THE STORY OF SPACE ACTIVITIES II.

Author(s) / Szerző(k):
Zsombor Rezsneki (PhD)
Ludovika University of Public Service
(Hungary)

E-mail:
drrezsneki@fitlaw.hu

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Abstract
This paper constitutes the second part of a two-part study. The first part examined the main stages that enabled the development of national space capabilities and was published in the 2025/1 issue of the journal Lélektan és Hadviselés. The present paper focuses on the space programs completed by the major space-capable countries, including the history of space missions, space telescopes, satellites, and space stations.
Keywords: Moon landing, rockets, satellites, outer space capability, geopolitics
Disciplines: military sciences, social sciences, engineering sciences

Absztrakt

AZ ŰRTEVÉKENYSÉGEK TÖRTÉNETE II.

Ez a tanulmány egy kétrészes tanulmány második részét képezi. Az első rész a nemzeti űrképességek fejlesztését lehetővé tevő főbb szakaszokat vizsgálta, és a Lélektan és Hadviselés folyóirat 2025/1-es számában jelent meg. A jelenlegi tanulmány a főbb űrképes országok által befejezett űrprogramokra összpontosít, beleértve az űrmissziók, űrteleszkópok, műholdak és űrállomások történetét.

Kulcsszavak: Holdraszállás. rakéták, műholdak, űrképesség, geopolitika,

Diszciplinák: hadtudomány, társadalomtudomány, műszaki tudomány

Space programs completed

In this subsection, the space programs beyond the atmosphere, i.e., those directed outward (Rezsneki, 2024), are analyzed and grouped, which best characterize the independence and technological development of a given country. As a geopolitical factor, the political, social, and economic components are examined, taking into account that the space achievements of a country, as well as its complexity and the process of its implementation, well characterize the given society and its political and economic structure. Technology and social preparedness are used as geopolitical indicators. From the first moment of the space race that started in the middle of the last century, rocket technology and satellite technology were the most expressive elements for demonstrating a country's space capabilities. Today is no different. It not only requires the highest technological preparedness from a given country, but is also a fundamental condition for both the protection of our planet Earth and interplanetary space travel. Without rocket technology, we cannot deploy spacecraft, and without satellite technology, we cannot access the appropriate information.

Space travels and space telescopes

The most comprehensive picture of a country's space capabilities can be obtained by evaluating its space travel, i.e. its outward activities. To interpret Table 1: the dates of individual programs differ from source to source, as some sources may have taken the date of completion as a basis, not the date of departure, which in the case of interplanetary travel can result in a difference of a few years to fifteen years. In the case of the programs, several experiments were carried out, but I did not indicate their number behind the program, for example, Pioneer–11, Venera–16, or Luna–26 today, etc. In the last column, the name of the planet indicates the destination, thus implying that during the journey the spacecraft may have passed by planets and other celestial bodies that were closer in the Solar System. Of course, the list of countries carrying out outward activities is constantly expanding, such as the United Arab Emirates (hereinafter referred to as UAE) and Israel, where the former has made successful steps towards Mars and the latter towards the Moon. However, these countries do not have a rocket capable of carrying out an interplanetary mission on their own, so they cannot be included in the list. Considering the direction of the publication, it is only worth examining the countries listed in the table, and I only took as a basis those space programs that help to understand the capabilities of each country relative to each other.

Table 1 clearly shows that the US leads the list of space travel numbers. It is followed by the outward activities of ESA and Japan. Russia slowly began to abandon the possibility of space travel at the end of the Soviet period, despite the fact that its technical capabilities would have made it possible, and only gained strength again with the improvement of the economy in the 2000s (Vzaoskaya, 2000).

After the economic collapse of the Soviet Union, it planned interplanetary travel mostly together with other countries. India and China lagged far behind these countries. Many other countries participated in one of the space programs in the table, to demonstrate their own technology, but these emerging countries - due to their lack of independence and capabilities - always join the space program of some developed country.

Comparing the technological achievements in Table 1, it is particularly noteworthy that the American Voyager-1 and Voyager-2 spacecraft have been active and sending valuable information to Earth since their launch in 1977. Voyager-1 left our solar system in 2012, Voyager-2 in 2018, and continues its journey of discovery in interstellar space (I1).

The interplanetary work carried out by the US is unique. Until now, only Europe has been capable of similar space travel.
In addition to Table 1, it is definitely worth mentioning space programs for observing non-specific celestial bodies and analyzing tools created for deeper understanding of outer space. These are space telescopes.

Since the 1970s, NASA, ESA, Japan and Russia (the Soviet Union) have only had spacecraft equipped with X-rays capable of studying the depths of space – other galaxies, black holes and other physical activities. Currently, only the US, Russia, Japan and ESA have demonstrated this capability multiple times (I2). For a long time, the most significant was the Hubble Space Telescope, launched in 1990 as part of a joint NASA-ESA pr ogram. However, in 2015, the Indian Space Research Organization (hereinafter referred to as ISRO) joined the elite club with its Astrosat program (I3). Currently, the most advanced spacecraft for studying space is the James Webb Space Telescope, launched in 2021 as part of a joint program between NASA, ESA and the Canadian Space Agency (hereinafter referred to as CSA) (I4). Japan launched its Hitomi space telescope in 2016, but the instrument was destroyed that year. On 28 August 2023, it successfully launched its XRISM space telescope, a joint effort of JAXA, NASA, ESA, and CSA, to study the afterlife of

Table 1: Space programs outward. Source: composed by the author based on the database of Space Agencies by countries

Country	**Mercur**	**Venus**	**Moon**	**Mars**	**Asteroid Copmet**	**Jupiter Saturn Uranus Neptunus Plutonus**
US	Mariner (1974) Messen-ger (2004)	Mariner (1962) Pioneer (1968) Magellan (1989) Cassini (1997) Galileo (1989) Messenger (2006) Parker Solar Probe (2018)	Pioneer (1958) Ranger1 (1961) Gemini (1964) Surveyor (1966) Apollo (1968) Voyager (1979) Clementine (1994) Lunar Prospector (1998) LRO & LCROSS (2009) Grail (2011) Ladee (2014)	Mariner (1962) Viking (1975) Galileo (1989) Mars Orbserver (1992) Mars Global Surveyor (1997) Mars Pathfinder (1997) Mars Polar Lander (1999) Rover Spirit (2004) Mars Reconnaissance Orbiter (2005) Scout (Phoenix) (2007) Curiosity (2011) Maven (2013) Ingenuity (2020) Perseverance (2020)	ICE (1986) Giacobini-Zinner comet Galileo (1991) Gaspra asteroid ISTP (1997) Hale–Bopp comet Contour (2002) Encke comet Stardust (2004) Wild–1 comet Deep Impact (2005) Tempel–1 comet Deep Impact (2010) Hartley–2 comet Stardust (2011) Tempel–1 comet Dawn (2011) Vesta asteroid Dawn (2011) eres asteroid OsirisRex (2016) Bennu asteroid	Pioneer (1972) Saturn Voyager–1 (1979) Saturn Voyager–2 (1986) Neptunus Cassini (1997) Saturn Galileo (1989) Saturn New Horizons (2006) Pluto Juno (2011) Jupiter
Russian Fede-ration (Soviet Union)	X	Luna (1959) Venera (1961) Venera7 (1970) Vega2 (1985)	Luna (1959) Zond (1968) Lunohod1 (1970) Luna (2023)	Luna (1959) Mars1 (1962) Mars3 (1971) Phobos 12 (1988) PhobosGrunt (unsuccessful) (2011) ExoMars (suspended) (2016)	X	X
China	X	X	Chang'e (2007) Chang4 (2019) Chang5 (2020)	Tianwen1 (2020) Huoxing1 (2020)	Chang'e (2012) Toutatis asteroid	X
India	X	X	Chandrayaan1 (2008) Chandrayaan2 (2019) Chandrayaan3 (2023)	Mars Orbiter Mission (2014)	X	X

Table 1 is continued on the next page...

Table 1 continued:

Country	**Mercur**	**Venus**	**Moon**	**Mars**	**Asteroid Copmet**	**Jupiter Saturn Uranus Neptunus Plutonus**
Japan	Bepi' Colombo (2018)	Akatsuki (2010)	MusesA (1990) Selene (2007)	Nozomi (2004)	MusesC (Hayabusha) (2003) Itokawa asteroid Hayabusha (2014) JU3 asteroid Hayabusha (2018) Ryugu asteroid ISTP (1997) HaleBopp comet	X
EU & ESA	Bepi' Colombo (2018)	Venus Express (2005) Solar Orbiter (2020)	Smart1 (2003)	MarsExpress (2003) Rosetta (2007) ExoMars (2016)	Giotto (1986) Halley's Comet & GriggSkejllerup comet ICE (1986) GiacobiniZinner comet Rosetta (2008) Stein asteroid Rosetta (2010) Lutetia asteroid. Rosetta (2016) 67P comet ISTP (1997) HaleBopp comet	Huygens (2005) Saturnusz JUICE (2023) Jupiter

black holes and stars (I5). Russia launched its Spektr-RG space telescope in 2019, which was developed with German and other foreign components, but is currently struggling with the fact that Germany, which carried out some of the development, does not allow the use of its instruments due to the Russian-Ukrainian conflict (I6). China is currently developing a space telescope similar to the above, Xuntian, which will be China's third space telescope after the HXMT space telescope launched in 2017, which was based on the results of the DAMPE space telescope launched in 2015, which was studied jointly with Switzerland and Italy (I7, I8, I9).

Sattelites

To say that we are in outer space requires us to pass through several layers of the Earth's atmosphere. From the Earth's surface, these are (I10):

- troposphere: 1–10 km
- stratosphere: 10 – 50 km
- mezosphere: 50 – 85 km
- termosphere: 85 – 600 km
- exosphere: 600 – 10 000 km

The troposphere is the densest layer of the atmosphere. About 80% of the mass of the atmosphere is concentrated here. The stratosphere accounts for 19% of the mass of the atmosphere and is also the location of the ozone layer. The mesosphere is best known for impacting meteors, which can be seen here before they are destroyed. This is followed by the thermosphere, where the Aurora Borealis phenomenon is visible, and then the exosphere, where real space travel takes place. The importance of the Kármán line, which was calculated by the Hungarian physicist Tódor Kármán – with a greater or lesser deviation – to be 100 km, should be highlighted (I11). In the scientific world, this is accepted as the boundary of outer space.
Satellites are deployed in space at different altitudes (I12):

- LEO (Low Earth Orbit) < 2000 km
- MEO (Medium Earth Orbit): 2000 km < 36 000 km
- GEO (Geostationaire Orbit): 36000 km
- HEO (Highly Elliptical Orbit): „Area at Moon" (I13)
- Cislunar space space around the Moon (Móczár, 2021)

Since the beginning of space exploration, 14,000 satellites have been launched beyond the atmosphere (I14). According to December 2021 data, 8,261 satellites are orbiting the Earth, of which 4,852 are active. The data is constantly changing – increasing or decreasing due to failure – as the number of orbital and suborbital launches exceeds a hundred per year and the number of satellites launched can be several hundred per month. At the beginning of 2022, active satellites are present around the Earth in the following distribution according to their purpose: communication (3,135); Earth observation (1,030); technology development (385); navigation, positioning (154); geological (22); other (18) (I15). As of April 2022, there were 5,465 active satellites orbiting the Earth, with the US having the most satellites with 3,433 satellites, followed by China with 541 satellites. Russia has 172 satellites, and the remaining 1,319 satellites are owned by other countries around the world (I16). As of February 2023, there are a total of 5,798 active satellites orbiting the Earth (I16). These numbers change monthly as countries continue to deploy spacecraft.

Currently, more than 80 countries and several private companies operate satellites. However, according to the current legal regulations, the launching state is responsible for damages caused by the spacecraft of private companies on its territory, so private companies are also subject to the jurisdiction of the given country. Constellations that are supervised by several nations occupy a significant place. ESA also has such multinational satellites. Their number can be estimated at more than 85, but they do not operate simultaneously (Heflich, & Saulnier, 2023).

At the same time, more than 50% of the satellites are owned by the American company SpaceX and the English company OneWeb (acquired by the Eutelsat Group on September 28, 2023) (I17, I18), China overtook the United Kingdom (ESA, European Space Agency member country) in terms of the number of satellites in early 2022 (I19). In terms of military use, 29 states were registered in 2020 that operated dual-use satellites. However, it is worth considering that these figures can only be considered as a generous estimate and that dual-use may arise in the case of all satellites. Of the 451 state satellites that are proven to be used for military purposes, the US has 204, China 114 and Russia 104 (I20). However, if we include the Starlink mega-constellation of the US-based company SpaceX, which has several thousand satellites – which also participated in the Russian-Ukrainian war – the number of dual-use satellites could increase several times (on August 26, 2023, the SpaceX mega-constellation reached 5,000, with an average of 50 satellites launched per week).

In terms of satellite capability analysis, the most reliable result is obtained when we consider the coordinated cooperation of satellites as constellations. Compared to solitary satellites, it is a significant organizational and technical step when several satellites are connected in order to obtain or transmit information. Such a constellation is the cooperation of satellites performing positioning, navigation, or timing (Positioning, Navigation, Timing, hereinafter referred to as PNT). Currently, there are four satellite systems that have achieved global coverage. Galileo (Europe), GLONASS (Russia), GPS (US) and BeiDou (China). At the regional level, NavIC (India) and QZSS (Japan) operate. Together, these satellite systems form the Global Satellite Navigation Systems (hereinafter referred to as GNSS), which were created through international cooperation.

The need for a GPS system arose during the Cold War in the 1960s for the US Navy to track nuclear-capable submarines, and was developed from 1973 and became fully operational in 1993 (I21). It was designed primarily for military use, but was later adapted for civilian applications. In the Soviet Union, development of the GLONASS system started in 1976, but after the collapse of the Soviet Union the system could not fulfil its purpose. It was only in 2012 that it reached the technological maturity to be successfully deployed by users (I22). In the 1980s and 1990s, China asked for and received help from Western space companies to build the constellation. In 1999, however, the US Cox report found that US, German and French companies had transferred special skills to Chinese engineers, leading the US to ban further technology transfer (I23). In 2004, China turned to Europe and a cooperation agreement was signed in which China joined in the initial research for the Galileo system. This was more of a financial contribution than a technological one on China's part. In 2008, however, the relationship was severed as China withheld technological know-how and developed technology that overlapped the Galileo bandwidth (I24). Currently, the European Galileo has the highest accuracy in the world (I26).

Today, the US company SpaceX owns the largest constellation of satellites, although not all of them are active, with 3 600 satellites launched so far (May 2023) and a further 7 500 satellites authorised by the end of 2023. The final plan is a second-generation constellation of 30 000 satellites. Second in line is the London-based OneWeb company (Eutelsat Group), which operates 650 satellites. Several companies and countries are planning to deploy similar constellations. Amazon is planning to deploy 3 200 satellite constellations under the Kuiper project, Canada's Telesat 300 (later 1 600) and Germany's Rivada 600 (I27). China has announced that it intends to launch 13 000 mega-constellations to counterbalance the SpaceX constellation, not secretly and with a similar name, "G60 Starlink"(I28). At the same time, years earlier, Rwanda had applied for a licence for 330 000 satellites from the International Telecommunication Union (ITU). While China intends to launch hundreds of satellites in the future with state support, Rwanda has already launched two. The number of satellites could reach 75 000 by the end of the decade, but the order of competition will remain unchanged. It is estimated that SpaceX and China will reach the required number, while OneWeb will remain the main competitor with almost 7 000 satellites, down from the 42 000 originally planned, and Amazon with around 3 200. South Korea will be on the space satellite map with 4 700 satellites (I29).

First step to be independent

Next, it is important to confirm which countries will be able to carry out space missions such as the above, or to independently launch spacecraft into orbit around the Earth in the near future. The surest way to do this is to look at the basic elements needed to launch a rocket system.

Table 2 summarizes the launch bases from which any ballistic missile could be launched. In the first column, next to the name of the country, is the total number of launch sites, including non-orbital launch sites, regardless of their inactive use. In the second column, the bases capable of serving space missions, and in the third column, the orbital launch sites by name can be found.

Analysis of Table 2 shows that the US and Russia are in first place, with India, Japan, ESA and China gradually catching up. Russia undertook a significant amount of wage startup before 2010, which was no longer required by other countries emerging after 2010 to develop their own – public and private – sectors (I32). Over the past few years, the number of Russian launches has been steadily declining as costs have been optimised in the market (I33) and orders for commercial launches have continued to fall as a result of the Russian-Ukrainian war (I34).

Table 2 shows that an increasing number of countries will be able to launch space assets in LEO orbits, so that they do not

Table 2: Launching sites by countries in year 2023. Source: I30.

Launching sites together orbital, suborbital and other ballistic by 57 countres regoin (pcs)(I31)	Active orbital launching sites	Released launches (orbital) from 1957–2023
Algeria (2)		
Antarktis (8)		
Antigua & Barbuda (1)		
Argentina (9)		
Australia (7)	1	Woomera Test Range
Bahama–islands (1)		
Barbados (2)		
Bermuda (1)		
Bulgaria (1)		
Brazil (3)	1	Alcantara Space Center
Canada (10)		
China (8)	4	Wenchang Satellite Launch Center Xichang Satellite Launch Center Taiyuan Satellite Launch Center Jiuquan Satellite Launch Center
Cook–islands (1)		
France (6)	1	Centre Spatial Guyanais
Germany (6)		
Greece (2)		
Greenland (2)		
Guam (1)		
Izland (1)		
India (3)	1	Satish Dhawan Space Centre
Indonesia (1)		
X-mass–island (1) (international)	1	Sea Launch Platform
Iran (2)	2	Semnan Satellite Launch Center Shahroud Missile Test Center
Irak (1)		
Izrael (1)	1	Palmachim Airbase
Olaszország (2)	1	San Marco Launch Complex
Japan (7–1)	2	Tanegashima Space Center Kagoshima Space Center
Kazakstan (7)	1	Bajkonur
Kerguelen–islands (1)		
Libia (1)		
Libanon (1)		
Maldív–islands (1)		
Marshall–islands (7)	2	Kwajalein Island, Reagen test site Omelek Island
Mauritius (1–1)		
Mexico (1–1)		
Mongolia (1–1)		

Table 2 is continued on the next page...

Table 2 continued:

Launching sites together orbital, suborbital and other ballistic by 57 countres regoin (pcs)(I31)	**Active orbital launching sites**	**Released launches (orbital) from 1957–2023**
New–Zeeland (4–3)	1	Onenui Station
Norvegia (3–1)		
North–Korea (13)	2	Sohae Satellite Launching Station Tonghae Station
Pakistan (2)		
Panama (1)		
Peru (1)		
Poland (1)		
Puerto–Rico (2)		
South–Africa (1)		
South–Korea (2)	2	Naro Space Center Jeju Island Launch Platform
Spain (2)	1	——
Suriname (1)		
Sveden (3)		
Taiwan (2)		
Turkez (1)		
Turks- és Caicos-islands (1)		
United Kingdom (5)		Spaceport, Cornwall
US (47)	10–1	Cape Canaveral Kennedy Space Center Starbase, Texas Edvards AFB, California Vadenberg, California Kaui test facility Wallops Flight Facility Wallops MARS Pacific Spaceport Complex
Russian Federation (31) (Szovjetunió)	6	Bajkonur űrkikötő Jasznij kilövőbázis Kapusztyin Jar rakétaindító telep Pleszeck űrkikötő Szvobodnij űrrepülőtér Vosztocsnij űrkikötő
Üzbekistan (1)		
Zaire (1)		

necessarily require the use of larger rocket systems capable of longer space missions.

Space stations

After analysing the space programmes essential for the exploration of space and the rocket launchers needed for their immediate implementation, this paper shows the conditions under which space stations were created. The continued existence and development of space stations is made possible by a combination of these areas.

In the 1960s, the US attracted the interest of the rival Soviet Union to set up its own programme with the Dyna-Soar military observation satellite. This technology already allowed the opposing sides to observe each other from space. The space station project could be implemented mainly as a spinoff of the Moon programme. The conquest of the Moon raised the question of whether Mars should be the next destination or whether the construction of a space station should take priority. However, the opposing groups eventually agreed that the effects of a continuous stay in space should be studied in advance before embarking on a longer space journey (Horváth, 2014). In 1963, the US published the design of the Manned Orbiting Laboratory (hereinafter referred to as MOL), and the Soviets had a design ready to be implemented, details of which were later included in the Almaz and Salyut programmes (Holsclaw, 2018). Both powers assured themselves that if the moon landing failed, its spacecraft would be used as a space station in the future. The MOL programme was cancelled by the US in 1969 and focused solely on the moon landing. At the same time, the Space Shuttle – STS – programme plans were published, with improvements carried over from the earlier Gemini project, which included the launch of continuous space assets, space experiments and live missions to an Earth-orbiting space station. The Soviet Union launched the Salyut-1 space station programme in 1971, but it was still fraught with many failures and came to a tragic end when the crew died on re-entry. The Soviet Union was keen to demonstrate a mission equivalent to the Moon programme, but the US had already sent 12 astronauts to the Moon during this period, 1969-1972. The Soviet Union made several attempts to land on the Moon as part of the N-1 programme (Johnson,1995), but these failed to reach beyond the Earth's atmosphere. The US cancelled the Moon programme in 1972. At the same time, it launched the Skylab space station in 1973 (Challirwar, 2019). The Soviet Union achieved undisputed success with the Salyut series of programmes, which included numerous experiments of importance to human life, but the real success was achieved with the US Space Shuttle programme. The US, the USSR and other countries used it to reach the MIR space station, but its main activity was to provide transit to the International Space Station for decades. The Space Shuttle programme carried out 135 missions from 1981 to 2011 (Zabel et.al, 2014).

Comparing the different space stations, as shown in Table 3, we can say that the Soviet Union, as in the "first man in space" race, wanted to get ahead of the US with simpler technology and riskier ways (I35, I36). As an earlier proof of this, Gagarin's spacecraft was not prepared for a safe re-entry and had to eject before impact. This fact was kept secret until 1991 (Kiss, 2020). The size of the Salyut was not competitive with the Skylab space station. At the same time, it was proven that the dual nature of Salyut, launched in 1971, was intended to observe the other side during the US lunar

Table 3: Installed space stations. Source: composed by the author based on database from NASA

Space Station	Mass (kg)	Length (meter)	Width (meter)	Altitude (km)
Saljut (Almaz miitary)	18 425	20	15	200
Skylab	76 540	25	17	440
MIR	129 700	19	31	350
International Space Station (ISS)	440 725	73	109	420
Tiangong	90 000	35	12	390

programmes. The US, however, developed and made Skylab more usable, while preparing a longer-range and more serious space station in all respects.

The Soviet Union carried out a number of experiments, but the results of the MIR space station, which followed the Salyut programme, were more satisfactory. The MIR space station still fell short of the size and achievements of the ISS, and the cost of maintaining it showed the future need for international cooperation. The newer version of the space station launched by China was also based on the designs of the MIR space station that operated in the 1980-90s (I37). The MIR space station is one fourth the size of the International Space Station, including the main module and the experimental modules (I38). The US and ESA launched the Spacelab microgravity laboratory in 1973, which was a joint programme and the construction of the two modules was carried out by ESA. The US provided the transport of the astronauts and the purchase of one of the modules. Spacelab had a pressurised module, a habitation module, a depressu-rised module and other related parts. The laboratory was not a full-fledged space station, but it operated until the ISS entered service and was used for dozens of missions (I39). The ISS was launched in 1998 and today research is carried out in cooperation with 15 countries. 227 space-walks have been carried out and 240 astronauts from 19 countries have visited the ISS (I40). More than 3000 experiments have been carried out for 108 countries (I41).

Russia announced in 2021 that it would leave the ISS programme as a former founding member and build its own space station. Construction is scheduled to start in 2027 and be completed in 2032. Russia has signed a partnership agreement with the ISS until 2028, but has already invited the BRICS countries (Brazil, Russia, India, China, South Africa) to its space station and offered them the opportunity to install their own module (I42). The new space station will be called the Russian Orbital Service Station (hereinafter referred to as ROSS) and will include new modules, a new spacecraft and a new transportation vehicle (I43). India has already announced in 2019 that it intends to launch a stand-alone space station by 2030, and the ongoing implementation of this is being seen under the Gaganyaan programme (I44).

The competition is even more interesting if we consider the developments that are now being organised by private companies. There are several projects currently being implemented by private companies that will fill the gap left by the ISS. The Heaven-1 model, developed by Vast and other companies (SpaceX, Axiom), will be launched in 2025 as a precursor to a new space station planned for around 2030. It will be able to accommodate 40 people at a time (I45). In 2027, the Starlab space station, developed by Nanoracks and other companies (Airbus, Thales Alenia Space, Voyager Space, Lockheed Martin), will begin operations with research, tourism and other missions (I46). Its size is just below that of the ISS. ISRO, whose main task is to transport astronauts to the space station, is also involved in the programme (I47). One will also be developed by Northrop Grumman and will be similar to – and replace – the ISS, which will become operational around 2028-2030 (I48). The Orbital Reef space station from Blue Origin and other companies (Sierra Space; Axiom Space; Boeing) will also debut in 2027 with a capacity close to that of the ISS (I49). Under the Artemis agreement (NASA, ESA and invited countries to build a lunar base), the Lunar Gateway will deploy a small space station around the Moon in preparation for an expedition to Mars. Its construction is of course not yet complete. These ventures are being led by private companies and space agencies from the US and Western Europe.

Findings

It is clear that after the turn of the 20th century, it was the US, Russia, Germany, the UK and France that put space exploration on a concrete scientific footing. Although real progress and inspiration had already been achieved in research before the Second World War, the merit of Nazi scientists in rocket research as a means of laying the technical foundations for its realisation cannot be denied. They went furthest in building missile systems, and the two main competing powers, by acquiring the designs and the scientists to develop them, became increasingly capable of conquering the new field of research. By then, of course, American and Soviet science was ready to explore the field of space exploration and develop their own space activities. My analysis has led me to conclude that the US had a clear technological edge and that the political attitude of decision-makers and the social acceptance of space exploration were in line with the objectives of the intended Moon landing. However, this was no longer the case in the Soviet Union. Because of the political establishment, e.g. scientists of exceptional talent were sent to labour camps in Siberia, and the passivity of society towards the persecution of the greatest scientists of the time was quite evident.

Space achievements continue to show that the world has not changed since the Cold War. The two poles remain, but the actors on one side have changed. The unity of the West has been maintained since the Second World War, but Russia (the Soviet

Union) has been joined – or superseded – by China. Apart from the Moon landing, the biggest technological demonstration, the construction and maintenance of the space station, is also associated with the US. Of course, the initial Soviet steps cannot be dismissed, but they were a substitute for the failure of the Moon landing. The Chinese space station, based mainly on Soviet technology, has not yet reached the level of the ISS, which has been in operation for 20 years, and the Chinese space station is still in its early stages of operation. It should be pointed out that a number of private space stations will be launched in the next few years with similar or better technical conditions than the ISS. It can be concluded that the launch of the Chinese space station seems to be overdue and does not represent an innovation in the scientific field. It only shows that that every country capable of doing great things if they get the support of western thoughts. Technological progress has not changed significantly, either in terms of launchers or satellite capabilities, compared with other countries. Of course, a number of countries are joining in the competition on the western side, but the objective remains the same: Asia wants to catch up with the alliance between the US and Europe.

However, the case of the defunct ISS shows that the state is withdrawing from the maintenance of the space station and handing it over to private companies, together with the tasks that go with it. The US and its allies have paved the way for a safe and viable way for enterprising private companies to continue.

At the same time, in terms of the space programmes that have been implemented, we see that there is a significant divergence between the allied sides, or rather between the two poles. The US and the European countries have a superiority in space exploration that the other side will probably not be able to match for decades (or rather this century). Especially as the Western countries are constantly coming up with new programmes and continue to lead the way. At the same time, China has received a great deal of help from Russia and owes much of the dynamic development of its space programme to this.

Based on the analysis of both missile capabilities and space station or satellite constellations, I have come to the conclusion that China and Russia are no longer competing with the US or some of the leading countries in Europe in terms of technology, but that private companies have emerged and are competing with China or other countries. The fact that the US government is now handing over to private companies the operation of space stations, as in the field of rocket launches and satellite capabilities, suggests that resources need to be devoted to more serious space exploration projects at state level. Furthermore, with private companies entering a particular field of space activities, the costs are also reduced and a country has to pay a fraction of what it did a decade or two ago to put its space assets into orbit. Moreover, not only political decision-makers but also economic decision-makers have become interested in the development of space activities.

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