Ninth International Conference
Globalization: business, finance and education – GB-2019

From Globalization to Planetization – is the Time of Colonization of the Solar System Approaching?

Pavel Stoynov
Sofia University "St. Kliment Ohridski"
Faculty of Economics and Business Administration
Sofia, Bulgaria
todorov@feb.uni-sofia.bg

Abstract.
It can be said that the globalization of the society is ongoing. Now, the main concern for the society is whether it will succeed to jump to other planets before the Earth resources become completely exhausted. The technologies now are developing rapidly but still the level allowing colonization of other planets is not achieved. Economies could assure fast development of the advanced technologies. Another important issues are the regional struggles between multi-polar political powers which spends resources for unnecessary political competition. Solving economic, technological and political issues are the key for speed-up of preparation for colonizing the near planets.

Also presented at the 11th International Conference "The Economies of the Balkan and the Eastern European Countries in the Changing World" - EBEEC-2019, Bucharest, Romania

Keywords: globalization, planetization, technologies, economy, policy
JEL CLASSIFICATION CODES O33, O57, N40

Introducation

Humanity today faces global challenges related to the overpopulation of the planet and its exhausted resources. To meet successfully these challenges, people must make effort to strengthen and concentrate the economical, political and technological potential of mankind in order to speed up planetization and further exploration of the space.

The term planetization is used so far with different meanings. In this article, it is used with two meanings:

1. Building sustainable human society and symbiosis between mankind and the Earth.
2. Human colonization of the other planets of the Solar system.

The planetization in the first sense is called inner planetization. Respectively, it is suitable to denote the first prospective stage of human penetration in space – the colonization of the planets of the Solar system – outer planetization.

1. From inner to outer planetization

Because of the fast growing of the human population and the decrease of natural resources on Earth, it is clear that at some stage the leave of Earth should be matter of surviving. Staying on Earth at some time would lead to extinction.

So, outer planetization and following penetration in deep space are necessary and humanity must perform intensive space exploration to finalize the outer planetization. Stephen Hawking, renowned British theoretical physicist, said: "I don't think the human race will survive the next thousand years, unless we spread into space. There are too many accidents that can befall life on a single planet. But I'm an optimist. We will reach out to the stars." (Highfield, 2001).

The potential objects of outer planetizations are the planets of the Solar system and their natural satellites.

The Moon is the closest object of interest. So it is explainable why it became the first celestial body to be the object of space exploration. It was the first outer planetization object to be flown by, orbited, and landed upon by spacecraft, and the only outer planetization object ever to be visited by humans.

In 1959 USSR obtained the first images of the far side of the Moon. In 1966 the Soviets started deploying landers to the Moon which were able to obtain data directly from the Moon's surface, closely followed by landers of USA. In the early 1970s, first uncrewed rovers of Lunokhod program were deployed by USSR and lunar soil samples were brought to Earth for study. This marked the first (and to date the only) automated return of extraterrestrial soil samples to Earth.

Crewed exploration of the Moon began in 1968 with the Apollo 8 mission that successfully orbited the Moon. In 1969, the Apollo 11 mission marked the first time humans set foot upon another world. The Apollo 17

mission in 1972 marked the sixth landing and the most recent human visit there, and the next, Exploration Mission 2, is expected to orbit the Moon in 2023.

The exploration of Mars has been an important part of the space exploration programs of the Soviet Union (later Russia), the United States, and later of EU, Japan and India. Dozens of robotic spacecraft have been launched toward Mars since the 1960s. These missions gathered data about current conditions and history of Mars.

In contrast to overall high failure rates in the exploration of Mars, India has become the first country to achieve success since the first trial. India's Mars Orbiter Mission (MOM) (Harris, 2014) is one of the least expensive interplanetary missions ever undertaken with an approximate total cost of US $73 million.

The first mission to Mars by any Arab country has been taken up by the United Arab Emirates. Called the Emirates Mars Mission, it is scheduled for launch in 2020.

The exploration of Jupiter has consisted solely of a number of automated NASA spacecraft visiting the planet since 1973. A large majority of the missions, like Pioneer and Voyager programs, were detailed observations without the probe landing or entering orbit. The Galileo and Juno spacecraft are the only spacecrafts to have entered the planet's orbit. As Jupiter is believed to have only a relatively small rocky core and no real solid surface, a landing mission is precluded.

Saturn has been explored only through automated spacecraft launched by NASA, including one mission (Cassini–Huygens) planned and executed in cooperation with other space agencies. These missions consist of flybys in 1979 by Pioneer 11, in 1980 by Voyager 1, in 1982 by Voyager 2 and an orbital mission by the Cassini spacecraft, which lasted from 2004 until 2017.

Saturn has at least 62 known. The largest of the moons is Titan, which is the only moon in the Solar System with an atmosphere denser and thicker than that of Earth. Titan is also the only object in the Outer Solar System that has been explored with a lander, the Huygens probe deployed by the Cassini spacecraft.

The exploration of Uranus has been entirely through the Voyager 2 spacecraft, with no other visits currently planned. The closest approach to Uranus occurred on 24 January 1986. Voyager 2 studied the planet's unique atmosphere and magnetosphere, examined its ring system and the moons of Uranus including all five of the previously known moons, while discovering an additional ten previously unknown moons.

Images of Uranus proved to have a very uniform appearance, with no evidence of the dramatic storms or atmospheric banding evident on Jupiter and Saturn. Great effort was required to even identify a few clouds in the images of the planet. The magnetosphere of Uranus, however, proved to be unique, being profoundly affected by the planet's unusual axial tilt. In contrast to the bland appearance of Uranus itself, striking images were obtained of the Moons of Uranus, including evidence that Miranda had been unusually geologically active.

The exploration of Neptune began with the 25 August 1989 Voyager 2 flyby. The possibility of a Neptune Orbiter has been discussed, but no other missions have been given serious thought.

Exploration of Neptune had obvious banding, visible clouds, auroras, and even a conspicuous anticyclone storm system rivaled in size only by Jupiter's small Spot. Neptune also proved to have the fastest winds of any planet in the Solar System, measured as high as 2,100 km/h (Suomi, Limaye, Johnson, 1991). Voyager 2 also examined Neptune's ring and moon system. It discovered 900 complete rings and additional partial ring "arcs" around Neptune. In addition to examining Neptune's three previously known moons, Voyager 2 also discovered five previously unknown moons, one of which, Proteus, proved to be the last largest moon in the system.

The dwarf planet Pluto presents significant challenges for spacecraft because of its great distance from Earth and small mass, making capture into orbit very difficult. Voyager 1 could have visited Pluto, but controllers opted instead for a close flyby of Saturn's moon Titan, resulting in a trajectory incompatible with a Pluto flyby. Voyager 2 never had a plausible trajectory for reaching Pluto (Harwood, 2013).

Pluto continues to be of great interest, despite its reclassification as the lead and nearest member of a new and growing class of distant icy bodies of intermediate size (and also the first member of the important subclass, defined by orbit and known as "plutinos"). After an intense political battle, a mission to Pluto dubbed New Horizons was granted funding from the United States government in 2003.New Horizons was launched successfully on 19 January 2006. In early 2007 the craft made use of a gravity assist from Jupiter. Its closest approach to Pluto was on 14 July 2015. The observations of Pluto began five months prior to closest approach and continued for 16 days after the encounter.

3. Planetization and economy

The space exploration is costly. USA can afford the largest spending for that purpose, but space exploration is a relatively minor line item in the U.S. budget. NASA’s spending peaked at almost 4,5% of the federal budget in fiscal year 1966, declined to 1% by 1975, and has gradually fallen to about 0,5% in recent years.

If the research and development budgets in the Obama administration's federal budget proposal is considered as an example, for fiscal year 2011 NASA would receive $11 billion, out of a total research and development budget of $148.1 billion. Other space activities are funded out of the research and development budget of the Department of Defense, and from the budgets of the other regulatory agencies involved with space issues.

The 2015 budget proposal for NASA is $17,5 billion, just below the $17,7 billion appropriated for 2014. Major expenditures include science missions ($5 billion), space operations such as the ISS ($3,9 billion), and new commercial and public exploration development ($4 billion).

Historically, 85-90% of NASA's budget went to private contractors—largely to design and manufacture rockets and spacecraft—while NASA maintained close oversight and operated the equipment. But now NASA is beginning to privatize operations as well through the Commercial Orbital Transportation Services program initiated in 2006.

Advocates believe private firms such as SpaceX and Orbital Sciences—both of which won contracts to ferry ISS cargo—can provide routine LEO access at a lower cost, eventually even for manned flight. Proponents of this shift say NASA could then focus more on missions that push scientific and exploration frontiers. Some go further in suggesting that NASA become more like the Defense Advanced Research Projects Agency or the National Science Foundation by setting objectives—such as capturing an asteroid—and then giving grants to private firms.

Entering of private companies in space industry in USA and in other countries show that the time of refunding of huge space exploration costs is coming. Revenues can be obtained from space travels or mining asteroids and planets.

Developments in late 2014 demonstrated the continuing challenge of pursuing safe and reliable space travel. Virgin Galactic had collected more than seven hundred deposits for planned suborbital flights, priced at $250 000 per seat, before a fatal crash during an October 31 test flight.

Some entrepreneurs see a commercial future in space beyond NASA contracts and satellite launches, although many ventures are still on the drawing board. Space Adventures offers customers the opportunity to orbit Earth and experience spectacular views and weightlessness.

Planetary Resources and Deep Space Industries are pursuing asteroid mining, which supporters believe could supply future space colonies and provide a new abundance of precious metals and rare earth elements.

4. Planetization and policy

This section considers the key policy-makers in the area of space exploration – the countries having enough human, economical and technological resources to participate in space exploration currently. The past achievements, the current state and the future of the space exploration are briefly presented.

The launch of Sputnik in October 1957, of the first human in space - Yuri Gagarin – in 1961 and the subsequent USSR achievements were the beginning of the space exploration era. Now, Russia is successor of USSR in space exploration.

The second major player in this more than 60-year-lasting process are USA. President John Kennedy committed the United States to a lunar landing. After six successful lunar missions, NASA's manned program pulled back to Earth, while robotic missions such as Voyager and Viking continued to explore the Solar System. NASA focused on sending astronauts into low earth orbit (LEO) with the 1973 launch of Skylab, the first U.S. space station, and the Space Shuttle.

The Space Shuttle served NASA for thirty years (1981–2011) and helped build the International Space Station (ISS), an orbiting laboratory that has been continuously occupied by humans since 2000.

NASA proposes to move forward with the development of the Space Launch System (SLS), which will be designed to carry people, as well as important cargo, equipment, and science experiments to Earth's orbit and destinations beyond.

The George W. Bush administration pushed for a return to the moon and a trip to Mars, but President Barack Obama favored an asteroid mission. The project has evolved into a plan to capture an asteroid twenty to thirty feet in diameter and redirect it into a lunar orbit for astronauts to visit early in the next decade. The Obama administration also set a goal of a manned mission to orbit Mars by the mid-2030s, which would require the commitment of subsequent presidents.

China became the third nation to independently launch a human into orbit in 2003. Launching before that 79 satellites since 1970. Chinese space program is also planning to reach the moon and to build 60-ton multi-module space station in near future.

Meanwhile, India launched its first unmanned mission to Mars in late 2013, and its probe entered Mars's orbit in September 2014. The Indian Space Research Organization has since reached an agreement with NASA on subsequent explorations of Mars.

Another international mission, the dramatic landing of a European Space Agency probe on a comet, attracted widespread interest in November 2014. Though a landing mishap failed to anchor the probe properly, it was still able to send a large amount of valuable data to scientists.

Space can also inspire international cooperation. The 1975 Apollo-Soyuz Test Project, where U.S. and Russian spacecraft docked for the first time, as well as today's ISS project unites leading fourteen nations in perhaps humanity's most expensive project.

The space agencies of Europe, Russia, and Japan were also important partners on robotic missions such as the Mars rovers Spirit and Opportunity. The ISS will likely deorbit in the 2020s, but many say deeper space missions will likely need to be international ventures.

Unfortunately the rivalry between the great power still limits the efforts for a complete collaboration. Each power has its own military space program.

At the beginning of 2019 the Pentagon issued a new document – Review of the anti-missile defense (2019) in which militarization of the close Earth orbit is considered. There will be a layer of cosmic sensors around the globe which will register early any ballistic missile launch from any point of the world. This will ensure more time for calculation of the missile trajectory and for eventual destroy of the missile. The prototype of such a sensor will be ready about 2020. There will be also deployment in orbit of laser systems to destroy the missiles of the enemy in the cosmos. A six-month test period is considered for military before to finally decide if the project will start. There are some alternative of the space defense system. For example, the missiles of the enemy can be destroyed by aircrafts F-35 or by drones equipped by laser weapon.

There are five space law treaties ratified by the United Nations Committee on the Peaceful Uses of Outer Space (OOSA Treaty Database, 2011) covering "non-appropriation of outer space by any one country, arms control, the freedom of exploration, liability for damage caused by space objects, the safety and rescue of spacecraft and astronauts, the prevention of harmful interference with space activities and the environment, the notification and registration of space activities, scientific investigation and the exploitation of natural resources in outer space and the settlement of disputes" (United Nations Treaties and Principles on Space Law, 2011).

Since October 1967 satellite based weapons systems have been limited by international treaty to conventional weapons only. Art.IV of the Outer Space Treaty (1967) specifically prohibits signatories from installing weapons of mass destruction in Earth orbit. The treaty became effective on 10 October 1967 and, as of May 2013, 102 countries are parties to the treaty with a further 27 pending full ratification.

The United Nations General Assembly adopted five declarations and legal principles which encourage exercising the international laws, as well as unified communication between countries with, among them:

- The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting (1982)
- The Principles Relating to Remote Sensing of the Earth from Outer Space (1986)
- The Principles Relevant to the Use of Nuclear Power Sources in Outer Space (1992)
- The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (1996).

All space exploration will be done with good intentions and is equally open to all States that comply with international law. No one nation may claim ownership of outer space or any celestial body. Activities carried out in space must abide by the international law and the nations undergoing these said activities must accept responsibility for the governmental or non-governmental agency involved. Objects launched into space are subject to their nation of belonging, including people. Objects, parts, and components discovered outside the jurisdiction of a nation will be returned upon identification. If a nation launches an object into space, they are responsible for any damages that occur internationally.

As the nation-state model fails to meet the global changes in the most adequate way, many researchers consider alternative types of human organization.

One proposal is the creation of a cosmic supra-state based on peace, justice and sustainable human progress.

But to reach this end the society has long way to pass. The opposition East-West from the cold war era was changed by the uni-polar world where USA hegemony took center stage. But recently the Islam challenged the Western cultural paradigm of modernity in the field of religion. The global terrorism challenged USA in the field of brute force. And a multi-polar world has emerged with China, India, Russia and EU challenged the USA in politics and economy.

The integration at national and other levels is one way to achieve inner planetization in the globalized world.

5. Planetization and technology

Space technology is technology for use in space exploration.

The main types of space technologies are: satellite technology, space exploration technology and space flight technology.

Satellite technology is related to development of satellites. The main types of satellites are: communications satellite, direct-broadcast satellite, earth observation satellite, geosynchronous satellite, military satellite, reconnaissance satellite, navigation satellite, tracking and data relay satellite, weather satellite.

Examples of space exploration technologies include are the space stations.,

Examples of Space flight technologies are rockets and space shuttles.

A booster rocket (or engine) is either the first stage of a multistage launch vehicle, or else a shorter-burning rocket used in parallel with longer-burning sustainer rockets to augment the space vehicle's takeoff thrust and payload capability.

NASA's Space Shuttle was the first manned vehicle to use solid-fueled boosters as strap-ons. The solid boosters consisted of stacked segments, and were recovered and reused multiple times.

In a new development program initiated in 2011, SpaceX developed reusable first stages of their Falcon 9 rocket. After launching the second stage and the payload, the booster returns to launch site or flies to a drone ship and lands vertically. (Wikipedia, 2019). The program is intended to reduce launch prices significantly.

Many common everyday services such as weather forecasting, remote sensing, GPS systems, satellite television, and some long distance communications systems critically rely on space infrastructure. Of the sciences, astronomy and Earth science (via remote sensing) benefit from space technology. Also, space technologies lead to transferring technologies and innovations in other industry sectors.

NASA catalogues some 1 800 spinoffs in which technologies originally developed for space exploration were transferred to the private sector. Some are obvious, such as communications satellites, but other transfers are less well known. Many medical advances derived from space technologies, from refinements in artificial hearts to improved mammograms and laser eye surgery. Space exploration drove the development of new materials and industrial techniques, including thermoelectric coolers for microchips, high temperature lubricants, and a means of mass-producing carbon nanotubes, a material with significant engineering potential. Even household products such as memory-foam mattresses, programmable ovens, vacuums, and ski apparel trace their origins to NASA.

Some of the best candidates for future deep space engine technologies include anti-matter, nuclear power and beamed propulsion. The latter, beamed propulsion, appears to be the best candidate for deep space exploration presently available, since it uses known physics and known technology that is being developed for other purposes.

References:

Harris, G., 2014. On a Shoestring, India Sends Orbiter to Mars on Its First Try. *New York Times*. 24 September 2014.

Harwood, W., 2013. Voyager 1 finally crosses into interstellar space. *CBS News*. (September 12, 2013).

Highfield, R., 2001. Colonies in space may be only hope, says Hawking. *The Daily Telegraph*. London. 15 of October 2001.

OOSA Treaty Database, 2019. *United Nations Office for Outer Space Affairs*.

Outer Space Treaty, 1967. *OOSA Treaty Database* (2019)

Review of the anti-missile defense, 2019. *Penthagon*.

Suomi, V., S. Limaye, D. Johnson, 1991. High winds of Neptune: A possible mechanism. *Science*. 251 (4996): 929–932.

The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, 1996. *OOSA Treaty Database* (2019)

The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, 1982. *OOSA Treaty Database* (2019)

The Principles Relating to Remote Sensing of the Earth from Outer Space, 1986. *OOSA Treaty Database* (2019).

The Principles Relevant to the Use of Nuclear Power Sources in Outer Space, 1992. *OOSA Treaty Database* (2019)

Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 2013. *United Nations Office for Disarmament Affair (2019)*.

United Nations Treaties and Principles on Space Law, 2011. *United Nations Office for Outer Space Affairs*, 2019.

Wikipedia (2019) https://www.wikipedia.org

Note: When no other reference showed, the facts used in the article are cited by Wikipedia (2019).