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Artist impression of UK Spaceport at Newquay

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The *Tiros Space Information (TSI) - News Bulletin* is published to promote the scientific exploration and commercial application of space through the dissemination of current news and historical facts.
In doing so, Tiros Space Information continues the traditions of the Western Australian Branch of the Astronautical Society of Australia (1973-1975) and the Astronautical Society of Western Australia (ASWA) (1975-2006).
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Calling card...

It was around 1983 that the office where I worked obtained a personal computer. Wow, what a marvellous thing that was. And whilst my colleagues played games on this, I saw it as a tool to place satellite data on a computer file. That work – of course undertaken during lunchtimes - led to my book Spacecraft Tables 1957-1990 that was published in 1991 by Univelt in the USA. 231 pages of tables showing spacecraft by programme, something that I had not found elsewhere.
From this developed, over a number of years, a detailed description of each spacecraft ever launched (or attempted to be launched). At first these descriptions were handwritten on pro-forma sheets photocopied at work but, when I eventually got my first own computer, I transferred this all to the computer. This data base was called World Spacecraft Digest.

At one stage I had visions of finding a publisher for this work but it soon became evident that printing it as a book would be too massive. And indeed, now World Spacecraft Digest contains details of about 8000+ spacecraft. With an average of two descriptions per page, that would amount to a 4000 page book – unrealistic.

Anyway, no need to despair – World Spacecraft Digest is now on the internet at worldspacecraftdigest.wordpress.com. It is a collection of 160 straight forward pdf files with information and it will be updated approximately every six months. And, just in case you start looking for it, the website does not have fancy links between data items.

Jos Heyman

UK Spaceport ?

The British government intends to establish a commercial spaceport to “secure low-cost access to space for our world-leading small- and micro-satellite industry.”
If the project goes ahead, it is expected the spaceport would be operational by 2020. Potential locations are Newquay in Cornwall; Llanbedr in Snowdonia, Wales; Glasgow Prestwick, Scotland; Campbeltown, Scotland; and Stornoway in the Western Isles.

Dream Chaser

Sierra Nevada Corp. has readied its Dream Chaser vehicle for a second round of test flights in the development of a version of that vehicle to transport cargo to the International Space Station.
Test will be conducted at NASA’s Armstrong Flight Research Center in California. One glide fight is scheduled December 2016. The tests will use the same vehicle that was used from 29 May 2012 to 26 October 2013 tests as a crewed vehicle.

SBIRS GEO-3

The third Space Based Infrared System Geosynchronous satellite (SBIRS GEO-3) is scheduled to be launched from Cape Canaveral on 3 October 2016.
The missile warning satellite will be launched with an Atlas V-401 launch vehicle.

QSS

On 15 August 2016 China launched the Quantum Science Satellite (QSS), also known as Micius, a 600 kg scientific spacecraft to study quantum communications between space and Earth by creating entangled photon pairs over great distances and testing the principles of quantum teleportation.
The satellite was named after Chinese scientist and philosopher Micius who, over 2,000 years ago, discovered that light travels in straight lines.

ISS

Russia is considering a reduction of its involvement in the operations of ISS by reducing its crew from three to two. This would be more in line with the current workload of the Russian crews.
At about the same time there is a delay in the launch of Russia’s Multipurpose Laboratory Module (MLM) that would increase the amount of experiments performed at any given time and justify a permanent crew of three.

Satellite Update

Launches in July 2016

Int.Des.	Name	Launch date	Launch vehicle	Country	Notes
2016 044A	Soyuz MS-01	7-Jul-2016	Soyuz FG	Russia	Docked with ISS
2016 045A	Progress MS-03	16-Jul-2016	Soyuz U	Russia	Docked with ISS
2016 046A	Dragon CRS-9	18-Jul-2016	Falcon 9 v.1.2	USA	Docked with ISS
2016 047A	SDS 4-1	28-Jul-2016	Atlas V-421	USA	Military comms.

Other updates

Int. Des.	Name	Notes
1998 067FW	Flock 1b-05	Re-entered 17 August 2015
1998 067GJ	Flock 1e-7	Re-entered 17 July 2016
1998 067GM	Flock 1e-6	Re-entered 21 July 2016
1998 067GT	Flock 1e-14	Re-entered 31 July 2016
2000 079A	Eros-A1	Re-entered 7 July 2016
2015 080A	Progress MS-01	Undocked and re-docked on 1 July 2016 and undocked and re-entered on 3 July 2016

Falcon 9

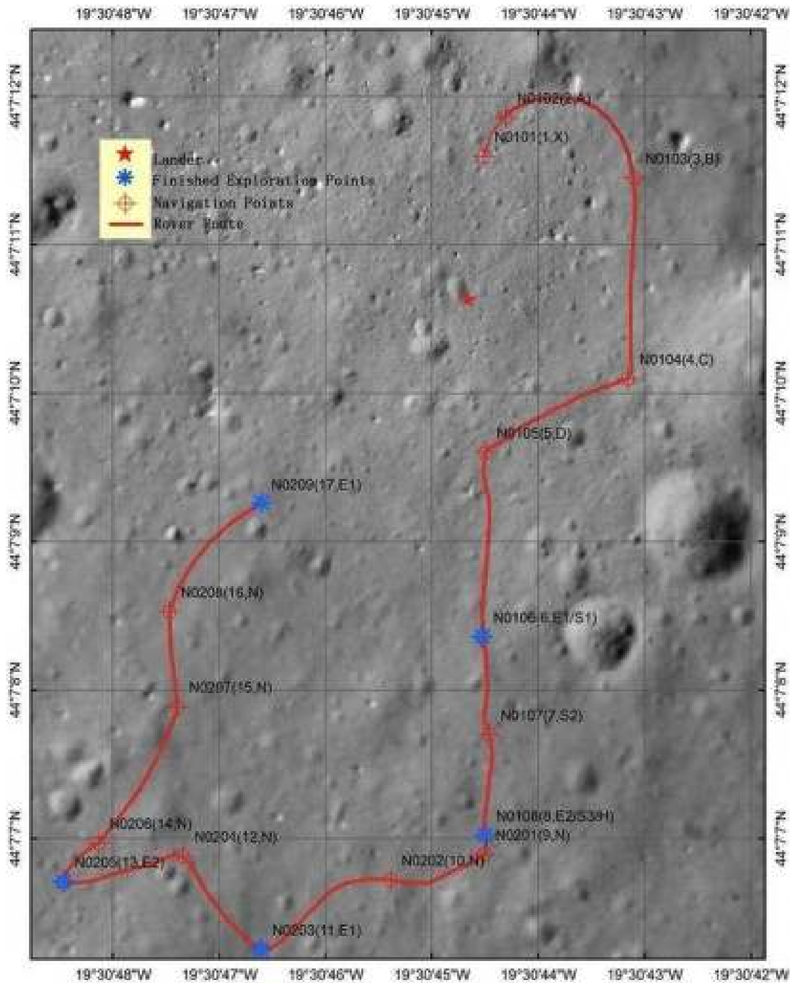
On 28 July 2016 SpaceX used the Falcon 9 first stage that was recovered on 6 May 2016 after placing JC Sat-14 in a geostationary transfer orbit, in a static test firing at the SpaceX's McGregor facility.

MUOS-5

After its launch on 24 June 2016 the US Navy's MUOS-5 communications satellite failed to achieve geostationary orbit due to the failure of its orbit raising system.
It was intended to be placed in a geostationary orbit over Hawaii but now remains in an orbit of 3828 x 15239 km miles with an inclination of 9.8º..
Other orbit adjustments are being investigated.

Yutu

The Chinese Yutu moon rover, that was delivered to the Moon with Chang'e-3 on 14 December 2013, stopped working on 28 July 2016.
During its 31 months of operation the rover vehicle moved over 100 m of the lunar surface.



Yutu route on the lunar surface

It had earlier stopped working in January 2014 but came to live again in February 2014

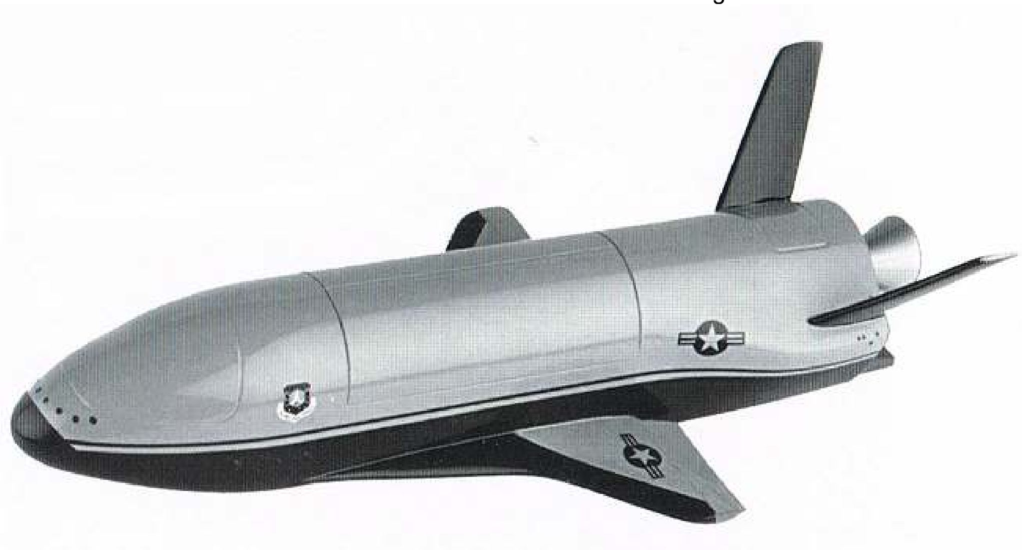
Cancelled Projects: Space Maneuvering Vehicle (X-40B)

By Jos Heyman

In the mid-1990s both NASA and the US Air Force started the development of a small re-usable space vehicle as as completely separate and ostensibly unrelated programs. The NASA project was identified as the X-37, whereas the US Air Force's project was identified as the Space Maneuvering Vehicle (SMV) or X-40.

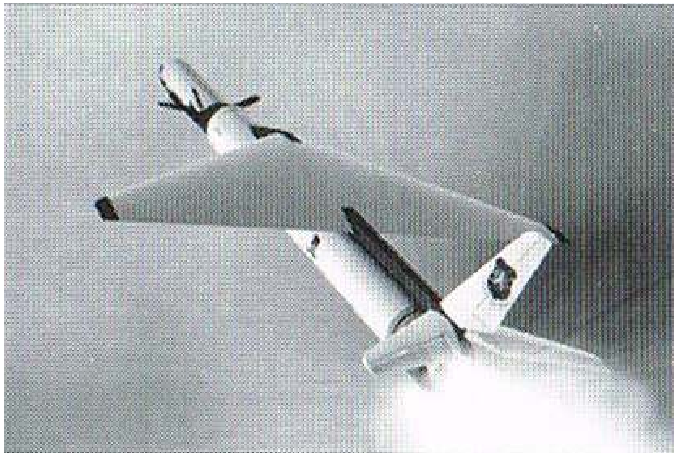
The purpose of both the X-37 and the X-40 programme was to lead towards an unmanned re-usable rocket powered spacecraft, that could be launched into orbit on the Space Shuttle or an expendable booster and then spend up to a year maneuvering in orbit before returning with a fully automatic gliding reentry for a horizontal landing on a predesignated runway.
It was envisaged that both vehicles could deliver small payloads to orbit as well as undertake remote examination of satellites and orbital reconnaissance.

The Space Maneuvering Vehicle (SMV), initially designated as X-40A but later as X-40B, was to be built by Boeing and was to have a span of 4.57 m and a length of 8.84 m. One of the launch vehicles it was considered with was the Orbital Sciences Pegasus.



SMV

In order to test the final low-speed approach and landing phase of a return from space Boeing built a 90% scale unpowered version of the SMV identified as the Integrated Technology Test Bed (ITTB). This demonstrator was ordered in October 1996.
The ITTB was assigned the military X-40A designation (resulting in the actual SMV being redesignated as X-40B).



SMV launched with a Pegasus

The ITTB had a wing span of 3.51 m and a length of 6.70 m. After static tests it made its first flight on 11 August 1998, when it was dropped at an altitude of 2740 m from a helicopter, following which it was first stablised by a parachute that was subsequently released. The vehicle then accelerated and performed a controlled glide that simulated the final approach and landing phases of such a vehicle returning from orbit. The X-40A then landed successfully on a runway at Holloman AFB, using an integrated Navstar Global Positioning Satellite and inertial guidance system.
The total flight time was 1.5 minutes.

X-40A

By 2000 the US Air Force had cancelled the SMV development and had joined NASA in the X-37 programme, The X-40 and X-37 projects were merged and the X-40A was transferred to NASA for tests in support of the X-37 development, where it joined the X-37A test vehicle by undertaking seven drop flights from a helicopter over Edwards AFB. The first of these glide flights was made on 14 March 2001 with the other flights on 12 April 2001, 26 April 2001, 5 May 2001, 8 May 2001, 17 May 2001 and 19 May 2001.

Al this research eventually lead to the launch of the first X-37B orbital launch on 22 April 2010. Since then the two X-37Bs have made three flights.

Soyuz – a golden jubilee

by Jos Heyman

Introduction

On 28 November 2016 it will be 50 years since the first pre-cursor of the Soyuz spacecraft was launched as Kosmos-133.
By the time of this golden jubilee, 319 spacecraft have been launched in this family of spacecraft.

Type	First	Last	Flights	Failures
Soyuz	23-Apr-1967	14-May-1981	41	1
Zond-1	2-Apr-1964	20-Oct-1970	7	2
Soyuz T	16-Dec-1979	13-Mar-1986	16	1
Soyuz TM	21-May-1986	25-Apr-2002	34	
Soyuz TMA	29-Oct-2002	14-Nov-2011	22	
Soyuz TMA-M	7-Oct-2010	18-Mar-2016	20	
Soyuz MS	7-Jul-2016	current	2	
Progress-1	20-Jan-1978	5-May-1990	42	
Progress M	23-Aug-1989	10-Nov-2009	69	
Progress M1	1-Feb-2000	29-Jan-2004	11	
Progress M-M	26-Nov-2008	1-Oct-2015	29	1
Progress MS	21-Dec-2015	current	3	
Various tests	28-Nov-1966	30-Aug-1985	23	5
Total			319	10

Table: Soyuz types

Over that period a total of 205 cosmonauts from 30 countries will have flown in Soyuz spacecraft, some of them multiple times.

Over the years the Soyuz spacecraft have been continuously developed to keep them up to date with modern technology, but at the same time the basic shape has been maintained.

In addition the spacecraft has also served at the basis of other spacecraft, in particular the Progress series of cargo spacecraft.

Initially developed as a crewed spacecraft for the USSR's lunar programme as well as its envisaged space station programme, the Soyuz family of spacecraft has supported the seven Salyut space stations, the Mir space station and is currently the main spacecraft supporting the International Space Station.

In this article we will look at this spacecraft that has carved out it unique place in space history.

Origins

The origins of the Soyuz spacecraft can be traced back to the late 1950s when the USSR was looking for a follow-on to the Vostok spacecraft with as specific objectives sending cosmonauts around the Moon and eventually land then on the Moon. At the same time the new spacecraft was envisaged to be used as a ferry spacecraft to Earth orbiting space stations. A lot of their inspiration came from the work of Konstantin Tsiolkovsky who, in the early 20th century, wrote theoretical works about spaceflight beyond Earth orbit.

As far as can be determined, work on the new spacecraft began in 1958 and was undertaken by Sergei Korolyov's OKB-1 design bureau, the precursor of the current Energiya corporation.

This was at a time that the United States had embarked on the military Dyna Soar programme that run from 1957 until its cancellation in 1963 and the civilian Mercury programme that was started in late 1958
It was also a period of (misinformed) hysteria about the 'Soviet lead in space' and the 'loss of the high ground' by the United States, and led to efforts of getting an American into space by the quickest possible means. These efforts were inspired by President John F. Kennedy's address to Congress on 25 May 1961 stating: *"I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to Earth."*
It was this inspiring statement, undoubtedly strengthened by the President's assassination on 22 November 1963, that triggered off a race between the United States and the Union of Socialist Soviet Republics to determine whether the words "*This is one small step*..." or similarly legendary words, would be spoken by an American or a Russian.
But, the USSR did not have such a strong inspirational commitment and, apart from strong government meddling, the effort was hindered by competition within the space industry, in particular between the two major designers Sergei Korolyov and Vladimir Chelomei.

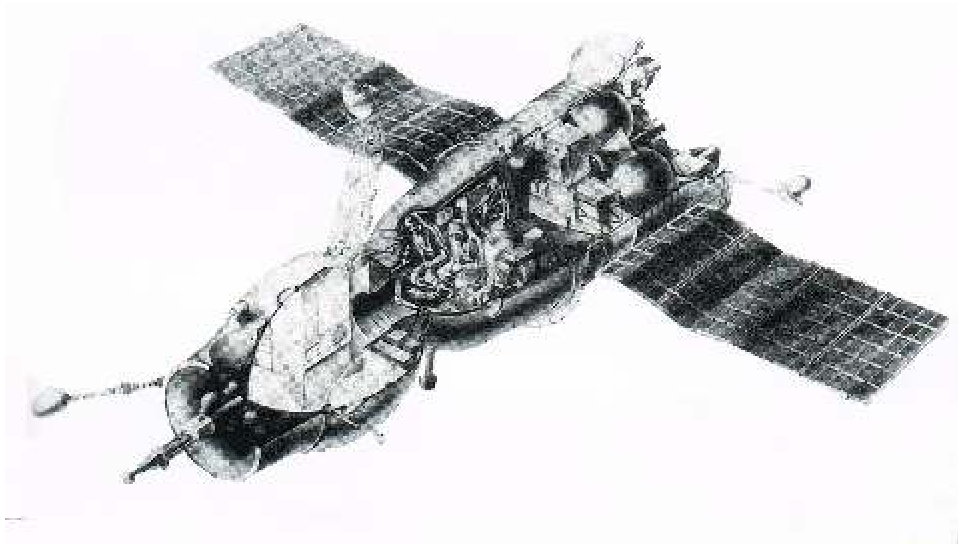
Lunar programme

OKB-1 responded to the 1958 requirement and by 1962 the design studies had evolved into the basic Soyuz spacecraft, identified as the Soyuz 7K (K = Korabl).

The basic Soyuz 7K, as eventually flown on the flights related to the lunar programme, consisted of:

1. a living compartment module, designated as Bitovoy Otsek (BO), which had a diameter of 2.26 m and a length of 2.98 m (incl. docking system). The module provided the cosmonauts' sleeping quarters, laboratory facilities as well as the cargo hold and the air lock;
2. the instrument and propulsion module, designated as Priborno Agregatniy Otsek (PAO), which consisted of a pressurised section for the instrumentation and an unpressurised engine compartment. It had a diameter of 2.72 m and a length of 2.60 m. The attitude control system used 30 thrusters and the main engine was a KTDU-35 with a thrust of 409 kg. There was also a limited performance back-up engine to be used in emergency cases. Two solar arrays of 3.6 m x 1.9 m could be carried, although when the Soyuz spacecraft was being used in conjunction with the Salyut space stations and the flight duration was shorter, the solar panels were replaced by batteries; and
3. a descent module, designated as Spuskaemiy Apparat (SA), which was bell shaped and had a length of 1.90 m and a diameter of 2.17 m. The bell shape provided some

aerodynamic lift allowing the spacecraft to perform 3 to 4 G re-entries although 10 to 16 G ballistic re-entries would also have been possible. Although the capsule was designed for landing on land or water, the landing normally took place over land. Descent was slowed down by a parachute whilst at a 2 m altitude small landing rockets would fire to lessen the impact.

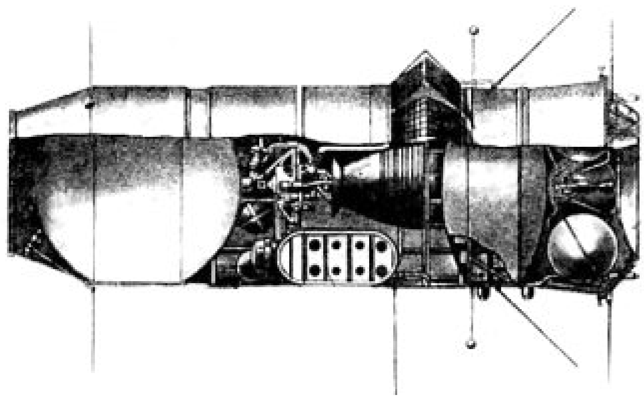


Soyuz 7K

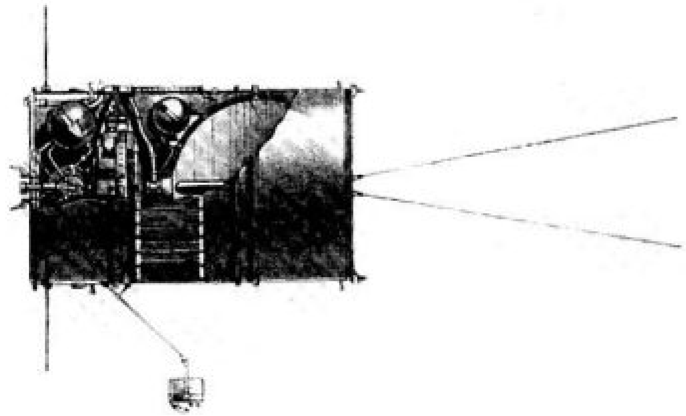
For the circumlunar mission it was part of the 7K-9K-11K complex in which 9K referred to a module that would be placed into a low-Earth orbit with a Proton launch vehicle. Following this three to four 11K tankers would be launched and would dock with the 9K and transfer fuel following which the 11Ks 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. Some reference sources have identified this version of the Soyuz as 7K-OK (for 7 Korabl-Orbital'nyy Korable).

The subsequent programme that foresaw a landing on the Moon and was far more ambitious than the earlier circumlunar programme. This programme was dependent upon the Nosital (N)-1 launch vehicle and in September 1963 the OKB-1 proposed to match the basic Soyuz spacecraft with the N-1 launch vehicle to achieve this crewed landing missions. 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;
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.



Soyuz 9K



Soyuz 11K

The other components of the programme were the Soyuz Lunova Orbitlny Korably (LOK) lunar orbit cabin, and the Soyuz Lunova Korably (LK) lunar cabin.
The Soyuz LOK lunar orbit cabin 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.

The mission profile intended to launch the Soyuz LOK and LK combination with an 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.

Soyuz LK

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 descent 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 flights in 1969 and 1970 to test the rendez-vous and docking systems of the LOK and LK and the first of three circumlunar flights was planned for 1973. The first lunar landing would have taken place in 1974. 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.

Artist impression of what never happened

The first orbital flight of a Soyuz spacecraft, in an uncrewed configuration, took place on 28 November 1966 as Kosmos-133. The intention was to launch and recover the spacecraft following a 33 orbits flight but it seemed that the spacecraft failed to stabilize and it was destroyed in orbit on 30 November 1966 to prevent it landing in China.

In spite of the problems that had been encountered with the Kosmos-133, Soyuz-1 was launched on 23 April 1967 with the cosmonaut Komarov on board. It was apparently intended that Soyuz-1 would be joined by Soyuz-2 to be crewed by Bykovski, Khrunov and Yeliseyev and that a crew exchange would have taken place in orbit. It has also been suggested that Soyuz-1 and -2 would dock or that a formation flight would be made. The programme was designated as Eksperimentalnaya Kosmicheeskaya Stanziya (EKS) which means Experimental Space Station). But during the flight, which lasted 26 hours, 48 minutes, the solar panels did not deploy properly, causing the thermal system and other subsequent systems, including the attitude control system, to malfunction. Nevertheless, Komarov succeeded in putting the spacecraft into a roll so that it stabilized for re-entry.
A re-entry during the 16th orbit failed and the cosmonaut tried again on the 18th orbit, on 24 April 1967. During that re-entry the main and emergency parachutes became entangled and the spacecraft smashed into the ground killing the cosmonaut. There is, however, also evidence which suggests that the cosmonaut had died prior or during re-entry.
It has been suggested that, under political pressure to achieve the crew transfer in space, the Soyuz-1 flight was made too early for it to be safe.

Following this docking was tested with Kosmos-186/188 and Kosmos-212/213 and only about one and a half year later, on 25 October 1968, a crewed attempt was made. Soyuz-2 was launched without a crew, followed the next day by Soyuz-3 with one crew member. It was the intention for

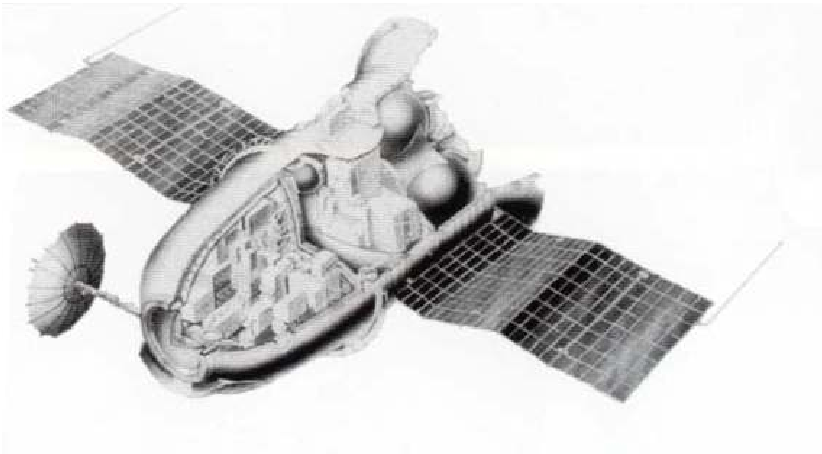
Soyuz-3 to dock with Soyuz-2. But, whilst the two spacecraft were, at one stage 40 m apart, the docking did not take place.

The process of docking was eventually achieved between Soyuz-4 and -5 on 16 January 1969 and two cosmonauts performed a tethered spacewalk of 37 minutes during which they transferred from Soyuz-5 to Soyuz-4. To prove that the transfer was actually made, they carried newspapers which were dated after the Soyuz-4 launch.

The docking was attempted again in October 1969 with the Soyuz-7 and -8 flights but, although the two spacecraft came within 480 m of each other, a failure in the manual controls prevented docking and instead a formation flight was performed.

It should be pointed out that by now the US had achieved a crewed Moon landing and it has been suggested that the Soyuz-8 was originally intended to dock with a test article of the Salyut space station, whlst it is likely that both Soyuz-7 and -8 were no longer connected with the lunar programme. Further flights with the Soyuz spacecraft were clearly associated with the space station programmes.

As stated earlier, the basic Soyuz spacecraft was also used for a number of circumlunar missions in the Zond programme.



Zond

The configuration of the circumlunar Zond spacecraft was similar to that of the Soyuz LOK, consisting of:

1. the Soyuz service module but with a single KTDU-53 engine;
2. the re-entry module as for Soyuz; and
3. a docking collar.

It was fitted with two solar panels.
Some of the other Zond flights may have included the LK module.
The programme was not very successful and, out of the seven launched Zond spacecraft, only four achieved their objectives.

The first of these, Zond-5 was launched on 15 September 1968 and flew successfully around the Moon on 18 September 1968 when it achieved a minimum distance from the Moon of 1950 km. During the flight around the Moon it also returned images from the far side of the Moon. Eventually the spacecraft re-entered over the Indian Ocean where it was recovered on 21 September 1968. This pattern was repeated with Zond-6 on 10 November 1968, but with a new re-entry technique which made it land in the USSR rather than in the Indian Ocean.
Two more circumlunar flights were achieved by Zond-7 and -8, in 1969 and 1970.
It should be noted that the Zond designation was also applied to a variety of spacecraft configurations, including Zond-1 to -3, which had nothing to do with the lunar programme and were totally unrelated in design.

Space Station transfer

For its use as a space station crew and cargo transfer vehicle, the solar panels and the toroidal fuel tanks were gradually deleted from the basic Soyuz spacecraft.
The interior of the orbital module itself was also changed to reflect the nature of a mission. It was initially intended to fit three seats, such as in Soyuz-10, which did not permit the cosmonauts to wear spacesuits. Soyuz-10 docked with the Salyut-1 space station on 23 April 1971.
The disaster with the next flight, Soyuz-11 on 29 June 1971, did however, cause a change in direction and, until the introduction of the Soyuz T version, all Soyuz flights were flown by two cosmonauts wearing space suits.

The Soyuz crew transfer spacecraft continued to serve the space station programme with crew transfers to Salyut and Mir space stations before graduating to the International Space Station.
Initially the Soyuz spacecraft was not considered flight worthy after a period of 90 days in space as after this the propellant lines and engine valves would degrade due to exposure to the toxic propellants. This feature dictated very much the comings and goings during the long duration missions which commenced with the Salyut-6 space station.

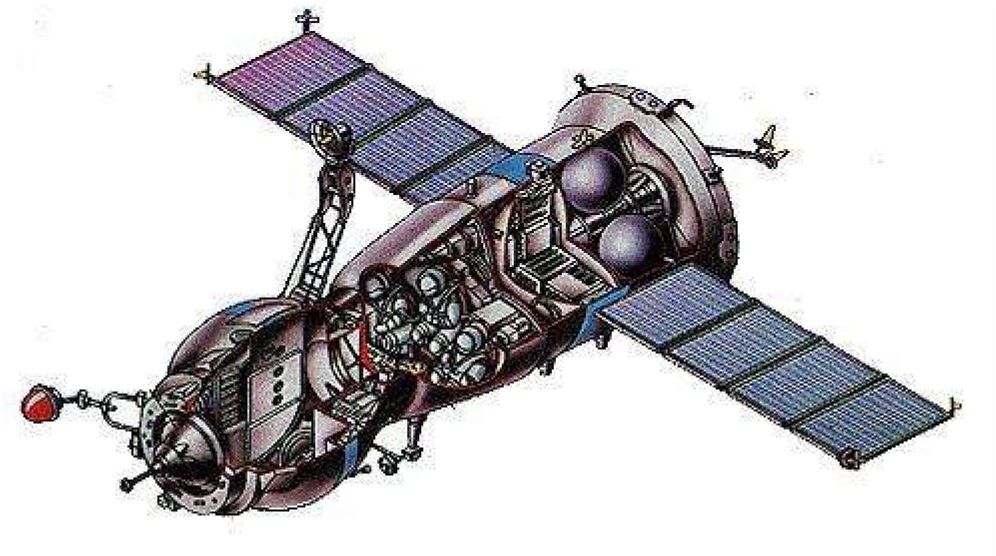
As a partner in the transfer to space stations, Energiya also developed the Progress cargo transfer spacecraft which was based on the Soyuz spacecraft.
It consisted of:

1. a cargo module which replaced the Soyuz's living compartment module and had a length of 3.15 m and diameter of 2.26 m. With a volume of 6.6 m^2, it could carry up to 2480 kg of cargo;
2. a refuelling module which replaced the Soyuz's descent module and which was 2.1 m long and had a diameter of 1.7 m; and
3. a propellant section and an instrument module with a length of 3.1 m and a diameter of 2.72 m.

The entire spacecraft had a length of 7.94 m and a diameter of 2.72 m. It had a launch mass of about 7000 kg, which would vary with the amount of cargo carried.
The first Progress spacecraft was launched on 20 January 1978 and docked at the rear port of the Salyut-6. Like the crewed Soyuz spacecraft, it continued to serve the Salyut-6 and -7 space stations as well as Mir and ISS which were all equipped with facilities for fuel transfers. The propulsion module of the Progress vehicle was also used to boost the orbit of the space station it was attached to.

Over time, both the Soyuz and Progress spacecraft went through a progressive modernisation process, keeping the spacecraft up to date.

Soyuz T was the first progressive development and could carry a crew of three cosmonauts wearing non-EVA rated spacesuits. In addition two solar panels with a span of 10.60 m were introduced. Other improvements included a redesigned fuel system and improved avionics.



Soyuz T

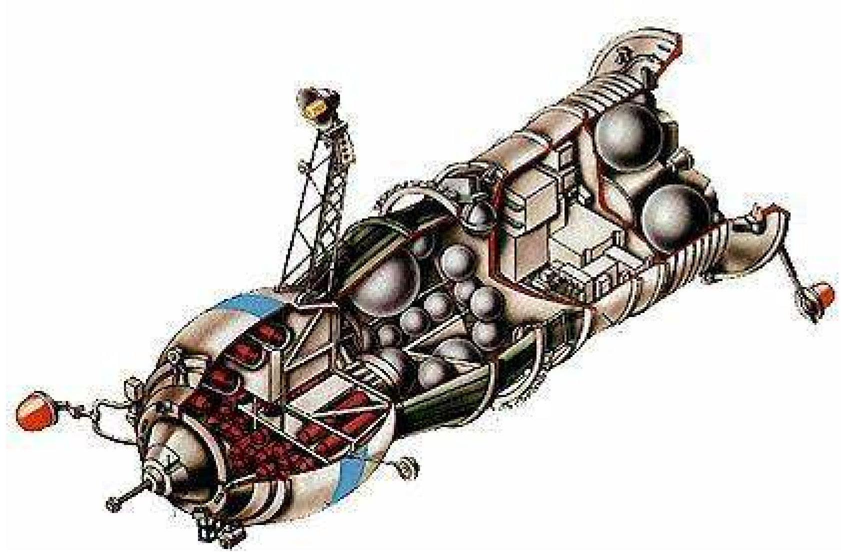
Soyuz TM spacecraft was fitted with the new Kurs docking system. Also, through the use of new parachutes its payload was increased and more space was available. In addition the spacecraft was fitted with the Luchs tracking system and incorporated various other improved instruments, including separate voice channels for each of the cosmonauts.

Soyuz TMA's main improvement was to the seating to accommodate taller cosmonauts, hence A = Anthropometricheski. In addition the solar arrays were extended to a span of 10.7 m.

The subsequent Soyuz TMA-M version carried improved avionics, data processing and cooling systems.

On the Progress side, the fitting of a Kurs docking system led to the Progress M version, which could dock at both the forward and the rear docking port of the Mir space station, thereby avoiding the need to shift spacecraft from the front to rear port etc. In addition Progress M had a re-entry module with a length of 1.47 m and a diameter of 0.78 m.

The Progress M1 cargo transfer spacecraft had an increased propellant load but a cargo capacity reduced to 2280 kg whilst Progress M-M was fitted with a new on-board digital control system.



Progress M

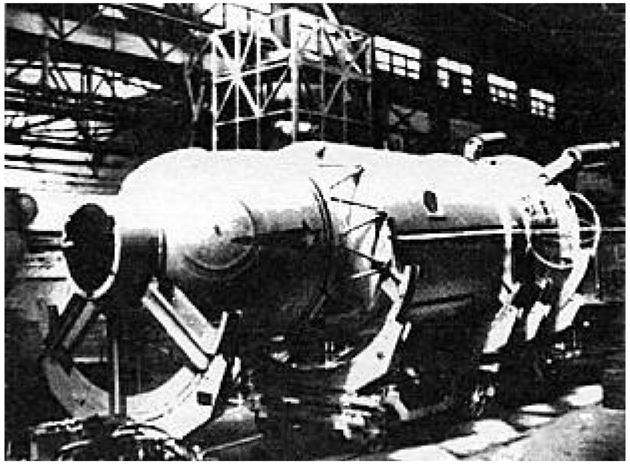
The latest version is the Progress MS-1 which was first flown on 21 December 2015. This improved version was fitted with a new rendez-vous and docking system identified as Kurs NA, a new antenna system identified as EKTS, a new computer, identified as TsVM-101, a smaller digital telemetry system as well as additional protection against space debris and micrometeorites. Through the use of lighter instrumentation, the cargo mass capacity was increased.
The TsVM-101 computer will also be the principal modification for the Soyuz MS version, which flew for the first time on 7 July 2016. Other improvements include the MBITS digital telemetry system, more power efficient solar panels, improved communications systems and modified docking and altitude control engines for increased fault tolerance during docking and deorbit burns.

Cancelled versions

In conclusion it is appropriate to make reference to some developments of the basic Soyuz spacecraft that never saw the light of day.
These included the Soyuz P (for Perekhvatchik = interceptor) which was intended to be used for piloted inspection and destruction of enemy spacecraft. After a rendez-vous with the enemy spacecraft a cosmonaut would make and EVA and, depending on the outcome of the inspection, the spacecraft would be destroyed, neutralized or returned to Earth for further inspection. The version was proposed in 1962 but further development was cancelled in early 1965.

The 1960s proposal for the Soyuz R (for Razvedchik = spy) envisaged a piloted reconnaissance spacecraft. 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.

Soyuz VI (for Voyenno-issledovatel'skiy) was a military research version of the basic Soyuz spacecraft. 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 use with 20 Almaz stations. Development was cancelled in February 1970.



Soyuz VI

The Soyuz 7K-S (for Spetsial'nyyye = Special) was a version of the 7K 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 of 6 August 1975 although further work on this versions had been cancelled in February 1970.

The Soyuz 7K-G (for Gruzovyye -= cargo) was intended to be a cargo transfer vehicle but its development was also cancelled in February 1970.

Conclusion

It is unusual to have a type of spacecraft like the Soyuz, reach a golden jubilee. It does, however, prove the versatility of the spacecraft in that it can be improved without affecting the major design concepts. As such, it is unlikely that we will see a replacement in the near future. In fact, in this author's opinion, the further application of modifications in line with new technologies, may see the basic design reach a 100th anniversary. Most of the readers, including your truly, will statistically not be able to witness that milestone event, so the suggestion is that we all have a toast of vodka on 28 November 2016 and salute the late Sergei Korolyov.

This is goodbye

It is with quite a lot of consideration and soul searching, as well as deep sadness, that I have decided - for strict personal reasons - to stop preparing the News Bulletin and this is - as far as I can see it - the last issue. Clearly the release of my lifetime work World Spacecraft Digest through the internet is also associated with this decision.

I started as the editor of then Astronautical Society of Western Australia's News Bulletin in July 1987 and have ever since then considered it a labour of love. Since then we have spread our wings and now go all over the world to about 200 recipients.

I have currently discussions with the Space Industry Association of Australia on the possibility of them continuing the News Bulletin, which first appeared in September 1973, under their banner but they are looking for an editor.

Should you feel that you can take on this task, wherever you may be in this small world, you may wish to contact the SIAA via contactus@spaceindustry.com.au. From my part, I will make my full database available to whoever may be the next editor. Furthermore, if the News Bulletin continues in whatever form, expect me to contribute occasional articles, as long as I can.

I wish to thank all readers for their support over these years .

Jos Heyman