganisms when breathing and of adhesion to the skin, which is exposed to ambient air during a stay in the ISS;
2. a Developmental Test Objective (DTO) experiment as described for STS-1 (1981 034A):
   • DTO 900 Solid Rocket Booster Thrust Oscillation;
3. several Short-duration Research and Station Experiments:
   • Shuttle Exhaust Ion Turbulence Experiments (SEITE) as described for STS-126 (2008 059A);
   • National Lab Pathfinder – Vaccine (NLP-Vaccine)-7, a commercial payload to investigate the use of ISS as a processing laboratory;
   • Sleep-Wake Actigraphy and Light Exposure during Spaceflight – Short (Sleep-Short) as described for STS-120 (2007 050A);
   • Spinal Elongation and its Effects on Seated Height in a Microgravity Environment (Spinal Elongation) investigation to provide quantitative data about the amount of change that occurs in the seated height due to spinal elongation in space;
   • Shuttle Ionospheric Modification with Pulsed Localized Exhaust Experiments (SIMPLEX) as described for STS-84 (1997 023A);
   • Ram Burn Observations (RAMBO), as described for STS-111 (2002 028A);
   • Maui Analysis of Upper Atmospheric Injections (MAUI) as described for STS-121 (2006 028A).
4. a number of experiments for installation on ISS:
   • Validation of Procedures for Monitoring Crew Member Immune Function (Integrated Immune);
   • National Lab Pathfinder – Cells (NLP-Cells-3);
   • Sleep-Wake Actigraphy and Light Exposure During Spaceflight – Long (Sleep-Long);
   • Transgenic Arabidopsis Gene Expression System (TAGES);
   • Analysis of a Novel Sensory Mechanism in Root Phototropism (Tropi);
   • Investigating Mechanisms of Heart Disease with New Portable Equipment (Card);
   • BioRhythms;
   • Educational Payload Observation (JAXA-EPO);
   • Nanoskeleton; and
   • Passive Dosimeter for Lifescience Experiment in Space (PADLES).

The orbiter docked with the PMA-2 port of the International Space Station (1998 067A) on 10 February 2010. On 12 February 2010 Behnken and Patrick undertook a 6 hours, 32 minutes EVA during which they prepared Tranquility for undocking and worked on the removal of a tool stowage assembly from Dextre. On the same day and during the EVA, the Tranquility module was unberthed from Endeavour’s payload bay and installed on the port side of the Unity module (1998 069F). The next day the Tranquility module was accessed and prepared for operations.

On 14 February 2010 Behnken and Patrick undertook a second EVA during which they install ammonia jumper cables, thermal insulation and other outfitting items on Tranquility. This EVA lasted 5 hours, 54 minutes.
On 15 February 2010 the Cupola was moved from the forward port of Tranquility to the nadir port of Tranquility whilst on 16 February 2010 the PMA-3 module was moved from the Harmony zenith port to the Tranquility front port.

The final EVA on 5 hours, 48 minutes took place on 17 February 2010 during which Behnken and Patrick connected PMA-3 cables and prepared Cupola for operations.

The orbiter undocked on 19 February 2010 and landed at the Kennedy Space Center after a flight of 13 days, 18 hours, 6 minutes.
Initially known as Node-3, the Tranquility module to the International Space Station (1998 067A) was built by Alcatel-Alenia Space and was similar to the Node-2 (Harmony) of the space station. Tranquility was brought to the International Space Station ISS (1998 067A) by STS-130 (2010 004A) and was attached to the port side of the Unity module (1998 069F) on 12 February 2010. Tranquility carried eight refrigerator-sized racks of environmental control and life support systems which contained:

1. the Oxygen Generation System that takes the station's water and splits it apart into hydrogen, which gets vented into space, and oxygen, which is returned into the cabin for the crew to breathe;
2. the Atmosphere Revitalization System that controls the station's carbon dioxide levels and maintains the temperature and atmospheric pressure at comfortable levels;
3. the Water Recovery System and Urine Processor Assembly that take waste water from the station's shower and toilets and purifies it, separating any contaminants and making it safe for the crew to drink; and
4. the Waste and hygiene compartment that provides a place for the crew to shower and use the bathroom in a way that allows the station to process the majority of the water used onboard so that it may be used again.

Tranquility had six attachment ports and was originally to provide attachment ports for the US Habitation Module and Crew Return Vehicle (CRV), both of which had been cancelled at an earlier date. Tranquility did not receive an International designation.

The Cupola module was attached to the front port of Tranquility during the launch. It was afterwards moved to the nadir port of Tranquility on 15 February 2010. The Cupola (Italian for 'dome') observatory module was originally planned to be built by NASA and Boeing but was cancelled due to budget cuts. It was then built by Alenia Spazio under the auspices of ESA. The 1880 kg module had a maximum diameter of 2.95 m and a height on 1.50 m. It was fitted with seven windows, the largest being 80 cm in diameter, and allowed the crew to conduct experiments, visually monitor dockings and make observations of Earth.

Cupola was originally to be flown on the cancelled mission ISS-14A.
The Solar Dynamics Observatory (SDO) was the first mission in NASA's Living With a Star (LWS) Program which aimed to understand the causes of solar variability and its impacts on Earth. The objective of SDO was to understand how the Sun's magnetic field is generated and structured and how this stored magnetic energy is converted and released into the heliosphere and geospace in the form of solar wind, energetic particles. It also studied the variations in the solar irradiance.

The 3100 kg spacecraft carried three scientific experiments:

1. Atmospheric Imaging Assembly (AIA) to image the solar atmosphere in multiple wavelengths to link changes in the surface to interior changes;
2. EUV Variability Experiment (EVE) to measure the solar extreme-ultraviolet (EUV) irradiance with unprecedented spectral resolution, temporal cadence, and precision, and
3. Helioseismic and Magnetic Imager (HMI) to provide a continual full-disk coverage of the Sun at higher spatial resolution.

Whilst in the geostationary belt, the satellite does not hover above one spot on the globe but, instead, drifts 28° north and south of the equator in a figure eight pattern.

Formerly known as Panamsat-11R but renamed when purchased by Intelsat, Intelsat-16 was built by Orbital Sciences using a Star 2 platform. The 2450 kg satellite carried 24 Ku band transponders. In November 2013 it was moved to 79°W; in June 2014 to 76°W and 58°W again in March 2016.
2010 007A (36400)
Name: Kosmos-2459
Country: Russia
Launch date: 1 March 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/DM2
Orbit: 19119 x 19146 km, inclination: 64.8°

Glonass M navigational satellite as described for 2001 053A.
<table>
<thead>
<tr>
<th><strong>2010 007B (36401)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong> Kosmos-2461</td>
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<td><strong>Country:</strong> Russia</td>
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<td><strong>Launch date:</strong> 1 March 2010</td>
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<td><strong>Re-entry:</strong> in orbit</td>
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<td><strong>Launch site:</strong> Baikonour</td>
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<tr>
<td><strong>Launch vehicle:</strong> Proton M/DM2</td>
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<tr>
<td><strong>Orbit:</strong> 19128 x 19135 km, inclination: 64.8°</td>
</tr>
</tbody>
</table>

Glonass M navigational satellite as described for 2001 053A.
2010 007C (36402)
Name: Kosmos-2460
Country: Russia
Launch date: 1 March 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/DM2
Orbit: 19131 x 19133 km, inclination: 64.8°

Glonass M navigational satellite as described for 2001 053A.
Name: GOES-15
Country: USA
Launch date: 4 March 2010
Re-entry: in orbit
Launch site: Cape Canaveral
Launch vehicle: Delta 4M+(4,2)
Orbit: geostationary at 105°W

Meteorological satellite as described for 2006 018A. Before the launch it was known as GOES-P. In December 2011 it was relocated to 135°W.
2010 009A (36413)
Name: YW-9A
Country: China
Launch date: 5 March 2010
Re-entry: in orbit
Launch site: Jiuquan
Launch vehicle: CZ 4C
Orbit: 1083 x 1100 km, inclination: 63.4°

Earth observation satellite as described for 2006 015A. Also known as Jian Bing 8-1.
2010 009B (36414)
Name: YW-9B
Country: China
Launch date: 5 March 2010
Re-entry: in orbit
Launch site: Jiuquan
Launch vehicle: CZ 4C
Orbit: 1083 x 1100 km, inclination: 63.4°

Companion satellite to YW-9A (2010 009A).
2010 009C (36415)
Name: YW-9C
Country: China
Launch date: 5 March 2010
Re-entry: in orbit
Launch site: Jiuquan
Launch vehicle: CZ 4C
Orbit: 1083 x 1100 km, inclination: 63.4°

Companion satellite to YW-9A (2010 009A).
Name: Echostar-14
Country: USA
Launch date: 20 March 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/Briz M
Orbit: geostationary at 119°W

Communications satellite owned by Echostar. The 634 kg satellite was built by Space Systems/Loral using the LS-1300 space platform. Fitted with 103 transponders in the Ku band, the satellite provided services for the DISH Network's more than 13 million direct-to-home television subscribers.
Crewed spaceflight with cosmonauts A. Skvortsov (Cmdr.), M. Komiyenko (Fl. Eng) and T. Caldwell (USA) (Fl.Eng), using a Soyuz TMA spacecraft as described for 2002 050A. The mission was also known as ISS-22S and the call sign was Pulsar. They were part of the twenty third permanent crew (EX-23) for ISS and later transferred to the twenty fourth permanent crew (EX-24). The spacecraft docked at the Poisk port of ISS (1998 067A) on 4 April 2010. The spacecraft undocked on 25 September 2010 and landed shortly afterwards. The mission had lasted 177 days, 1 hour, 19 minutes.
Crewed spaceflight with astronauts A. Poindexter (Cmdr.), J. Dutton (Pilot), R. Mastracchio, C. Anderson, D. Metcalf-Lindenburger, S. Wilson and N. Yamazaki (Japan) (all Mission Specialists), using the orbiter Discovery as described for 1981 034A. The objective was to fly the International Space Station (ISS)-19A mission which carried the Leonardo Multi Purpose Logistic Module (MPLM) to deliver a number of racks:

1. Muscle Atrophy Research and Exercise System (MARES) for research on musculoskeletal, biomechanical, and neuromuscular human physiology to better understand the effects of microgravity on the muscular system;
2. Window Observational Research Facility (WORF) to provide a new capability for scientific and commercial payloads and educational opportunities;
3. Minus Eighty-Degree Laboratory Freezer for ISS (MELFI)-3, a European Space Agency-built and NASA-operated freezer that allowed samples to be stored on the station at temperatures as low as -80°C;
4. EXPedite the PRocessing of Experiments to Space Station (EXPRESS) Rack-7, a multipurpose payload rack system that stores and supports experiments aboard the International Space Station; and
5. Crew Quarters No. 4.

In addition a replacement Ammonia Tank Assembly was carried on the Lightweight Multi-Purpose Experiment Support Structure Carrier.

Other experiments carried by the orbiter were:

1. Mycological Evaluation of Crew Exposure to ISS Ambient Air (Myco) as described for STS-130 (2010 004A);
2. the Biological Research in Canisters (BRIC)-16 experiment as described for STS-64 (1994 059A), concentrating on the germination of Arabidopsis thaliana seeds in microgravity;
3. Mouse Immunology to expand the knowledge base of the effects of the space environment on mammalian immunology;
4. the Space Tissue Loss (STL) instrument as described for STS-45 (1992 015A);
5. the Education Payload Operations-Robotics (EPO-Robo) to create an on-orbit video demonstrating the operations of the robotic arm of the Space Shuttle;
6. several Developmental Test Objective (DTO) experiments as described for STS-1 (1981 034A):
   • DTO 701A TriDar Sensor (Triangulation and LIDAR Automated Rendezvous and Docking);
   • DTO 703 Sensor Test for Orion Relative Navigation Risk Mitigation (STORRM);
   • DTO 854 Boundary Layer Transition (BLT) Flight Experiment;
   • DTO 900 Solid Rocket Booster Thrust Oscillation;
7. a Detailed Supplementary Objective (DSO) experiment as described for STS-1 (1981 034A):
   • DSO-640: Physiological Factors;
8. several Short-duration Research and Station Experiments:
   • Shuttle Exhaust Ion Turbulence Experiments (SEITE) as described for STS-126 (2008 059A);
   • National Lab Pathfinder – Vaccine (NLP-Vaccine)-8, a commercial payload to investigate the use of ISS as a processing laboratory;
   • Sleep-Wake Actigraphy and Light Exposure during Spaceflight – Short (Sleep-Short) as described for STS-120 (2007 050A);
   • Shuttle Ionospheric Modification with Pulsed Localized Exhaust Experiments (SIMPLEX) as described for STS-84 (1997 023A);
   • Ram Burn Observations (RAMBO), as described for STS-111 (2002 028A); and
   • Maui Analysis of Upper Atmospheric Injections (MAUI) as described for STS-121 (2006 028A).
On 7 April 2010 the orbiter docked with the PMA-2 port of the International Space Station (1998 067A). The next day, 8 April 2010, the MPLM was taken out of the payload bay and attached to the Harmony module. The first EVA took place on 9 April 2010, when Mastracchio and Anderson prepared the new ammonia tank assembly for removal from the cargo bay and placement to the Space Station robotic arm for temporary storage, retrieved the MPAC/SEED from Kibo exposed facility, replace rate gyro assembly and prepared the P6 solar array batteries for replacement. The EVA lasted 6 hours 27 minutes.

Mastracchio and Anderson made a second EVA of 7 hours, 26 minutes on 11 April 2010 during which they replaced the ammonia tank assembly on the S1 truss, installed two port radiator grapple fixture stowage beams and retrieved two debris covers from external stowage platform 2.

The final EVA took place on 13 April 2010 when Mastracchio and Anderson installed the spent ammonia tank assembly in the payload bay and installed and retrieved a number of other fixtures. This EVA lasted 6 hours, 24 minutes.

On 16 April 2010 the MPLM was returned to the payload bay followed by separation from the ISS on 17 April 2010. Landing took place at the Kennedy Space Center and the mission duration was 15 days, 26 hours, 48 minutes.
CryoSat-2 was a 3.5 year radar mission to replace the satellite that failed on 8 October 2005. CryoSat-2 had the same mission objectives and instrument as the failed satellite and monitored the thickness of land ice and sea ice and helped explain the connection between the melting of the polar ice and the rise in sea levels and how this is contributing to climate change. CrySat-2 was the third mission in ESA's Earth Explorers programme.
<table>
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<tr>
<td>Country</td>
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<td>Launch vehicle</td>
<td>GSLV Mk.2</td>
</tr>
<tr>
<td>Orbit</td>
<td>failed to orbit</td>
</tr>
</tbody>
</table>

Gsat-4, also known as Healthsat, was a 2220 kg experimental communications satellite carrying a multi-beam Ka band transponder as well as the GPS Aided Geo Augmented Navigation (GAGAN) navigation payload operating in the C, L1 and L5 bands. In addition the satellite carried a number of technological experiments including an on-board structural dynamic experiment, a thermal control coating experiment and a vibration beam accelerometer.

The Israeli Tavuex-2 payload, consisting of a set of three telescopes which were to image the sky in the ultraviolet sky in order to study black holes, was deleted from the satellite due to concerns that the new upper stage may have reduced the rocket's payload capacity.

Failure of the third stage of the launch vehicle prevented the satellite being placed in its intended geostationary orbit at 82°E.
2010 014A (36511)
Name: Kosmos-2462
Country: Russia
Launch date: 16 April 2010
Re-entry: 21 July 2010
Launch site: Plesetsk
Launch vehicle: Soyuz U
Orbit: 181 x 351 km, inclination: 67.2°

Yantar 4KS2 military reconnaissance satellite as described for 2004 038A.
The Orbital Test Vehicle (OTV)-1 was a test flight of the first X-37B, an unmanned space vehicle capable of staying in space for up to 21 days before gliding to an autonomous re-entry and landing at the end of its flight. Designed by Boeing and funded by the USAF, it provided the US military with a testing platform for new space technologies. The X-37B incorporated a number of untested technologies, including new thermal protection tiles underneath and high-temperature components and seals. No details of the experiments carried on this flight, were released.

The 5000 kg spacecraft had a wing span of 14’11” and a length of 29’. It was powered by a Rocketdyne AR-2/3, which was fuelled by hydrogen peroxide and JP-8. It was also known as USA-212.

In August 2010 its orbit was raised by 50 km and further orbital maneuvers had been observed on 6 October 2010, 1 November 2010 and 12 November 2010. The last observed orbit was circular at 285 km with an inclination of 40°.

For the landing at Vandenberg AFB the spacecraft fired its main engine to descent from orbit and went through the hot temperatures created during the re-entry into the atmosphere protected by an insulating shield of blankets and ceramic tiles.
2010 016A (36516)
Name: SES-1
Country: Luxembourg
Launch date: 24 April 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/Briz M
Orbit: geostationary at 101°W

Communications satellite owned by SES World Skies and built by Orbital Sciences using the Star 2.4 platform. The 2561 kg satellite carried 24 C band transponders and 24 Ku band transponders. The satellite was initially known as AMC-4R and had been ordered by SES Americom.
Name: Kosmos-2463
Country: Russia
Launch date: 27 April 2010
Re-entry: in orbit
Launch site: Plesetsk
Launch vehicle: Kosmos 3M
Orbit: 970 x 1021 km, inclination: 82.9°

Parus military navigational satellite as described for 1974 105A.
Name: Progress M-05M  
Country: Russia  
Launch date: 28 April 2010  
Re-entry: 15 November 2010  
Launch site: Baikonour  
Launch vehicle: Soyuz U  
Orbit: 247 x 262 km, inclination: 51.6°

Cargo transfer spacecraft as described for 2008 060A. Progress M-05M docked at the Pirs nadir port of ISS (1998 067A) on 1 May 2010. The flight was also known as ISS-37P. The spacecraft undocked on 28 October 2010 and continued flight in an independent science programme until it re-entered.
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Name: Celestis-9  
Country: USA  
Launch date: 4 May 2010  
Re-entry: n.a.  
Launch site: White Sands  
Launch vehicle: SpaceLoft XL  
Orbit: suborbital to 113 km

The Celestis-9 payload (Pioneer Flight) carried a number of human remains, including those that were on Celestis-8 of 2 May 2009. The flight also carried a number of student experiments. The launch took place from the Spaceport America facility.
The Pad Abort-1 test carried a dummy Orion crew module to an altitude of 1.2 km where it separated and landed successfully with parachutes, at a distance of 2 km from the launch site.

The flight lasted 2 minutes and 14 seconds.

Further tests of the Pad Abort system and the associated Ascent Abort system, were cancelled on 30 April 2010 as the Orion spacecraft is no longer planned to serve as a crewed spacecraft except as a space station ‘lifeboat’ function.
Crewed spaceflight with astronauts K. Ham (Cmdr.), T. Antonelli (Pilot), S. Bowen, M. Good, G. Reisman and P. Sellers (all Mission Specialists), using the orbiter Atlantis as described for 1981 034A. Good replaced K. Nyberg due to a medical condition.

The objective was to undertake the International Space Station (ISS)-ULF4 mission. At one stage this mission was associated with STS-137.

The flight carried a new pressurized component for Russia, the Mini Research Module (MRM-1), also known as Rassvet, was carried. The Rassvet module also carried US pressurized cargo. A radiator, airlock and European robotic arm for the Russian Multipurpose Laboratory Module (MLM) were also payloads on the flight. MLM, or Nauka, is scheduled to be launched in 2013 as ISS-3R.

In addition the orbiter carried:

1. an Integrated Cargo Carrier (ICC) as described for 2000 027A, in Vertical Light Deploy (VLD) mode to deliver maintenance and assembly hardware:
   - six battery Orbital Replacement Units (ORU)s for the Port 6 (P6) Integrated Equipment Assembly (IEA);
   - the Space-to-Ground Antenna (SGANT) and SGANT boom that was stored on the External Stowage Platform (ESP)-3 as described for STS-102 (2001 010A). The SGANT provides Ku band communication between the space station and the Tracking Data and Relay (TDRS) satellites;
   - the Replacement Unit Temporary Platform (EOTP) that was also stored on the External Stowage Platform 3 (ESP-3) as described for STS-102 (2001 010A);
2. a number of experiments for installation on ISS:
   - Biology and Biotechnology Gravity Related Genes in Arabidopsis (Genara)-A to provide an understanding of microgravity-induced, altered-molecular activities that will help to find plant systems that compensate the negative impact on plant growth in space;
   - Regulation by Gravity of Ferulate Formation in Cell Walls of Rice Seedlings (Ferulate), to test the hypothesis that microgravity modifies ferulic acid, thereby decreasing the mechanical strength of cell walls;
• Investigation of the Osteoclastic and Osteoblastic Responses to Microgravity Using Goldfish Scales (Fish Scales) to examine regenerating scales collected from anesthetized goldfish in microgravity;
• Hydrotopism and Auxin-Inducible Gene Expression in Roots Grown Under Microgravity Conditions (HydroTropi) to determine whether hydrotropic response can be used for the control of cucumber (Cucumis sativus) root growth orientation in microgravity;
• Microbial Dynamics in International Space Station (Microbe-I) to monitor microbes on board the space station that may affect the health of crew members;
• Cube Lab, a low-cost 1 kilogram platform for educational projects on the space station;
• Japan Aerospace Exploration Agency – Education Payload Observation (JAXA-EPO);
• Bisphosphonates as a Countermeasure to Spaceflight Induced Bone Loss (Bisphosphonates) to examine whether antiresorptive agents can protect station crew members from the regional decreases in bone mineral density;
• Nutritional Status Assessment (Nutrition), a comprehensive in-flight study done by NASA to date of human physiologic changes during long-duration spaceflight;
• Dietary Intake Can Predict and Protect Against Changes in Bone Metabolism During Spaceflight and Recovery (Pro K), an evaluation of a dietary countermeasure to lessen bone loss of astronauts;
• Repository (Repository) is a storage bank that is used to maintain biological specimens over extended periods of time;
• Selectable Optical Diagnostics Instrument – Aggregation of Colloidal Suspensions (SODI-Colloid) to study the aggregation (mass) phenomena of colloids (tiny solid particles suspended in a liquid) in the microgravity environment on board the space station;
• Japan Aerospace Exploration Agency – Commercial Payload Program, commercial items sponsored by JAXA sent to the space station to experience the microgravity environment;

3. several Developmental Test Objective (DTO) experiments as described for STS-1 (1981 034A):
   • DTO 805 Crosswind Landing Performance;
   • DTO 900 Solid Rocket Booster Thrust Oscillation;
4. a Detailed Supplementary Objective (DSO) experiment as described for STS-1 (1981 034A):
   • DSO-641: Risk of Orthostatic Intolerance During Re-exposure to Gravity;
5. several Short-duration Research and Station Experiments:
   • Shuttle Exhaust Ion Turbulence Experiments (SEITE) as described for STS-126 (2008 059A);
   • Biology and Biotechnology Microbiology (Micro)-2, a biology experiment to expand the understanding of how spaceflight affects the biological and molecular functions of the cell and the molecular mechanisms;
   • National Lab Pathfinder – Cells (NLP-Cells)-4, a commercial payload serving as a pathfinder for the use of the space station as a National Laboratory after station assembly is complete;
   • National Lab Pathfinder – Vaccine (NLP-Vaccine)-9, a commercial payload to investigate the use of ISS as a processing laboratory;
   • Sleep-Wake Actigraphy and Light Exposure during Spaceflight – Short (Sleep-Short) as described for STS-120 (2007 050A);
   • Shuttle Ionospheric Modification with Pulsed Localized Exhaust Experiments (SIMPLEX) as described for STS-84 (1997 023A);
   • Ram Burn Observations (RAMBO), as described for STS-111 (2002 028A); and
   • Maui Analysis of Upper Atmospheric Injections (MAUI) as described for STS-121 (2006 028A).

On 16 May 2010 the orbiter docked with the PMA-2 port of the International Space Station (1998 067A). Three spacewalks took place. On 17 May 2010 Reisman and Bowen installed a spare space-to-ground Ku-band antenna on the station’s truss and installed a new tool platform on the Dextre robotic arm. They also did some preparatory work for the next two EVAs. The EVA lasted 7 hours, 25 minutes.

On 18 May 2010 the Rassvet module was attached to the nadir port of the Zarya module of the International Space Station. The second EVA of 7 hours, 9 minutes, was on 19 May 2010 and Bowen and Good removed and replaced three of the six batteries on the port truss.
The used batteries were installed on the ICC cargo for return to Earth. On 21 May 2010 Good and Reisman performed the final EVA of 6 hours, 46 minutes, and installed the final three new batteries on the truss and put the old batteries on the carrier. They also retrieved a grapple fixture from Atlantis payload bay and brought it inside the station for use as a spare.

The ICC was placed in the payload bay on 22 May 2010.
The orbiter undocked on 23 May 2010 and landed at the Kennedy Space Center after a mission of 11 days, 18 hours, 28 minutes.
Rassvet (meaning ‘Dawn’) was built by Energya and began life as a Docking and Stowage Module (DSM) that was to provide stowage space as well as another docking port for Soyuz-TMA and Progress-M flights. With the cancellation of the last of the two planned Russian Research Modules, the DSM was modified to become the Mini Research Module-1. It incorporates the pressurized components of the cancelled Science Power Platform. The module had an empty mass of 5075 kg and 17$m^3$ of pressurised volume. For the flight to the space station it carried 2,940 kg of cargo including a spare elbow for the European Robotic Arm and equipment to be installed on the Multi-Purpose Laboratory Module to be launched in 2012. The module was lifted out of the payload bay on 18 May 2010 and was permanently attached to the nadir port of the Zarya module of the International Space Station (1998 067A). On the opposite site of the module, facing the Earth, was another docking port.
Name: KSat
Country: Japan
Launch date: 20 May 2010
Re-entry: 28 June 2010
Launch site: Tanegashima
Launch vehicle: H 2A-202
Orbit: 257 x 287 km, inclination: 29.9°

Cubesat developed at the Kagoshima University. It carried an instrument to study atmospheric water vapor. The 1 kg satellite was also known as Hayato.
2010 020B (36574)
Name: WasedaSat-2
Country: Japan
Launch date: 20 May 2010
Re-entry: 12 July 2010
Launch site: Tanegashima
Launch vehicle: H 2A-202
Orbit: 276 x 291 km, inclination: 29.9°

Cubesat developed at the Waseda University. The 1 kg satellite carried a camera for Earth observations. It failed to operate. There is no information on WasedaSat-1.
<table>
<thead>
<tr>
<th><strong>2010 020C (36575)</strong></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong></td>
<td>Negai*</td>
</tr>
<tr>
<td><strong>Country:</strong></td>
<td>Japan</td>
</tr>
<tr>
<td><strong>Launch date:</strong></td>
<td>20 May 2010</td>
</tr>
<tr>
<td><strong>Re-entry:</strong></td>
<td>26 June 2010</td>
</tr>
<tr>
<td><strong>Launch site:</strong></td>
<td>Tanegashima</td>
</tr>
<tr>
<td><strong>Launch vehicle:</strong></td>
<td>H 2A-202</td>
</tr>
<tr>
<td><strong>Orbit:</strong></td>
<td>269 x 289 km, inclination: 29.9°</td>
</tr>
</tbody>
</table>

Cubesat developed at the Soka University. The 1 kg satellite tested a field programmable gate array in orbit and carried also a camera to return images of Earth.
Previously known as Planet C, the 480 kg Akatsuki spacecraft carried six instruments to study the Venus atmosphere:
1. two infrared cameras to observe lower level clouds and collect data on potential active volcanoes;
2. a longwave infrared instrument and an ultraviolet imager to look at cloud tops and track global storm;
3. a lightning and airglow camera to take pictures of the night side of Venus; and
4. a radio science experiment to derive temperature and vapour profiles of the atmosphere.

On 6 December 2010 the spacecraft failed to be placed in an orbit around Venus. Akatsuki was targeted for an insertion orbit with a low point of 550 km and a high point of more than 190,000 km above the surface of Venus. Three more thruster burns had been planned for 9 December, 11 December and 13 December 2010 to reach the spacecraft's desired orbit of 550 x 80,000 km. However, after analysis of communications data, JAXA engineers concluded the spacecraft was not inserted into the desired orbit after that the orbit insertion motor worked for only 2½ minutes rather than 12 minutes. It is believed this was due to a faulty valve in the orbit insertion engine.

The spacecraft remained in its interplanetary orbit and, based on the alignment of the planet and the spacecraft's trajectory, another chance to perform a Venus orbit insertion was planned for late 2015 using the reaction control thrusters.

In November 2011 three short burns of the spacecraft's reaction control thrusters modified the spacecraft's trajectory slightly.

On 9 December 2015 the spacecraft, using the reaction control thrusters again, was successfully placed in an 400 x 440,000 km orbit around Venus with an inclination of 3°. The observation programme will commence in April 2016.
The 310 kg Interplanetary Kite-craft Accelerated by Radiation Of the Sun (Ikaros) was a solar sail demonstrator that deployed a 20 x 14 m solar sail on 9 June 2010. The spacecraft deployed two tiny 6 x 6 cm subsatellite cameras called DCAM-1 and -2 to monitor the success of the deployment process. Each of the DCAMs featured a camera and was battery powered and had an operating time of 15 minutes. DCAM-1 was deployed on 14 June 2010 and DCAM-2 on 19 June 2010. They did not receive separate International Designations. It is thought they remained in an orbit similar to Ikaros.

The spacecraft flew past Venus on 8 December 2010 in an interplanetary orbit.
2010 020F (36578)
Name: UNITEC-1
Country: Japan
Launch date: 20 May 2010
Re-entry: in orbit
Launch site: Tanegashima
Launch vehicle: H 2A-202
Orbit: 0.72 x 1.07 AU, inclination: 2.0°

Satellite developed by the Unisec organization to test new spacecraft computer hardware. It had a mass of 16 kg. The satellite failed after a few hours. It was also known as Shin'en.
2010 021A (36581)
Name: Astra-3B
Country: Luxembourg
Launch date: 21 May 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5ECA
Orbit: geostationary at 23.5°W

Communications satellite owned by SES and built by Astrium using the Eurostar E3000 platform. The 5471 kg satellite carried 52 transponders in the Ku and Ka bands.
2010 021B (36582)
Name: ComsatBw-2
Country: Germany
Launch date: 21 May 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5ECA
Orbit: geostationary at 13.2°E

Military communications satellite as described for 2009 054B.
Navigational satellite as described for 1989 013A. This next generation of satellites, which carried no apogee kick motor as the launch vehicle provided direct insertion into the appropriate orbit, was built by Boeing/Rockwell and utilized a modular approach that allowed payloads to be changed when technology changes. The satellites had a mass of 1630 kg. Navstar 2F-1 was also known as GPS 2F-1, USA-213, Polaris, Navstar-62, Navstar-65 and SVN-62. There is a total requirement for 33 satellites to be launched over a period of 12 years.
Space Environment reliability Verification Integrated System (SERVIS)-2 was designed to verify the use of commercial off-the-shelf technologies in a space environment and from that establish evaluation and equipment design guidelines for the use of such technologies. The 740 kg satellite was designed by the Institute for Unmanned Space Experiment Free Flyer (USEF), in Tokyo, under a contract from the Ministry of Economy, Trade and Industry (METI) and the New Energy and Industrial Technology Development Organisation (NEDO).
2010 024A (36590)
Name: Beidou 2G-3
Country: China
Launch date: 2 June 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ-3C
Orbit: geostationary at 84.7°

Navigational satellite in the Compass system as described for 2007 011A. In November 2012 it was relocated to 110.5°E.
Name: Badr-5B
Int. Agency: Arabsat
Launch date: 3 June 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/Briz M
Orbit: geostationary at 26°E

Communications satellite owned by Arabsat. The 5420 kg satellite was built by EADS Astrium using the Eurostar 2000+ spacebus. It carried 52 Ku and Ka band transponders. The satellite was also referred to as Arabsat-5B.
<table>
<thead>
<tr>
<th>Data Point</th>
<th>Details</th>
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<tbody>
<tr>
<td>2010 026A (36595)</td>
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<tr>
<td>Name:</td>
<td>Falcon 9/Dragon Mock Up</td>
</tr>
<tr>
<td>Country:</td>
<td>USA</td>
</tr>
<tr>
<td>Launch date:</td>
<td>4 June 2010</td>
</tr>
<tr>
<td>Re-entry:</td>
<td>27 June 2010</td>
</tr>
<tr>
<td>Launch site:</td>
<td>Cape Canaveral</td>
</tr>
<tr>
<td>Launch vehicle:</td>
<td>Falcon 9</td>
</tr>
<tr>
<td>Orbit:</td>
<td>138 x 140 km, inclination: 34.5°</td>
</tr>
</tbody>
</table>

This was a test flight of the Falcon 9 launch vehicle. It carried a Mock Up of the Dragon spacecraft, as described for 2010 066A. The Dragon Mock Up did not separate from the orbiting upper stage. The total mass was approximately 8000 kg. The first stage of the launch vehicle impacted into the Atlantic Ocean but was destroyed by the impact and could not be recovered as intended.
The Science and Technology Satellite (STSAT)-2B was similar to STSAT-2 which failed on 25 August 2009. The first stage of the launch vehicle failed after a flight of about 2 minutes and exploded. The intended orbit was 300 x 1500 km.
Satellite for space science and engineering experiments. The spacecraft conducted a series of maneuvers towards a rendez-vous with the SJ-6F satellite (2008 053B) on 16 August 2010. Subsequent orbital data of SJ-6F indicates that there may have been physical contact between the two spacecraft. Although the purpose of the rendez-vous remains unknown, it is not thought to be related to anti-satellite technologies.
Picard was a French/Swiss/Spanish mission that used a Myriade microsatellite bus to undertake the simultaneous measurement of the absolute total and spectral solar irradiance, the diameter and solar shape, and to the Sun's interior probing by the helioseismology method. These measurements will allow to study their variations as a function of the solar activity and determine how it affects the Earth's climate. The satellite had a mass of 150 kg and carried:

1. the SODISM SOlar Diameter Imager and Surface Mapper, an imaging telescope to measure the solar diameter and shape with an accuracy of a few milliarc second and to perform helioseismologic observations to probe the solar interior;
2. the SOVAP SOlar VAriability PICARD radiometer to measure the total solar irradiance; and
3. the PREMOS PREcision Monitor for OScillation instrument, a set of 3 photometers to study the ozone formation and destruction and to perform helioseismologic observations, and a radiometer to measure the total solar irradiance.

The spacecraft was named after the French astronomer Jean Picard (1620-1682).
Prisma consisted of two satellites that conducted extensive formation-flying, rendezvous and close approach demonstrations using GPS and optical navigation. The two craft performed autonomous formation flying whereby the Main craft located the Target at a long distance, approach it, flew around it and then left it again. The experiments consisted of:

1. a GPS-based navigation experiment to evaluate the use of GPS as a sensor for automatic formation flying. This experiment was provided by Germany;
2. an optical sensor based on star tracker technology to be evaluated as a tracking and rendezvous/docking sensor. This experiment was a joint venture between Denmark and Sweden;
3. a flight qualification test of a radio frequency metrology formation flying package intended for ESA’s Darwin project and provided by France;
4. a new satellite propulsion system using non-toxic propellant, HPGP (High Performance Green Propellant), developed in Sweden;
5. new avionics and power systems derived from the corresponding systems on ESA’s SMART-1 lunar probe;
6. new onboard software using Matlab/Simulink and automatic code generation to an even higher degree than in the SMART-1 project; and
7. a silicon-based cold-gas microthrusters developed in Sweden.

The two satellites, named Mango and Tango, were bolted together for the launch and were separated on 11 August 2010, with Tango (2010 028F) being the new satellite being ejected. Mango, with a mass of 150 kg, was the active satellite that flew in formation with the 40 kg Tango.

By January 2011 formation flight with a distance of 2 m had been achieved.
The Blok Perspektivnoy Avioniki (BPA)-1 was a technology development experiment for aircraft and spacecraft navigation developed by Khartron-Arkos. It remained attached to the upper stage of the launch vehicle.
2010 028F (36827)
Name: Prisma-Tango
Country: Sweden
Launch date: 11 August 2010
Re-entry: in orbit
Launch site: Ysne
Launch vehicle: Dnepr 1
Orbit: 784 x 787 km, inclination: 98.3°

Formation flying satellite as described for 2010 028B.
Crewed spaceflight with cosmonauts F. Yurchikhin (Cmdr), D. Wheelock (USA) (Fl.Eng) and S. Walker (USA) (Fl. Eng) using a Soyuz TMA spacecraft as described for 2002 050A. The mission was also known as ISS-23S and the call sign was Olympus. They were part of the twenty fourth permanent crew (EX-24) for ISS. They later transferred to the twenty fifth permanent crew (EX-25). The spacecraft docked at the Zvezda aft port of ISS (1998 067A) on 17 June 2010.

On 28 June 2010 Soyuz TMA-19 was moved from the aft port of the Zvezda service module to the Rassvet Earth facing port. The docking was manually as the equipment for automatic docking was yet to be fitted to the Rassvet port.

The spacecraft undocked again on 25 November 2010. Their time in space had been 163 days, 6 hours, 11 minutes.
TerraSAR-X add-on for Digital Elevation Measurement (TanDEM-X) was an Earth observation satellite fitted with radar that delivered elevation data with an accuracy of up to 2 meters. It operated in close formation flight with the near identical TerraSAR-X (2007 026A) which allowed the development of three dimensional images.

The 1350 kg satellite was built by Astrium and incorporated a cold gas thruster system to TanDEM-X for small maneuvers to keep the satellite positioned in the correct location.

The two satellites are scheduled to map the complete land area of Earth -150 million square kilometers - on a 12-metre grid and with a relative vertical accuracy of less than 2 meters.
2010 031A (36608)
Name: Ofeq-9
Country: Israel
Launch date: 22 June 2010
Re-entry: in orbit
Launch site: Palmachim
Launch vehicle: Shavit-2
Orbit: 343 x 586 km, inclination: 141.8°

Military photo reconnaissance satellite as described for 1995 018A.
The 4940 kg Badr-5A communications satellite, owned by Arabsat, was based on the Eurostar E3000 platform supplied by Astrium and carried 24 C band and 24 Ku band transponders. It was also known as Arabsat-5A.
2010 032B (36745)
Name: Cheollian
Country: South Korea
Launch date: 26 June 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5ECA
Orbit: geostationary at 128°E

Also known as Communication Ocean and Meteorology Satellite (COMS), the spacecraft carried three payloads dedicated to meteorology applications, ocean observation and telecommunications. These were:
1. a meteorology imager to perform continuous observation from its orbital position of world scale meteorological phenomena;
2. a multi-band imager with a resolution of 400 m dedicated to ocean observation and in particular to monitor changes in the marine ecosystem; and
3. an experimental Ka-band telecommunications payload to validate wide-band multi-media telecommunications services.

The satellite had a mass of 2460 kg.
2010 033A (36748)
Name:         Progress M-06M
Country:      Russia
Launch date:  30 June 2010
Re-entry:     6 September 2010
Launch site:  Baikonour
Launch vehicle: Soyuz U
Orbit:        346 x 359 km, inclination: 51.6°

Cargo transfer spacecraft as described for 2008 060A.
After a failed attempt on 2 July 2010, Progress M-03M docked at the Zvezda aft port of the ISS (1998 067A) on 4 July 2010. The flight was also known as ISS-38P. The spacecraft undocked on 31 August 2010 and remained in orbit for autonomous tests in the Radio Progress experiment until it re-entered.
Name: Echostar-15
Country: USA
Launch date: 10 July 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/Briz M
Orbit: geostationary at 61.5°W

Communications satellite owned by EchoStar. The 5521 kg satellite was built by Space Systems/Loral using the LS-1300 platform. It was fitted with 32 Ku band transponders. In June 2013 the satellite was moved to 45.1°W and was moved back to 61.6°W in November 2015.
2010 035A (36795)
Name: Cartosat-2B
Country: India
Launch date: 12 July 2010
Re-entry: in orbit
Launch site: Sriharikota
Launch vehicle: PSLV-CA
Orbit: 628 x 647 km, inclination: 98.1°

Cartographic satellite as described for 2007 001B.
Student satellite developed by engineering students from Bangalore and Hyderabad. The 850 grams satellite carried a CMOS camera to obtain monochrome images of the Earth with a resolution of 94 meters.
AISSat-1 was a 6 kg satellite constructed by UTIAS/SFL, at the University of Toronto, Canada, on behalf of the government of Norway. The primary mission was to investigate the feasibility and performance of a spacecraft-based Automatic Identification System (AIS) sensor in low-Earth orbit as a means of tracking maritime assets. It was deployed through the Nanosatellite Launch System (NLS)-6 as described for 2003 031H.
AISat-2A was the first of two Earth observation satellites built for the Algerian National Space Technology Centre (CNTS) by EADS Astrium using the Myriade space platform. The 117 kg satellite was fitted with a payload capable of supplying images with a resolution of 2.5 meters in panchromatic mode and 10 meters in each of 4 colour bands in multispectral mode.
2010 035E (36799)
Name: TI Sat
Country: Switzerland
Launch date: 12 July 2010
Re-entry: in orbit
Launch site: Sriharikota
Launch vehicle: PSLV-CA
Orbit: 619 x 639 km, inclination: 98.1°

Cubesat designed and built at SUPSI-DTI. The objectives of the satellite were:
1. monitoring of the durability of exposed thin bonding wires, PCB tracks and lines (Atomic Oxygen effects);
2. verification of the system fault tolerance scheme;
3. acquisition of spacecraft environment and operating data; and
4. all firmware, in house developed baseband modulation schemes.
It was deployed through the Nanosatellite Launch System (NLS)-6 as described for 2003 031H
2010 036A (36828)
Name: Beidou 2-IGSO1
Country: China
Launch date: 31 July 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ 3A
Orbit: 35670 x 35893 km, inclination: 55.1°

Navigational satellite in the Compass system as described for 2007 011A.
Name: Nilesat-201
Country: Egypt
Launch date: 4 August 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5ECA
Orbit: geostationary at 7°W

Communications satellite owned by Nilesat and built by Thales Alenia using the Spacebus 4000B2 platform. The 3200 kg satellite carried 24 Ku-band and 4 Ka-band transponders.
Name: Rascom QAF-1R
Int. Agency: Rascom
Launch date: 4 August 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5ECA
Orbit: geostationary at 2.85°E

Communications satellite owned by the Regional African Satellite Communications (Rascom) and built by Thales Alenia using the Spacebus 4000 B3 platform that was fitted with 12 Ku band and 8 C band transponders. The 3050 kg satellite was a replacement for Rascom QAF-1 (2007 063A) which was crippled by a helium leak that rendered its primary orbit-raising engine nearly useless.
Name: YW-10
Country: China
Launch date: 9 August 2010
Launch site: Taiyuan
Launch vehicle: CZ 4C
Orbit: 628 x 629 km, inclination: 97.8°

Earth observation satellite as described for 2006 015A. The satellite was fitted with SAR radar imaging equipment and was also known as Jian Bing 5-3.
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Name: Dragon BP  
Country: USA  
Launch date: 12 August 2010  
Re-entry: n.a.  
Launch site: ---  
Launch vehicle: ---  
Orbit: app. 4 km

Test of the parachute deployment systems and recovery operations of the Dragon spacecraft described for 2010 066A. The test used a boilerplate version of the Dragon spacecraft which was dropped from an helicopter at an altitude of 4 km following which the craft deployed two drogue parachutes for stability and then three orange and white main parachutes unfurled to a diameter of 35 m each. The test was performed in the Pacific Ocean off Morro, California and the capsule was recovered by boat and returned to shore.
The Advanced Extremely High Frequency (AEHF) military communications satellite system consisted of a three-satellite, cross-linked constellation in geosynchronous orbit that provided secure, survivable, and protected communications systems for the US military. Built by Lockheed Martin, using the A2100M spacecraft bus, the system replaced the MILSTAR-II communications system. The 4080 kg satellite was fitted with transponders operating in the extremely high frequency (EHF) and super high frequency (SHF) bands. Originally six satellites were planned but the system was limited to three satellites in 2004. The series also carried the military designation ES-17. AEHF F-1 was also known as USA-214.

After its launch AEHF-1 was placed in a 222 x 50000 km orbit with an inclination of 22.2°. Following this the on-board Liquid Apogee Engine was to have fired three times over the course of several days to raise the orbit's low point to 19000 km and reduce the inclination to 6°, achieving an intermediate orbit. Then the electric propulsion system using Hall Current Thrusters would be fired almost continuously for weeks to finish shaping the orbit into a circular, geosynchronous altitude 36000 km and 4.8° inclination. AEHF-1 was expected to reach its on-orbit testing location at 90° W over the equator within 105 days of liftoff. But the Liquid Apogee Engine failed to operate and it was decided to use the spacecraft's tiny 5-pound-thrust hydrazine motors to push the spacecraft toward its intended preliminary destination. This push was assisted by the electric propulsion system and eventually other systems would have taken over. Obviously the climb to the higher took longer and the desired orbit was not reached until 24 October 2011. It was, however, expected that there would be sufficient residual hydrazine and xenon propellant to operate for its full 14 years mission life.
The Tianhui-1A was a mapping satellite used for scientific research, mapping and land resource surveys and to help promote economic development. The 2500 (?) kg satellite was developed by the China Aerospace Science and Technology Corp. It carried an onboard CCD camera with a 5m spatial resolution as well as a Multispectral Scanner operating in four spectral bands with a 10m spatial resolution and 60km ground swath.
2010 041A (37137)
Name: Kosmos-2466
Country: Russia
Launch date: 2 September 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/DM2
Orbit: 19070 x 19189 km, inclination: 64.8°

Glonass M navigational satellite as described for 2001 053A.
2010 041B (37138)
Name: Kosmos-2465  
Country: Russia  
Launch date: 2 September 2010  
Re-entry: in orbit  
Launch site: Baikonour  
Launch vehicle: Proton M/DM2  
Orbit: 19030 x 19230 km, inclination: 64.8°

Glonass M navigational satellite as described for 2001 053A.
2010 041C (37139)
Name: Kosmos-2464
Country: Russia
Launch date: 2 September 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/DM2
Orbit: 19082 x 19178 km, inclination: 64.8°

Glonass M navigational satellite as described for 2001 053A.
2010 042A (37150)
Name: Zhongxing-6A
Country: China
Launch date: 4 September 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ 3B/E
Orbit: geostationary at 124°E

Communications satellite owned by China Satcom. The satellite was based on the DFH-4 platform and was fitted with 24 C band, 8 Ku band and 1 S band transponders. The satellite was originally known as Xinnou-6 and Sinosat-6.
<table>
<thead>
<tr>
<th><strong>2010 043A (37152)</strong></th>
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</table>
| **Name:**            | Gonets M-2  
| **Country:**         | Russia  
| **Launch date:**     | 8 September 2010  
| **Re-entry:**        | in orbit  
| **Launch site:**     | Plesetsk  
| **Launch vehicle:**  | Rokot/Briz KM  
| **Orbit:**           | 1496 x 1506 km, inclination: 82.4°  

Message relay communications satellite communications satellite as described for 2005 048A.
2010 043B (37153)
Name: Kosmos-2467
Country: Russia
Launch date: 8 September 2010
Re-entry: in orbit
Launch site: Plesetsk
Launch vehicle: Rokot/Briz KM
Orbit: 1498 x 1509 km, inclination: 82.4°

Strela 3 military communications satellite as described for 1985 003A.
2010 043C (37154)
Name: Kosmos-2468
Country: Russia
Launch date: 8 September 2010
Re-entry: in orbit
Launch site: Plesetsk
Launch vehicle: Rokot/Briz KM
Orbit: 1497 x 1507 km, inclination: 82.4°

Rodnik military communications satellite as described for 2005 048B.
**2010 044A (37156)**  
**Name:** Progress M-07M  
**Country:** Russia  
**Launch date:** 10 September 2010  
**Re-entry:** 20 February 2011  
**Launch site:** Baikonour  
**Launch vehicle:** Soyuz U  
**Orbit:** 350 x 359 km, inclination: 51.6°

Cargo transfer spacecraft as described for 2008 060A. Progress M-07M docked at the Zvezda rear port of ISS (1998 067A) on 12 September 2010. The flight was also known as ISS-39P. The spacecraft undocked on 20 February 2011.
Satellite in the Quasi-Zenith Satellite System (QZSS). The constellation of three satellites complemented the GPS system by providing coverage for areas where there are mountains and high rise buildings, thereby overcoming ground interference.

The 4100 kg satellite was built by Mitsubishi Electric Corp. and was fitted with four L-band navigation signals.
<table>
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<th>2010 046A (37162)</th>
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<td><strong>Name:</strong></td>
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<td><strong>Country:</strong></td>
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<td><strong>Launch date:</strong></td>
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<td><strong>Re-entry:</strong></td>
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<td><strong>Launch site:</strong></td>
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<tr>
<td><strong>Launch vehicle:</strong></td>
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<tr>
<td><strong>Orbit:</strong></td>
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</table>

Also known as USA-215, Gladys and NROL-41, it has been suggested that this was the first Topaz satellite, a progressive development of one surviving component of the Future Imagery Architecture (FIA) program that was cancelled in 2007 as being too costly. This was the E-305 that involved a radar imaging single or multi-dish vehicle designed to replace the operational Lacrosse/Onyx spacecraft that are known to carry two elongated radar imaging dishes. It was designed to be deployed in a constellation of spacecraft providing near real time constant coverage of points of interest. Current sources have quoted E-530 in connection with USA-215 and this may be a development of the E-305 program.
Earth observation satellite as described for 2006 015A. The satellite was fitted with electro-optical equipment and was also known as Jian Bing 6-4.
2010 047B (37166)
Name: Zheda Pixing-1B
Country: China
Launch date: 22 September 2010
Re-entry: in orbit
Launch site: Jiuquan
Launch vehicle: CZ 2D
Orbit: 622 x 657 km, inclination: 98.0°

Small satellite as described for 2007 019B with an estimated mass of 3.5 kg, developed by Zhejiang University.
2010 047C (37167)
Name: Zheda Pixing-1C
Country: China
Launch date: 22 September 2010
Re-entry: in orbit
Launch site: Jiuquan
Launch vehicle: CZ 2D
Orbit: 623 x 657 km, inclination: 98.0°

Small satellite as described for 2007 019B with an estimated mass of 3.5 kg, developed by Zhejiang University.
The Space Based Space Surveillance (SBSS)-1 was the first in a series of satellites that carried sensors that are capable of detecting and monitoring orbital debris. The series probably carried the military designation LS-15A.

The 1031 kg satellite was built by Ball and Boeing using the BCP2000 platform and was fitted with a 30 cm telescope on a two axis beryllium gimbals with a 2.4 megapixel image sensor. The satellite was also known as USA-216.
2010 049A (37170)
Name: Kosmos-2469
Country: Russia
Launch date: 30 September 2010
Re-entry: in orbit
Launch site: Plesetsk
Launch vehicle: Molniya M
Orbit: 556 x 39134 km, inclination: 62.8°

Oko military early warning satellite as described for 1972 072A.
2010 050A (37174)
Name: Chang'e-2
Country: China
Launch date: 1 October 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ 3C
Orbit: 100 x 100 km, inclination: 86.0°

Originally built as a back-up to Chang’e-1 (2007 051A), the 2480 kg spacecraft carried improved instruments including a charge-coupled device (CCD) camera that could image landing sites for the proposed Chang’e-3 lander.

The spacecraft took a more direct trajectory out of Earth orbit, reaching the Moon in about 5 days. A lunar orbit of 119 x 8599 km was achieved on 6 October 2010 which was reduced to about 100 x 100 km by 9 October 2010. By 27 October 2011 it was further reduced to 15 x 100 km. It may have been in a lunar polar orbit like Chang’e-1.

After concluding its primary mission in April 2011, the spacecraft was sent to the L2 Lagrange Point on 9 June 2011 to conduct long distance tracking and control tests. This orbit was achieved on 25 August 2011.

On 15 April 2012 the spacecraft left this orbit towards a fly-by mission with asteroid 4179 Toutatis which took place on 13 December 2012 at a distance of 3.2 km.

After the fly-by the spacecraft continued its flight into deep space, to be used to test China’s deep space tracking and control capabilities. The spacecraft had enough fuel on board to continue functioning up to a distance of 300 million kilometers from Earth.
2010 051A (37179)
Name: SJ-6G
Country: China
Launch date: 6 October 2010
Re-entry: in orbit
Launch site: Taiyuan
Launch vehicle: CZ 4B
Orbit: 587 x 606 km, inclination: 97.8°

Shi Jian scientific satellite as described for 2004 035A.
2010 051B (37180)
Name: SJ-6H
Country: China
Launch date: 6 October 2010
Re-entry: in orbit
Launch site: Taiyuan
Launch vehicle: CZ 4B
Orbit: 588 x 604 km, inclination: 97.8°

Shi Jian scientific satellite as described for 2004 035A.
2010 052A (37183)
Name: Soyuz TMA-01M
Country: Russia
Launch date: 7 October 2010
Re-entry: 16 March 2011
Launch site: Baikonour
Launch vehicle: Soyuz FG
Orbit: 347 x 359 km, inclination: 51.6°

Crewed spaceflight with cosmonauts A. Kaleri (Cmdr), O. Skripochka (Fl.Eng.) and S. Kelly (USA) (Fl.Eng) using an improved Soyuz TMA spacecraft as described for 2002 050A. This new Soyuz TMA-M version carried improved avionics, data processing and cooling systems. It was also referred to as 7K-STMA and 11F747.

The Soyuz TMA-01M mission was also known as ISS-24S and the call sign was Ingul.
The crew were members of the twenty fifth permanent crew (EX-25) and later the twenty sixth permanent crew (EX-26) for ISS. The spacecraft docked at the Poisk docking port of ISS (1998 067A) on 10 October 2010.
The spacecraft undocked on 16 March 2011. The mission duration was 158 days, 20 hours, 44 minutes.
Direct broadcasting satellite owned by Sirius XM, which company took over XM Satellite Radio on 29 July 2008. The Sirius XM-5 was built by Space Systems/Loral using the LS-1300 space platform. The 5820 kg satellite was fitted with an X-band uplink and S-band downlink payload.
2010 054A (37188)
Name: Globalstar FM-79
Country: USA
Launch date: 19 October 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Soyuz 2.1a/Fregat
Orbit: 919 x 926 km, inclination: 52.0°

The Globalstar 2 series were replacement satellites in the Globalstar first generation communications system as described for 1998 008A. The satellite was also known as Globalstar 2-1. The 700 kg satellites were built by Alcatel Alenia and integrated with the Globalstar constellation of satellites, whilst at the same time supporting the higher data speeds and other new services available to current handheld devices.
2010 054B (37189)
Name: Globalstar FM-74
Country: USA
Launch date: 19 October 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Soyuz 2.1a/Fregat
Orbit: 920 x 926 km, inclination: 52.0°

Communications satellite as described for 2010 054A. The satellite was also known as Globalstar 2-2.
2010 054C (37190)
Name: Globalstar FM-76
Country: USA
Launch date: 19 October 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Soyuz 2.1a/Fregat
Orbit: 917 x 926 km, inclination: 52.0°

Communications satellite as described for 2010 054A. The satellite was also known as Globalstar 2-3.
2010 054D (37191)
Name: Globalstar FM-77
Country: USA
Launch date: 19 October 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Soyuz 2.1a/Fregat
Orbit: 916 x 926 km, inclination: 52.0°

Communications satellite as described for 2010 054A. The satellite was also known as Globalstar 2-4.
2010 054E (37192)

Name: Globalstar FM-75
Country: USA
Launch date: 19 October 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Soyuz 2.1a/Fregat
Orbit: 920 x 926 km, inclination: 52.0°

Communications satellite as described for 2010 054A. The satellite was also known as Globalstar 2-5.
2010 054F (37193)
Name: Globalstar FM-73
Country: USA
Launch date: 19 October 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Soyuz 2.1a/Fregat
Orbit: 917 x 926 km, inclination: 52.0°

Communications satellite as described for 2010 054A. The satellite was also known as Globalstar 2-6.
2010 055A (37196)
Name: Progress M-08M
Country: Russia
Launch date: 27 October 2010
Re-entry: 24 January 2011
Launch site: Baikonour
Launch vehicle: Soyuz U
Orbit: 247 x 273 km, inclination: 51.6°

Cargo transfer spacecraft as described for 2008 060A. Progress M-08M docked at the Pirs nadir port of ISS (1998 067A) on 30 October 2010. The flight was also known as ISS-40P. The spacecraft undocked on 24 January 2011.
Communications satellite owned by Eutelsat and built by Thales Alenia using a Spacebus 4000C3 platform. The 5370 kg satellite was fitted with 53 Ku band transponders and 3 Ka band transponders. Following the launch the satellite was declared a total loss as a result of a sizeable leak in the fuel tanks. The satellite was not placed in its intended geostationary orbit at 16°E.
2010 056B (37207)
Name: B Sat-3B
Country: Japan
Launch date: 28 October 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5 ECA
Orbit: geostationary at 100°E

Communications satellite as described for 2007 036B.
2010 057A (37210)
Name: Beidou 2-G4
Country: China
Launch date: 31 October 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ 3C
Orbit: geostationary at 160°E

Navigational satellite in the Compass system as described for 2007 011A.
2010 058A (37212)
Name: Meridian-3
Country: Russia
Launch date: 2 November 2010
Re-entry: in orbit
Launch site: Plesetsk
Launch vehicle: Soyuz 2.1a
Orbit: 960 x 39388 km, inclination: 62.8°

Communications satellite as described for 2006 061A.
2010 059A (37214)
Name: Feng Yun 3-B
Country: China
Launch date: 4 November 2010
Re-entry: in orbit
Launch site: Taiyuan
Launch vehicle: CZ 4C
Orbit: 826 x 827 km, inclination: 98.7°

Meteorological satellite as described for 2008 026A.
2010 060A (37216)
Name: Cosmo-4
Country: Italy
Launch date: 6 November 2010
Re-entry: in orbit
Launch site: Vandenberg
Launch vehicle: Delta 7420-10
Orbit: 621 x 624 km, inclination: 97.9°

Earth observation satellite as described for 2007 023A.
Name: SkyTerra-1
Country: USA
Launch date: 14 November 2010
Re-entry: in orbit
Launch site: Baikonour
Launch vehicle: Proton M/Briz M
Orbit: geostationary at 101.3°W

Dedicated internet access satellite owned by Light Squared and built by Boeing using a Boeing BSS-702HP platform. The 5360 kg satellite was fitted with L band equipment to provide a seamless mobile broadband communications system by combining space based and ground based facilities. The satellite was originally known as Mobile Satellite Ventures (MSV)-1.
2010 062A (37222)
Name: STPSat-2
Country: USA
Launch date: 20 November 2010
Re-entry: in orbit
Launch site: Kodiak
Launch vehicle: Minotaur 4/HAPS
Orbit: 630 x 654 km, inclination: 72.0°

The 135 kg STPSat-2, carried two experiments:
1. Space Phenomenology Experiment (SPEX) to evaluate sensor compatibility for the space environment; and
2. Ocean Data Telemetry MicroSatLink (ODTML) to provide two way data relay from terrestrial (ocean or land) sensors to users (standalone or on the internet).

The satellite was also known as USA-217.
The launch was also identified collective as the STP-S26 mission.
The Radio Aurora Explorer (RAX) was a 3 kg triple cubesat structure developed at the University of Michigan and which investigated the energy flow in the ionosphere. It was also known as USA-218.
The Organics and/or Organisms Exposure to Orbital Stresses (O/OREOS) satellite was a NASA sponsored satellite that exposed two biological specimens and four types of reaction cells containing organic molecules to the space environment, and monitored changes to them induced by space exposure. In addition O/OREOS carried the De-orbit Device Development device, a set of mylar panels that could be extended to increase the satellite's drag and enable a quicker decay into the atmosphere. The satellite, which was also known as USA-219, had a mass of 5 kg.
The Fast Affordable Science and Technology Satellite - Huntsville (FASTSAT-HSV), also known as USA-220, was a small technological satellite to test out low-cost technologies for rapidly built small satellite missions. The 140 kg satellite was developed by the University of Texas and carried three technology demonstration experiments and three atmospheric research instruments;

1. NanoSail D-2 (2010 062L), a cubesat which failed to be ejected on 6 December 2010 but spontaneously ejected on 19 January 2011;
2. Threat Detection System;
3. Miniature Star Tracker;
4. Thermosphere Temperature Imager (TTI) to measure spacecraft drag and other flight characteristics;
5. MINI-ME, a low-energy neutral atom imager to detect neutral atoms formed in the plasma population of the Earth’s outer atmosphere to improve; and
6. Plasma and Impedance Spectrum Analyzer (PISA), an instrument to test a new measurement technique for the type and density of thermal electrons in the ionosphere.
FalconSAT-5 was a 161 kg microsatellite developed at the United States Air Force Academy. This satellite, which was also known as USA-221, carried the following experiments:

1. Ion Source, a payload resembling that of the Flight heritage Ion Source from the Air Force Research Laboratories (AFRL).
2. Wafer-Integrated Spectrometer (WISPERS) to measure ions resulting from ion sources to validate USAFA and AFRL plume models;
3. Smart Miniaturized ElectroStatic Analyzer (SmartMESA) to detect the temperature and density of ambient ions to validate ionospheric data assimilation models; and
4. Receiver UHF/VHF Signal Strength (RUSS) to measure UHF/VHF signal strength and characterize UHF/VHF signal distortion to improve ionospheric models.
The Formation Autonomy Spacecraft with Thrust, Relnav, Attitude and Crosslink (FASTRAC), were two nanosatellites developed by the University of Texas (UT) at Austin. The two 15 kg satellites were intended to be separated about 30 minutes after orbit insertion but this separation did not take place until 22 March 2011 when FASTRAC-B (2010 062M) separated.

The objective of FASTRAC was to investigate technologies for the flying of satellites in formation. These technologies included on-orbit micro-thrust capability, relative navigation, attitude determination and satellite crosslink communications.

FASTRAC-A was also known as USA-222, Sara-Lily (after the daughter of one of the UT engineers), Nanosat-3A, Oscar-69 and FO-69.
STP S26-Ballast A was a dummy satellite that was placed in a higher orbit to demonstrate the capability of the Minotaur 4 to deliver payloads to multiple orbits in a single mission. The separation system was built by Boeing and was known as Demonstration Separation System (DSS). The system relied on a Hydrazine Auxiliary Propulsion System (HAPS) to take the launch vehicle into a secondary orbit.
<table>
<thead>
<tr>
<th>Name</th>
<th>STP S26-Ballast B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>USA</td>
</tr>
<tr>
<td>Launch date</td>
<td>20 November 2010</td>
</tr>
<tr>
<td>Re-entry</td>
<td>in orbit</td>
</tr>
<tr>
<td>Launch site</td>
<td>Kodiak</td>
</tr>
<tr>
<td>Launch vehicle</td>
<td>Minotaur 4/HAPS</td>
</tr>
<tr>
<td>Orbit</td>
<td>1150 x 1150 km, inclination: 72.0°</td>
</tr>
</tbody>
</table>

Dummy satellite as described for 2010 062J.
NanoSail D-2 was a cubesat-based solar sail demonstrator that was to be ejected from FASTSAT-HSV (2010 062D) after the launch on 20 November 2010. Data from FASTSAT-HSV indicated that the ejection window opened on 6 December 2010 but the ejection of NanoSail D-2 failed. However, on 18 January 2011 the satellite ejected spontaneously. NanoSail D-2 was intended to deploy the four booms and 100 square feet solar sail automatically after three days and did so on 21 January 2011. Unlike previous solar sail experiments, the NanoSail D-2 experiment was to demonstrate the use of the atmospheric drag created by the sail in the early de-orbiting of satellites.
<table>
<thead>
<tr>
<th>2010 062M (37380)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name: FASTRAC-B</td>
</tr>
<tr>
<td>Country: USA</td>
</tr>
<tr>
<td>Launch date: 22 March 2011</td>
</tr>
<tr>
<td>Re-entry: in orbit</td>
</tr>
<tr>
<td>Launch site: Kodiak</td>
</tr>
<tr>
<td>Launch vehicle: Minotaur 4/HAPS</td>
</tr>
<tr>
<td>Orbit: 627 x 651 km, inclination: 72.0°</td>
</tr>
</tbody>
</table>

FASTRAC-B was similar to FASTRAC-A (2010 062F) but with the micro thruster replaced by the Inertial Measurement Unit (IMU) MASIMU01 used to measure the separation. It was originally intended to separate from FASTRAC-A 30 minutes after the launch. FASTRAC-B was also known as Emma (after the daughter of one of the team members), Nanosat-3B, USA-228, Orca-70 and FO-70.
2010 063A (37232)
Name: Orion-5
Country: USA
Launch date: 21 November 2010
Re-entry: in orbit
Launch site: Cape Canaveral
Launch vehicle: Delta 4 Heavy
Orbit: geostationary at 100°E

Military electronic intelligence gathering satellite as described for 1995 022A. Also known as NROL-32 and USA-223.
2010 064A (37234)
Name: Zhongxing-20A
Country: China
Launch date: 24 November 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ 3A
Orbit: geostationary at 130°E

Military communications satellite as described for 2000 003A. It was also known as Shen Tong (ST)-1B.
2010 065A (37237)
Name: Intelsat-17
Int. Agency: Intelsat
Launch date: 26 November 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5ECA
Orbit: geostationary at 66°E

Communications satellite owned by Intelsat and built by Space Systems/Loral using the LS-1300 platform. The 5540 kg satellite carried 28 C-band transponders and 46 Ku-band transponders.
The Highly Adaptable Satellite (HYLAS) was a communications satellite owned by Avanti Communications. The 2750 kg satellite was built by Antrix, a subsidiary of the Indian space agency, using the I-2K platform and was fitted out by EADS Astrium with 2 Ku band and 8 Ka band transponders. The satellite provided broadband internet access and distributed and broadcasted High Definition Television (HDTV).
Three Glonass M navigational satellites as described for 2001 053A. They failed to orbit after the third stage of the launch vehicle failed.
Also known as COTS-1, the Dragon C-1 was a test flight of the Dragon spacecraft as part of NASA's Commercial Orbital Transportation Services (COTS) programme. It demonstrated the Dragon systems over two orbits, lasting 3 hours, 27 minutes. At the end of the flight the spacecraft descended on three parachutes into the Pacific Ocean off California. The first stage of the Falcon 9 launch vehicle was not recovered. Space Exploration Technologies Inc. (SpaceX)'s Dragon was selected as one of the finalists in NASA's Commercial Orbital Transportation Services (COTS) programme in August 2006.

The Dragon spacecraft came in two separate versions, a cargo version and a crewed version which was capable of carrying seven astronauts. The spacecraft, which had a height of 5.10 m and a diameter of 3.66 m, consisted of two modules:
1. the recoverable spacecraft module equipped with hatches and windows which was further subdivided into a pressurized section for cargo or crew with temperature controls and protection against radiation and micrometeorites, as well as an unpressurized section for thrusters, propellant, parachutes and a heat shield for thermal protection during re-entry; and
2. the Trunk, an unpressurized section for unpressurized cargo and small deployable satellites. It also supported the solar panels and thermal radiators. The trunk was jettisoned before re-entry.

On top of this was the nosecone which contained the Passive Common Berthing Mechanism (PCBM) which allowed docking with the US modules of ISS with the help of the space station’s robotic arm. The nose cone was separated after stage separation.

The spacecraft had a mass of 3310 kg and a volume of 6.8 m$^3$.

The Dragon C-1 was a simplified test of the Dragon spacecraft. It lacked the solar arrays and the docking mechanism of the operational Dragon C spacecraft. In addition the unpressurised trunk remained connected to the Falcon-9 upper stage and only the spacecraft itself separated. Six cubesats were deployed separately from the trunk.
The CubeSat Experiments (QbX) cubesats were built by the Boeing Phantom Works for the U.S. National Reconnaissance Office (NRO) under a contract that may involve ultimately as many as 50 triple-unit cubesats, for use in technology demonstrations. The first 12 were the Colony 1 series. QbX-2 was also known as Colony 1-2.
The Space Missile Defense Command - Operational Nanosatellite Effect (SMDC-ONE)-1 was the first small experimental communications satellite for the US Army to provide real time voice and text message data relay to and from field deployed tactical radio systems. The system will consist of eight triple cubesats with a mass of 4 kg each.
2010 066D (37247)
Name: Perseus-003
Country: USA
Launch date: 8 December 2010
Re-entry: 31 December 2010
Launch site: Cape Canaveral
Launch vehicle: Falcon 9
Orbit: 223 x 242 km, inclination: 34.5°

Cubesat developed by the Los Alamos National Laboratory and also referred to as LANL Cubesat-3. It had a mass of 1.5 kg.
The objective of the Perseus program was to develop a rapid-response satellite capability to enable many different mission types. The first phase of the effort focused on demonstrating the ability to build and launch a useful satellite quickly and at low cost, gaining cubeSat experience, and validating the LANL design methodology. The satellites were designed and built in less than six months and entirely at LANL at very low cost.
Successful in-orbit tests include two-way communication, three-way communication and collection of telemetry.
2010 066E (37248)
Name: Perseus-001
Country: USA
Launch date: 8 December 2010
Re-entry: 31 December 2010
Launch site: Cape Canaveral
Launch vehicle: Falcon 9
Orbit: 241 x 222 km, inclination: 34.5°

Cubesat developed by the Los Alamitos National Laboratory and as described for 2010 066D. Also known as LANL Cubesat-1.
2010 066F (37249)
Name: QbX-1
Country: USA
Launch date: 8 December 2010
Re-entry: 6 January 2011
Launch site: Cape Canaveral
Launch vehicle: Falcon 9
Orbit: 255 x 277 km, inclination: 34.5°

CubeSat as described for 2010 066B. Also known as Colony 1-2.
2010 066G (37250)
Name: Perseus-002
Country: USA
Launch date: 8 December 2010
Re-entry: 30 December 2010
Launch site: Cape Canaveral
Launch vehicle: Falcon 9
Orbit: 186 x 197 km, inclination: 34.5°

Cubesat developed by the Los Alamitos National Laboratory and as described for 2010 066D. Also known as LANL Cubesat-2.
2010 066H (37251)
Name: Perseus-000
Country: USA
Launch date: 8 December 2010
Re-entry: 30 December 2010
Launch site: Cape Canaveral
Launch vehicle: Falcon 9
Orbit: 194 x 203 km, inclination: 34.5°

Cubesat developed by the Los Alamitos National Laboratory and as described for 2010 066D. Also known as LANL Cubesat-0.
Mayflower-Caerus was a triple unit Cubesat built as a joint mission by Novaworks of Northrop Grumman and the University of Southern California as a technology mission. It was a triple cubesat with a mass of 3 kg. The Mayflower component comprised two cubesat units fitted with eight Pumpkin deployable solar panels that unfurled into two arrays. The CAERUS component was a single unit Cubesat built by the University of Southern California as a technology mission. It transmitted beacon data in the amateur band. It was named after the Greek word for "opportunity".
2010 067A (37254)
Name: Soyuz TMA-20
Country: Russia
Launch date: 15 December 2010
Re-entry: 24 May 2011
Launch site: Baikonour
Launch vehicle: Soyuz FG
Orbit: $349 \times 356$ km, inclination: $51.6^\circ$

Crewed spaceflight with cosmonauts D. Kondratyev (Cmdr), C. Coleman (USA) (Fl. Eng) and P. Nespoli (ESA, Italy) (Fl. Eng) using a Soyuz TMA spacecraft as described for 2002 050A. The mission was also known as ISS-25S and the call sign was Varyag. The ESA part of the mission was named MagISStra. They were members of the twenty sixth permanent crew (EX-26) and later the twenty seventh permanent crew (EX-27) for ISS. The spacecraft docked at the MRM-1 docking port of ISS (1998 067A) on 17 December 2010. The spacecraft undocked on 23 May 2011 and positioned itself at a distance of about 200 m from the space station to take photos of the space station with the STS-134 (2011 020A) orbiter Endeavour docked to it, before re-entering.

The mission had lasted 159 days, 15 hours, 18 minutes.
2010 068A (37256)
Name: Beidou 2-IGSO2
Country: China
Launch date: 17 December 2010
Re-entry: in orbit
Launch site: Xichang
Launch vehicle: CZ 3A
Orbit: 356717 x 35857 km, inclination: 55.2°

Navigational satellite in the Compass system as described for 2007 011A.
Gsat-5 Prime (P) was a 2310 kg communications satellite fitted with 24 normal C-band transponders and 12 extended C-band transponders. It was built using the platform that was to be Gsat-5 (also known as Insat 4-D).

Control over the launch vehicle was lost after 47 seconds, before the separation of the strap-on boosters. The launch vehicle was subsequently destroyed by safety officials and the spacecraft failed to reach its intended geostationary orbit at 55°E.
<table>
<thead>
<tr>
<th><strong>2010 069A (37258)</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong></td>
<td>KA-Sat</td>
</tr>
<tr>
<td><strong>Int. Agency:</strong></td>
<td>Eutelsat</td>
</tr>
<tr>
<td><strong>Launch date:</strong></td>
<td>26 December 2010</td>
</tr>
<tr>
<td><strong>Re-entry:</strong></td>
<td>in orbit</td>
</tr>
<tr>
<td><strong>Launch site:</strong></td>
<td>Baikonour</td>
</tr>
<tr>
<td><strong>Launch vehicle:</strong></td>
<td>Proton M/Briz M</td>
</tr>
<tr>
<td><strong>Orbit:</strong></td>
<td>geostationary at 9°E</td>
</tr>
</tbody>
</table>

Communications satellite owned by Eutelsat and built by Astrium using the Eurostar E3000 platform. The 6150 kg satellite was fitted with 82 Ka band transponders to service internet requirements. In March 2012 it was renamed as Eutelsat KaSat 9-A.
2010 070A (37264)
Name: Hispasat 1-E
Country: Spain
Launch date: 29 December 2010
Re-entry: in orbit
Launch site: Kourou
Launch vehicle: Ariane 5ECA
Orbit: geostationary at 30°W

Communications satellite owned by Hispasat. Built by Space Systems/Loral using the LS-1300 platform, the 5,270 kg was fitted with 53 Ku-band transponders. It was renamed as Hispasat 30W-5 in February 2016.
<table>
<thead>
<tr>
<th><strong>2010 070B (37265)</strong></th>
<th><strong>Name:</strong> Mugunghwa-6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country:</strong> Korea</td>
<td></td>
</tr>
<tr>
<td><strong>Launch date:</strong> 29 December 2010</td>
<td></td>
</tr>
<tr>
<td><strong>Re-entry:</strong> in orbit</td>
<td></td>
</tr>
<tr>
<td><strong>Launch site:</strong> Kourou</td>
<td></td>
</tr>
<tr>
<td><strong>Launch vehicle:</strong> Ariane 5ECA</td>
<td></td>
</tr>
<tr>
<td><strong>Orbit:</strong> geostationary at 116°E</td>
<td></td>
</tr>
</tbody>
</table>

Communications satellite owned by Koreasat and built by Thales Alenia using the Star platform from Orbital Sciences. The 2750 kg satellite was fitted with 30 Ku-band transponders. The satellite was also known as Koreasat-6.