INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY

MODEL UNITED NATIONS - 2019

UNITED NATIONS COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE

BACKGROUND GUIDE

LETTER FROM THE CHAIRPERSON

Dear Delegates,

It would be our greatest honour to serve on the executive board for the simulation of the United Nations Committee on the Peaceful Use of Outer Space (UNCOPUOS) at Indian Institute of Space Science and Technology Model United Nations 2019.

At this moment that you might be experiencing pangs of anxiety and excitement while you are into your preparation for committee. We guess that the first timers might be a little nervous about meeting new people, or perhaps the experienced ones are a little eager to get into those fancy formal attire.

We value your involvement to redefine diplomacy and thus, with utmost sincerity we have tried to prepare this study guide so that you can best represent your country stepping into the shoes of diplomats, and more importantly your ideas at the simulation of the committee on the peaceful use of outer space

Kindly utilise this document as a guide, and not as an encyclopaedia, as it does not contain all the information, analysis or concepts related to the agenda. It tries to introduce the agenda to you in a way that you are all at par with your understanding, and that you are aware of some basics. Do keenly take note of this document, but we definitely encourage you to go way beyond it. Surprise us if you can. Do make keen note of further Reading section and references sections in the study guide which might skeletally guide you through your further research.

We will be following a customised version of the UNA-USA rules of procedure (will be explained in detail during the 1st session of the Committee). All documentations (formal and informal) will be accepted only in English. All other UN recognised languages shall be suspended for this simulation. The committee will happen in 2 Sections sequentially, discussing both the subcommittees namely Legal Subcommittee and Scientific and Technical Subcommittee in the two-day tenure

Rest assured, we promise you that we will try to make this a memorable experience for all. There will be both moments of laughers and of serious contemplation, deliberation and negotiation and what else a lot of learning and socialising. We look forward to meet each one of you at IIST MUN 2019.

Best Regards
Annamalai Moorthy - Chairperson
On behalf of the Executive Board of UNCOPUOS
Indian Institute of Space Science and Technology Model United Nations 2019

EB composition:
Annamalai Moorthy (Chairperson)
Nihal Sahu (Vice-Chairperson)

REGIMES FOR THE USE OF NUCLEAR POWER IN SPACE EXPLORATION

A space exploration mission requires power at many stages: for the initial launch of the space vehicle and for subsequent manoeuvring; for instrumentation and communication systems; for warming or cooling vital systems; for lighting; for experiments and many more uses, especially in manned missions.

To date, chemical rocket thrusters have been used for launching. It would be tempting to believe that all power could be supplied by solar means since the sun is available and free. However, in many cases the mission may take place in the dark and large solar panels are not always suitable for a mission. Figure 1 shows the regimes of possible space power applicability.

For short durations of up to a few hours, chemical fuels can provide energy of up to 60 000 kW, but for durations of a month use is limited to a kilowatt or less. Owing to the diffuse nature of solar power, it is not practicable to provide rapid surges of large amounts of energy. On the other hand, solar power is most efficient for power levels of some 10–50 kW for as long as it is needed.

Nuclear reactors can provide almost limitless power for almost any duration. However, they are not practicable for applications below 10 kW. Radioisotopes are best used for continuous supply of low levels (up to 5 kW) of

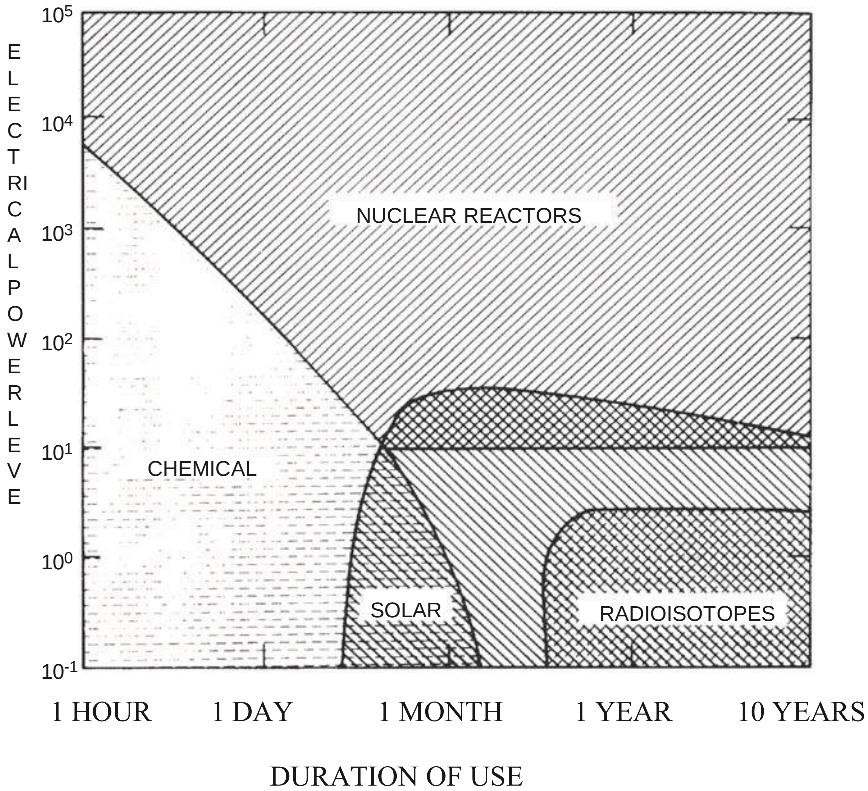


FIG. 1. Regimes of possible space power applicability. Source: Los Alamos National Laboratory.

power or in combinations up to many times this value. For this reason, especially for long interplanetary missions, the use of radioisotopes for communications and the powering of experiments is preferred.

Figure 2 shows that from any nuclear process, heat is emitted. This heat can then either be converted into electricity or it can be used directly to supply heating or cooling. The initial decay produces some decay products and the use of the thermal energy will provide some additional excess thermal energy to be rejected.

The nuclear process shown in Fig. 2 can either be a critical reactor or radioisotope fuel source such as plutonium oxide. In either case the heat can be converted to electricity either statically through thermoelectrics or a thermionic converter, or dynamically using a turbine generator in one of several heat cycles (Rankine, Stirling, Brayton). A classification of potential space applications of nuclear power is shown in Table 1. The nuclear workhorses for current space missions are the RTGs and the TEGs powered by radioisotopes in the Russian Federation that provide electricity through static (and therefore reliable) conversion at power levels of up to half a kilowatt, or more by combining modules.

Nuclear reactors have also been used in space, one by the USA in 1965 (SNAP-10A) successfully achieved orbit. The former Soviet Union routinely flew spacecraft powered by reactors: 34 had been launched prior to 1989 (see Appendix IX). A Soviet position paper stated that the investigation of outer space is "unthinkable without the use of nuclear power sources for thermal and electrical energy". The USA agreed.

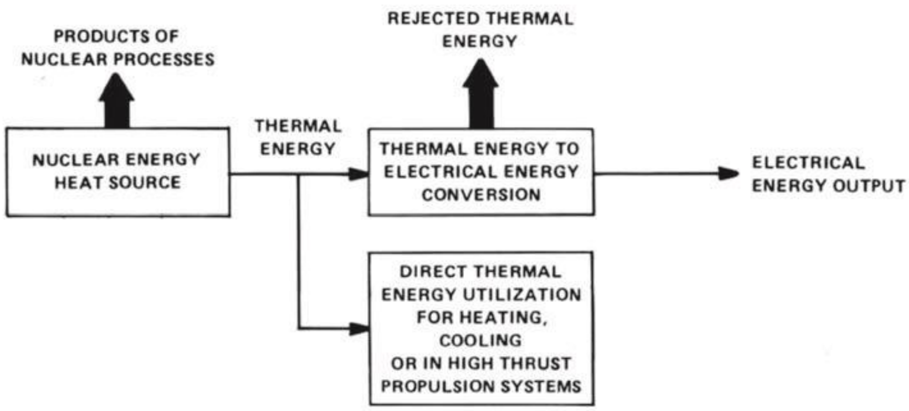
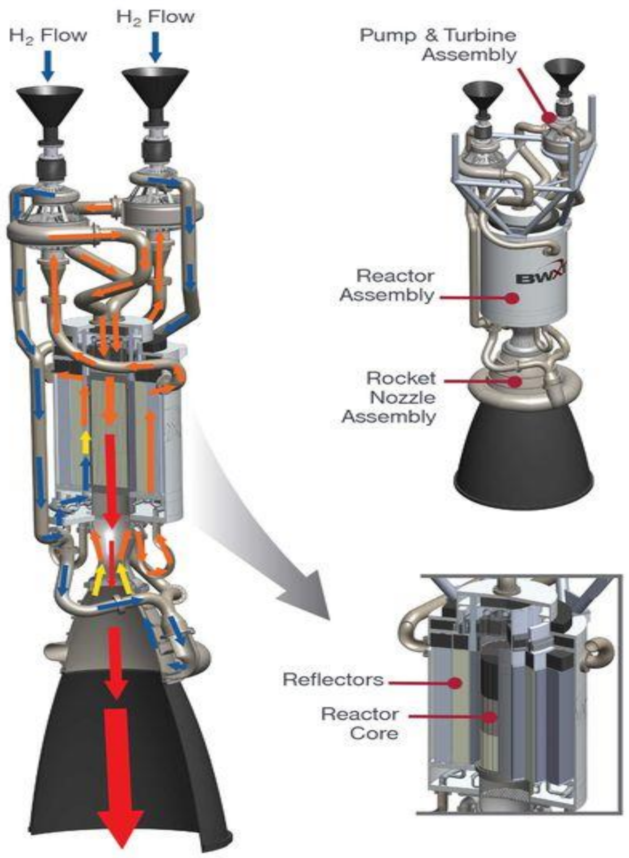


FIG. 2. Generic space NPS. Source: Los Alamos National Laboratory.

WHY NUCLEAR ? WHY NOT ALTERNATIVES ?

Nuclear vs. Chemical vs. Electric

A major advantage of NTP engines is that they can run much longer than chemical rocket engines, such as the Space Shuttle main engines or the Merlin engines on SpaceX Falcon 9 rockets, and still produce significantly more thrust than an electric propulsion system, such as the ion thrusters used on satellites. NTP is a happy medium.



A nuclear thermal propulsion engine diagram with arrows that show the flow path of the hydrogen propellant. The arrow colors represent the relative gas temperature, with blue as the coldest and red as the hottest.

Notable statistical insights by BWXT NUCLEAR ENERGY, INC.

"The Space Shuttle main engines were mounted on that enormous orange tank, full of oxygen and hydrogen, and as enormous as it was, it only had enough fuel to power the three main engines on the Space Shuttle for about 10 minutes," says Sheehy. "And then you've used all of that propellant and the enormous orange tank is gone." The NTP system NASA and BWXT are designing, on the other hand, could fire continuously for an hour or more.

"The other important consideration is how you size your engine," says Sheehy. "What we're looking at for the NTP system is an engine that would be in the range of 15,000 to 25,000 pounds of thrust force, and we might group three of those together."

The efficiency of a rocket engine is measured in specific impulse. "It's sort of similar to miles per gallon on a car," says Sheehy. Engineers measure the amount of thrust force of an engine in pounds of thrust, and then divide that value by the fuel consumption rate in pounds per second, which leaves you with a specific impulse measured in seconds.

"[NTP specific impulse] is actually twice as good as a chemical system, your typical hydrogen-oxygen rocket," says Sheehy. "It's 450 seconds for chemical rockets. The NTP system we're designing would be about 900 seconds. So you get a lot more thrust force for flow rate of propellant."

An electric propulsion engine—such as a Hall thruster that ionizes xenon gas—has a high specific impulse, as much as 10 times that of NTP. But the thrust is very low. That makes the technology good for making minor adjustments to the orbits of satellites. The biggest ion thrusters in space are only about 4 1/2 kilowatts. A much larger, 100-kilowatt ion thruster known as X3 is currently being tested at NASA Glenn as a potential engine for missions to Mars, but even an ion thruster that big has a much lower thrust force than an NTP system.

Notable statistical insights by LOS ALAMOS NATIONAL LABORATORY:

"A chemical system has tremendous thrust force, but low miles per gallon, and you can only carry enough propellant to thrust for minutes," says Sheehy. "A solar electric system has very low thrust force, but very high miles per gallon, and you can carry enough fuel to thrust for years. NTP kind of marries the high thrust of the chemical system with a higher... miles per gallon or specific impulse."

The efficiency of NTP comes from its propellant of choice: molecular hydrogen. By using the lightest molecule available, the engine can hurl exhaust out the back at incredible speeds—about 9 kilometers per second. "What you want to do in rocketry is throw things out the back very fast, and the way to get things going very fast—or part of the way to do that—is if they're very light," Sheehy says.

Liquid hydrogen can be a tricky propellant, though, because the boiling point is so low. For molecular hydrogen to remain a liquid, its cryogenic tanks need to be cooled to 20 degrees Kelvin, colder than -250 degrees Celsius. Designing the propellant tanks will be one of the challenges for NASA, although the rest of the engine components for the NTP system should be relatively straightforward.

"There's been a lot of development over the last 50 or 60 years working with hydrogen as a propellant," says Sheehy. "All the engine components, like pumps and valves and those sorts of things, have been refined over decades, and so there's a heritage there."

THE FUTURE

Future space missions will require high power sources. An overview of future missions and their corresponding power requirements is given in

NUCLEAR ENERGY FOR INTERPLANETARY MISSIONS

The use of nuclear energy can dramatically change the capabilities of interplanetary spacecraft. When compared with chemical propulsion systems currently used for interplanetary missions for example, nuclear electrical propulsion systems (representing a combination of an NPS and electrical propulsion) will provide significant progress. First, nuclear electrical propulsion will give a significantly higher acceleration and/or allow delivery of a heavier payload or the use of a cheaper launch vehicle, and second, it will permit the use of a straight trajectory with simple flight programmes without gravitational manoeuvres, with reduced times of flight as well as wider launch windows.

As a result, nuclear electrical propulsion systems can be used to overcome the existing energy barriers and to implement radically new science projects. For exploration of the outer planets (at a distance greater than 5 au[3]), nuclear energy has no competitors since the power of solar cells is reduced to unacceptable levels in these regions. To satisfy near term requirements, about 30–100 kW will be needed for both transportation and research. Thus, power and propulsion for such spacecraft can only be ensured by means of nuclear power.

Moreover, if nuclear energy is used, the duration of most missions even to the remotest parts of the solar system will not exceed 10 years, and no more than 5 years for missions closer than Jupiter.

It is believed by many experts that, for many reasons, the NPS concept of using a thermionic reactor/energy converter is the most practicable for this type of mission. The nearest competitor in terms of the level of readiness is an NPS which employs a dynamic turbine cycle of energy conversion that offers a higher energy potential and requires fewer developments in technology.

Introduction of nuclear energy in space applications can be accelerated if this is done on the basis of international cooperation. At the moment, the circumstances are favourable for such interactions. Anticipated NASA activities aimed at implementing US Government initiatives may correlate well with Russian activities in the field of space nuclear power. This provides a good foundation for cooperation. The future, hopefully, will witness the same level of international cooperation as that demonstrated in the building and use of the ISS.

Active space exploration started at the beginning of the 20th century when amateur and semi-professionals engaged in rocket science, conducting trial and error experiments to leave the ground, if not earth. They made steady but not dramatic progress.

However, just as flight had received government support during World War I, so rocket development received the same support during World War II, and spacecraft development received government backing during the Cold War. The advances in each case were dramatic.

Fortunately, since the Cold War ended, space exploration has matured in a healthier environment. International cooperation is the order of the day, including the building and manning of the earth's first space station.

On one hand, a large number of nations cooperate in the business of launching meteorological and telecommunications satellites and in putting basic scientific experiments into orbit in order to improve the quality of life and education of their own populations. Launching satellites into earth orbit is now an everyday business. On the other hand, a number of the larger nations, China, Japan, the Russian Federation and the USA are, or want to become, engaged in the exploration of the planets and space. This is an expensive business and one without an immediate financial return. However, the potential rewards in terms of new mineral resources and in an expansion of the human realm are large enough to make the investment worthwhile.

When planners begin to examine return space travel goals beyond earth orbit, beyond 2005 when the ISS is scheduled to be complete, they are faced with making bigger, more powerful and incredibly more expensive versions of the chemical rockets currently in use. Either that, or they will need to consider a demonstrated technology that was abandoned almost 30 years ago: nuclear rocket propellant engines as well as nuclear powered generators for use on planets such as Mars. Designs already exist for all these enterprises.

Nuclear propulsion is again coming to the fore in space just as a new generation of terrestrial nuclear power plants started to be introduced in 2003.

One system that holds promise is a concept for a bimodal nuclear thermal rocket, a mission design that uses nuclear reactors to produce thrust as well as electricity for a manned mission to Mars. It was developed at the US Glenn Research Center. The detailed mission design would send two cargo vehicles to Mars in 2011, followed by a crew carrier that would leave earth in 2014. Each of the vehicles would be launched in two parts aboard chemical rockets made of modified space shuttle style rocket boosters. The two part vehicles would be assembled in earth orbit before the nuclear reactors are started up to propel the spacecraft to Mars. A block of three small nuclear rockets capable of producing 7000 kg of thrust each would drive each of the vehicles. The reactor cores would provide plenty of energy to get the cargo and crew to and from Mars quickly, to brake into planetary orbit, generate electrical power and even produce artificial gravity during transit.

It is a fact that serious manned missions in space, in particular the first one to Mars, will require nuclear power if humankind is to take the next step beyond the threshold of its own world.

However, the work on building specific space systems that use nuclear power has been halted since 1990. Space nuclear power activities were transferred backwards from the development level to the research level thus postponing, for the time being, further work on the building of space reactors.

Space technologies are not used merely because humankind is not ready to use them. In the future, space nuclear power will be needed in various high power demand space missions. For example, the flow of data will grow enormously and spacecraft with sufficiently powerful nuclear systems placed in geostationary orbits will be needed to manage this flow of data; the previously used low power RTGs will not do the job.

High end technologies can also be developed in space. For a variety of reasons, certain processes cannot take place on earth. For example, super pure materials, single crystals and inorganic materials that are needed on earth can only be produced in space. In the long term, it may be possible to transmit power to the earth from space by microwave or laser energy to provide inaccessible areas with electrical power.

Furthermore, the exploration of outer space will continue as humans venture to Mars and beyond. All this requires significant energy and, thus, necessitates the use of NTPs.

It is necessary to start preparing for these prospects now, for it will take several decades to master many of the necessary technologies and techniques on a wide scale. Reference points should be established correctly and the development of key technologies systematically pursued. These key technologies include energy conversion systems for high power levels, heat rejection systems, fabrication of required materials, etc. Many of them can be used in other areas as well, for example, thermionic converters are applicable to solar energy conversion, including solar bimodal systems.

Development of space NPSs is a complex and expensive activity. To do it successfully, it is necessary to establish international cooperation and collaboration in this field. This cooperation can be built around the extensive nuclear technology base that has been created in the Russian Federation and the USA in past years.

The scale of growth of space activities, the complication of tasks to be fulfilled by space techniques, and the increasing requirements for power and propulsion lead to the use of nuclear power. Nuclear power will dominate in providing propulsion and power units for future near earth and interplanetary missions. There are no alternatives for missions to outer space or for landing on planetary surfaces.

An efficient way to facilitate space nuclear power development is to organize international programmes that use the best achievements of the participating countries. Possible international cooperative efforts include a nuclear-powered probe for missions to the outer planets of the solar system and a manned mission to Mars.

However, beyond the purely scientific rationale for space exploration it is clear that exploration facilitated by nuclear power could pay great dividends in many areas of terrestrial development. These areas include civil nuclear power, direct conversion systems, medicine, laser equipment and electronic devices, optics, time keeping processes, refrigeration equipment and materials technology. Many of these benefits to the quality of life on earth arise from our exploration in space no matter what energy option is selected. Many come from simply orbiting the earth on extended missions using chemical propulsion and solar power. However, some benefits only arise from space exploration beyond the capabilities of solar power, when power, heat and propulsion requirements mandate the nuclear option. As a result, research and development into nuclear power and generating systems in space is at the forefront of innovation.

The timing of the research and development work is also of importance. A mission to Mars that would require nuclear power is on the same timescale as the construction of a new innovative nuclear power plant. Both are targeted about 30 years hence. This conjunction provides for real cross-fertilization possibilities from the space related research and development work.

Space related nuclear power research and development can be of the greatest benefit to research and development efforts in the area of innovative reactors and fuel cycles, currently ongoing and being fostered internationally by various initiatives. Ideas that stimulate a new vision for terrestrial power systems, both large and small, include new ion plasma propulsion systems, new high efficiency gas cooled reactors, a re-examination of high efficiency generation cycles perhaps involving fluids other than steam and the use of heat pipes for compact reactors for very specialized and localized usage. Cross-fertilization between space nuclear power research and development on the one hand and innovative reactor and fuel cycle technology research and development for terrestrial applications on the other is possible and should be encouraged.

ONGOING INTERNATIONAL SPACE PROGRAMMES

While the former Soviet Union/Russian Federation and the USA have had extensive space programmes based on rocket programmes of the 1920s and 1930s, other nations have established successful space programmes in the past three decades: Australia, Austria, Brazil, Canada, China (including Taiwan, China), Denmark, France, Germany, India, Italy, Japan, Netherlands, Norway, Spain, Sweden, Turkey, Ukraine and the United Kingdom all have space agencies, as has Europe (ESA).

CHINA

China's space programme started in 1959 and its first satellite, Dongfanghong-I, was successfully developed and launched on 24 April 1970, making China the fifth country in the world with such capability.

By October 2000, China had developed and launched 47 satellites of various types, with a flight success rate of over 90%. Altogether, four satellite series have been initially developed by China: recoverable remote sensing satellites; Dongfanghong telecommunications satellites; Fengyun meteorological satellites; and Shijian scientific research and technological experiment satellites. The Ziyuan earth resource satellite series will be launched in the very near future. China is the third country in the world to have mastered the technology of satellite recovery, with a success rate reaching an advanced international level, and it is the fifth country capable of independently developing and launching geostationary telecommunications satellites. By 2001, China's capability with regard to the development of meteorological and earth resource satellites had reached the international level of the 1990s. The six telecommunication, earth resource and meteorological satellites developed and launched by China in the past few years are in stable operation and have generated remarkable social and economic returns.

Zhuang Fenggan, vice-chairperson of the China Association of Sciences, declared in October 2000 that one day the Chinese would create a permanent lunar base with the intention of mining the lunar soil for helium-3 (to fuel nuclear fusion plants on earth).

FRANCE

The Astérix technological capsule was the first French satellite placed into orbit by Diamant, launched from the Hammaguir base in southern Algeria on 26 November 1965. In 1968, an independent launch site at Kouros in French Guiana started operation with the launch of a Véronique probe.

France now has both a cooperative manned space exploration programme and a domestic business of launching satellites for other nations. The heart of the national programme is the Ariane series of launchers, which since 1994 has completed an average of ten launches per year — 90 to the end of 2002.

France's strategic space programme to 2010 makes note of the following objectives:

(a) A Mars exploration programme, in partnership with the USA, focusing chiefly on a Mars sample return mission (one of the major technical and scientific challenges for space exploration in the early 21st century);
(b) Exploration of objects such as comets and asteroids to learn more about the structure of the primordial solar system;
(c) Exploration of distant planets to understand their features and climates better.

Manned exploration has so far been limited to cooperation with the ISS effort. There are no declared objectives for using nuclear power in future French space programmes. The only power objective noted is in the more efficient use of focused solar power.

INDIA

India launched its first satellite, INSAT-1, in 1990 and its second, INSAT2A, in 1992. These early satellites were launched using the Ariane launch vehicle from Kouros in French Guiana. The second satellite had a seven year mission to provide communications and meteorological surveillance. Five more similar satellite launches were made prior to mid-2002. Four scientific satellites in the IRS series have been launched from Sriharikota in India, SROSS-C2 is another scientific series for topographical mapping.

PSLV, the latest multisatellite vehicle, launched from Satish Dhawan Space Centre on the east coast of India, has also been used to launch other nation's satellites (Belgium, Germany, Republic of Korea). The PSLV-C3 launcher (with three satellites) uses a combination of solid and liquid propellants. The four stages are as follows:

(1) The first stage is one of the largest solid propellant boosters in the world and carries 138 t of hydroxyl terminated polybutadiene (HTPB) propellant. It has a diameter of 2.8 m. The motor case is made of maraging steel. The booster develops a maximum thrust of about 4430 kN. Six strap-on motors, four of which are ignited on the ground, augment the first stage thrust. Each of these solid propellant strap-on motors carries 9 t of HTPB propellant and produces 677 kN of thrust.
(2) The second stage employs the Vikas engine and carries 40 t of liquid propellant (unsymmetrical dimethyl hydrazine) as fuel and nitrogen tetroxide (N_2O_4) as oxidizer. It generates a maximum thrust of 724 kN.
(3) The third stage uses 7 t of HTPB based solid propellant and produces a maximum thrust of 324 kN. Its motor case is made of Kevlar epoxy fibre.
(4) The fourth and terminal stage of the PSLV has a twin-engine configuration using liquid propellant. With a propellant loading of 2 t (monomethyl hydrazine plus mixed oxides of nitrogen), each of these engines generates a maximum thrust of 7.4 kN.

While a larger vehicle (GSLV-D1) has completed a developmental flight, there is no intention to use nuclear propellants since all the missions are in earth orbit with durations of 7 years or more. Satellites are equipped with solar panels.

ITALY

Italy was one of the first European nations to operate its own earth satellite (launched by the USA in 1964). Through the ASI, established in 1988, Italy is also a contributor to the ESA programmes. There is also careful consideration being given to nuclear powered deep space exploration. The following is an example given in a press release from late 1998 by Discovery-on-Line:

> "'A nuclear-powered engine could someday shorten a spacecraft's journey to Mars from three years to only 45 days.' That's according to Professor Carlo Rubbia, winner of the 1984 Nobel Prize for Physics. He says his brainchild could open the way to a systematic exploration of our planetary system by humans. 'Nuclear energy on Earth is competing with many other alternatives and is not without problems, but in deep space travel it offers unique possibilities' says Rubbia, introducing his project during a 1998 conference at CERN, the European particle physics laboratory in Geneva. Indeed, nuclear energy seems to be the innovative ingredient in any recipe for deep space exploration, though none of the propulsion tools considered so far has been able to offer a quick ticket to Mars. With his so-called fission fragment rocket, Rubbia

claims he has finally found the solution. Fission fragments are the direct products of a nuclear reaction in which a nucleus is split into fragments, accompanied by a release of energy."

Rubbia's engine is based on this process and on a key element — ^{242}Am. A chemical element somewhat similar to lead, americium was first separated from ^{239}Pu in 1944. The combustion chamber of Rubbia's engine would be covered with a thin layer of ^{242}Am whose fission, induced by neutrons, produces highly ionized fragments. The process continues with hydrogen entering the chamber. The fission fragments pass through hydrogen and the resulting heat creates a powerful propellant. The energy supplied by 1 g of americium is about the same as that of 1 t of the best chemical propellant. A few kilos of americium would be sufficient for the 194 million km voyage to Mars for a spacecraft and its crew.

Rubbia's light and simply structured spacecraft would allow round trip travel to Mars in a maximum of five months, including the necessary stay on the planet.

JAPAN

Japan has had an indigenous space programme from early on. A successive series of launch vehicles have been produced starting with the N1 launched from the Tanegashima Space Center in 1975.

SELENE (SELenological and ENgineering Explorer) will be the first large lunar probe made in Japan. It was developed in the first ISAS/NASDA joint lunar programme and was launched by the H-11A vehicle in 2003. The major objectives of the mission are to acquire scientific data on the origin and evolution of the moon and to develop the technology for future lunar exploration. The scientific data will also be used for exploring the possibility of future utilization of the moon. A major Japanese endeavour is the Kibo experimental space module which will conduct a number of experiments. The module will be supported from the ISS. To date no nuclear reactors or RTGs have been used in the Japanese programme.

LEGALITY

The following are the five major treaties with respect to the Outer Space

- The "Outer Space Treaty"
    - Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies
    - Adopted by the General Assembly in its resolution 2222 (XXI), opened for signature on 27 January 1967, entered into force on 10 October 1967

- The "Rescue Agreement"
    - Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space
    - Adopted by the General Assembly in its resolution 2345 (XXII), opened for signature on 22 April 1968, entered into force on 3 December 1968

- The "Liability Convention"
    - Convention on International Liability for Damage Caused by Space Objects

    - Adopted by the General Assembly in its resolution 2777 (XXVI), opened for signature on 29 March 1972, entered into force on 1 September 1972

- The "Registration Convention"
    - Convention on Registration of Objects Launched into Outer Space
    - Adopted by the General Assembly in its resolution 3235 (XXIX), opened for signature on 14 January 1975, entered into force on 15 September 1976

- The "Moon Agreement"
    - Agreement Governing the Activities of States on the Moon and Other Celestial Bodies
    - Adopted by the General Assembly in its resolution 34/68, opened for signature on 18 December 1979, entered into force on 11 July 1984.

PRINCIPLES

The five declarations and legal principles are:

- The "Declaration of Legal Principles
    - Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space
    - General Assembly resolution 1962 (XVIII) of 13 December 1963

- The "Broadcasting Principles"
    - The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting
    - General Assembly resolution 37/92 of 10 December 1982

- The "Remote Sensing Principles"
    - The Principles Relating to Remote Sensing of the Earth from Outer Space
    - General Assembly resolution 41/65 of 3 December 1986

- The "Nuclear Power Sources" Principles
    - The Principles Relevant to the Use of Nuclear Power Sources in Outer Space
    - General Assembly resolution 47/68 of 14 December 1992

- The "Benefits Declaration"
    - 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
    - General Assembly resolution 51/122 of 13 December 1996

Other Highly Important References

1. SAFETY FRAMEWORK FOR NUCLEAR POWER SOURCE APPLICATIONS IN OUTER SPACE
2. United Nations Deliberations on the Use of Nuclear Power Sources in Space: 1978-1987

3. 47/68. Principles Relevant to the Use of Nuclear Power Source in Outer Space
4. STI/PUB/1197 – Role of Nuclear Power and Nuclear Propulsion in the Peaceful use of outer Space
5. Chicago Journal of International Law regarding Nuclear Power Sources and Future Space Exploration

LETTER FROM THE VICE-CHAIRPERSON

Delegates,

Welcome to IIST MUN 2019! This background guide will particularly focus on the simulation of the LEGAL SUBCOMMITTEE of the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS).[1] My name is Nihal Sahu,[2] and I will be Vice-Chairperson of the Committee and specifically involved with conducting the Legal Subcommittee, given my specific expertise in the subject matter.

Our agenda is **"DEFINING THE ACCOUNTABILITY OF PRIVATE SPACE ENTERPRISES AND THEIR ROLE IN THE SPACE INDUSTRY."**

We have, however, a shortage of time. We will be conducting two subcommittees, over two days. You will have one day to address the unbounded issue of private accountability in the space industry. This is no easy task. Your ability to explain concepts in a concise manner, and to express your arguments persuasively will be tested. I will, however, be providing signposts, and specific issues that you might want to research on.

A detailed background guide, I think, sometimes acts as a deterrent to further research. This is not my intention. This clarification is two-fold. First, I do not intend to restrict the scope of your research, except as provided by the broad terms of the agenda. Second, I do not intend to control committee. The EB will not substantively influence the direction of committee, to make committee change course. I am mindful of the effects this can have, and what is particularly at stake. I will conduct myself accordingly.

I wish you the best of luck.

Yours sincerely,

Nihal Sahu

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[1] For the purpose of clarity, I will be informal throughout this document.
[2] B.A. LLB (Hons.) Student at the National University of Advanced Legal Studies, Kochi.

I. Committee

Our first consideration is the committee itself:

> "The Committee on the Peaceful Uses of Outer Space (COPUOS) was set up by the General Assembly in 1959 to govern the exploration and use of space for the benefit of all humanity: for peace, security and development. The Committee was tasked with reviewing international cooperation in peaceful uses of outer space, studying space-related activities that could be undertaken by the United Nations, encouraging space research programmes, and studying legal problems arising from the exploration of outer space.
>
> The Committee was instrumental in the creation of the five treaties and five principles of outer space. International cooperation in space exploration and the use of space technology applications to meet global development goals are discussed in the Committee every year. Owing to rapid advances in space technology, the space agenda is constantly evolving. The Committee therefore provides a unique platform at the global level to monitor and discuss these developments.
>
> The Committee has two subsidiary bodies: the Scientific and Technical Subcommittee, and the Legal Subcommittee, both established in 1961. The Committee reports to the Fourth Committee of the General Assembly, which adopts an annual resolution on international cooperation in the peaceful uses of outer space."[3]

We are specifically interested in the Legal Subcommittee:

> "The Legal Subcommittee meets every year for two weeks to discuss legal questions related to the exploration and use of outer space. Topics include the status and application of the five United Nations treaties on outer space, the definition and delimitation of outer space, national space legislation, legal mechanisms relating to space debris mitigation, and international mechanisms for cooperation in the peaceful exploration and use of outer space."[4]

This provides us with some guidance as to the scope of this committee, if we are to be restricted by the "include" clause in the preceding quote. Let us proceed to an analysis of the treaties.

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[3] http://www.unoosa.org/oosa/en/ourwork/copuos/index.html
[4] http://www.unoosa.org/oosa/en/ourwork/copuos/comm-subcomms.html

II. Space Law: A History

Before moving to any further examination, the founders of space law needed to resolve an important question: Is it really necessary or even desirable, to create a special set of rules to govern man's activities and consequential matters in outer space?[5] There are some important reasons to answer in the affirmative. Most importantly, spacecraft do not meet the requirements of the definition of an aircraft as laid down in air law, as codified in the Chicago Convention of 1944. [6] Even if it had fit the definition, air law in general excludes state owned aircraft.

There began a search for a model or a structural analogy upon which a propose space treaty could be based. The most tempting touchstone was the Antarctic Treaty of 1959, but this was soon abandoned. The most important principles of space law were laid down by the UNCOPUOS as follows: prohibition of national appropriation of outer space and celestial real bodies; equal rights for all states to free use of outer space throughout its continuity; freedom of scientific investigation of outer space; Preservation of sovereign rights of states over the space objects launched by them; Collaboration of states with the aim of rendering assistance to the crews of space ships in emergencies.

Since treaties had to be made, treaties were made. This is, of course, a general deviation from the customary United Nations practice of waiting until things are too late. The five United Nations treaties on outer space are, to quote the American Bar Association Journal:

> Outer Space Treaty: The foundation of international space law, it forbids weapons of mass destruction in space and reserves the moon and other bodies for peaceful purposes. It opened for signature in January 1967 and entered into force on Oct. 10, 1967.
>
> Rescue Agreement: It outlines the obligations for any state party that becomes aware that the personnel of a spacecraft are in danger. The Rescue Agreement went into force in December 1968.
>
> Liability Convention: Coming into force in 1972, it established liability rules for space. The Soviet Union was penalized under this convention when one of its nuclear-powered satellites crashed in Canada in 1978.
>
> Registration Convention: In 1976, it created a system to identify and register space objects.
>
> Moon Agreement: It was opened for signatures in 1979 but did not enter into force until 1984. The agreement reaffirmed and elaborated on the Outer Space Treaty as it relates to the moon and other celestial bodies, which should be used exclusively for peaceful purposes, their environments should not be disrupted, and the United Nations should be informed about any stations built on those bodies.[7]

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[5] An Introduction to Space Law 3, V. Kopal (Kluwer)
[6] Chicago Convention on International Civil Aviation of 7 December 1944; 15 UNTS 295; ICAO Doc. 7300-5; TIAS No. 1591.
[7] http://www.abajournal.com/magazine/article/space_law/

Among these, particularly important to you are the Rescue Agreement, and the Liability Convention. I shall briefly make a note on the latter.

The Liability Convention imposes an obligation upon States to bear full international responsibility for all space objects launched from their territory, or within their facilities, or where the launch was caused by them. The State will bear full accountability and full liability to pay damages. How would this interface with private space enterprise? What modifications must be made? These are just a few of the questions the Liability Convention puts to you.

III. The Agenda

The verbatim of the agenda is important. It defines the scope of our discussion. Our agenda is **"DEFINING THE ACCOUNTABILITY OF PRIVATE SPACE ENTERPRISES AND THEIR ROLE IN THE SPACE INDUSTRY."**

The agenda, then, has two clauses: the accountability clause (A); and the role clause (B). This places upon you two obligations. To define the accountability of private space enterprises, *in general.* And to define their role in the space industry. To speak in broad terms, defining accountability is a substantive task that includes the imposition of obligations, the assessment of liability, and the creation of a regulatory framework. Defining a *role*, in contrast, merely involves a normative consensus-based value judgment regarding the intended role and operational scope of private space enterprises. These value judgments can, however, take a substantive form.

You will, of course, have the initial responsibility to denote and demarcate those value judgments, and express them through the United Nations system. You may express them through additional treaties, amendments to existing treaties, additional protocols to treaties, and by general recommendations to higher bodies.