This file includes details of selected cancelled spacecraft and programmes where such spacecraft were related to actual spacecraft listed in the main body of the database or were significantly developed or completed at the time of cancellation.
AggieSat-1 was a microsatellite proposed by the Texas A&M University to undertake three technology experiments:

1. a simple microsatellite propulsion system using water as the propellant;
2. a versatile miniature positioning mechanism using a reusable shape memory alloy as the actuator; and
3. an enzymatic energy source using glucose as the fuel.

It was developed as part of the Air Force Research Laboratory's Nanosat-4 competition and was co-sponsored by the Air Force Office of Scientific Research, NASA and the American Institute of Aeronautics and Astronautics. AggieSat1 was not selected by the Air Force but the experience served in the development of AggieSat-2 (2009 038B).
The Altair, formerly known as the Lunar Surface Access Module (LSAM) was to be the main spacecraft for crewed lunar mission as part of the Constellation programme announced by President Bush on 14 January 2004 and cancelled by President Obama in 2010.

It would have been capable to fly four astronauts to the Moon, land them on the Moon, provide life support and a base for the astronauts during their stay on the Moon and then fly them back into lunar orbit where they would dock with the Orion spacecraft for the return flight to Earth.

The vehicle was to be 9.40 m high, have a diameter of 7.50 m whilst the landing gear's span would be 13.50 m. Its volume would be 31.8 m$^3$.

The spacecraft was to consist of two components:
1. The descent stage which had the landing legs, the majority of the crew's consumables (oxygen and water), and scientific equipment; and
2. The ascent stage which housed the four astronauts.

The descent stage, which would have a mass of 35,000 kg, was to be fitted with four modified RL-10 rocket engines that provided 67,700 Newton. The RL-10 had already served on the Centaur upper stage of the Atlas V launch vehicle, but the Altair version could be throttled down to as low as 10% of the rated thrust so that they could be used for both the lunar orbit insertion (LOI) and landing stages of the lunar mission.

The ascent stage was to have a mass of 10,800 kg and was to be powered by a single engine, probably similar to the one fitted to the Orion spacecraft.

Versions of the Altair could also have been used to fly uncrewed missions to carry supplementary equipment to the Moon.

Altair was to have two hatches. One was on the top of the spacecraft and was to be used for docking with the Orion as well as internal transfer between Altair an Orion. The other hatch was to be used for accessing the lunar surface. This incorporated an airlock similar to that on the Space Shuttle and ISS so that
astronauts could change into and out of the spacesuits without the need to depressurise the remainder of Altair and to prevent moon dust from entering the spacecraft.

On 28 January 2009 NASA issued its request for proposal for the conceptual phase to the aerospace industry. The Altair Conceptual Design Contract would have been managed by the Johnson Space Center in Houston.

Whilst the Apollo lunar flights saw all components launched together on a single Saturn V rocket, the lunar missions in the Constellation programme would have seen separate launches of the components and their assembly in low-Earth orbit.

A lunar mission was to start with the launch of an Ares V vehicle carrying the Altair/Earth Departure Stage (EDS) components and place these into a 360 km altitude orbit with an inclination of 28.5°. The launch was to take place from launch Pad 39A.

Approximately 90 minutes after the Ares V launch, an Ares I launch vehicle with an Orion crewed spacecraft would be launched from Launch Pad 39B. The Orion would be placed in the same orbit as the Altair/EDS and the two spacecraft would dock.

When docking and other activities were completed, the EDS would fire for five minutes to perform the translunar injection (TLI) burn to place the combined spacecraft into a trans lunar orbit, accelerating the combination from 28,000 km/h to 40,200 km/h.

On completion of the TSI burn the EDS would be jettisoned and would be placed either into an orbit around the Sun or a slightly different translunar trajectory that would see it impact on the Moon.

The trans-lunar coast or the Orion/Altair combination was to last four days during which the four man crew would monitor the Orion's systems, inspect their Altair spacecraft and its support equipment, and, if necessary, change their trajectory towards the selected landing site.

On approaching the lunar far side, the Altair's engines would be placed in the proper direction for the lunar orbit insertion (LOI) burn. Once in orbit, the crew would adjust the trajectory and prepare the Orion for unmanned flight. All four crew members would then transfer to the Altair and undock the Orion which would be placed in a 95 to 110 km high circular orbit around the Moon.

Following this the four RL-10 engines on the Altair's descent stage would fire and the crew would eventually land. Upon landing the crew were to begin their activities on the Moon.

Once the lunar deployment operations had been completed, the crew would enter the Altair’s ascent stage and lift off from the Moon's surface, powered by a single ascent engine, using the descent stage as a launchpad. It would then dock with the Orion spacecraft that was left in lunar orbit. Once the crew has transferred from the Altair into the Orion, the Altair would be separated and allowed to crash into the Moon's far side.

The Orion's engines would then fire its engine the return trip. This firing was referred to as the Trans Earth Injection (TEI). Upon reaching Earth, the Orion Service Module would be jettisoned and a special reentry trajectory established. This trajectory was designed to both slow the Orion Command Module vehicle from its speed of 40,200 km/h to 480 km/h following which the landing could take place in a similar manner as for the Low-Earth orbit flights.

Subsequent flights that had been scheduled at the time of cancellation were Altair-2 (June 2019), Altair-3 (December 2019) and Altair-4 (June 2020)
Communications satellite to be owned by SES Americom and to be built by Alcatel using a Spacebus 4000. It was to be fitted with 60 C band transponders. However, with changing requirements, SES Americom 'recontracted' the satellite with the different payload and renamed it as AMC-23.
Communications satellite to be owned by SES Americom and to be built by Alcatel using a Spacebus 3000B3 platform. The satellite was previously known as GE-3E, and was intended to be a back-up to GE-2E which was to be deployed sometime in 2003 at 24°W. Both satellites, which were to be fitted with 40 Ku band transponder, were cancelled in 2001.
Name: AMC-22
Country: USA
Launch date: 2004
Launch vehicle: ?

Communications satellite to be owned by SES Americom and to be built by Alcatel. The satellite, based on a Spacebus 4000, was to carry 60 C band transponders and was to be located at 37.5°W. It was previously known as GE-3i and was cancelled in March 2002.
Crewed spaceflight with astronauts V. Grissom, E. White and R. Chaffee using Apollo spacecraft CSM-012 as described for 1966 059A. The back-up crew consisted of W. Schirra, D. Eisele and W. Cunningham. Eisele had originally been named in the prime crew but he developed a shoulder condition that required surgery and was replaced by Chaffee. The flight was scheduled for 21 February 1967 but during a launch pad test on 27 January 1967, in which the astronauts were in the spacecraft, an electrical short cut caused a fire which killed the astronauts.

Investigation of the CM revealed that three key errors of judgement had been made in the design of the Command Module:

1. in a 100% oxygen atmosphere pressurised at 110 KPA virtually any non-metallic material (the crew compartment was full of such material) would burn explosively; Although two flash fires had occurred in boilerplate cabin mock-ups in 1963 NASA had remained blind to the danger;
2. the quality control and workmanship of the CM were poor and had been the subject of critical reports as early as 1965 but nothing had been done to address the problem because of the pressure to win the race to the Moon; the risk of fire was extremely high; and
3. the access hatch could not be opened in a launch pad emergency.

This was the lethal cocktail of errors that turned the CM into a death trap.

The indirect cause of the disaster was that the basic design of the CM had been frozen for years while most attention was devoted to the development problems of the LM. Ironically, a revised access hatch that could be opened in three seconds, was already on the drawing board and was to be incorporated into the CM.

Drastically improved quality control and endless testing produced a CM that was fireproof at 34.5 KPA of 100% oxygen. No amount of testing could produce a CM that was fireproof at 110 KPA of 100% oxygen and a revised launch pad atmosphere of 60:40 oxygen/nitrogen was adopted. The mission was identified as AS-204 and the name change to Apollo-1 was not made until 24 April 1967.
Name: Apollo-18
Country: USA
Launch date: 1973
Launch vehicle: Saturn 5

Crewed spaceflight with astronauts E. Cernan, R. Evans and J. Engle using Apollo spacecraft CSM-115 and Lunar Module LM-12 as described for 1966 059A. The mission would have landed near Schroters Valley and would have evolved three EVAs. It was cancelled on 2 September 1970. The name Apollo-18 was eventually used for the United States part of the Apollo Soyuz Test Project as 1975 066A, using spacecraft CSM-111.
Name: Apollo-19
Country: USA
Launch date: 1974
Launch vehicle: Saturn 5

Crewed spaceflight using Apollo spacecraft CSM-116 and Lunar Modele LM-13 as described for 1966 059A. Astronauts F. Haise, W. Pogue and G. Carr had trained for this mission which would have landed near the collapsed lava tubes at Hyginus Rille. It would have involved three EVAs. The mission was cancelled on 2 September 1970 and the spacecraft was eventually used for the Skylab-2 mission (1973 032A).
Name: Apollo-20  
Country: USA  
Launch date: 1974  
Launch vehicle: Saturn 5  

Crewed spaceflight using Apollo spacecraft CSM-117 and Lunar Module LM-14 as described for 1966 059A. Astronauts C. Conrad, P. Weitz and J. Lousma are thought to have been intended as the crew although their assignment was never formalised. The flight would have landed at the crater Copernicus and would have remained on the Moon for up to six days during which three EVAs would have been made. It would also have placed a data relay satellite in lunar orbit.

The mission was cancelled on 4 January 1970 and the spacecraft was eventually used for the Skylab-3 mission (1973 050A).
On 14 January 2004 President George W. Bush announced the Vision for Space Exploration which included plans for a return to the Moon with a lunar outpost to be established by 2012. Based on this NASA initiated the NASA’s Constellation programme that involved the development of new systems and vehicles to support the next generation of space exploration.

The vehicles were to serve as a replacement of the Space Shuttle and provide on-going access to the International Space Station as well as a vehicle for the exploration of the Moon and other planets. The programme consisted of the Orion spacecraft, the Ares launch vehicle series as well as vehicles that were more specific for a certain type of mission. Of these latter the Altair lunar craft was the only one planned at the time the programme was cancelled.

Planning for the Mars mission was expected to start in 2020 and the first crewed mission to Mars could have taken place in 2037.

The Constellation programme was cancelled by President Obama in 2010 although several early tests had conducted on 8 July 2009, 28 October 2009 and 6 May 2010.

The Ares 1-Y flight was to demonstrate a high altitude abort. The launch vehicle was to consist of a five-segment first stage, a flight production second stage and a functioning command module and abort system. The Orion service module and upper stage J-2X engine were to be simulated on the flight. In the high altitude abort the small rockets of the abort system would separate the (simulated) Orion spacecraft safely from a falling booster.
Also known VLBI Space Observatory Program (VSOP)-2, Astro-G was a follow up of the Haruka or Muses-B (1997 005A) mission and would have undertaken Very Long Baseline Interferometry (VLBI) to obtain very high angular resolution imaging of celestial radio sources, by combining the signals from widely separated radio telescopes.

Proposed in September 2005, Astro-G was to employ a 10-m off-axis paraboloid antenna with dual-polarization observing bands at 8, 22, and 43 GHz.

The planned launch date was early 2012 with a H 2A-202 but development was cancelled in July 2011 due to a lower than expected accuracy of a large 10-m diameter antenna reflector.
The United States Air Force, and later the Department of Defence, were not interested in NASA's lunar flight plans but were, instead, interested in the military potential of a crewed Earth orbital facility using the Gemini spacecraft as described for 1964 018A as a basis.

Blue Gemini was the name given to an Air Force proposal to continue Gemini flights after Gemini-12 for Air Force research purposes and the development of a satellite inspector. The programme envisaged seven flights which were to land with a paraglider wing and skids, rather than in the sea.

In 1963 Congress refused to fund Blue Gemini and the proposal lapsed.
Name: BMEWS  
Country: USA  
Launch date: 1968 to 1975  
Launch vehicle: Atlas Agena D

The BMEWS series of satellites is the prime example where historians, at the time of the launch, deduced an objective from the little bit of information that was available and which, with the passing of time, proved to be incorrect.

The Ballistic Missile Early Warning System (BMEWS) satellites were to have followed in the footsteps of the Midas series, described for 1960 ζ 1, as an experimental early warning system. Also referred to as AFP-224A and Program 949, the satellites were to have been built by TRW and were to have been equipped with infrared sensors developed by Aerojet and a television system developed by RCA. Six satellites were earmarked as such and the first satellite in the series was placed in a near-geostationary orbit with an inclination of 10° giving it a figure 8 orbit with an apogee over the USSR. This type of orbit gave the satellite an extended time over the western part of the USSR. The second satellite in the series was placed in a geostationary orbit, whilst the third failed to achieve a correct orbit. Following the failure of fourth satellite, the fifth achieves the desired geostationary orbit. The final satellite was believed to have been an experimental flight.

Subsequent information led to the revision of the objectives of the satellites concerned, as shown in the table. Ironically, none of the satellites were associated with early warning efforts.

<table>
<thead>
<tr>
<th>Name</th>
<th>Int. Des.</th>
<th>Launch</th>
<th>Real identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEWS-1</td>
<td>1968 063A</td>
<td>6-Aug-1968</td>
<td>Canyon-1</td>
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<tr>
<td>BMEWS-4</td>
<td>---</td>
<td>4-Dec-1971</td>
<td>Canyon-4</td>
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<td>BMEWS-6</td>
<td>1975 055A</td>
<td>18-Jun-1975</td>
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<td>Name:</td>
<td>Buran-2</td>
<td></td>
<td></td>
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<td>-----------</td>
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<td></td>
<td></td>
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<tr>
<td>Country:</td>
<td>USSR</td>
<td></td>
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<tr>
<td>Launch date:</td>
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<td></td>
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</tr>
<tr>
<td>Launch vehicle:</td>
<td>Energia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First flight of the second Buran shuttle vehicle as described for 1998 100A. The flight would have been automatic and would have lasted one or two days. The Buran programme was cancelled on 30 June 1993.

In 2007 it has been rumoured that a second flight of a Buran like vehicle was made on 4 February 1992. The rumour stated that the vehicle, named Baikal, was to dock with the Mir space station but that the vehicle experienced stability problems at an altitude of 100 km and was turned back and successfully landed after a flight of 22 minutes. The story was supported by photos. However, experts have identified the story as an April fools joke with the photos being ‘photoshoped’ from Buran pictures.
Name: Buran-3  
Country: USSR  
Launch date: mid 1992  
Launch vehicle: Energia

Second flight of the second Buran shuttle vehicle as described for 1998 100A. The flight would have been automatic and would have lasted up to eight days. It was intended to fit a docking port in the cargo bay which would have allowed a Soyuz TM spacecraft to dock. Three Soyuz TM spacecraft were fitted with an APAS-89 docking port. One was completed and eventually flew as Soyuz TM-16 (1993 005A), whilst components of the other two spacecraft were used in subsequent Soyuz TM spacecraft.

The mission intended for the shuttle to dock with the Mir space station (1986 017A) where it would be prepared by the crew of the space station. Following this, Buran-3 would have separated after which the Mir crew would have docked with Buran-3 using their Soyuz TM vehicle and conduct various tests before undocking again and letting Buran-3 re-enter and land automatically. The Buran programme was cancelled on 30 June 1993.
Second flight of the first Buran shuttle vehicle as described for 1998 100A. The flight would have been automatic and would have lasted up to 20 days. The Buran programme was cancelled on 30 June 1993.
Name: Buran-5
Country: USSR
Launch date: 1995
Launch vehicle: Energia

First flight of the third Buran shuttle vehicle as described for 1998 100A with two astronauts. It would have docked with the Mir space station (1986 017A) and deliver an additional module. The Buran programme was cancelled on 30 June 1993.
Earth imaging satellite to be built by Orbital Sciences. Development was cancelled in early 1998 due to cost overruns, launch scheduling problems and doubt about the effectiveness of the payload instruments. The Clark satellite was originally built by CTA which was taken over by Orbital Sciences.
The growing international concern about the potential threat of stray asteroids to the Earth gave rise to the Clementine-2 proposal for an asteroid encounter mission which would use antiballistic missile projectiles as penetrators. Clementine-2 would carry three of such missiles, designated as Light Exo-Atmospheric Projectiles (LEAP). The penetrators would be used to gather data on the mineral content of the asteroids. The spacecraft would fly as close as 50 km from an asteroids and would carry sensors which operate in the visible and infrared bands.

It was also briefly considered to send the spacecraft into a lunar orbit and send three micro rover vehicles to the surface to inspect the remains of Apollo-15 (1971 063A) and undertake astronomical observations. The rover vehicles would have been called Huey, Louie and Dewey, after the Disney cartoon characters. The proposal was not proceeded with and was cancelled in 1997.
The Celestial Observation Satellite (COS)-A was a proposal for a joint gamma ray and X-ray astronomical satellite to be flown in a circular orbit. The proposal was made in March 1968, at the same time as COS-B (1975 072A) and was abandoned in July 1969 in favour of COS-B. No hardware was ever constructed.
The Comet Rendezvous Asteroid Flyby (CRAF) mission was conceived in the mid-1980s by NASA’s Jet Propulsion Laboratory and was to have rendezvoused with the Comet Tempel 2 and flown alongside the comet for at least three years.

The mission was a collaborative project of NASA, the European Space Agency and the federal space agencies of Germany and Italy. The United States Air Force and the United States Department of Energy were also involved.

It would have been the first use of the so called Mariner Mark II space platform that had been developed by the Jet Propulsion Laboratory. It was the intention to use the same platform for a Pluto fly-by, a Neptune orbiter and Cassini, with eventually only the use for Cassini materialising. Launch was initially envisaged with the Space Shuttle but was later shifted to a Titan 4 Centaur launch vehicle because of the radio isotope thermal power generators it was to carry.

The launch was to take place on 21 February 1993 with a Venus fly-by at a distance of 9000 km on 16 August 1993 and an Earth fly-by of 300 km on 25 June 1994. The spacecraft would then have flown past asteroid Hestia on 27 January 1995 following which it would have reached Tempel 2 on 20 October 1996. It would then have orbited Tempel 2 until 31 December 1999. The spacecraft would have maneuvered to within 25 kilometers of the comet's nucleus for a series of observations as well as shooting two penetrators into the nucleus itself for detailed in-situ measurements. The spacecraft would then fly in close formation with the comet until it would get closer to the Sun at which time the spacecraft would have maneuvered farther away to observe the comet's coma and tail.

In addition the spacecraft would have carried a 26 kg penetrator package. At the end of the three years fly-by, CRAF would have approached the comet within 4 to 5 km following which the 18 kg and 1.18 m long penetrator would have been fired into the surface to a depth of 40 to 148 cm. Designed by the University of Arizona the penetrator would have been propelled by a 300 N thrust solid fuelled motor. The penetrator was to incorporate a gas analyser, temperature gauges, a differential scanning calorimeter, a gamma ray spectrometer, accelerometers as well as sample inlets.

In 1989 funding for the project was, however, suspended and scientist started selecting new target, in particular Comet Kopff, Wild 2 and Wirtanen were considered with Kopff eventually selected when funding was re-instated.

The spacecraft was to carry the following instruments:
1. an imaging facility;
2. a visual and infra-red mapping spectrometer;
3. a thermal infra-red radiometer;
4. a cometary matter analyser;
5. a comet/ice dust experiment;
6. a scanning electron microscope and particle analyser;
7. a comet dust environment monitor;
8. a neutral gas and ion mass spectrometer;
9. a comet retarding ion mass spectrometer;
10. a suprathermal plasma instrument to investigate the cometary environment;
11. a magnetometer;
12. a coordinated radio, electrons and wave experiment;
13. a radio science experiment; and
14. the penetrator.

With a launch in August 1995, the spacecraft was to make an Earth fly-by in July 1997, and then encounter Hamburga in January 1998. In August 2000 it was to encounter Comet Kopff and adjust its flight path in such a manner that it would be in the same trajectory as the comet until March 2003, allowing an extended period to study the comet. The penetrator was to be released in July 2001. When further delays occurred and a launch was planned for April 1997, the flight profile was changed into a Mars-Earth-Earth gravity assist trajectory to reach Kopff in January 2006. On its way it would have flown past the asteroids Thisbe, Fortuna and Tamariwa. Once it had reached Comet Kopff a rocket burn would have placed the spacecraft in an orbit around the comet from where it would observe the comet's activities. Eventually it would have adjusted its orbit to move into the comet's tail to collect dust and analyse this with the spectrometers it carried. The mission would have ended with the spacecraft making a soft landing on the comet's surface in September 2011.

CRAF was cancelled in the early 1993 in order to free budget up for the Cassini-Huygens (1997 061A) mission to Saturn, which used the same Mariner Mark II bus. Most of CRAF's scientific objectives were later accomplished by the smaller NASA spacecraft Stardust (1999 003A) and Deep Impact (2005 001A) and ESA's Rosetta (2004 006A) mission.
The Crew Return Vehicle (CRV) was intended to be docked with the International Space Station (ISS) for a period of up to three years to provide a spacecraft for emergency returns from the space station. The vehicle was to be designed to accommodate up to seven crew members in a shirt-sleeve environment. Because of the need to be able to operate with incapacitated crew members, flight and landing operations were to be performed autonomously. The undocking process was to have been as little as 3 minutes in an emergency situation.

The CRV was to have a length of 9.10 m and a cabin volume of 11.8 m³ and, in an operational situation, would have been launched by Ariane 5 or the Space Shuttle. The design had no space maneuvering propulsion system although a Deorbit Propulsion Stage with a length of 4.72 m, attached to the aft end of the spacecraft, would have had eight rocket engines to deorbit the CRV as well as reaction control thrusters.

The first space Space Shuttle flight was identified as STS-136 and STS-140 (depending on the launch manifest consulted) and the mission was also identified as the International Space Station (ISS)-18A mission. Development of the CRV had been cancelled on 29 April 2002.

The CRV concepts were to be tested on the X-38 Advanced Technology Demonstrators which was subsequently cancelled.
The European Crew Transfer Vehicle (CTV) was to be a crewed spacecraft to carry up to six astronauts to the International Space Station (1998 067A). To be launched by an Ariane 5 launch vehicle or the Space Shuttle, CTV was to offer a greater flexibility than STS with a better capability and utility than Soyuz TM. In addition to the astronauts it could also carry up to 800 kg cargo to and from ISS.

Design studies envisaged a landing suspended from a parachute or a parafoil and the design could have incorporated lifting body technology.

Development, undertaken by Aerospatiale, MAN Germany and Alenia Spazio of Italy, was slowed down in 2002 because of the cancellation of NASA’s X-38 vehicle and subsequently cancelled.
Name: D1B  
Country: France  
Launch date: ?  
Launch vehicle: Diamant A(?)

Scientific satellite which was cancelled in the early stages of development. The objective may have been to undertake geodetic studies.
Name: D3
Country: France
Launch date: ?
Launch vehicle: Diamant(?)

Meteorological satellite which was cancelled and evolved into the Eole (1971 071A) satellite.
Name: D4
Country: France
Launch date: ?
Launch vehicle: Diamant(?)

Radio astronomy satellite which was cancelled in the early stages of development.
Name: DMSP F-20
Country: USA
Launch date: 2017
Launch vehicle:

Military meteorological satellite as described for 1999 067A and which was held in storage. The US Air Force wanted to place the last DMSP meteorological satellite in orbit by 2017 to provide coverage of the Middle East region that was provided by a civilian European satellite that was to be retired around the same time.

Congress denied funding for the launch in 2015.
Records claim that the Dyna Soar project commenced on 14 October 1957, a mere 10 days after the launch of Sputnik-1 (1957 a 2). On that day the United States Air Force issued, what must be seen as preliminary directives for a maneuverable space plane. The concept was to a certain extent a follow-on from earlier studies undertaken not only for the USAF but also for NASA, under a variety of project names including Hywards, 118P, Brass Ball and Bomi.

The project, with the military designation X-20, was an attempt to combine the best features of two approaches: high speed flight in space and the capability to return with airplane like control. In March 1958 eight aerospace companies submitted proposals and in June of that year Boeing as well as a Bell/Martin consortium were awarded contracts for further studies into the project. By 9 December 1959 it was obvious that the Bell/Martin proposals relied heavily on unproven technology and Boeing was awarded a development contract.

The craft being developed by the company was a delta-winged glider. It was to be rocketed into space by a powerful booster and, once in orbit, the pilot would be able to fly to any point on the globe at speeds of more than 27,000 km/h. When the pilot would have completed his mission, the craft would fly back into the atmosphere and land at any airfield.

The term Dyna Soar was derived from 'dynamic' and 'soaring', meaning that the vehicle was to use both centrifugal force and aerodynamic lift. Centrifugal force was to sustain the craft at orbital speeds when it would be flying just fast enough to off-set the pull of the Earth's gravity. The aerodynamic lift would be given by the wings and would be used for flight in the atmosphere.

The maneuverability in the space environment was to be achieved by a series of small gas jets mounted on the craft whilst retro-rockets were to slow the craft prior to its glide into and through the Earth's atmosphere. This re-entry was to be in a long single glide during which the craft would encounter severe heating of the surfaces. To resist the heat, ceramic materials were to be used in addition to high nickel alloy steel, molybdenum and columbium. The heat resistant materials were to radiate the heat from the surfaces of the craft back into the atmosphere. Nevertheless the surface of the Dyna Soar would be scorched until it would have looked like an old fashioned wood stove but it would have been a simple task to prepare the craft for re-launching.

The design incorporated many unusual features, including the main landing gear which was to consist of landing skids with wire brushes mounted on the skids whilst the nose gear resembled a shallow kitchen pan. This unusual combination was dictated by the fact that the high re-entry temperatures ruled out rubber tyres and lubricated bearings, and hence conventional brakes.
The unusual aerodynamic regimes necessitated extensive wind tunnel research. In fact, the most extensive wind tunnel research on any single craft undertaken up to that time was performed with the Dyna Soar design. By 1961 the design was frozen and the Air Force formally ordered ten production vehicles for which it allocated the serials 61-2374 through 61-2383.

The craft had a span of 6.17 m, a length of 10.77 m, a height of 2.44 m and an empty mass of 4912 kg. It had no propulsion system.

At that point of time it was planned to fly seven scale models of the X-20 on top of Scout rockets into sub-orbital trajectories to test high speed flight as well as thermal protection.

It was further envisioned that air drop tests would commence in 1963 using a B-52 mothership. These flights, which would be uncrewed as well as crewed, would take place over Edwards Air Force Base, in California. In 1964 the first uncrewed sub-orbital flight was to take place whilst the first uncrewed orbital flight was to take place in late 1965. After two such flights the first crewed orbital flight was scheduled for early 1966 after which flights at three months' intervals were planned. At that point in time funds would be available for a total of twelve flights. All orbital flights were to be launched by a modified Titan launch vehicle. There are alternative schedules.

<table>
<thead>
<tr>
<th>Flight</th>
<th>Date</th>
<th>Details</th>
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<tr>
<td>Air drop tests-1 to -20</td>
<td>May 1965 and later</td>
<td>Drop tests from B-52</td>
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<tr>
<td>Dyna Soar-1</td>
<td>January 1966</td>
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</tr>
<tr>
<td>Dyna Soar-2</td>
<td>April 1966</td>
<td>Uncrewed</td>
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<td>Dyna Soar-3</td>
<td>July 1966</td>
<td>Wood; single orbit</td>
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<tr>
<td>Dyna Soar-4</td>
<td>October 1966</td>
<td>Crewed*; single orbit with maneuvering</td>
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<tr>
<td>Dyna Soar-5</td>
<td>February 1967</td>
<td>Crewed*; single orbit with maneuvering</td>
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<td>Dyna Soar-7</td>
<td>July 1967</td>
<td>Crewed*; re-use of earlier spacecraft</td>
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<td>Dyna Soar-8</td>
<td>September 1967</td>
<td>Crewed*; single orbit with maneuvering</td>
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<td>March 1968</td>
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</table>

*The other five X-20 pilots in active training at the end of the program were Crews, Gordon, Knight, Rogers, and Thompson.

In mid-1961 the government began to question the project and delays crept into the programme, leaving only the pure space flight aspect. When it appeared that this was adequately being met by the other crewed space projects of the United States, eventually the entire Dyna Soar project was cancelled on 10 December 1963.

By that time Boeing had built a full scale mock-up of the Dyna Soar and some material for production had been cut although no construction had commenced. Also the Air Force had selected a number of potential pilots for the project's initial phase and subsequent 'operational' phase. This selection had taken place in three groups on 15 March 1962, 20 April 1962 and 22 October 1962. On cancellation of the programme most of these pilots went back to other duties although some of them eventually became astronauts.

Like the later MOL programme, the Dyna Soar project was not directly connected with the lunar effort which dominated the United States' thinking in those days. It is further doubtful whether the project had any significant direct impact on the Space Shuttle project. Nevertheless, had the project been completed, it would have provided the United States with an alternative means to space and as such the cancellation of the Dyna Soar programme must be considered an unfortunate step.
In 2006 Echostar ordered the CMBStar or Echostar-13 satellite from Space Systems/Loral to provide mobile video services to hand-held devices before the 2008 summer Olympics in Beijing, China. The satellite was to be based on the LS-1300 platform. Further development was suspended in May 2008.
The Earth Observing System (EOS) series of satellites was proposed by NASA for launch from June 1998 and comprised originally of various series of coordinated polar-orbiting satellites designed to monitor and understand key components of the climate system and their interactions through long-term global observations.

The EOS-AM series of three satellites were to be polar orbiting satellite to cross the equator at 10.30 am local time, to characterise the radiation balance of terrestrial surfaces, clouds and aerosols. The satellites were to be built by Lockheed Martin and were scheduled for launch in 1998, 2003 and 2008. Eventually only one was launched as Terra Earth (1999 068A).

The EOS-PM series of three satellites were to cross the equator at 1.30 pm local time, and were to study clouds, precipitation and radiative balance, terrestrial snow and ice, sea surface temperatures as well as ocean productivity. The satellites were to be built by TRW and were to be launched in 2000, 2005 and 2010. Eventually only one was launched as Aqua (2002 022A).

The EOS-Chem series of three satellites were to be built by TRW and were to investigate atmospheric chemicals and their transformations as well as ocean surface stress. The planned launch dates were 2002, 2007 and 2012. Eventually only one was launched as Aura (2004 026A).

Other series of satellites which were never launched included:

1. EOS-Color, a single satellite which was to be launched in 1998 into a sun-synchronous polar orbit and was to study the biomass and the productivity of aerosols;
2. EOS-Aero series of five satellites which were to be launched in 2000, 2003, 2006, 2009 and 2012 into an orbit with an inclination of 57° from 2000 onwards and would have studied atmospheric aerosols; and
3. EOS-Altimetry series of three satellites which were scheduled to be launched into a sun-synchronous polar orbit in 2002, 2007 and 2012 to study ocean circulation and ice sheet mass balance.
<table>
<thead>
<tr>
<th>Name:</th>
<th>ERS-14, -23, -24, -25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country:</td>
<td>USA</td>
</tr>
<tr>
<td>Launch date:</td>
<td>?</td>
</tr>
<tr>
<td>Launch vehicle:</td>
<td>?</td>
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</tbody>
</table>

Several satellites in the Environmental Research Satellite (ERS) series have been unaccounted for and may have been cancelled at a very early stage of development. It has been suggested that ERS-14 was to be a Tetrahedral Research Satellite whereas ERS-23, -24 and -25 were to be Octahedral Research Satellite as described for 1962 αχ 1.
Name: ESRO-3  
Int. Agency: ESRO  
Launch date: September 1971  
Launch vehicle: Scout

Ionospheric satellite which was cancelled. The platform was similar to that of ESRO-1 (1968 084A). The 80 kg satellite would have carried:

1. the S-45 instrument to measure the ionospheric electron temperature and density;
2. the S-85 instrument to measure the low energy auroral electrons; and
3. the S-94 experiment to study auroral particles.

The programme was cancelled by 1965 and all of the experiments were transferred to other satellites.
Retrievable payload carrier as described for 1992 049B.
The payload candidates for the Eureca-2 mission were
1. the Automated Mirror Furnace (AMF) as described for Eureca-1 (1992 049B);
2. the Multi Furnace Assembly (MFA) as described for Eureca-1 (1992 049B);
3. the Solution Growth Facility (SGF) as described for Eureca-1 (1992 049B);
4. the Surface Adhesion Forces (SAF) experiment to study the dependence of surface forces and
interface energies;
5. the Protein Crystallisation Facility (PCF) as described for Eureca-1 (1992 049B);
6. the Exobiology and Radiation Assembly (ERA) as described for Eureca-1 (1992 049B);
7. the Solar Constant and Variability Instrument (SOVA) as described for Eureca-1 (1992 049B);
8. the Advanced Solar Gallium Arsenide Array (ASGA) as described for Eureca-1 (1992 049B);
9. a botany facility for plant growth;
10. the Space Particle Intact Capture Experiment (SPICE);
11. the Synoptic Monitoring of Orbital Debris (SYNMOD);
12. the International Diffuse EUV Spectrometer (IDES);
13. the Measurement of Orbit Atoms and Molecules (MAM);
14. the Plasma Electron Gun Payload (PLEGPAY);
15. the Optical Fibres In Space experiment; and
16. the European Science and Exposure Facility (ESTEF), a small platform for a variety of exposure
experiments.

This list exceeded the carrying capability of 1000 kg, in spite of the fact that there was to be an additional
payload panel on the bottom of the platform. The development was not proceeded with. If launched the
spacecraft would have been retrieved in December 1995.
At the time of cancellation the payload had not yet been assigned to a specific Space Shuttle flight.
Name: Eureca-3
Int. Agency: ESA
Launch date: January 1998
Launch vehicle: STS

Retrievable payload carrier as described for (1992 049B).
Although the final payload was never determined it may have included the following experiments:

1. several materials and fluid sciences experiments:
   - Low-Temperature Vapour Growth Facility (LTVGF);
   - Forced Convention instrument;
   - Automated Gradient Furnace (AGF);
   - Sesame, a dedicated furnace for the growth of semi-conducting ternary compounds;

2. Radiation Monitoring In Space (RAMOS), a life sciences experiment

3. Visible Explorer and Ultraviolet Infrared Observer (Vexuvio), an Earth observation experiment;

4. Occulation Spectrometer;

5. several space science experiments:
   - Multi-Layer Grating Spectrometer (MGS) for solar observations;
   - Absolute Radiometric Measurements in Space (ARMS);
   - Experiment for Measuring Long Term Solar Diameter Variations (EUDOSSO);
   - Masar clock, provided by ESA;

6. several technology experiments:
   - Flight Demonstration of an Arcjet Propulsion System (Diva);
   - Arcjet test;
   - Evaporator test;
   - Microwave radar;
   - Eureca based tether initiated re-entry demonstration;
   - Global Positioning System;

7. three possible NASA payloads:
   - Optical Properties Monitor (OPM);
   - Space Particle Intact Capture Experiment (SPICE); and
   - Masar clock, provided by NASA.

The development was not proceeded with. If launched the spacecraft would have been retrieved in August 1998. At the time of cancellation the payload had not yet been assigned to a specific Space Shuttle flight. The objectives and payloads for the Eureca-4 and -5 missions were never determined.
<table>
<thead>
<tr>
<th>Name:</th>
<th>Eutelsat W-1</th>
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<tbody>
<tr>
<td>Int. Agency:</td>
<td>Eutelsat</td>
</tr>
<tr>
<td>Launch date:</td>
<td>1998</td>
</tr>
<tr>
<td>Launch vehicle:</td>
<td>Ariane 44P</td>
</tr>
</tbody>
</table>

Communications satellite to be owned by the Eutelsat organisation and built by Alcatel. It was to be placed in geostationary orbit at 7°E. The satellite was destroyed in a fire at Alcatel in May 1998 and was later rebuilt and launched as Eutelsat W-5 (2002 051A).
The US Air Force Academy’s FalconSat-4 programme started in January 2005 with a symposium at which 25 different possible payloads were presented. Of these a PowerSail experiment and a top side ionospheric sounder payload were further investigated with the ionospheric sounder eventually selected. When it became evident that funds would not be available the FalconSat-4 programme merged with the FalconSat-5 programme.
The Full-sky Astrometric Mapping Explorer (FAME), also known as Midex-4, was a space telescope designed to obtain highly precise position and brightness measurements of 40 million stars. It was cancelled.
FGB-2 was to be a conversion of a back-up of the Zarya FGB Functional Cargo Block which was to be made available for commercial purposes. FGB-2 offered 20m$^3$ of internal volume for particular experiments or technology development work and would have been attached to the lower Zvezda port of the International Space Station (1998-067A). Proposed in 2000, the proposal was not proceeded with. The module was later modified to be used as the Nauka MLM module.
The Freedom space station was an international venture of the United States (71.4%), the European Space Agency (12.8%), Japan (12.8%) and Canada (3%).

The original design of the space station would have consisted of a large truss structure with a length of 155 m and eight solar wings measuring 33 x 10.3 m each. This structure would provide the facility to attach the various modules of the space station, leading towards a total mass of 225 tons:

1. the US Manned Laboratory;
2. the Habitation Module;
3. the European Columbus (eventually launched on 11 February 2008) module;
4. the Japanese JEM module; and
5. the Canadian Mobile Service System.

Over the years the size of the space station was, however, reduced as a result of cost cutting and ultimately a length of 90 m was envisaged.

The station was to be built up over a period of four years using approximately 25 space shuttle flights which were designated as SSF/L-1 to L-11 (for logistics purposes), SSF/MB-1 to M-14 which provided the parts for the Manned Base (MB). There were also SSF/UF flights, the Utilisation Flight (UF).

In the first phase, requiring three shuttle flights, the basic functional parts of the space station would have been constructed, incl. the first solar panels, communication facilities and docking facilities.

The fourth shuttle flight would have placed the US Manned Laboratory into orbit, thereby giving the station a crew-tended capability. This module would have supported multi-disciplinary payloads such as materials sciences and life sciences, and measured 13.5 m in length and 4.22 m in diameter. In the final configuration it would have been the centre of the space station.

By the completion of the eleventh shuttle flight, the space station would have achieved the capability to be permanently crewed. For this a Habitation Module of the same size of the Laboratory Module was to be attached to the framework. This module was to provide living quarters for a crew up to eight.

In the last phase the Columbus module and the Japanese Experiment Module will be attached to the space station.

In the mean time shuttle flights would also have delivered several pressurised and unpressurised logistics carrier as well as several resource nodes which were to be used to control extra vehicular operations by the crew as well as by automated means, to provide a general command centre and a back-up centre and to allow control of the space shuttle operations in the vicinity of the space station.

Mounted on the truss structure would be the Canadian Mobile Service System, which could move over rails along the truss structure and was to be equipped with a remote manipulator system.
In early 1993 budget cutbacks resulted in significant reviews of the Freedom programme with three options:

1. **Option A**, with an estimated cost of US$ 5 billion over a 5 year period, was a simpler and more spartan version of the original idea. It would provide for missions of 30 days duration and would have to maneuver frequently thereby inducing some gravitational force and vibrations which would affect microgravity experiments. Commencing as a single orbiting spacecraft, which could be constructed with three shuttle flights, it would use the shuttle orbiter as a 'plug-in' habitat for the astronauts with the experiments being conducted on the orbiter. It would, however, have a growth potential as the core beam of the spacecraft could be extended and more modules could be added.

2. **Option B**, with a price tag of US$ 9 billion over 5 years, was a half length version of the original design requiring six to seven shuttle flights to construct but with no crew quarters in the initial phases. Again, there was a potential for later additions which would require up to 13 shuttle flights and would require by far the most space construction work.

3. **Option C** was perhaps the most radical departure from the original design and foresaw a large module with a length of 28 m and a diameter of 7 m and, subsequently a significant larger volume than any of the other designs but, at the same time, limited by the extend of solar panels that could be attached, a limitation that would preclude simultaneous running of all the experiments. Whilst the option allowed for the radial docking of the ESA Columbus (eventually launched on 11 February 2008) module and the Japanese JEM module, the large solar panels may have limited the effectiveness of some experiments by blocking the observation range. This option would have cost US$ 7 billion over 5 years. The C option module would be launched on a single flight, using the main engines and solid boosters of the space shuttle.

At the same time consideration was given to Russian involvement in the programme which led to a change from the original orbit with a 28.5° inclination to an orbit with a 51.6° inclination. Although the higher inclination would require a bigger shuttle boost, meaning more flights and lesser capacity, the orbit would allow more scientific observation of the Earth's surface and a better coordination of science endeavours with the Russians.

In late 1993 the A option was chosen, and the name 'Alpha' was attached to the space station project. With Russia joining the project it became known as International Space Station (1998 067A).
The Gravity and Extreme Magnetism (GEMS) mission was part of NASA’s Small Explorer (SMEX) programme and was to be the 13th satellite in that series. It would have made use of Orbital’s LEOStar-2 TM spacecraft design.

The satellite was to carry an X-ray polarimeter instrument comprising two co-aligned telescopes and a focusing optical system to collect X-rays. Detectors would have measured the polarization of the X-rays, from which astronomers could have determined the shape and spin rate of matter around black holes and highly-magnetized neutron stars, thereby unlocking a previously hidden astrophysical aspect.

The mission was cancelled in June 2012 due to cost overruns.
Name: GOES-Q
Country: USA
Launch date: 2010
Launch vehicle: Delta 4M+ (4,2)

Meteorological satellite as described for 2006 018A. With the continued performance of the earlier generation of GOES satellites, GOES-Q was not required and was cancelled in 2002.
<table>
<thead>
<tr>
<th>Name</th>
<th>Gsat-5</th>
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<tbody>
<tr>
<td>Country</td>
<td>India</td>
</tr>
<tr>
<td>Launch date</td>
<td>2008</td>
</tr>
<tr>
<td>Launch vehicle</td>
<td>GSLV</td>
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</tbody>
</table>

Also known as Insat 4-D, this satellite was to carry 12 normal C-band transponders and six extended C-band transponders. It was to be placed in a geostationary orbit at 82°E. The satellite was initially intended to be a spare and was rebuilt as Gsat-5 Prime which failed on 25 December 2010.
In the 1980’s the European Space Agency started planning for a re-usable spaceplane to provide it with independent crewed access to space. The plan envisaged a spacecraft that could take three astronauts on missions of 30 to 90 days in space. Hermes commenced as a pure French project but, with increasing costs, the development became a European effort with substantial funding from Germany in November 1987.

In 1984 Hermes was seen as a small mini-space shuttle that would consist of two modules: the spaceplane itself that could carry 4 to 6 astronauts plus a 4500 kg payload in its cargo bay and a cone shaped Resource Module at the rear of the spacecraft that would be left behind before re-entry. The spaceplane itself was anticipated to be able to conduct at least 30 flights without major servicing. Payloads to be returned to Earth could be contained in a small payload bay, but most experiments were included in an expendable pressurized supply module, equipped with a docking port, mounted to the base of the glider.

As the Hermes was too heavy to be launched by the existing Ariane 4 launcher, the Ariane 5 vehicle was developed to launch the Hermes from Kourou. It would land at Kourou as well, with alternative landing sites at Fort de France Island, Bermudas or Istres in south France.

The mission envisioned included flights to the proposed European remote sensing Polar Platform (PPF), flights to ESA’s Man-Tended Free Flyer (MTFF) Station and flights to the proposed Columbus (eventually launched on 11 February 2008) module for the Freedom space station.

The original Ariane 5 proposal envisaged mating the Ariane booster stage with a new upper stage burning liquid oxygen and hydrogen which would have boosted the payload capability to more than 15 tonnes. Eventually Ariane 5 became, however, a totally new vehicle with an even large capability.

Over the same period the Hermes itself reduced in size with a crew of three and a 3000 kg pressurised payload and a length of 15.51 m and a span of 10.57 m. The cargo bay had a diameter of 2.70 and a length of 7.70 m.

In April 1985 Dassault-Breguet and Aerospatiale submitted their designs for Hermes to the French national space agency CNES and in October 1985 CNES awarded a contract to Aerospatiale with some assistance from Dassault-Breguet. The cost was expected to be about $1.9 billion, including $1.1 billion for development and construction of two vehicles.
By the time ESA took over the project in November 1987 the cost was expected to be $4.25 million including two qualifications flights, as well as $3.36 million for the development of the Ariane 5 launch vehicle. France was to absorb 45% of the cost whilst Germany was to fund 30%.

But by the time the first phase of the Hermes development was completed in November 1991, ESA decided to have a year long "reflection" period to review and reconsider its plans to build its own space shuttle and space station or if new partners could be found to share cost and development, in particular in view of the political developments in post-USSR Russia.

In the new political arena ESA and Russia agreed to cooperate on future launchers and a replacement for the Mir space station. Both Russia and ESA then joined NASA in the International Space Station programme and the need for a European crew transport system disappeared as both Russia and the USA had existing capabilities that did not need expansion. Accordingly ESA decided to cancel the Hermes development in November 1992. A 'reduced' Hermes X-2000 unmanned technology demonstrator was briefly considered but was cancelled at the same time. At the time of cancellation $2 billion had been spent on the Hermes project.

Had the Hermes programme continued the first unmanned mission would have taken place in 2002 with the first crewed mission in 2003. The programme would have been managed by a industrial company named Euro Hermesspace, with the French companies Aerospatiale and Dassault-Breguet controlling 51.6%, Germany’s DASA 33.4% and Italy’s Aeritalia 15%.
The H 2 Orbiting Spaceplane (Hope) was to be used ferry astronauts and supplies to the International Space Station. It was to be developed in piloted and automatic versions. The programme commenced in the 1980s and various test vehicles. The Orex tests demonstrated the thermal protection and atmospheric re-entry systems and was flown as the Ryusei satellite (1994 007A).

The Automatic Landing Flight Experiment (Alflex) tests demonstrated the low-speed aerodynamic and landing systems. The vehicle, with a span of 3.78 m and a length of 6.10 m, was dropped from a helicopter flying at high altitude. Thirteen flights were conducted from July to August 1996. The Hyflex tests demonstrated hypersonic flights.
The Hope-X was an orbital test version which was never built. Development ceased in 2000.
Horyu-1 was a cubesat developed by students of the Kyushu Institute of Technology. The objectives of the satellite included space material exposure tests, flight test of a CMOS camera module for micro-satellites, and taking high resolution images of the Earth. Development was cancelled when Horyu-2 (2012 025D) took precedent.
Horyu-3 was a 3U cubedsat built by Kyusyu Institute of Technology (KIT) and was to be launched as a secondary payload on the HTV-5 (2015 038A) launch. The satellite was to continue the investigation of the electric arcing mechanism of high voltage currents undertaken with Horyu-2 (2012 025D). In addition it was to demonstrate inter-satellite communication by using Light Emitting Diode (LED), Earth observation by using CMOS camera and sending birthday messages from space using the amateur radio band. Development ceased in mid 2014.
The seventh mission in the Earth System Science Pathfinder (EESP), and also referred to as EESP-7, the Hydrosphere State (Hydros) was to provide measurements of surface soil moisture (0–5 cm depth) and land freeze/thaw. The launch was planned for September 2010 but was cancelled in December 2005 due to budget restrictions. It was resurrected in 2008, with modifications, as SMAP to be launched in January 2015.
The Interim Control Module (ICM) for the International Space Station (1998 067A) was proposed to provide the attitude control facilities for the space station, in case the Russian Service Module might not have been ready in time. The ICM would be a modification of the upper stage booster that placed the NOSS ocean surveillance satellites into orbit. This booster has been referred to as the NRL Upper Stage and the Titan Launch Dispatcher.

With a mass of 12,500 kg this module would have been launched by means of the Space Shuttle. ICM had a limited life time and was considered as a temporary measure only until the SM would be completed. The Service Module, then known as Zvezda (2000 037A), was eventually launched on 12 July 2000 and the ICM was cancelled.
Name: ICO-3 to -15
Int. Agency: ICO
Launch date: 2009 to 2011
Launch vehicle: Proton M/Briz M

Communications satellite as described for 2001 026A. In April 2004 Boeing terminated the contract for the remaining ICO series satellites. Ten of the satellites (ICO-3 to -12) were scheduled to be launched on 5 Proton M/Briz M launch vehicles between 2009 and 2011, with the remaining three spacecraft, ICO-13, -14 and -15 to be available as spares.
Name: IMEWS-24, -25
Country: USA
Launch date: 2007/2008
Launch vehicle: Delta 4 Heavy

Military early warning satellite as described for 1989 046A. Following the launch of IMEWS-23 (2007 054A) IMEWS-24 and -25 were cancelled.
Name: Intelsat-1001
Int. Agency: Intelsat
Launch date: mid 2003
Launch vehicle: Zenit 3SL

Communications satellite as described for 2004 022A.
The satellite was cancelled in November 2002 as construction was significantly delayed. It was to be located in a geostationary orbit over 50°W.
The Improved Tiros Operational System (ITOS)-C was a satellite in the National Oceanographic and Atmospheric Administration (NOAA) series as described for NOAA-1 (1970 106A). It was not launched.
The International Space Station (ISS)-9A.1 mission was to be flown by the Space Shuttle, as described for 1981 034A and was to deliver four solar arrays as well as the European Robotic Arm (ERA) to the International Space Station (1998 067A). Following re-assessment of STS operations in 2004, the flight was cancelled and the payloads distributed over other flights.
The objective of the International Space Station (ISS)-14A mission was deliver to the International Space Station (1998 067A) port rails, two SPP arrays as well as the Service Module Micrometeoroid and Orbital Debris Shields. The original payload also included the Cupola module was rescheduled for launch on ISS-20A. The mission was deleted from the ISS Assembly Plan in 2006. At one stage the mission was to have been flown by STS-136 which was cancelled.
The International Space Station (ISS)-16A mission was to deliver the US Habitation Module to the International Space Station (1998 067A). The mission was deleted from the ISS Assembly Plan in 2006 and was at one stage scheduled for STS-138 which was cancelled.

The 3855 kg US Habitation Module was to provide living quarters for a crew of four and was to be fitted with a shower, a galley as well as a wardroom. Problems with the development of caused the completion of the 8.80 m long and 4.80 m diameter module to be put on an indefinite hold. In February 2006 it was decided to cancel further development and the available hardware was transferred to the Marshall Space Flight Center (MSFC) for conversion and use as a test facility in the development of improved life support systems for current and future spacecraft.
The International Space Station (ISS)-3R mission was to deliver the Russian Universal Docking Module to the International Space Station (1998 067A) which was to be linked to the Service Module in place of Docking Compartment-1. It would have provided five docking ports for the Docking Compartment-2, the Russian Research Modules and the Russian Life Support Modules. It was cancelled and but mission designator was later re-assigned to the launch of the Nauka MLM module.
The ISS-6R mission was to carry parts of the Russian Science and Power Platform (SPP) to the International Space Station (1998 067A). SPP would have provided the Russian laboratory module with 25 kW of power as well as heat rejection for the scientific experiments and general operations. Due to budget restrictions SPP was cancelled and was to be replaced with one of the four American solar arrays.
The ISS-7R mission was to carry parts of the Russian Science and Power Platform (SPP) to the International Space Station (1998 067A). SPP would have provided the Russian laboratory module with 25 kW of power as well as heat rejection for the scientific experiments and general operations. Due to budget restrictions SPP was cancelled and was to be replaced with one of the four American solar arrays.
Name: ISS-8R
Country: Russia
Launch date: 2009
Launch vehicle: Proton K

The International Space Station (ISS)-8R mission was to launch and connect the Russian Research Module-1 to the International Space Station (1998 067A). It was cancelled in 2007.
The International Space Station (ISS)-9R mission was to deliver the Docking and Stowage Module to the International Space Station (1998 067A). It was to be attached to the Zarya nadir port to provide on-orbit storage and a Soyuz TM docking facility. It was cancelled.
The International Space Station (ISS)-10R was to launch and connect the Russian Research Module-2 to the International Space Station (1998 067A). It was cancelled.
The International Space Station (ISS)-11R mission was to launch and connect the Russian Life Support Module-1 to the International Space Station (1998 067A). It was cancelled.
The International Space Station (ISS)-12R mission was to launch and connect the Russian Life Support Module-2 to the International Space Station (1998 067A). It was cancelled.
Name: Jabiru-1
Country: Australia
Launch date: 2015
Launch vehicle: Ariane 5ECA

Communications satellite to be owned by NewSat satellite and built by Lockheed Martin using the A2100AXS platform. It was to carry 50 Ka band, 18 Ku band and 1 S band transponders. The Ku and S band transponders were to be leased out as Measat-3C.
It was intended to place the satellite in geostationary orbit at 90°E.
Proposed in 2000, Jig was a proposed multipurpose facility that could be used to assemble, launch, service and retrieve small spacecraft from the International Space Station (1998 067A). It would also have supported astronauts working on EVAs. The facility was not proceeded with.
The Lincoln Experimental Satellite (LES)-7 satellite for experimental communications was cancelled. The satellite was intended to have an all-solid-state, 100 MHz bandwidth, single-conversion, X-band repeater and a multibeam antenna. It was apparent that the technology was ahead of its time and there was no financial support for the mission that was cancelled in 1970. Nevertheless the multibeam antenna was built and tested at an antenna test range.
The Little Joe (LJ)-3 and -4 flights in the Mercury programme as described for 1961 αα 1, were to evaluate the spacecraft re-entry dynamics with launches planned for August 1959. The flights were subsequently cancelled.

Some references link the LJ-3 and LJ-4 designations with the LJ-2 (4 December 1959) and LJ-1B (21 January 1960) flights respectively.
The LK-1, designed by OKB-52, headed by Chelomei as article 11F94, was designed for the USSR circumlunar flight programme. Design commenced in 1961 and in August 1964 twelve were ordered to be built from 1965 onwards. In October 1965 development was cancelled.

The spacecraft was to consist of:
1. the ADU Emergency Engine Unit, a solid fueled escape tower;
2. the Vozvrashchaemiy Apparat (VA) re-entry capsule for one or two cosmonauts and had a diameter of 2.8 m and a length of 3.6 m;
3. the PAB Equipment-Rocket System Block, a service module with a length of 4.7 m and a diameter of 2.9 m, which carried the electrical power and communications systems, a small rocket system for midcourse maneuvers on the lunar flyby trajectory, solar panels and a parabolic antenna; and
4. the RB Translunar Injection Stage.

The LK-1 would be placed into a parking orbit of the earth by the UR-500K (Proton) launch vehicle. With proper optimisation of the booster, based on early flight tests, it was felt that the LK-1 would ultimately be capable of carrying two cosmonauts.

The programme was eventually cancelled and components of it transferred to OKB-1, the Korolyov design bureau.

The VA capsule of the LK-1 was further developed, as described for 1976 121A, for use with the TKS space station resupply ship, as described for 1977 066A.
Name: Luna-25
Country: USSR
Launch date: 1977
Launch vehicle: Proton K/D

Type E-8 lunar spacecraft with the Lunokhod-3 rover vehicle as described for 1970.095A, which was cancelled.
Name: Luna-26(?)
Country: USSR
Launch date: 1978(?)
Launch vehicle: Proton K/D

Type E-8-5M lunar sample return spacecraft as described for 1974 084A, which was cancelled.
Name: Mars94
Country: Russia
Launch date: 1994
Launch vehicle: Proton K/D2

The Mars94 mission was postponed and became Mars96, launched as Mars-8 (1996 064A).
The Mars Surveyor 2001 Lander mission was to place the Athena rover vehicle on the surface of Mars. It was one of two missions in the Mars Surveyor 2001 programme, the other one being the The Mars Surveyor Orbiter 2001, which was renamed 2001 Mars Odyssey (2001 014A) and was launched on 7 April 2001. The 628 kg Mars Surveyor 2001 Lander was to have been launched on 10 April 2001 and would have reached Mars on 22 January 2002.

The three legged lander with a mass of 328 kg, would have carried the following instruments:

1. the Mars Descent Imager (MARDI);
2. the Mars Radiation Environment Experiment (MARIE), designed to study the radiation environment at the surface;
3. a Panoramic Camera (PanCam);
4. a small Thermal Emission Spectrometer (Mini-TES);
5. the Mars Environment Compatibility experiment (MECA) to measure the toxicity to humans of martian soil and dust;
6. the Mars In-situ Propellant production experiment (MIP) a payload that was to demonstrate the manufacture of oxygen from the atmosphere of Mars; and
7. a robotic arm and camera.

The Athena rover was designed and built by Lockheed Martin but, prior to the mission’s cancellation date, had already be replaced by a smaller rover based on the Sojourner that had been part of the Mars Pathfinder (1996 068A) mission of 1997. This rover was named Marie Curie and would have carried an Alpha-Proton X-ray Spectrometer (APXS), stereo black and white front cameras and a mono black and white rear camera.

The Marie Curie rover had six wheels, was 28 cm high, 63 cm long, and 48 cm wide and had a ground clearance of 13 cm. The mass was 13.81 kg. It was planned for the rover to traverse over 100 m during the mission, up to 10 m from the lander.

The mission was cancelled in May 2000 after the failures of the Mars Climate Orbiter (1998 073A) and the Mars Polar Lander (1999 001A) in 1999 but eventually evolved into the Mars Surveyor 2003 double-rover missions that placed the MER-A (2003 027A) and MER-B (2003 032A) rovers on the surface of Mars. Following the cancellation the Mars Surveyor 2001 Lander was kept in storage and then used as the lander on the Phoenix (2007 034A) mission of 4 August 2007. This mission also carried the MECA and MARDI instruments as well as the Robotic Arm.
The Mars Surveyor 2003 Orbiter was one of the two missions considered for launch in May/June 2003, the other one being the Mars Surveyor 2003 Rover (Lander) which was eventually launched as the Mars Explorer Rover (MER)-A (2003 027A) and MER-B (2003 032A) rovers on the surface of Mars.

The Mars Surveyor 2003 Orbiter was to be a multi-instrument spacecraft similar in size to the Mars Global Surveyor (1996 062A) that had been launched on 7 November 1996. It was intended to carry the instruments that had been carried on the Mars Climate Orbiter (1998 073A) that had been launched on 11 December 1998 but had failed to enter Martian orbit.

The mission was subsequently cancelled in 2001.
On 25 October 1961 it was decided to modify four Mercury spacecraft as described for 1961 αα 1 for the Manned One Day Mission (MODM) project and flights MA-10, MA-11, MA-12 and MA-13 were scheduled for 1963. The four converted spacecraft were SC/12, SC/15, SC/17 and SC/20. MA-10 would have been flown by Alan Shepard using Mercury spacecraft SC/15. His back-up was Gordon Cooper. Flight MA-11 would have used SC-12 and would have been flown by Virgil Grissom with Walter Schirra as back-up. Schirra would ultimately have flown on MA-12. No details of an astronaut assignment for MA-13 has been found.

However, by October 1962 it had been decided to cancel the last of the short duration flights, designated MA-9, and move, instead, directly to the one day flights and subsequently the first long duration mission MA-10 was redesignated as MA-9 and the mission objective was changed. There was no change in astronaut. Subsequent to this the MA-11 mission had been redesignated as MA-10. By this time MA-12 and MA-13 had already been cancelled as the Mercury programme was behind schedule and the astronauts were already heavily involved in the Gemini programme.
Name: Measat-4  
Country: Malaysia  
Launch date:  
Launch vehicle:  

In December 2004 ISRO (Antrix) and MEASAT signed an agreement for the procurement of the Measat-4 communications satellite comprising the I-3K platform fitted with Ku transponders. Development was most likely cancelled.
The Mir-2 designation has been used for a range of proposals for a next generation space station for the USSR.
The original concept for the Mir-2 space station was a vast 400,000 kg space station to be built by the Energia design bureau.
In 1990 the Energia design bureau had developed a concept which would employ a truss with a span of 104 m and a transverse beam of 54 m. These would support 4 crew modules, each 14 m, 4.5 m in diameter and a mass of 20 tons. The space station would be crewed by 6 to 12 cosmonauts and logistics support would be provided by improved versions of the Soyuz and Progress spacecraft as well as the Buran re-usable space shuttle. It would be placed in an orbit with an inclination of 65°.
In 1992 the design was scaled down to a core module to be based on the Mir (1986 017A) design but, rather than clustering the additional modules around a single point, it was intended to place four Kvant-1 size modules underneath the core module. In addition the new space station was to have a large beam on which solar panels could be deployed and would also have docking ports compatible with the VKK shuttle and the American Space Shuttle.
Mir-2 was originally to be launched with an Energia launch vehicle occupying a large payload bay which is about half the size of the core of the Energia. The proposal was to dock Mir-2 with Mir in 1994, by which time Spektr (eventually launched as 1995 024A) would have separated from Mir. In this new configuration Mir would function as a command and control module whilst Mir-2 would have become the new core module. In 1995 a new biological module would been added and eventually, in 1996, it was scheduled to separate Mir from Mir-2. The Priroda module (eventually launched as 1996 023A) would, by then have been transferred to Mir-2 whilst in 1997 the biological module would have been replaced by another biotechnical module.
In its ultimate configuration, Mir-2 was to be dedicated solely to applied scientific activities and materials processing whilst the research science, which was originally conducted on Mir, would have been a thing of the past.
In 1993 the size of the station had been downgraded from a mass of 80 tons to 20 tons, with the core module being based on the Mir space station. To facilitate the operations of the space station it was proposed to continue the use of the Soyuz TM ferry spacecraft. The propulsion unit of this spacecraft would also form the basis of a much larger cargo transfer vehicle whilst the propulsion unit was also proposed for use as a space tug. The add-on modules for Mir-2 would be of a new design with a mass of 8000 kg.
The Russian involvement in the international Alpha/Freedom space station caused the demise of the Mir-2 development.
The Manned Orbiting Laboratory (MOL) programme was commenced in 1963 as an alternative to the Dyna Soar project. The objective of this programme was to demonstrate the use of a crew in performing military functions in space. This knowledge was deemed essential before any specifications of an operational nature could be drawn up and as such, the programme was more scientific and engineering in nature than direct military.

It was anticipated that during a series of 30 day duration flights a range of scientific, technical and biological experiments could be conducted whilst an number of EVA’s would evaluate the ability of an astronaut to work outside the spacecraft.

Given the go-ahead on 25 August 1965, MOL was to consist of the Gemini B, a Gemini spacecraft with the original Service Module removed and an access hatch cut through the heat shield, and a new, non-recoverable, Laboratory Module which could accommodate the two crew members during their mission. The latter would have an aft section with living quarters and a forward section for the mission experiments. The dimensions of the Laboratory Module, which was to be built by Douglas, have been quoted as 3.05 m in diameter and 12.8 m in length. The mass was 9100 kg.

The programme envisioned seven flights, the first two of which would be automated with the remaining flights being crewed and taking place at six months’ intervals. The MOL was to use the Titan IIIM version of the Titan IIIC launch vehicle, which was to be fitted with two larger solid fuelled strap-on boosters.

All flights were to be launched from Vandenberg AFB in California, into a polar orbit which would ensure that any sensitive instrumentation would not fall over foreign territory should a mission fail. Whilst it was not the stated intention to perform operational activities on MOL it is interesting that the laboratory was also designated as KH-10 in the series of United States military reconnaissance satellites. The name Dorian has also been associated with the programme as well as AFP-632 and 287.

Seventeen military astronauts were selected for the programme in three groups on 12 November 1965, 17 June 1966 and 30 June 1967. Several were designated for the first few flights. Seven of these astronauts were later absorbed in other space programmes.

By 1964 12 primary and 18 secondary experiments had been selected for the MOL project, which included:

1. EVA experiments;
2. control of a remote maneuvering unit;
3. space navigation;
4. biomedical experiments;
5. secure communications;
6. communications propagation;
7. ionospheric ducting communications;
8. test of expandable structures;
9. advanced rendez-vous radar;
10. hydrogen reduction atmospheric regeneration;
11. solar X-ray warning system;
12. water recovery system;
13. materials degradation tests;
14. multi-band spectral observations; and
effect of the ionosphere on radio signals.

From the start the MOL project was bedevilled by the twin problems of development delays and a perception that it was a duplication of NASA's plans for the Apollo Applications Program and the subsequently cancelled Manned Orbital Research Laboratory (MORL).
The latter was a study into the feasibility of adapting a Saturn 1B stage into an orbiting laboratory and eventually materialised as Skylab.

On 3 November 1966 the one and only MOL research flight was launched using the Gemini recovered from the unmanned Gemini-2 mission. The flight was not identified as MOL but rather by the designation of one of its three payloads: OV4-3 as described for 1966 099A.

By 1969 the first launch date had slipped to 1972 and the MOL project was eventually cancelled on 10 June 1969.

In the selection of candidate astronauts, there was an implied follow-on of the MOL programme. Such a follow-on would probably have involved the possibility of expanding the station by clustering several modules.
The Manned Orbital Research Laboratory was a NASA project for a 10 crew space station to remain in orbit for over 2 years. The space station, to be built by Douglas, consisted of a control deck, crew quarters, a docking test area and a short radius centrifuge. Based on the Saturn 1B stage, it may be regarded as a precursor to Skylab.
Name: MR-5
Country: USA
Launch date: 1961
Launch vehicle: Redstone

Crewed sub-orbital flight with astronaut J. Glenn using a Mercury spacecraft as described for 1961 αα 1. The purpose of the Mercury-Redstone (MR)-5 flight was to familiarise an astronaut with spaceflight. The mission was cancelled as a result of the progress made by the USSR in the Vostok programme.
Name: MR-6
Country: USA
Launch date: 1961
Launch vehicle: Redstone

Crewed sub-orbital flight with astronaut D. Slayton using a Mercury spacecraft as described for 1961 αα 1. The purpose of the Mercury-Redstone (MR)-5 flight was to familiarise an astronaut with spaceflight. The mission was cancelled in July 1961 as a result of the progress made by the USSR in the Vostok programme.
The ESA proposed Man-Tended Free Flying platform (MTFF) was intended to be a free flying addition of the Columbus (eventually launched on 11 February 2008) programme that would have been used for sensitive microgravity research. Proposed in 1986, the MTFF was designed in Germany and would have been serviced by the subsequently cancelled Hermes spaceplane. Operation would have been totally under the control of ESA although, by choosing an orbit inclination similar to that of the Space Shuttle, at that time 28°, it could also have been serviced by the Space Shuttle.

In 1991 the first flight of MTFF was postponed to sometime after 2000 but eventually the programme was cancelled as ESA concentrated solely on the Columbus module for the International Space Station (1998 067A).
The New Shepard re-usable launch vehicle was being developed by the Blue Origin Corporation with funds from NASA’s Commercial Orbital Transportation Services (COTS) programme. The vertical-takeoff, vertical-landing (VTVL), single-stage-to-orbit manned rocket was based on the DC-X concepts that were tested in the 1990s.

New Shepard was to consist of a Propulsion Module (PM) and a Crew Capsule (CC). The PM was to be fitted with nine rocket engines fuelled by high test peroxide (HTP) and RP-1 kerosene. This would take it to an altitude of 40 km where the engines would be switched off, allowing the spacecraft to coast to an altitude of 100 km. At this point the CC would separate whilst the PM would perform a powered landing. The CC would continue its mission and eventually land, suspended from a parachute.

The spacecraft was to have a height of 15 m, a diameter of 7 m and a mass of 75,000 kg.

The name, New Shepard, was in reference to the first American astronaut in space, Alan Shepard.

Sub-orbital tests were undertaken with the Goddard vehicle on 13 November 2006, 22 March 2007 and 19 April 2007. This was followed by sub-orbital propulsion module tests on 6 May 2011 and 24 August 2011.

In August 2012 the company was denied further funds by NASA and further work was cancelled although a launch abort test was completed on 19 October 2012. Further tests were conducted for the purpose of sub-orbital flights with the spacecraft.
The Naval Postgraduate School Satellite (NPSat)-1 was a low-cost, technology demonstration satellite with a mass of about 80 kg, intended as an educational tool and to demonstrate the use of a COTS architecture. It was intended to be launched for a two year mission as a secondary payload and be placed in an approximate 550 x 800 km orbit with an inclination between 30° and 80°.

The payload included two experiments by the Naval Research Laboratory (NRL):
1. the coherent electromagnetic radio tomography (CERTO) experiment which was to measure total-electron-content (TEC) in the ionosphere; and
2. a Langmuir probe to augment CERTO data by providing on-orbit measurements.

It also carried four experiments designed by the Naval Postgraduate School:
1. a Visible wavelength Imager (VISIM);
2. several micro-electromechanical systems (MEMS)-based rate sensors.
3. a novel design for a configurable, fault-tolerant spacecraft computer board, and
4. Solar Cell Measurement System (SMS),

NPSat-1 was originally scheduled to be launched on 9 March 2007 as part of the STP-1 flight, along with Orbital Express-Astro (2007 006A), MidSTAR-1 (2007 006B), Orbital Express-NextStar/CSC (2007 006C), STP Sat-1 (2007 007D), FalconSat-3 (2007 007E) and CFESatASTRO (2007 007F) but was not ready in time. A new suggested date of 7 December 2009 was not met either. Of all the experiment, the SMS experiment was later moved to a dedicated cubesat mission, NPS-SCAT (2013 064K) launched on 20 November 2013.

One reference has suggested that the satellite may be launched on a military Falcon Heavy launch in 2016 but, in absence of any further data on the experiments, it may be assumed that the satellite, fitted with the experiments designed in the first half of the previous decade as described above, has been cancelled.
Name: NROL-29  
Country: USA  
Launch date: 2012  
Launch vehicle: Atlas V-521

Cancelled reconnaissance satellite which was originally scheduled for 2007. In some references it has been incorrectly linked to USA-202 (2009 001A) and USA-224 (2011 002A).

A number of satellites in the National Reconnaissance Office’s NROL series for which no data has been found, may have been cancelled.
The Orbital Maneuvering Vehicle (OMV) was to be developed by TRW as a means to fly payloads to their desired orbit as well as retrieve payloads for servicing in the Space Shuttle low orbit. Cancelled in 1989, the OMV was to be a flat vehicle of 1.5 m length and a diameter of 5.00 m. In the centre was a propulsion module which would have provided the thrust for the vehicle for the flight between the home base and the target. Around this module were the various flight control, communication and telemetry packages as well as 24 reaction control thrusters for short range operations and attitude control. Initially the OMV was to be equipped with a docking mechanism only but at a later date it was envisaged to attach other components such as a satellite refuelling kit or robotic arms. The first flight was anticipated in 1991.
The OPS-4 space station was the fourth in a series of military space stations designed by the Chelomey bureau as Almaz or Orbitalnaya Ploshchad' Stantsii (OPS) (Orbital Piloted Station), as described for Salyut-2 (1973 017A). If it had been launched it probably would have been known as Salyut-7.

OPS-4 was the first station that would have been fitted with a launched with a Mech-A Synthetic Aperture Radar and a second TKS docking port. Also the previous station's Shchit-1 23 mm defense cannon was to be replaced by an advanced Shchit-2 space-to-space cannon with two projectiles.

The flight plan for OPS-4 was:

1. December 1980: launch of OPS-4;
2. January 1981: launch of TKS-1. The flight was cancelled in 1981 and the spacecraft was eventually flown as Kosmos-1267 (1981 039A);
3. April 1981: launch of TKS-2. The flight was cancelled in 1981 and the spacecraft was eventually flown as Kosmos-1443 (1983 013A);
4. August 1981: launch of TKS-3. The flight was cancelled in 1981 and the spacecraft was eventually flown as Kosmos-1686 (1985 086A); and
5. April 1982: launch of Soyuz Almaz 4 with a crew consisting of Malyshev and Laveykin, using a Soyuz spacecraft. The flight was cancelled in 1981.

At the time of cancellation on 28 June 1978, OPS-4 had undergone electrical tests and was ready to be transferred to Baikonour for launch.
Name: Orbcomm FM-37/43
Country: USA
Launch date: 2000
Launch vehicle: Pegasus XL

Communications satellite as described for 1995 017A. The flight was cancelled but the designations, and possibly some of the satellite platforms, were subsequently used for 2008 031A, 2008 031B, 2008 031C, 2008 031D, 2008 031E, 2011 058C and 2012 001B.
Refer to the proposed Orion programme for details of cancelled components.
A radio amateur satellite, similar to Oscar-2 (1962 \( \chi 2 \)), was built but was never launched so that efforts could be concentrated on Oscar-3 (1965 016F).
Name: OV2-2
Country: USA
Launch date: 1966
Launch vehicle: Titan IIIC

Military scientific satellite as described for 1965 082A. OV 2-2 was to carry out optical measurements from a 400 km circular orbit to provide a better understanding of the physics of space radiation and its relation to the Sun. The satellite was to carry instruments similar to those carried on OV 2-3 (1965 108A). The mission was cancelled when the Titan IIIC development was cancelled.
Name: OV2-4  
Country: USA  
Launch date: 1966  
Launch vehicle: Titan IIIC

Military scientific satellite as described for 1965 082A. OV2-4 was to carry out optical measurements from a highly eccentric trans-lunar orbit to provide a better understanding of space radiation and its relation to the Sun. The mission was cancelled when the Titan IIIC development was cancelled.
Name: OV4-2
Country: USA
Launch date: 1967
Launch vehicle: Titan III

A set of 'Whispering Gallery' satellites as described for 1966 099B and 1966 099D. The programme was cancelled along with the cancellation of the MOL programme.
Name: OV5-7
Country: USA
Launch date: 1969
Launch vehicle: Atlas Altair 3

Military scientific satellite as described for 1967 040D.
The objective was to measure solar radiation. It had been intended to fly the payload on the launch vehicle which carried 1969 025A and others on 18 March 1969. Instead, OV5-7, which was also known as ERS-22, was cancelled to make way for the OV 1-17A (Orbiscal-2) payload.
The Polar Platform (PPF) was to be an integral part of the Columbus (eventually launched on 11 February 2008) programme being undertaken by the European Space Agency in conjunction with the United States’ Freedom space station. It was to be used as the workhorse for future Earth observation missions to be placed in polar orbit with typical altitudes of 700 to 850 km.

The spacecraft was to use a modular approach and would have consisted of a Service Module, to provide the main support functions, as well as a Payload Module, to be optimised for a specific mission. Accordingly the mass of the spacecraft can vary from 800 to 2400 kg.

The Payload Module was to consist of two to five sections each with a diameter of 1.2 m and a height of 1.6 m. Common to all payload configurations were a number of systems to provide data management, data communication, power distribution and thermal control.

This method of construction would have enabled a wide range of payload requirements to be met without the need to design a new spacecraft.

The spacecraft was to be developed by a European consortium headed by British Aerospace but was cancelled due to cost restraints.
The Propulsion Module was a back up to the Russian Zvezda module for the International Space Station (1998 067A). The Module, to be fitted with propellant tanks, engines and avionics, would have been attached to the front of the space station, so that, whenever the module would have to be used, the entire space station would first have to be rotated by 180°. The other alternative was to attach the module to the Z1 truss, requiring the station to be tipped on its back before the Propulsion Module could be used effectively. The successful launch of Zvezda (2000 037A) made the module unnecessary.
The Progress M2 was a proposed development of the Progress M cargo spacecraft for use with the proposed Mir-2 space station which was subsequently cancelled. To be launched with the Zenit launch vehicle it would have been able to carry a much larger payload of 5700 kg. The 12.60 m long and 13300 kg spacecraft would have consisted of a 5300 kg service module, a 2300 kg pressurized forward module and a docking port. It could also be outfitted as a space station module that could have remained attached to Mir-2.

The initial design was identified as article 11F615A75 and was designed for use with a 90 tons Mir-2. When Mir-2 was redesigned in 1992, the redesigned Progress M2 was renamed as article 11F615A77. Development was cancelled in 1993 along with the Mir-2 space station. One consideration in the cancellation was that, in the post USSR era, the Zenit launch vehicle was Ukrainian rather than Russian.
Name: Prospector
Country: USA
Launch date: 1960's
Launch vehicle: Atlas

Development of the Surveyor spacecraft as described for 1966 045A, which would have added track treads or balloon wheels to the spacecraft to give it mobility for the exploration of the Moon. Not proceeded with.
Name: Radio-9
Country: USSR
Launch date: ?
Launch vehicle: ?

Radio amateur satellite in the Radio or RS series or, alternatively, a radio amateur transponder on another satellite. Radio-9 was cancelled.
Name: Radose-5E4
Country: USA
Launch date: ?
Launch vehicle: Thor Ablestar(?)

Radiation experiment satellite as described for 1963 038C. It is assumed the satellite was cancelled at an early stage.
Follow on from the Ranger series which terminated with Ranger-9 (1965 023A). The Block IV series, which was to constitute three spacecraft, Ranger-10,-11 and –12, were to be fitted with a gamma ray spectrometer in addition to the TV system, whilst a Block V series comprising Ranger-13 to –24 were to incorporate the originally planned seismometer module. None of the Block IV and V spacecraft were launched.
<table>
<thead>
<tr>
<th>Name:</th>
<th>Satec/Unosat</th>
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<tr>
<td>Country:</td>
<td>Brazil</td>
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<td>Launch date:</td>
<td>August 2003</td>
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<td>Launch vehicle:</td>
<td>VLS</td>
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The Satélite Tecnológico (Satec) was built by the Instituto Nacional de Pesquisas Espaciais (INPE) whilst Unosat was a student built satellite from the Universidade Norte do Paraná (Unopar). Unosat was to carry a communications transmitter whilst Satec was fitted with a navigational experiment. The satellites were to be placed in a 750 km orbit with an inclination of 16° by the third Veículo Lançador de Satélites (VLS) launch vehicle which exploded on 22 August 2003 during launch pad tests when one of the four rocket engines ignited by mistake. The explosion killed over 20 people and injured many more.
The 24 to 30 SBIRS Low satellites were part of the Space Based Infrared System (SBIRS) of early warning satellites as described for 2011 019A. They were to carry radar to track hostile ballistic missiles and discriminate between the warheads and other objects, such as decoys, that would separate from the missile bodies throughout the middle portion of their flights. When the development was cancelled in 2001, TRW had built two SBIRS-Low Flight Demonstration System (FDS) satellites to test some of the hardware. These satellites were scheduled to be launched in late 1999 aboard a single Delta 7420-10C launch vehicle. The two satellites were eventually re-used as the basis for the STSS Demo-1 (2009 052A) and -2 (2009 052B).
The Small Demonstration Satellite (SDS)-2 was intended to carry the Compact InfraRed Camera (CIRC), an infrared camera equipped with an uncooled infrared array detector (microbolometer) to demonstrate the potential of the microbolometer, especially for wildfire detection but also for other applications. The satellite was cancelled and the experiment was, instead, deployed to the Kibo space station module in 2013.
The Small Demonstration Satellite (SDS)-3 was to be deployed in 2010 as a sub-satellite of the HTV-2 (2011 003A). It appeared to have been cancelled.
China's first crewed spacecraft proposal was known as Shuguang (Dawn). The two man capsule looked like a Gemini spacecraft.
Development began in 1966 and the first flight was planned for 1973. The first flights would probably have been sub-orbital carrying dogs and it was also anticipated that the first orbital flights would have carried monkeys. A group of 19 astronauts was selected in 1971 and training had commenced. In the wake of the Cultural Revolution the project was officially terminated on 13 May 1972. It is not known if any and what hardware had been built although it is believed that there was a wooden mock-up for training purposes.
Shi Jian (SJ)-3 was a proposal for an Earth observation satellite which was not proceeded with.
Second Skylab space station as described for 1973 027A. The space station would have been placed in a 390 x 500 km orbit with an inclination of 55°. The program was cancelled on 13 August 1973 and hardware was transferred to the National Air and Space Museum in Washington. Crews for the Skylab-6 to –9 missions had not been assigned at the time of cancellation.
Name: Skylab-5  
Country: USA  
Launch date: April 1974  
Launch vehicle: Saturn 1B

Crewed spaceflight with astronauts V. Brand (Cmdr.), W. Lenoir (Science Pilot) and D. Lind (Pilot) using Apollo spacecraft CSM-119 as described for 1973 032A. The mission was to dock with the Skylab space station as described for 1973 027A and would have lasted 20 days during which a new range of scientific experiments would have been conducted and Skylab would have been boosted into a higher orbit. The mission was cancelled due to budgetary restraints and the optimism that no boost was required.
Name: Skynet-3  
Country: United Kingdom  
Launch date: mid 1970's  
Launch vehicle: ?

Skynet-3 was to be a military communications system for the British forces overseas. The reduced commitment of these forces, led to the cancellation of the programme.
Name: Solrad-5A
Country: USA
Launch date: ?
Launch vehicle: TAT Agena D(?)

Scientific satellite as described for 1960 eta 2. It is assumed that Solrad-5A was cancelled at an early stage. Based on releases of data in 2005 and 2012 that Solrad satellites were a cover name for the Poppy military electronic intelligence gathering satellite as described for 1962 βτ 1, it is tempting to suggest that Solrad-5A could have been associated with one of the two Poppy satellites placed in orbit on 13 December 1972, ie Poppy-1A (1962 βτ 1) or Poppy-1B for (1962 βτ 3). However, the 2012 data states clearly that the Poppy-1A and -1B were launched without an unclassified Solrad scientific experiment. Neither are there any references that might suggest the possibility that the Solrad-5A experiments were intended for one of those satellites but were not completed in time.

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In 1958 the USSR issued requirements of a circumlunar mission. OKB-1, headed by Korelyov, responded to the requirement and by 1962 the design studies had evolved into the 7K-9K-11K complex in which 7K represented the crewed Soyuz spacecraft as described for 1967 037A and also referred to as 7K-OK (for 7 Korabl-Orbital'nyy Korabl).

The design studies were based on the use of the Soyuz and Proton launch vehicles, as the N-1 was not yet available, and envisaged the launch of the 9K rocket stage into a low-Earth orbit, followed by three or four 11K tankers. The tankers would dock with the 9K and transfer fuel following which the 11Ks would be discarded. This would be followed by the launching of the 7K with a crew, docking with the 9K, and then a circumlunar flight.

The 9K was 7.8 m long and consisted of the 9KM translunary rocket engine and the 9KN jettisonable compartment with the orbital correction engine, instruments and docking mechanisms.

The 11K, with a length of 4.2 m, consisted of the 11KA oxidiser tank and the 11KB fuel tank.

Several 7K-OK test flights were made in the Kosmos and Zond series, until, by 1963, the focus shifted to a crewed moon landing. Both the 9K and the 11K were formally cancelled on 18 August 1965.

By now the N-1 launch vehicle had been designed and OKB-1 responded in September 1963 by proposing the basic Soyuz spacecraft for the programme. The programme consisted of five stages:

1. L1: six circumlunar flights using the 7K-9K-11K complex, in which the 7K was designated as 7K-L1 and as described for 1968 013A;
2. L2: six flights of an automatic rover vehicle designated as 13K, in combination with the 9K and 11K spacecraft;
3. L3: crewed lunar landing using the 7K with a separate landing craft. It would have required one launch with a Soyuz launch vehicle and three launches with N-1;
4. L4: a single lunar orbital flight with a modified 7K, to be launched with N-1;
5. L5: and advanced lunar rover, launched by a single N-1.

In a parallel programme, OKB-52 (headed by Chelomei) was awarded a contract to develop a spacecraft for circumlunar flights in August 1954. Known as the LK-1 vehicle, its development was later transferred to OKB-1.

The merged programme revolved around the Nosital (N)-1 launch vehicle. The existence of this launch vehicle was suspected by western observers for a long time and was, in fact, assigned the identification G-1. Not until 1989 and 1990 was the existence confirmed by the USSR.

The other components of the programme were the Soyuz Lunova Orbitlny Korably (LOK) lunar orbit cabin, and the Lunova Korably (LK) lunar cabin.
The Soyuz LOK lunar orbit cabin, also known as 7K-LOK or T1K, was to carry the crew to the Moon, remain there in lunar orbit and then, after the LK had docked again, fly the crew back to Earth. It consisted of:
1. Stikovochniy Uzel (SU), the docking apparatus;
2. Dvigatelniy Orbitalniy Kompleks (DOK), the orbital engine system;
3. Bitovoy Otsek (BO), the living compartment;
4. Spuskaeniy Apparat (SA), the descent module;
5. Perekhodnoy Otsek (PO), the transition compartment;
6. Priborniy Otsek (PO), the equipment compartment;
7. Agregatniy Otske (AO), the engine compartment; and
8. Energo-Otsek (EO), the power module.

It is understood 14 examples were built of which one was used for ground tests, two were without a heatshield and were used for tests, seven were used on the Zond programme whilst four were intended to be flown as crewed spacecraft.

One of these may have been involved in a launch pad explosion of a Proton K/D launch vehicle on 15 July 1968. The explosion occurred during fuelling of the launch vehicle's Block D oxidiser tank in preparations of a launch that was intended to carry Soyuz 7K-L1 as described for 1968-013A. The rocket and spacecraft were relatively undamaged.

The Soyuz LK, also known as T2K, was essentially a combination of a spherical cabin fitted with an ascent stage as well as a descent stage which also served as the lunar landing and launch platform. It consisted of a reaction control system module with a length of 1.7 m, a lunar descent/ascent stage of app. 5.7 m high and a descent propulsion stage. The ascent stage was fitted with the same engine that was used for the descent and would have left the lander's legs behind on the surface of the Moon.

Soyuz LK hardware was built and has been viewed by western observers.

The mission profile intended to launch the Soyuz LOK and LK combination with a N-1 launch vehicle. Two cosmonauts were to be carried.

From the low-Earth orbit, the fourth stage of the N-1, also designated as the first stage of the Lunova Raket Kompleks (LKR), would send the spacecraft into a trans-lunar trajectory. Powered by a Kuznetsov NK-31 engine, this stage would separate after trans-lunar injection.

The fifth stage, also referred to as the second stage of the LKR, would perform the mid-course corrections and the lunar orbit insertion as well as serve as a braking motor for the lunar landing. It would separate from the LK at an altitude of 2 km following which the LK would descend on its own.

Once in lunar orbit one cosmonaut would make a spacewalk to transfer from the Soyuz LOK to the LK. The latter would then separate and descend to the surface of the Moon, using the remaining propellant of the second stage of the LKR to take the LK out of lunar orbit and into a landing trajectory. At an altitude of 1.5 km
the LKR would separate from the LK and impact on the lunar surface. An engine on board of the LK would be
used for the final landing phase.

Following landing, the single cosmonaut would have undertaken an EVA of about 90 minutes, wearing a semi-
rigid Kretchet spacesuit with a hoop structure which would allow him to re-erect himself should he fall. After
about 4 hours, the LK would take off from the Moon again, leaving the landing platform behind, and rendez-
vous with the Soyuz LOK which had remained in lunar orbit. After the transfer of the cosmonaut, the LK would
be jettisoned. Using a boost engine the Soyuz LOK would then be sent into a trans-Earth trajectory. Eventually
the re-entry capsule of the Soyuz LOK would return the two cosmonauts to the surface of the Earth.

When initiated, the programme foresaw two low-Earth test flight in 1969 and 1970 to test the rendez-vous and
docking systems of the LOK and LK. Each test comprised two Soyuz spacecraft. The first test would have
been crewed by Khrunov and Yeliseyev flying the active spacecraft and Grechko and Kuklin flying the passive
spacecraft. The second test would have seen Fartushny and Shatalov flying the active spacecraft and
Patsayev, Shonin and Yazdosky flying the passive spacecraft. One member of the latter crew would have
transferred to the other spacecraft.

These would have been followed by three automatic LOK spacecraft in 1972 which would have been placed
in a lunar orbit to photograph and survey potential landing sites.

It was planned to conduct three circumlunar flights in 1973. The crews for these flights were Leonov and
Makarov, Bykovsky and Rukavishnikov and Popovich and Sevastyanov.

The first lunar landing would have been flown in 1974. It has been suggested the cosmonauts Leonov and
Makarov were in training for the first crewed lunar landing flight. The first mission would have been
accompanied by a separate unmanned LK module that would be placed on the Moon near the landed landing
site, in case of an emergency.

The programme was cancelled in May 1974 and the principal reason was, apart from the fact the United
States 'won' the race, the problems encountered with the N-1 launch vehicle. Other causes cited include the
lack of funds due to a conflict of interests between the military and the Academy of Sciences, on one hand,
and designer groups, on the other hand. It has also been suggested that the OKB-1 design bureau lacked the
technological expertise.

A further phase of the lunar programme would have involved the launch of two N-1F rockets (a development
of the N-1) with a huge lunar lander designated as L3M, that could take three cosmonauts to the Moon for a
month's stay. This programme, which was to take place in the late seventies or early eighties, possibly never
proceeded beyond the planning stage and it is likely that no hardware was developed. It has been stated that
for the programme to proceed, at least eight successful N-1 launchings were to take place first.

Development flights in the lunar programmes were made under various designations: Kosmos, Polyot, Soyuz
and Zond and, in absence of official objective statements, the place of each of the flights in either lunar
programme, as well as the general effort to master crewed spaceflight and the effort towards the space station
objective, can only be guessed.

Known article number are 11F91 for the Soyuz 7K-L1, 11F92 for the Soyuz 7K-L1A and 11F93 for the Soyuz
7K-LOK.

In 1965 consideration was given to 7K-PLK, an alternative of the 7K-L1 to be launched with a Proton launch
vehicle.

**Associated flights:**

Polyot-1 (1963 043A), Polyot-2 (1964 019B), Kosmos-133 (1966 107A), Kosmos-140 (1967 009A), Kosmos-
146 (1967 021A), Kosmos-154 (1967 032A), Soyuz-1 (1967 037A), Kosmos-186 (1967 105A), Kosmos-188
072A), Zond-5 (1968 076A), Soyuz-2 (1968 093A), Soyuz-3 (1968 094A), Zond-6 (1968 101A), Soyuz-4
(1969 004A), Soyuz-5 (1969 005A), N-1 (21 February 1969), N-1 (3 July 1969), Zond-7 (1969 067A), Soyuz-
November 1972).
The Soyuz P (for Perekhvatчик = interceptor), also known as 7K-PPK (Пилотируемый Пerekhvatчик Корабль = manned interceptor spacecraft), was intended to be a version of the Soyuz spacecraft for the piloted inspection and destruction of enemy spacecraft. After a rendezvous with the enemy spacecraft a cosmonaut would make and EVA and, depending on the outcome of the inspection, the spacecraft would be destroyed, neutralised or returned to Earth for further inspection. Proposed in 1962, development was cancelled in early 1965.
In the 1960s the OKB-1 design bureau undertook work on a piloted reconnaissance spacecraft identified as Soyuz R (for Razvedchik = spy) or 7K-TK. The system consisted of two separate components which were to be docked in space and would be equipped with elint and photo reconnaissance equipment. The project was never completed and was cancelled on 30 March 1966. Features of the design were carried forward into the Yantar 4th generation military reconnaissance satellites as described for 1975 080A.
Soyuz VI (for Voyenno-issledovatel'skiy) or 7K-VI, refers to a military research version of the basic Soyuz spacecraft. It was also known as article 11F73. Objectives included Earth observation, orbital inspections and destruction of enemy satellites. It was envisaged to be used with the military Almaz space station and at one stage it was suggested that, between 1968 and 1975, 50 Soyuz VI spacecraft would be produced for used with 20 Almaz stations. Development was cancelled in February 1970.
Associated with the cancelled Soyuz VI was the Soyuz 7K-S (for Spetsial'nyye = Special). Derived from the 7K-OK, this version was to be fitted with new digital computers as well as an internal crew transfer docking system. It was to be built in two versions, the 7K-S-1, a short duration version, and the 7K-S-2, a long duration version. Three were actually built of which one was used for the Kosmos-670 flight (1974 061A). Like the Soyuz VI, work on this version was cancelled in February 1970.
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<td>1969</td>
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Associated with the cancelled Soyuz VI was the Soyuz 7K-G (for Gruzovyye = cargo). Derived from the 7K-OK this version was to be used as a cargo transfer vehicle. Like the Soyuz VI, work on this version was cancelled in February 1970.
The Space Tug was envisaged as a highly versatile, multi-application, manned or unmanned system comprised of a crew module, a propulsion module, an intelligencer module and a cargo module each of which could operate independently or with other modules. In addition auxiliary modules were envisaged such as Lunar Landing Legs, Power, Manipulator Systems and Satellite Repair Kits. Each of these modules was intended to be reusable in an effort to greatly reduce the recurring costs of space operations.

It was further envisaged that the main propulsion system would employ the same oxygen/hydrogen fuelled engines as planned for the Space Shuttle.

The Space Tug was seen to be able to perform a wide variety of missions including moving payloads from low-Earth orbits to higher orbits, retrieving unmanned spacecraft, moving cargo, adjusting spacecraft orbits and general support of the space station. It would also have been compatible for transport into deep space and was to be operated in a crewed as well as uncrewed mode. It was also intended as the lander component of further lunar missions and interplanetary missions. When not in use, the vehicle would have been 'parked' in Earth orbit when not needed.

The task to develop the Space Tug as well as the Space Shuttle and the intended Space Station was seen too much for NASA and getting Europe involved in the overall Space Transportation System seemed to be a perfect solution. Based on this President Nixon took the step in October 1969 President Nixon to invite Europe to participate in this programme.

Subsequently the European Launcher Development Organisation (ELDO) undertook studies on the feasibility of the Space Tug which could use the same propulsion techniques as those used for Europa III. These preliminary so called Phase A studies were undertaken under contract from ELDO by two separate consortiums headed by ERNO, from Germany and MBB, also from Germany whereas other European aerospace companies, like Hawker Siddeley Dynamics, British Aircraft Corp., MAN, Fokker/VFW, SABCA and Sulzer Bros were also involved.

These two extensive studies clearly showed the technological significance of the Space Tug and its potential role in the design of missions in future decades although they did not consider, in detail, technological challenges and pre-development aspects.
ELDO estimated that the development of the Space Tug would cost about $500 million and in 1972 it was estimated that about 20 to 30 Space Tugs would be required. At the same time, the US Air Force was also looking at the possibility of acquiring the Space Tug, either being built in Europe or in the US under licence.

One of the space tug designs that was advanced, was to be 9.10 m long and 4.57 m in diameter.

But when President Nixon approved the Space Shuttle programme on 5 January 1972, the entire programme had undergone major changes as compared to the 1970 concept. In particular ELDO was advised in June 1972 that the Space Tug was withdrawn. European participation was still desired but now became focused on a Shuttle-borne, shirt-sleeve environment laboratory for scientific research under low-gravity conditions in fields like biomedicine and materials science, which eventually resulted in Spacelab. Work on the Space Tug was stopped immediately and the group of ELDO engineers who had been working on it for two years, was officially disbanded on 31 July 1972 and all of the Organisation's contractual obligations with industry were liquidated. At that time, ELDO had spent up to $ 4 million on the studies.
A satellite in the Shuttle Pointed Autonomous Research Tool of Astronomy (Spartan) programme as described for 1985 048E. The satellite was to undertake ultraviolet stellar astronomy with a Far Ultraviolet Camera developed at the US Naval Research Laboratory.
A satellite in the Shuttle Pointed Autonomous Research Tool of Astronomy (Spartan) programme as described for 1985 048E. The satellite was to conduct plasma physics studies. It was to be launched on the STS-81B mission which was cancelled.
A satellite in the Shuttle Pointed Autonomous Research Tool of Astronomy (Spartan) programme as described for 1985 048E. The satellite was to test an inflatable structural system for the Shooting Star Experiment (SSE), a technology demonstrator flight for solar thermal propulsion.
The Explorer for Spectroscopy and Photometry of the Intergalactic Medium's Diffuse Radiation (SPIDR), also known as SMEX-8, was a mission to map the "cosmic web" of hot gas that spans the universe. SPIDR's data was to answer fundamental questions concerning the formation and evolution of galaxies, clusters of galaxies, and other large structures in the universe as well as address a number of questions related to hot gas in our own galaxy. The mission was cancelled in 2003.
Originally named Deep Space (DS)-3, the Space Technology (ST) 3 mission was to comprise three satellites placed arranged in an equilateral triangle, with a 100m to 1 km baseline. The purpose of the programme was to conduct spaceborne optical interferometry. In addition the satellites would test communicating with each other by means of laser technology and using the telemetry data to keep the satellites in a perfect distance and alignment from.

The mission, which was also referred to as Starlight, was cancelled and replaced by a ground demonstration of the interferometry technology.

The ST 3 was a numerical follow-on from the DS-1 (1998 061A) and DS-2 (1999 001A) missions although those missions never carried the ST 1 or ST 2 designation.
Originally named Deep Space (DS)-4, the Space Technology (ST) 4, also known as Champollion, was to test new space technologies necessary for the next generation of outer solar system spacecraft. It was to rendezvous with Comet Tempel 1 and get into an orbit around the comet from where it would study the comet nucleus and deploy a lander. The encounter was scheduled for 2006. The 1051 kg spacecraft was to be equipped with cameras, a gas chromatograph/mass spectrometer, an infrared/spectrometer microscope, and a gamma-ray spectrometer for in-situ measurements. Originally it was also intended to return a sample to Earth in 2010, but this was deleted at a very early stage of the development.

The mission was cancelled in 1999.
Name: STS-10
Country: USA
Launch date: December 1983
Launch vehicle: STS

Crewed spaceflight with astronauts T. Mattingly (Cmdr.), L. Shriver (Pilot), E. Onizuka and J. Buchli (Mission Specialists) using the orbiter Challenger as described for 1981 034A. The objective of the mission was to launch the Teal Ruby satellite which was eventually cancelled. In addition five experiments for the measurement of infra-red, ultraviolet, X-ray, gamma ray and plasma in the upper atmosphere were to be carried.
Because of problems with the IUS upper stage, which was to place Teal Ruby into its higher orbit, the mission was cancelled in June 1983.
Teal Ruby was several times rescheduled for other missions and eventually cancelled.
Crewed spaceflight with astronauts H. Hartsfield (Cmdr.), M. Coats (Pilot), J. Resnik, S. Hawley, R. Mullane (all Mission Specialists) and C. Walker (Payload Specialist) using the orbiter Discovery as described for 1981 034A.

The objective of the mission was to launch TDRS-2. The payload also included the Materials Experiment Assembly (MEA) mounted on the Mission Peculiar Equipment Support Structure (MPESS) as described for STS-49 (1992 026A). MEA was a self contained facility for experiments in the materials processing field as described for STS-7 (1983 059A).

Because of problems with the IUS upper stage, which was to place TDRS-2 into its higher orbit, the mission was cancelled in October 1983.

TDRS-2 was several times rescheduled and was eventually placed on the STS-51L flight of 28 January 1986.
Name: STS-41E  
Country: USA  
Launch date: May 1984  
Launch vehicle: STS  

Crewed spaceflight with astronauts K. Bobko (Cmdr.), D. Williams (Pilot), R. Seddon, D. Griggs and J. Hoffman (all Mission Specialists) using the orbiter Columbia as described for 1981 034A. Previously identified as STS-14, the objective of the mission was to place Syncom IV-1 and Anik C-1 in orbit as well as fly the OAST-1 payload.

On cancellation of this flight in February 1984, Syncom IV-1 was re-scheduled first to STS-41D (1984 093A) and then to STS-51A (1984 113A), whilst Anik C-1 was first re-scheduled for STS-51E (which was also cancelled) and then to STS-51D (1985 028A). The OAST-1 payload was flown on STS-41D (1984 093A). Syncom IV-1 was eventually launched as 1984 113C, whilst Anik C-1 was launched as 1985 028B.
Crewed spaceflight with astronauts K. Bobko (Cmdr.), D. Williams (Pilot), R. Seddon, D. Griggs and J. Hoffman (all Mission Specialists) using the orbiter Discovery as described for 1981 034A. Previously identified as STS-15, the objective of the mission was to deploy the Syncom IV-2, SBS-4 and Telstar 3-C satellites. The flight was also to involve the first automatic landing at Edwards AFB. The flight was cancelled in July 1984 and the payload transferred to STS-41D (1984 093A). Syncom IV-2 was eventually launched as 1984 093C, SBS-4 as 1984 093B and Telstar 3-C as 1984 093D.
At the time of cancellation, in April 1984, the objectives of the STS-41H mission, previously identified as STS-19, had not yet been finalised.

Either the mission would have been a Department of Defense mission, in which case the crew would have been K. Bobko (Cmdr.), R. Grabe (Pilot), R. Mullane, R. Stewart and D. Hilmers (all Mission Specialists) or the mission would have deployed the TDRS-2 satellite, in which case the crew would have been F. Hauck (Cmdr.), D. Walker (Pilot), J. Allen, D. Gardner and A. Fisher (all Mission Specialists). The mission was to be flown in the orbiter Challenger as described for 1981 034A.

TDRS-2 was eventually placed on the STS-51L flight of 28 January 1986.
Crewed spaceflight with astronauts K. Bobko (Cmdr), D. Williams (Pilot), R. Seddon, D. Griggs, J. Hoffman (all Mission Specialists), P. Baudry (France) (Payload Specialist) and E. Garn (Observer) using the orbiter Challenger as described for 1981 034A.

The objective of the mission was to launch the TDRS-2 and Anik C-1 satellites. Because of the continuing problems with TDRS, the flight was cancelled on 1 March 1985, when the launch vehicle was already on the launch pad. The remaining payload was incorporated into STS-51D (1985 028A). The crew also transferred to STS-51D although Baudry was transferred to STS-51G (1985 048A) as this provided the earliest opportunity to fly the French mid-deck payload.

TDRS-2 was eventually placed on the STS-51L flight of 28 January 1986, whilst Anik C-1 became 1985 028B.
Crewed spaceflight with astronauts V. Brand (Cmdr.), M. Smith (Pilot), R. Springer, O. Garriott, C. Nicoller (ESA) (all Mission Specialists), M. Lampton and B. Lichtenburg (both Payload Specialists) using the orbiter Challenger described for 1981 034A. The flight was to undertake the Earth Observation Mission (EOM)-1 which was to utilise a short Spacelab pressurised module and two pallets. It would have carried several experiments previously carried on the Spacelab-1 mission flown on STS-9 (1983 116A) including the European Grille Spectrometer, the Waves in OH Emissive Layers experiment, a French wide field camera to provide ultraviolet astronomical data and the Space Experiment with Particle Accelerators. The flight was cancelled in November 1984.
Name: STS-51K
Country: USA
Launch date: September 1985
Launch vehicle: STS

Crewed spaceflight with astronauts S. Nagel (Pilot), B. Dunbar and G. Bluford (both Mission Specialists) as well as other crew members not yet assigned at the date of cancellation, using the orbiter Atlantis as described for 1981 034A.

The mission, which was cancelled in January 1985, was to fly the Spacelab D-1 mission which was rescheduled to fly on STS-61A (1985 104A).
Immediately following the disaster with the orbiter Challenger (STS-51L) on 28 January 1986, all Space Shuttle flights were suspended pending the completion of a detailed investigation. At that point in time flights up to September 1988 had been placed on the manifest, with 58 flights from Cape Canaveral and well as 8 from Vandenberg.

The following list provides details of future flights as they were available at the time of the launch of STS-51L. The immediate next flights have also been discussed separately.

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<td>STS-81R</td>
<td>Columbia</td>
<td>Sep-1988</td>
<td>Italsat-1</td>
</tr>
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<td>STS-81S</td>
<td>Challenger</td>
<td>Sep-1988</td>
<td>MSL-13, Westar-B</td>
</tr>
<tr>
<td>STS-82A</td>
<td>Discovery</td>
<td>Oct-1987</td>
<td>DoD</td>
</tr>
<tr>
<td>STS-82B</td>
<td>Discovery</td>
<td>Dec-1987</td>
<td>OSTA-7, Cobe</td>
</tr>
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<td>STS-82C</td>
<td>Discovery</td>
<td>Jun-1988</td>
<td>SPP</td>
</tr>
<tr>
<td>STS-82D</td>
<td>Discovery</td>
<td>Sep-1988</td>
<td>DoD</td>
</tr>
</tbody>
</table>

Mission STS-61D was a crewed spaceflight with astronauts J. Fabian (Cmdr.), D. Gaffney (Pilot), R. Phillips (Payload Specialist), R. Seddon and J. Bagian (both Mission Specialists) using the orbiter Challenger as described for 1981 034A. The objective of the mission was to fly the Spacelab-4 mission which was to study the biomedical problems associated with humans in space and the effect of microgravity on living systems. The Challenger disaster of 28 January 1986 caused the cancellation of this mission. The flight eventually evolved into the Space Life Sciences (SLS)-1 mission flown on STS-40 (1991 040A).
Crewed spaceflight with astronauts J. McBride (Cmdr.), R. Richards (Pilot), R. Parker, J. Hoffman, D. Leestma (all Mission Specialists), R. Parise and S. Durrance (both Payload Specialists) using the orbiter Columbia as described for 1981 034A. The objective of the flight was to fly the Astro-1 payload. The Challenger disaster of 28 January 1986 caused the cancellation of this mission. Astro-1 was eventually flown on STS-35 (1990 106A).
Crewed spaceflight with astronauts D. Walker (Cmdr.), R. Grabe (Pilot), N. Thagard and J. van Hoften (both Mission Specialists) using the orbiter Atlantis as described for 1981 034A. The objective of the mission was to place the Galileo spacecraft into orbit. The Challenger disaster of 28 January 1986 caused the cancellation of this mission.

Galileo was eventually launched as 1989 084B on the STS-34 mission (1989 084A).
Name: STS-62A
Country: USA
Launch date: 20 March 1986
Launch vehicle: STS

Crewed spaceflight with astronauts R. Crippen (Cmdr.), G. Gardner (Pilot), J. Ross, D. Gardner, R. Mullane (all Mission Specialists), B. Watterson (Military Space Engineer) and E. Aldridge (Payload Specialist) using the orbiter Discovery as described for 1981 034A. This was to be the first flight from the Vandenberg Shuttle launch facility and the mission would have launched the Teal Ruby satellite, which was eventually cancelled, and the CIRRIS payload as described for STS-4 (1982 065A). The Challenger disaster of 28 January 1986 caused the cancellation of this mission. Teal Ruby was eventually cancelled whilst CIRRIS was flown on STS-39 (1991 031A).
Immediately following the STS-107 (2003 003A) disaster all Space Shuttle flights were suspended pending the completion of a detailed investigation. At that point in time flights up to 2008 had been placed on the manifest. The following list provides details of future flights as they were available at the time of the launch of STS-107. Some of the flights were eventually flown with the same number whilst other flights were renumbered or cancelled. Some cancelled flights have been discussed separately.

<table>
<thead>
<tr>
<th>Name</th>
<th>Orbiter</th>
<th>Launch</th>
<th>Mission</th>
<th>Flown as</th>
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<tr>
<td>STS-114</td>
<td>Atlantis</td>
<td>1-Mar-2003</td>
<td>ISS-ULF1</td>
<td>STS-114</td>
</tr>
<tr>
<td>STS-115</td>
<td>Endeavour</td>
<td>23-May-2003</td>
<td>ISS-12A</td>
<td>STS-115</td>
</tr>
<tr>
<td>STS-116</td>
<td>Atlantis</td>
<td>24-Jul-2003</td>
<td>ISS-12A,1</td>
<td>STS-116</td>
</tr>
<tr>
<td>STS-118</td>
<td>Columbia</td>
<td>13-Nov-2003</td>
<td>ISS-13A,1</td>
<td>STS-118</td>
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<tr>
<td>STS-119</td>
<td>Atlantis</td>
<td>Jan-2004</td>
<td>ISS-15A</td>
<td>STS-119</td>
</tr>
<tr>
<td>STS-120</td>
<td>Endeavour</td>
<td>Feb-2004</td>
<td>ISS-10A</td>
<td>STS-120</td>
</tr>
<tr>
<td>STS-121</td>
<td>Atlantis</td>
<td>Jul-2004</td>
<td>ISS-ULF2</td>
<td>STS-126</td>
</tr>
<tr>
<td>STS-122</td>
<td>Columbia</td>
<td>Apr-2004</td>
<td>HST SM-4</td>
<td>STS-125</td>
</tr>
<tr>
<td>STS-123</td>
<td>Discovery</td>
<td>Oct-2004</td>
<td>ISS-1E</td>
<td>STS-122</td>
</tr>
<tr>
<td>STS-124</td>
<td>Columbia</td>
<td>Jan-2005</td>
<td>ISS-UF-3</td>
<td>Cancelled</td>
</tr>
<tr>
<td>STS-125</td>
<td>Endeavour</td>
<td>Apr-2005</td>
<td>ISS-UF-4</td>
<td>Cancelled</td>
</tr>
<tr>
<td>STS-126</td>
<td>Discovery</td>
<td>Jul-2005</td>
<td>ISS-UF-5</td>
<td>Cancelled</td>
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<tr>
<td>STS-127</td>
<td>Atlantis</td>
<td>Oct-2005</td>
<td>ISS-UF4,1</td>
<td>Cancelled</td>
</tr>
<tr>
<td>STS-128</td>
<td>Discovery</td>
<td>Jan-2006</td>
<td>ISS-UF-6</td>
<td>Cancelled</td>
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<tr>
<td>STS-129</td>
<td>Endeavour</td>
<td>Mar-2006</td>
<td>ISS-1J/A</td>
<td>STS-123</td>
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<td>STS-130</td>
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<td>Jul-2006</td>
<td>ISS-1J</td>
<td>STS-124</td>
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<td>STS-131</td>
<td>Endeavour</td>
<td>Oct-2006</td>
<td>ISS-ULF3</td>
<td>STS-129</td>
</tr>
<tr>
<td>STS-132</td>
<td>Atlantis</td>
<td>Jan-2007</td>
<td>ISS-9A,1</td>
<td>STS-112</td>
</tr>
<tr>
<td>STS-133</td>
<td>Columbia</td>
<td>Apr-2007</td>
<td>ISS-UF-7</td>
<td>Cancelled</td>
</tr>
<tr>
<td>STS-134</td>
<td>Discovery</td>
<td>Jun-2007</td>
<td>ISS-2J/A</td>
<td>STS-127</td>
</tr>
<tr>
<td>STS-135</td>
<td>Endeavour</td>
<td>Nov-2007</td>
<td>ISS-ULF5</td>
<td>STS-133</td>
</tr>
<tr>
<td>STS-136</td>
<td>Discovery</td>
<td>Jan-2008</td>
<td>ISS-14A</td>
<td>Cancelled</td>
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<tr>
<td>STS-137</td>
<td>2008</td>
<td>ISS-20A</td>
<td>STS-130</td>
<td></td>
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<tr>
<td>STS-138</td>
<td>2008</td>
<td>ISS-16A</td>
<td>Cancelled</td>
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</tr>
<tr>
<td>STS-139</td>
<td>2008</td>
<td>ISS-17A</td>
<td>Cancelled</td>
<td></td>
</tr>
<tr>
<td>STS-140</td>
<td>2008</td>
<td>ISS-18A</td>
<td>Cancelled</td>
<td></td>
</tr>
<tr>
<td>STS-141</td>
<td>2008</td>
<td>ISS-19A</td>
<td>Cancelled</td>
<td></td>
</tr>
</tbody>
</table>

STS-122 was a crewed spaceflight with astronauts unnamed at the time of cancellation, using the orbiter Columbia as described for 1981 034A. The objective was to undertake the fifth servicing mission of the Hubble Space Telescope (1990 037B). It would have involved the installation of a third generation Wide Field Camera and the Cosmic Origins Spectrograph. Also the last of the three original Fine Guidance Units would have been replaced in addition to checking and servicing the batteries and other equipment. The mission was cancelled in 2004 in view of heightened safety precautions with the Space Shuttle as well as a means to save funds. It was later re-instated and flown as STS-125 (2009 025A).
Name: STS-123  
Country: USA  
Launch date: October 2004  
Launch vehicle: STS

Crewed spaceflight with astronauts unnamed at the time of cancellation, using the orbiter Discovery as described for 1981 034A. The objective was to undertake the International Space Station (ISS)-UF4 mission and would have carried an Express Pallet. The mission was at one stage scheduled for STS-125. The mission was cancelled in 2003 following the STS-107 (2003 003A) disaster.
Crewed spaceflight with astronauts unnamed at the time of cancellation, using the orbiter Discovery as described for 1981 034A. The objective was to undertake the International Space Station (ISS)-UF3 mission and would have carried a Multi-Purpose Logistics Module (MPLM), as described for 2001 010A, and an Express Pallet. The mission was at one stage scheduled for STS-124. The mission was cancelled in 2003 following the STS-107 (2003 003A) disaster.
Crewed spaceflight with astronauts unnamed at the time of cancellation, using the orbiter Discovery as
described for 1981 034A. The objective was to undertake the International Space Station (ISS)-UF5 mission
and would have carried a Multi-Purpose Logistics Module (MPLM), as described for 2001 010A, and an
Express Pallet. The mission was at one stage scheduled for STS-126.
The mission was cancelled in 2003 following the STS-107 (2003 003A) disaster.
Name: STS-132
Country: USA
Launch date: June 2006
Launch vehicle: STS

Crewed spaceflight with astronauts unnamed at the time of cancellation, using the orbiter Atlantis as described for 1981 034A. The objective was to undertake the International Space Station (ISS)-UF6 mission and would have carried a Multi-Purpose Logistics Module (MPLM), as described for 2001 010A, and an Express Pallet. The mission was at one stage scheduled for STS-128.
The mission was cancelled in 2003 following the STS-107 (2003 003A) disaster.
Name: STS-136
Country: USA
Launch date: 2007
Launch vehicle: STS

Crewed spaceflight with astronauts unnamed at the time of cancellation, using the orbiter Discovery as described for 1981 034A. The objective was to deliver the first US Crew Return Vehicle (CRV) to the International Space Station (ISS) (1998 067A). The mission was at one stage scheduled for STS-140. The mission was cancelled in 2003 following the STS-107 (2003 003A) disaster.
Crewed spaceflight with an orbiter as described for 1981 034A. The flight, for which neither a crew or an orbiter had been determined at the time of cancellation in 2003, was to undertake the International Space Station (ISS)-19A mission. A Multi-Purpose Logistics Module (MPLM), as described for 2001 010A, and other station hardware would have been delivered to the International Space Station (ISS) (1998 067A) as part of this mission. The mission was at one stage scheduled for STS-141. The mission was eventually flown as STS-131 (2010 012A).
Crewed spaceflight with astronauts unnamed at the time of cancellation, using an orbiter as described for 1981 034A. The objective was to undertake the International Space Station (ISS)-UF7 mission and would have carried the Centrifuge Accommodations Module to the International Space Station (ISS) (1998 067A). The mission was at one stage scheduled for STS-133. The mission was cancelled in 2003 following the STS-107 (2003 003A) disaster.
Name: STS-139
Country: USA
Launch date: 2008
Launch vehicle: STS

Crewed spaceflight with an orbiter as described for 1981 034A. The flight, for which neither a crew or an orbiter had been determined at the time of cancellation in 2003, was to undertake the International Space Station (ISS)-17A mission. The mission was eventually flown as STS-128 (2009 045A).
Extra recumbent seats to be located in the aft middeck of a STS-3xx mission

The designations in the STS-3xx range were used by NASA to identify contingency rescue flights in case an orbiter would be damaged, using an orbiter as described for 1981 034A. Details of the flights, which were also referred to as Launch On Need (LON) are listed in the following table. The first two were both designated as STS-300, with the next flight being STS-301. After that the first digit of the orbiter’s normal flight designation was replaced by a ‘3’. None of the flights took place.

<table>
<thead>
<tr>
<th>Mission</th>
<th>Target mission</th>
<th>Rescue crew</th>
</tr>
</thead>
<tbody>
<tr>
<td>STS-300 Atlantis</td>
<td>STS-114 (2005 026A)</td>
<td>S. Lindsey (Cmdr.), M. Kelly (Pilot), P. Sellers and M. Fossum (Mission Specialists)</td>
</tr>
<tr>
<td>STS-300 Atlantis</td>
<td>STS-121 (2006 028A)</td>
<td>B. Jett (Cmdr.), C. Ferguson (Pilot), J. Tanner and D. Burbank (Mission Specialists)</td>
</tr>
<tr>
<td>STS-301 Discovery</td>
<td>STS-115 (2006 036A)</td>
<td>M. Polansky (Cmdr), W. Oefelein (Pilot), C. Fuglesang, R. Curbeam (Mission Specialists)</td>
</tr>
<tr>
<td>STS-317 Atlantis</td>
<td>STS-116 (2006 055A)</td>
<td>F. Sturckow (Cmdr.), L. Archambault (Pilot), J. Reilly, S. Swanson (Mission Specialists)</td>
</tr>
<tr>
<td>STS-318 Endeavour</td>
<td>STS-117 (2007 024A)</td>
<td>S. Kelly (Cmdr.), C. Hobaugh (Pilot), T.Caldwell, R. Mastracchio (Mission Specialists)</td>
</tr>
<tr>
<td>STS-322 Atlantis</td>
<td>STS-120 (2007 050A)</td>
<td>S. Frick (Cmdr.), A. Pointdexter (Pilot), L. Melvin, R.Walheim (Mission Specialists)</td>
</tr>
<tr>
<td>STS-323 Endeavour</td>
<td>STS-122 (2008 005A)</td>
<td>D. Gorie (Cmdr.) G. Johnson (Pilot), R. Behnken, M. Foreman (Mission Specialists)</td>
</tr>
<tr>
<td>STS-324 Discovery</td>
<td>STS-123 (2008 009A)</td>
<td>M. Kelly (Cmdr.), K. Ham (Pilot), K. Nyberg, R. Garan (Mission Specialists)</td>
</tr>
<tr>
<td>Flight Number</td>
<td>Mission</td>
<td>Mission Date</td>
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<tr>
<td>STS-326</td>
<td>Endeavour</td>
<td>(2008 027A)</td>
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<tr>
<td>STS-400</td>
<td>Endeavour</td>
<td>(delayed)</td>
</tr>
<tr>
<td>STS-401</td>
<td>Discovery</td>
<td>(delayed)</td>
</tr>
<tr>
<td>STS-400</td>
<td>Endeavour</td>
<td>(2009 025A)</td>
</tr>
<tr>
<td>STS-319</td>
<td>Discovery</td>
<td>(2008 059A)</td>
</tr>
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<td>STS-327</td>
<td>Endeavour</td>
<td>(2009 012A)</td>
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<td>Discovery</td>
<td>(2009 038A)</td>
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<td>Atlantis</td>
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<td>STS-332</td>
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<td>STS-333</td>
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<td>(2011 008A)</td>
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<td>STS-335</td>
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<td>(renamed)</td>
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<td>STS-335</td>
<td>Atlantis</td>
<td>(2011 020A)</td>
</tr>
<tr>
<td>None</td>
<td>STS-135</td>
<td>(2011 031A)</td>
</tr>
</tbody>
</table>

The rescue mission flights were intended to be launched within 40 days from the launch of the original mission during which time the crew of the damaged or disabled orbiter would have taken refuge in the International Space Station (1998 067A).

To save weight, and to allow the combined crews of both shuttles to return to Earth safely, many shortcuts would have had to be made.

Special equipment for these flights included:
1. an extra three recumbent seats to be located in the aft middeck (ditch area);
2. two handholds located on the starboard wall of the ditch area;
3. individual Cooling Units mounting provisions;
4. seat 5 modification to properly secure in a recumbent position;
5. sky genie mounting provisions for four additional sky genies; and
6. Escape Pole mounting provisions for three additional lanyards.

The preparation of the rescue mission would commence two days after the launch of the original mission. Following the inspection of the orbiter in space and assuming the orbiter was considered flightworthy to continue the original mission, the rescue mission would be cancelled. If, however, the orbiter was considered not safe for flight, the crew would ‘de-crew’ the damaged orbiter and undock it automatically. The damaged orbiter would then automatically go through a normal re-entry sequence and, if it survived the re-entry, land at either Edwards Air Force Base or White Sands which have sufficient room to allow a large margin of error for the landing, whilst also having the shortest possible approach flight over land.

To allow the remotely controlled flight an 8.5 m long Remote Control Orbiter Inflight Maintenance (RCO IFM) cable was developed provide an electrical signal connection between the Ground Command Interface Logic.
(GCIL) and the flight deck panel switches. With this system, signals could be sent from the Mission Control Center to the unmanned Shuttle to control the range of flight control systems. The RCO IFM cable was brought to the International Space Station on STS-121 (2006 028A) and will be returned to Earth on the final STS flight.

The rescue mission would carry a crew of four, a commander, a pilot and two mission specialists. Two days after the launch, and following the routine inspection of the heat resistant tiles, it would dock with the International Space Station. On the fourth day the crews of both missions would enter the rescue orbiter which would then undock and land at either the Kennedy Space Centre or Edwards AFB on the fifth day.

As the STS-125 Hubble Space Telescope servicing mission had a different orbit from the International Space Station missions, there would not have been an option for a shuttle crew to use the ISS as a safe haven and a rescue mission would be different. The rescue flight, designated as STS-400 would have to be launched only ten days after call up as the maximum time the crew could remain on the shuttle is 23 days. Because of this the orbiter was rolled to its launch pad about two weeks before the STS-125 launch. The rescue mission would have required a shuttle to shuttle docking, where the rescue shuttle would have been under the damaged shuttle but upside down and facing the other direction so a docking in the format of grappling, would have been possible.
Initially the orbiter Endeavour was assigned to this mission but due to delays with STS-125 the orbiter Discovery was assigned and the mission was designated as STS-401. When further delays with STS-125 occurred the mission was again designated as STS-400 and the orbiter Endeavour was again assigned. However, the crew assigned to the STS-400 mission was not the same crew as for the next mission to be flown by the orbiter Endeavour (i.e. STS-127).

The rescue flight would have lasted seven days. Rendezvous would have been on day 2 of the mission with the first EVA taking place on Day 2. During this EVA McArthur, Feustel and Grunsfeld would have moved to Endeavour. Two EVAs on Day 4 would have transferred Johnson, Massimino, Good and Altman, with Grunsfeld participating in EVA 2. Following this the two orbiters would have separated with further preparations for the landing on Days 5 and 6 and a landing on Day 7.
On 27 January 1964 Hughes started a preliminary design study of the Surveyor Block II spacecraft. This spacecraft would have an increased payload capability. Whilst it was intended to retain the basic design developed for the A-21 and A-21A (Block I) spacecraft, as described for 1966 045A, some strengthening to accommodate the increased payload would have been necessary.

In addition two different types of vernier engines were considered, one similar to the Block I spacecraft and the other with an extended thrust range of 20 to 180 lb per chamber.

Also two different power systems were considered for the Surveyor Block II, a solar panel + battery configuration as well as a solar panel + radioisotopic-thermoelectric generator (RTG) + battery configuration, for which the SNAP-11 version of the RTG was considered and which would have suited the envisaged 30 and 90 day missions.

Furthermore alternate designs for the main retro rocket engine were studied using either steel or titanium cases. As far as the main retro propellant was concerned, consideration was given to a propellant with aluminium additive as well as a beryllium additive.

Finally two Earth-Moon trajectories options were included in the study: the 66 hour option of transit trajectory employed for the Block I Surveyor and a 90 hour option trajectory.

Although no specific payloads were considered, four mission profiles were considered:

1. Landing and limited survival: the payload for such a mission would have to be self-sufficient, including independent power and communications although the basic bus would provide communications to initiate payload operation on the lunar surface;

2. Thirty-day lunar survival: this profile was similar to the mission performed by the A-21A spacecraft, but with the greater payload weight capability;

3. Ninety-day lunar survival: this profile was to be similar as the thirty-day lunar survival, but for 90 days;

4. Two-year lunar survival: this profile was to be similar as the other profiles but with a two year survival.

Early in the study it was concluded that the two year lunar survival profile was not feasible with the existing basic Surveyor spacecraft structure.

Using a range of combinations, four major configurations emerged. The A and B configurations were intended to provide soft lunar landing and a relatively short period of post-landing assessment of spacecraft and payload condition. Spacecraft operation beyond this period would be possible, but should not be expected on a routine basis. These configurations would have been met by a slightly improved A-21 spacecraft.
The C and D configurations were to provide for 30- to 90-day survival of the spacecraft. The C configuration incorporated the RTG which was considered the most attractive for this type of mission because it permitted a higher payload weight to be realized for a given injected weight whilst its probability of 90-day survival would be higher as well. The spacecraft for these two configurations would have been designated A-25.

Finally, the Block II Surveyor Study considered the addition of lunar surface mobility to the basic bus by means of a lift off from the surface and lateral movement to another location. This was, indeed, tested with Surveyor-6.

Based on a 1 July 1964 go-ahead, including the scientific payload definition by JPL, the spacecraft configuration was to be defined by 1 September 1964. An initial February 1967 launch, with subsequent launches every 2 months, was planned with a total of 14 launches taking place until December 1969. As far as can be determined no hardware for the Block II spacecraft had been built when the programme was cancelled on 13 December 1966.

The Surveyor Block III was associated with a proposed Surveyor Lunar Roving Vehicle (SLRV) that would have been carried to the lunar surface with a modified Surveyor spacecraft.

A preliminary design study was undertaken by Bendix. The small 50 kg rover would have been fitted with a small scientific package including a television camera and a penetrometer. Power for the rover would have been provided by a radioisotopic-thermoelectric generator (RTG).

The primary mission for the SLRV was to survey and obtain proposed landing sites for the Apollo programme and to contribute new scientific knowledge about the moon. It was thought that such a survey would enhance the probability of a successful landing of the Apollo Lunar Excursion Module (LEM). Mission time for the SLRV was estimated to be 3 to 3½ months, depending on the lunar surface conditions. A ground clearance of 27 cm was foreseen and it was envisaged that the rover would explore a circular area with a diameter of 3200 m from the point of deployment.

The SLRV was not further developed.
TacSat-1 was the first satellite in a series of microsatellites managed by the Department of Defence’s Office of Force Transformation (OFT) and the Naval Research Laboratory (NRL) to demonstrate to military leaders, and in particular those in a battlefield situation, the use of satellite systems in a quick response situation and with an emphasis on selectable payloads and coverage for military conflicts at any location on Earth.

TacSat-1 was to demonstrate the use of the Secure Internet Protocol Router Network (SIPRNet), a classified military internet like network that allowed tactical control of payload and dissemination of data. The satellite was also to provide battlefield imagery and other data from the satellite as it passed overhead, having a turnaround time of minutes. The images were to have a resolution of 1 m.

The sensor suite included a Visible Camera to provide modest resolution images. For this a HanVision HVDUO-F7 Industrial Camera was selected. This commercially available camera featured a CMOS color image sensor featuring 24 bit digital color output, 2268 x 1152 x 3 photodetectors and 3 FPS output. The spatial resolution of the data was 70 m.

The second camera was a commercially available InfraSPOT Indigo Omega infrared camera that used a microbolometer FPA, a new technology for thermal imaging that did not require cryogenic cooling, thereby reducing complexity in size, weight, and power. The camera collected radiation in the spectral range 7.5-12 µm.

The satellite was also to carry a Specific Emitter Identification (SEI) sensor to identify and capture information from items on the battlefield emitting measurable electronic signals. In particular the SEI was to be used locate ships by listening to radio signals, following which pictures would be taken with the camera systems.

The satellite used a MicroStar platform provided by Orbital Space Corporation (OSC). In fact the platform intended to become the Orbcomm FM-29 satellite, was used and converted. This allowed the use of the avionics, solar arrays other hardware components of the unlaunched communications satellite. TacSat-1 had a diameter of 1.05 m and a height on 0.5 m. The mass was 132 kg.
The satellite was approved on 7 May 2003 and was scheduled to be flown on the first Falcon 1 launch that was to take place in 2004. Following technical problems with the satellite, it was moved to the third Falcon 1 flight which eventually flew in 2008 but without TacSat-1 which had been cancelled in August 2007. This cancellation was decided after that TacSat-2 (2006 058A) had been launched on 16 December 2006 (with a Minotaur launch vehicle) and had demonstrated a large part of the technologies that were to be demonstrated by TacSat-1. TacSat-1 was briefly resurrected in September 2008 and was then also referred to as TacSat-1A. It was, to be launched by the sixth Falcon 1 in 2009. But, with further flights of the Falcon 1 being deleted after the fifth flight, TacSat-1A was never further pursued. The Orbcomm FM-29 designation was subsequently used for 2008 031F, which was also known as Orbcomm CDS 3-1.
The second satellite in ESA’s Thor-Delta series, TD-2, was to study the effects of solar activity on the Earth’s upper atmosphere. It would have carried:

1. S-39, a solar X-ray spectrometry instrument provided by the University of Leicester, UK;
2. S-45, an ionospheric composition and ion temperature probe provided by the University College London, UK;
3. S-80, a neutral particle composition of the upper atmosphere experiment provided by the University of Bonn, Germany;
4. S-85, a low energy auroral electrons experiment provided by the Radio and Space Research Station, Slough, UK
5. S-94, an auroral particles instrument provided by the Kiruna Geophysical Observatory, Sweden;
6. S-97, a light emission from oxygen and ionised nitrogen experiment provided by the CNES Service d’Aéronomie, France;
7. S-99, a solar protons experiment provided by the Utrecht Observatory, the Netherlands;
8. S-103, another solar protons experiment provided by the Max Plank Institut, Garching, Germany;
9. S-106, a solar UV spectroscopy instruments provided by the University College London, UK;
10. S-118, an optical determination of thermospheric of O2 concentration experiment provided by the University of Munich, Germany; and
11. S-126 a scanning of the solar corona instrument provided by the Utrecht Observatory, The Netherlands

The satellite was to be placed in a 350 x 1000 km polar orbit but, due to funding problems with Italy and the United Kingdom, it was cancelled on 25 April 1968. Some of the experiments were eventually flown on ESRO-4 (1972 092A) whereas others were abandoned.

At an earlier date TD-3 (ionospheric studies, with a launch in 1970), TD-4 (atmospheric studies, with a launch in 1970), TD-5 (probably ionospheric studies, with a launch in 1971) and TD-6 (no mission objective known and a launch in 1971) had been cancelled.
Teal Ruby, also known as AFP-888 or STP P80B, was a joint project by DARPA and the USAF to test the feasibility of detecting missile and aircraft movements from space. The payload consisted of an infra-red telescope, an extreme ultraviolet spectrometer, an auxiliary ion propulsion unit and a stellar horizon atmospheric dispersion experiment. The three axis stabilized spacecraft measured 2.4 x 2.4 x 0.7 m and was built by Rockwell. It had a mass of 1940 kg. It would have been placed in a 740 x 740 km polar orbit with an inclination of 70° (if launched from Vandenberg) or 57° (if launched from Cape Canaveral).

The satellite was originally scheduled to be launched on STS-10 but the launch was cancelled because of problems with the IUS upper stage. It was then rescheduled for STS-62A, the first launch from Vandenberg which was to take place on 20 March 1986 and was cancelled after the Challenger disaster. It was eventually re-scheduled for the STS-39 (1989 084B) flight in July 1990 but the programme was cancelled in October 1988 as the objectives had been achieved, in the mean time, by ground based tests. The satellite, which was completed, was placed in storage.
<table>
<thead>
<tr>
<th>Name</th>
<th>Telstar 3-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>USA</td>
</tr>
<tr>
<td>Launch date</td>
<td>?</td>
</tr>
<tr>
<td>Launch vehicle</td>
<td>?</td>
</tr>
</tbody>
</table>

Communications satellite as described for 1983 077A. The satellite was not launched.
Communications satellite owned by Loral. The satellite was to be placed at 154°W and would have carried 92 transponders in the Ku, C and Ka bands. In 2004, before completion, the satellite was sold to Intelsat and was renamed and launched as Intelsat Americas-8 (2005 022A). It was renamed Galaxy-28 in 2007.
Name: Telstar-9
Country: USA
Launch date: 2004
Launch vehicle: Zenit 3SL?

Communications satellite owned by Loral. The satellite will carry 92 transponders in the Ku, C and Ka bands. It would have been located at 93°W.
<table>
<thead>
<tr>
<th>Name:</th>
<th>Thor-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country:</td>
<td>Norway</td>
</tr>
<tr>
<td>Launch date:</td>
<td>?</td>
</tr>
<tr>
<td>Launch vehicle:</td>
<td>?</td>
</tr>
</tbody>
</table>

The Thor-4 communications satellite for Telenor was cancelled in 2001.
Name: TKS-1
Country: USSR
Launch date: January 1981
Launch vehicle: Proton K

Crewed spaceflight to the cancelled OPS-4 space station with cosmonauts A. Berezovoi, Y. Glazkov and V. Makrushin using a TKS spacecraft as described for 1977 066A. The mission would have lasted three months. The flight was cancelled in 1981 and the spacecraft was eventually modified and used as Kosmos-1267 (1981 039A).
Name: TKS-2
Country: USSR
Launch date: April 1981
Launch vehicle: Proton K

Crewed spaceflight to the cancelled OPS-4 space station with cosmonauts V. Kozelski, Y. Artyukhin and V. Romanov using a TKS spacecraft as described for 1977 066A. The mission would have lasted four months. The flight was cancelled in 1981 and the spacecraft was eventually modified and used as Kosmos-1443 (1983 013A).
Name: TKS-3
Country: USSR
Launch date: August 1981
Launch vehicle: Proton K

Crewed spaceflight to the cancelled OPS-4 space station with cosmonauts G. Sarafanov, V. Preobrazhenski and D. Yuyukov, using a TKS spacecraft as described for 1977 066A. The flight was cancelled in 1981 and the spacecraft was eventually modified and used as Kosmos-1686 (1985 086A).
<table>
<thead>
<tr>
<th>Name</th>
<th>TOSZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>USSR</td>
</tr>
<tr>
<td>Launch date</td>
<td>1965</td>
</tr>
<tr>
<td>Launch vehicle</td>
<td>N-1</td>
</tr>
</tbody>
</table>

The Tyazholaya Orbital'naya Stanciya Zemli (= Heavy Orbital Station of the Earth) (TOSZ) was a proposal for a heavy space station made by the Korolyev OKB in 1961. It was also referred to as Tyazholaya Kosmicheskaya Stanciya (= Heavy Space Station) (TKS). With a length of 52 m, diameter of 4.2 m and mass of 150 tons, it would have provided room for three cosmonauts which would be conducting military and scientific missions. The core module was to be placed in orbit by an N-1 flight in 1965, with another three modules to follow. The diameter of the core module would have been 4.15 m with a length of 12 m. The other two modules would have measured 4.5 m diameter and 20 m length.

The completed space station would have had four docking ports/airlocks.
<table>
<thead>
<tr>
<th>Name</th>
<th>Uragan</th>
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<tbody>
<tr>
<td>Country</td>
<td>USSR</td>
</tr>
<tr>
<td>Launch date</td>
<td>1982</td>
</tr>
<tr>
<td>Launch vehicle</td>
<td>Zenit 2</td>
</tr>
</tbody>
</table>

The development of a crewed space interceptor was commenced in September 1978 using the name Uragan. The vehicle had a diameter of 9.5 m and a length of 12.5 m, with a mass of 13,000 kg. It was to be fitted with space-to-space missiles and up to nine cosmonauts had been selected for the programme. Its configuration was confirmed by the Bor-4 tests as described for 1982 054A, whilst two boiler plate models were possibly launched as Kosmos-1871 (1987 065A) and Kosmos-1873 (1987 071A). The programme was cancelled on 1 September 1987, probably as the result of the cancellation of military Space Shuttle flights from Vandenberg. The name Uragan has also been used for Glonass navigational satellites as described for 1982 100A.
Name: USA-163  
Country: USA  
Launch date: 2002  
Launch vehicle: Titan 2 or Titan 401B

USA-163 represents a gap in the USA series. It is possible that it was intended to assign the name to either DMSP F-16 or Orion-3, both of which were substantially delayed. Orion-3 (2003 041A) was eventually launched as USA-171 whilst DMSP F-16 (2003 048A) was launched as USA-172. It has also been suggested USA-163 was a sub-satellite of NOSS 3-1 (2001 040A). None of the above suggestions have been substantiated in any way.
The Vegetation Canopy Lidar (VCL) was the first mission in NASA's Earth System Science Pathfinder (ESSP) program and has also been referred to as EESP-1. It was to provide the first global inventory of the vertical structure of forests across Earth using a multibeam laser-ranging device. VCL has been delayed and finally cancelled due to problems with the science payload. The 420 kg satellite was to have been placed in a 400 km orbit with an inclination of 67°. The completed bus was reused for the GLORY satellite that failed on 4 March 2011.
Crewed spaceflight with cosmonauts B. Volynov and G. Shonin using a Voskhod spacecraft as described for 1964 065A. The back-up crew consisted of V. Shatalov and G. Beregevol. The purpose of the flight was a mission of up to 18 days. It is believed the mission, which may have been scheduled for 10 March 1966, was cancelled on 6 January 1966.

One of the experiments considered at one stage, was a test of artificial gravity generated by a tether cable with an object attached to it.
Crewed spaceflight with cosmonauts I. Solovyova and V. Ponomaryova using a Voskhod spacecraft as described for 1964 065A. The purpose of the flight was to dock with the Voskhod-5 and the spacecraft may have been fitted with a Polyot maneuvering engine. The back-up crew for this flight consisted of T. Kuznetsova and Z. Yorkina. The flight was cancelled late 1965 because of the progress that was being made with the Soyuz programme. It has been suggested that it was intended for one of the cosmonauts to make an EVA.
Crewed spaceflight with cosmonauts G. Beregovoi and G. Katys using a Voskhod spacecraft as described for 1964 065A. The back-up crew consisted of V. Shatalov and L. Dyomin. The purpose of the flight was to dock with Voskhod-4 and for a medical doctor to observe a number of animals. The flight was cancelled late 1965.
Crewed spaceflight with cosmonauts Y. Khrunov and A. Voronov using a Voskhod spacecraft as described for 1964 065A. The back-up crew consisted of V. Gorbatko and P. Kolodin. The purpose of the flight was to test the UPMK maneuvering unit during an EVA. The flight was cancelled late 1965.
Crewed spaceflight with cosmonaut B. Yegorov or V. Komarov using a Vostok spacecraft as described for 1961 μ 1. The back-up for this flight was V. Lazarev. The flight, which was to have flown through the lower Van Allen radiation belts for radiological-biological studies, would have lasted for 10 days. It was cancelled early in 1964.
Name: Vostok-8
Country: USSR
Launch date: June 1964
Launch vehicle: Vostok

Crewed spaceflight with cosmonaut P. Belyayev using a Vostok spacecraft as described for 1961 μ 1. The flight, which was to have flown through the lower Van Allen radiation belts for radiological-biological studies, would have lasted for 10 days. It was cancelled early in 1964.
Crewed spaceflight with cosmonaut B. Volynov using a Vostok spacecraft as described for 1961 μ 1. The flight, which was to have been a high altitude flight to conduct biological studies as well as solar physics studies and engineering tests, would have lasted for 10 days. It was cancelled early in 1964.
Name: Vostok-10
Country: USSR
Launch date: April 1965
Launch vehicle: Vostok

Crewed spaceflight with cosmonaut G. Beregevoi using a Vostok spacecraft as described for 1961 μ 1. The flight, which was to have been a high altitude flight to conduct biological studies as well as solar physics studies and engineering tests, would have lasted for 10 days. It was cancelled early in 1964.
Name: Vostok-11
Country: USSR
Launch date: June 1965
Launch vehicle: Vostok

Crewed spaceflight with cosmonaut A. Leonov using a Vostok spacecraft as described for 1961 μ 1. The flight would have tested extra-vehicular activity and the spacecraft was to be modified by the removal of the ejection seat and a built-in airlock. It was cancelled early in 1964.
Name: Vostok-12
Country: USSR
Launch date: August 1965
Launch vehicle: Vostok

Crewed spaceflight with cosmonaut Y. Khrunov using a Vostok spacecraft as described for 1961 μ 1. The flight would have tested extra-vehicular activity and the spacecraft was to be modified by the removal of the ejection seat and a built-in airlock. It was cancelled early in 1964.
<table>
<thead>
<tr>
<th>Name:</th>
<th>Vostok-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country:</td>
<td>USSR</td>
</tr>
<tr>
<td>Launch date:</td>
<td>April 1966</td>
</tr>
<tr>
<td>Launch vehicle:</td>
<td>Vostok</td>
</tr>
</tbody>
</table>

Crewed spaceflight with cosmonaut V. Gorbatko using a Vostok spacecraft as described for 1961 μ 1. The flight, which was to have been a high altitude flight to conduct biological studies as well as solar physics studies and engineering tests, would have lasted for 10 days. It was cancelled early in 1964.
The X-38A or Experimental Crew Return Vehicle (X-CRV) was an uncrewed proof-of-concept design of a Crew Transfer Vehicle (CRV).
The first of three sub-scale X-38s had serial number V131. The first captive flights, with the NB-52A carrier aircraft, took place on 30 July 1997 and 2 August 1997 whilst the first glide-flight was on 12 March 1998, followed by a second flight on 9 February 1999.
The second example, V132, tested flight controls and flew for the first time on 5 March 1999 with further flights on 9 July 1999 and 30 March 2000.
The third, full scale, vehicle, V133, was to begin drop tests in 2000 but was not completed. Instead V131 was modified in 2000 and reserialled as V131R. It made its first free flight on 2 November 2000 with two more flights on 10 July 2001 and 13 December 2001.
The first spaceflight, using the full scale V201, was expected in 2000. V201 was to be delivered to orbit by the Space Shuttle Columbia and then make a full re-entry and landing in the western USA or in Australia. The vehicle was to be fitted with thrusters. By then the development of the X-38A was cancelled.
YamSat (in which Y = Youth, A = Amateur Radio and M = Micro electronics) was a cubesat developed and built by the National Space Program Office of Taiwan and Taiwan universities.

Scheduled for launch in 2003 on a Dnerp flight, three items were built. The YamSat-1A was to be the flight article, YamSat-1B was a back-up and YamSat-1C was used for public demonstrations. Each of the three articles had minute differences.

The instruments on board of the 1 kg satellite, were a micro spectrometer and an amateur radio transponder. Tests were completed in March 2002 but the 2003 launch was cancelled after objections by Russia and China.
Name: Zircon  
Country: United Kingdom  
Launch date: 1989?  
Launch vehicle: ?

Geostationary satellite to be placed at 53°E to intercept message transmissions from Warsaw Pact nations. The programme was cancelled in 1987. It has, however, also been suggested that one of the Skynet-4 satellites was in fact a Zircon satellite whilst other sources have suggested that either DSCS II-16 (1989 069A) or DSCS III-4 (1989 069B) was a Zircon satellite.
Name: Zond-9
Country: USSR
Launch date: ?
Launch vehicle: Proton K/D

Cancelled lunar mission.
Name: Zond-10  
Country: USSR  
Launch date: ?  
Launch vehicle: Proton K/D  

Cancelled lunar mission.