SPACE LAW: AN INTRODUCTION FOR SPACE SCIENTISTS

Rafael Moro Aguilar, LL.M.

Head of Legal Affairs,

Orbspace Engineering

Member of the Spanish Delegation to UNCOPUOS

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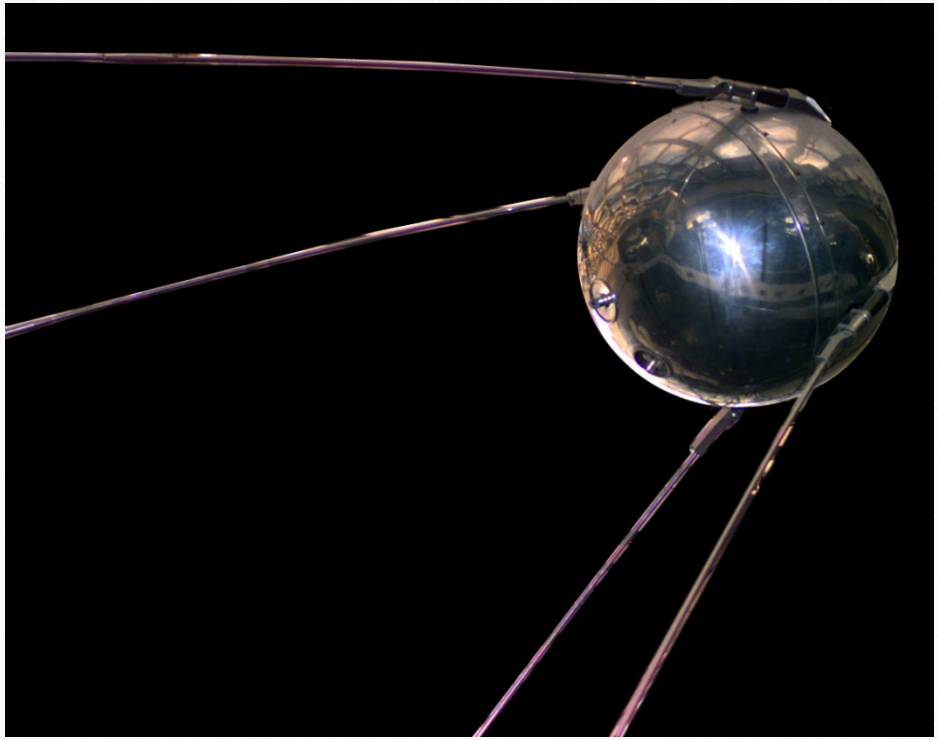
OVERVIEW OF SPACE LAW

- **4 October 1957: The conquest of space begins**
- **On that day, Space law is born > No country complained about the overflight of *Sputnik 1***



"All the News That's Fit to Print"

The New York Times.

LATE CITY EDITION

VOL. CVII...No. 36,308 NEW YORK, SATURDAY, OCTOBER 5, 1957. FIVE CENTS

SOVIET FIRES EARTH SATELLITE INTO SPACE; IT IS CIRCLING THE GLOBE AT 18,000 M. P. H.; SPHERE TRACKED IN 4 CROSSINGS OVER U. S.

HOFFA IS ELECTED TEAMSTERS' HEAD; WARNS OF BATTLE

Debate Ten Feet 3 to 1 —Says Union Will Fight 'With Every Ounce'

COURSE RECORDED

Navy Picks Up Radio Signals—4 Report Sighting Device

560 MILES HIGH

Visible With Simple Binoculars, Moscow Statement Says

Device Is 8 Times Heavier Than One Planned by U.S.

FALBUS COMPARES HIS STAND TO LEE'S

ARGENTINA TAKES EMERGENCY STEPS

SATELLITE SIGNAL

OVERVIEW OF SPACE LAW

United Nations: COPUOS

- Created by the U.N. General Assembly in 1959 by its Resolution 1472 (XIV)
- 83 Member States and 35 int'l organizations as permanent observers (2016), including ESA
- Three annual sessions: 1) Scientific & Technical Subcommittee (Febr.) 2) Legal Subcommittee (March-April) and 3) full (Plenary) Committee (June)
- Its Legal Subcommittee started working in 1962. It has been highly successful in the creation of international space law since then

OVERVIEW OF SPACE LAW

- There are five UN Treaties on outer space: The Outer Space Treaty (1967), the Rescue Agreement (1968), the Liability Convention (1972), the Registration Convention (1974), and the Moon Agreement (1979)
- Five UNGA Declarations of Principles: on General Principles (1963); on Direct TV Broadcasting (1982); on Satellite Remote Sensing (1986); on the Use of Nuclear Power Sources in outer space (1992); and on International Space Cooperation and Benefits (1996)
- This series of UN-sponsored Treaties and Declarations is sometimes referred to as the "Corpus Iuris Spatialis"
- Other texts adopted since 1996: COPUOS Guidelines on Space Debris Mitigation (2007) is the most relevant

OVERVIEW OF SPACE LAW

- The most important international legal text is the Outer Space Treaty (OST)

  - It was negotiated in COPUOS in 1966 > Basically between the USA and the USSR, with some other States also making additional proposals

  - Adopted by UNGA in October 1966 (> Space week)

  - Effective in 1967. Since then, it has been ratified by 103 States (as of 2016)

  - It provides the basic regulatory framework for all space activities carried out by all States of the world

  - Sometimes called the "Carta Magna" of outer space

OVERVIEW OF SPACE LAW

THE "TEN COMMANDMENTS"© OF INTERN'L SPACE LAW

- Free access to outer space and celestial bodies.
- Outer space and celestial bodies are not subject to appropriation, either by States or by individuals.
- International Law is applicable in outer space.
- Outer space can be used only for peaceful purposes.
- Astronauts are considered 'envoys of mankind' and must be assisted in case of accident or emergency.
- States are responsible for the space activities of their non-governmental entities.
- Launching States are internationally liable for damages caused by their space objects.
- Space objects must be registered. The State of Registry will retain jurisdiction and control over the space object.
- Duty of cooperation and duty of non-interference of all States.
- Duty of non-contamination of space and earth environments.

OVERVIEW OF SPACE LAW

- Free access of all States to outer space and to the celestial bodies

  - Outer space is "the province of mankind". It must be explored and used for the benefit of all mankind

  - All States can explore and use outer space and celestial bodies > Free access without discrimination on a first come, first served basis

  - The special case of GEO (declared as a limited natural resource by the ITU) > certain *a priori* planning has been introduced for its utilisation

OVERVIEW OF SPACE LAW

- Outer space and celestial bodies are not subject to appropriation, either by States or by individuals

  - Outer Space and celestial bodies are commonly considered as "res communis", i.e. belonging to all

  - No State can claim sovereignty over any part of outer space or over a celestial body

  - No individual can claim ownership over any part of outer space or over a celestial body

OVERVIEW OF SPACE LAW

- International Law is applicable in outer space

  - Space activities shall be carried out in accordance with international law

  - In particular, the United Nations Charter is applicable in outer space

  - Other texts also: e.g. The Universal Declaration of Human Rights is applicable in outer space

OVERVIEW OF SPACE LAW

- Outer space should be used only for peace-ful purposes

  - Placing atomic weapons and other weapons of mass destruction in outer space is expressly prohibited

  - Other types of weapons are not prohibited

  - "Defensive" –or "non-aggressive"– activities are allowed in terrestrial orbits

  The term "defensive" is subject to interpretation. Anti-satellite arms (ASAT) have been tested in space. Reconnaissance and other military satellites are also permitted

  - The Moon and the other celestial bodies are de-militarized areas > no military bases or activities are allowed, no testing of weapons, etc

OVERVIEW OF SPACE LAW

- Astronauts are considered 'envoys of mankind'

  - States are required to assist and rescue them in case of danger or accident. States that are parties to the Rescue Agreement are obliged to follow the procedure established in that treaty

  - Same requirement applies to any space objects found on the surface of the Earth: they must be returned to the launching authority

OVERVIEW OF SPACE LAW

- States are responsible for the space activities of their non-governmental entities

  - "Non-governmental entities" means commercial entities (companies & business), private associations, etc. "Their" is usually interpreted as "entities having their nationality"

  - The obligation arises for States to control and supervise private space activities. This is the root of national space laws, defining 1) the conditions for private entities to obtain authorisation to carry out space activities, and 2) the State's supervision

OVERVIEW OF SPACE LAW

- Launching States are internationally liable for damages caused by their space objects to third parties

  - According to the Liability Convention: damages on the Earth's surface and to airplanes in flight > absolute liability (i.e. the launching State must compensate in full, and in any case, except in case of gross negligence by the victim)

  - Damages in outer space > fault liability (the launching State must compensate only in case of negligence)

  - In case of several launching States > joint and several liability. They may reach agreements among themselves in order to apportion the liability

  - Only case so far: Soviet *Cosmos-954* satellite in 1978

OVERVIEW OF SPACE LAW

- Registration (I). Satellites and other space objects must be inscribed:

  - In an International Register, maintained by the U.N.

  - In a national register, maintained by each State of registry > For instance, Spain has a national registry of space objects since 1995 (Ministry of Foreign Affairs). ESA has also its own registry of space objects

  - Registration is *a posteriori* and it only provides general indications about the object: designation or number, functions, orbital parameters, radio frequency used, and date of launch. The goal is the identification of the object for liability purposes

OVERVIEW OF SPACE LAW

- Registration (II). The State of registry will retain jurisdiction and control over the space object

  - Each State has jurisdiction over the space objects that are registered under its name. It is so even after the objects have ceased to operate. States also have the ownership and the right of restitution of their space objects after the objects have landed or have fallen onto the Earth (> Principle 5 above)

  - Jurisdiction on board determines issues such as applicable laws and tribunals (civil and criminal), nationality of patents, etc.

  - Control means that the ultimate control over the space object is in the hands of the State of registry

OVERVIEW OF SPACE LAW

- Duty to cooperate and to render mutual assistance in the course of the exploration and utilization of outer space

  - Duty of States to inform the U.N. and the international community about their space activities

  - Duty of active cooperation and of mutual assistance between States

  - Duty also of non-interference: States may not obstruct the free use by other States. In case of potential interference between two space activities, the concerned States must enter into consultations

OVERVIEW OF SPACE LAW

- Duty to preserve the outer space and the Earth's environment:
  - Duty of space debris mitigation and prevention
  - Duty of biological, radiological, chemical non-contamination of the celestial bodies > 'States Parties shall adopt appropriate measures' (Art. IX)
  - Planetary protection, this is the duty to prevent biological contamination of celestial bodies with potential biological interest (such as Mars, or the icy moons of Jupiter and Saturn)…
  - …as well as the duty to prevent biological back contamination of the Earth's biosphere as a result of introducing extraterrestrial materials

    > COSPAR Planetary Protection Policy (PPP) is not binding law, but it is applied nevertheless by space faring nations

OVERVIEW OF SPACE LAW

Other U.N. rules and principles

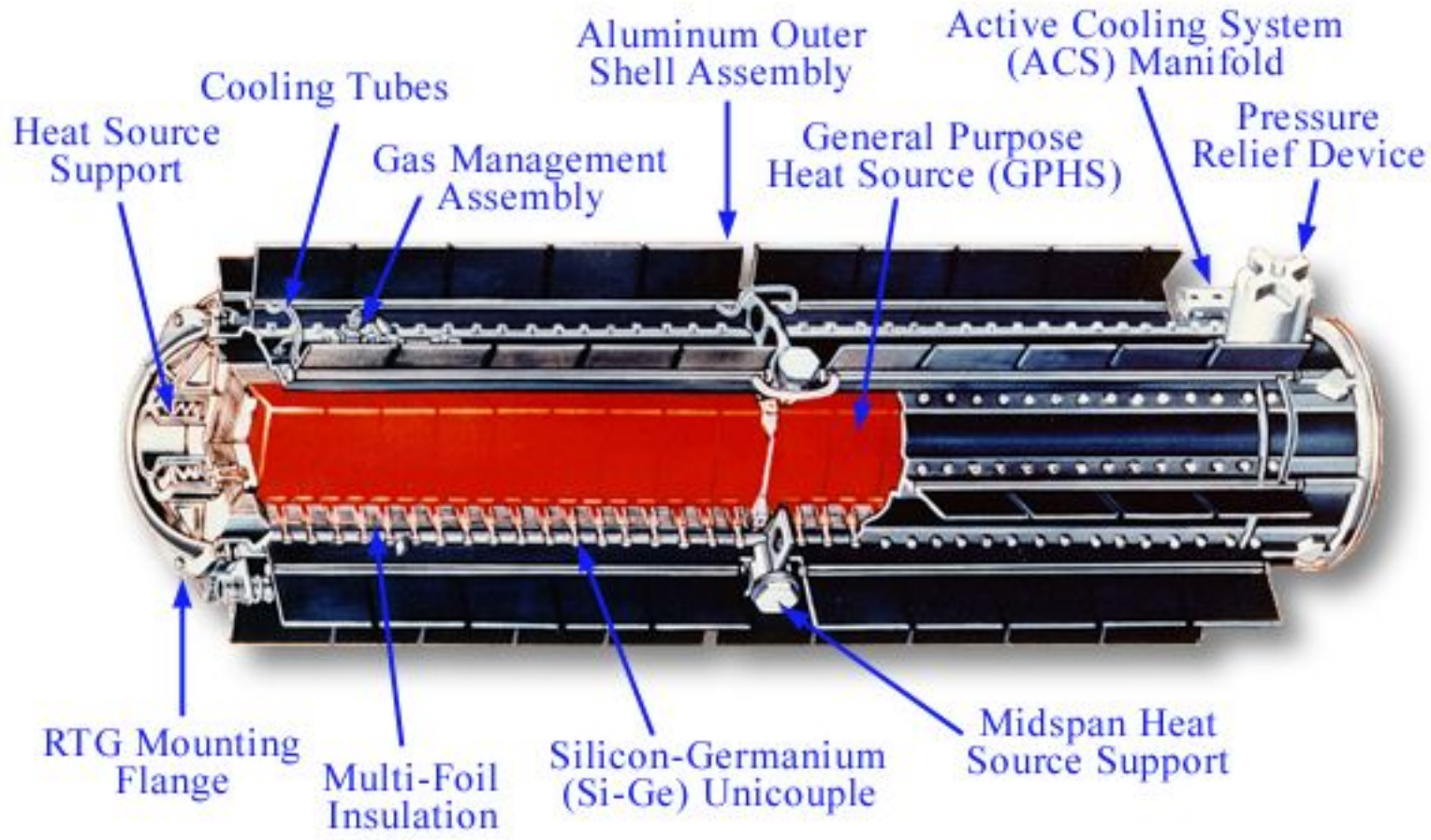
- There are several UNGA Resolutions which provide additional rules on specific aspects, such as satellite remote sensing of the Earth (1986)
  - **Earth observation** > the basic principle is freedom of observation combined with free access by sensed States to the remote sensing data, without discrimination
  - Other principles state that remote sensing of the Earth from space should be used for the mitigation of natural disasters and for the preservation of the natural environment

OVERVIEW OF SPACE LAW

Other U.N. rules and principles

- UNGA Resolution on the use of nuclear power sources in outer space (1992)
  - **Nuclear power sources such as RTGs** should be reserved to interplanetary missions, where they are often indispensable
  - If used in Earth's orbits, they should be stored in a sufficiently high orbit after the operational life of the satellite, so that a long period of time will pass before they fall back to Earth
  - If an accident involving a NPS is imminent, the launching State must alert the international community and provide information

GPHS-RTG


Aluminum Outer Shell Assembly
Active Cooling System (ACS) Manifold
Cooling Tubes
Heat Source Support
Gas Management Assembly
General Purpose Heat Source (GPHS)
Pressure Relief Device
RTG Mounting Flange
Multi-Foil Insulation
Silicon-Germanium (Si-Ge) Unicouple
Midspan Heat Source Support

SELECTED TOPICS

The International Space Station (ISS)

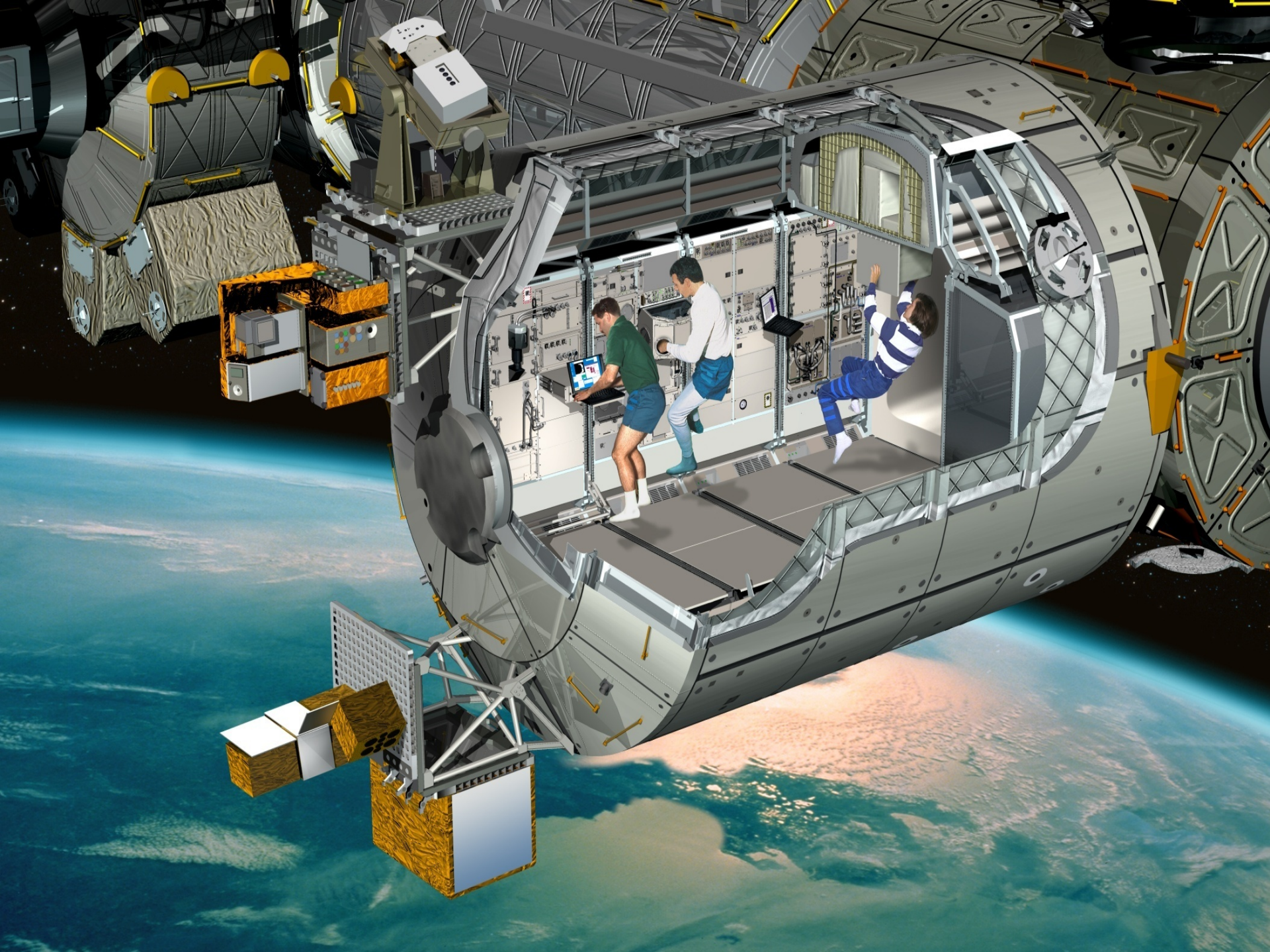
- The ISS is governed by a special multilateral treaty entered into by the 15 participating States: the Inter-Governmental Agreement (IGA)
- The original IGA was signed in 1988 by the USA, Canada, ESA and Japan.
- It was later updated and expanded, in order to include Russia as an ISS Partner. The second and final version of the IGA dates from 1998 (in force since 2001)
  - ESA participates in the ISS: it is called "the European Partner"

SELECTED TOPICS

- The IGA establishes "a long-term international cooperation among the Partners… for the detailed design, development, operation, and utilization of a permanently manned civil Space Station for peaceful purposes, in accordance with interna-tional law" (Art. 1.1)
- The IGA establishes the equality of all the ISS Partners, but Art. 1 specifies that NASA will have a lead role as coordinator of the whole program

SELECTED TOPICS

- The IGA establishes the non-liability between the ISS partners. It establishes inter-party waiver clauses ("cross-waivers"), so that they will not claim for damages to each other in case of accident
- Every Partner must register its own space objects (e.g. *Columbus* is registered by ESA, *Kibo* by Japan, the robotic arm *Dexter* by Canada…), and thus will retain jurisdiction over the space object and materials and staff on board (Art. 5 IGA)
- The protection of intellectual property rights in the ISS: Art. 21 IGA. Inventions will be patented in the state exercising jurisdiction over the module



SELECTED TOPICS

The issue of criminal law in the ISS

- General rule > jurisdiction of the State of registry
- But > in the IGA, the Parties retain the criminal jurisdiction over their respective nationals on ISS
  - If misconduct of a national affects the life or health of the national of other Partner, or damages the property of another Partner, the national State of the alleged perpetrator is to consult the other party and consider a prosecution
  - The affected Partner State may exercise criminal jurisdiction 90 days after such consultation, if the national State of the perpetrator so agrees or fails to prosecute
  - Extradition is also possible, and mutual assistance between the partners is required (Art. 22 IGA)

SELECTED TOPICS

- In addition, there is an ISS Crew Code of Conduct
  - (contained in IGA Arts. 11.2 and 11.6). Every Partner must approve the Code and is to ensure that every astronaut observes it
  - For example, it is forbidden to take materials on-board the *ISS* for private gain
- In the CCoC, the authority of the commander and a chain of command is established in the *ISS*. The commander is the main person responsible for the mission abord the *ISS*. The spaceflight director is the main person responsible for the mission on the ground
- Disciplinary measures are an exclusive matter of the national state of each astronaut

SELECTED TOPICS

Space Tourism

- It refers to several 'paying passengers' who have travelled in *Soyuz* spacecraft to the ISS (Dennis Tito in 2001 and 7 others afterwards)

- This activity is regulated by a special agreement, called the 'Crew-members Principles', negotiated between Russia and NASA, and signed by all the ISS Partners. It was added to the IGA in 2001
  - Introduced the new category of "space flight participants" (or "visiting crewmembers"), and regulated the process and criteria for their selection, assignment, training and certifica-tion

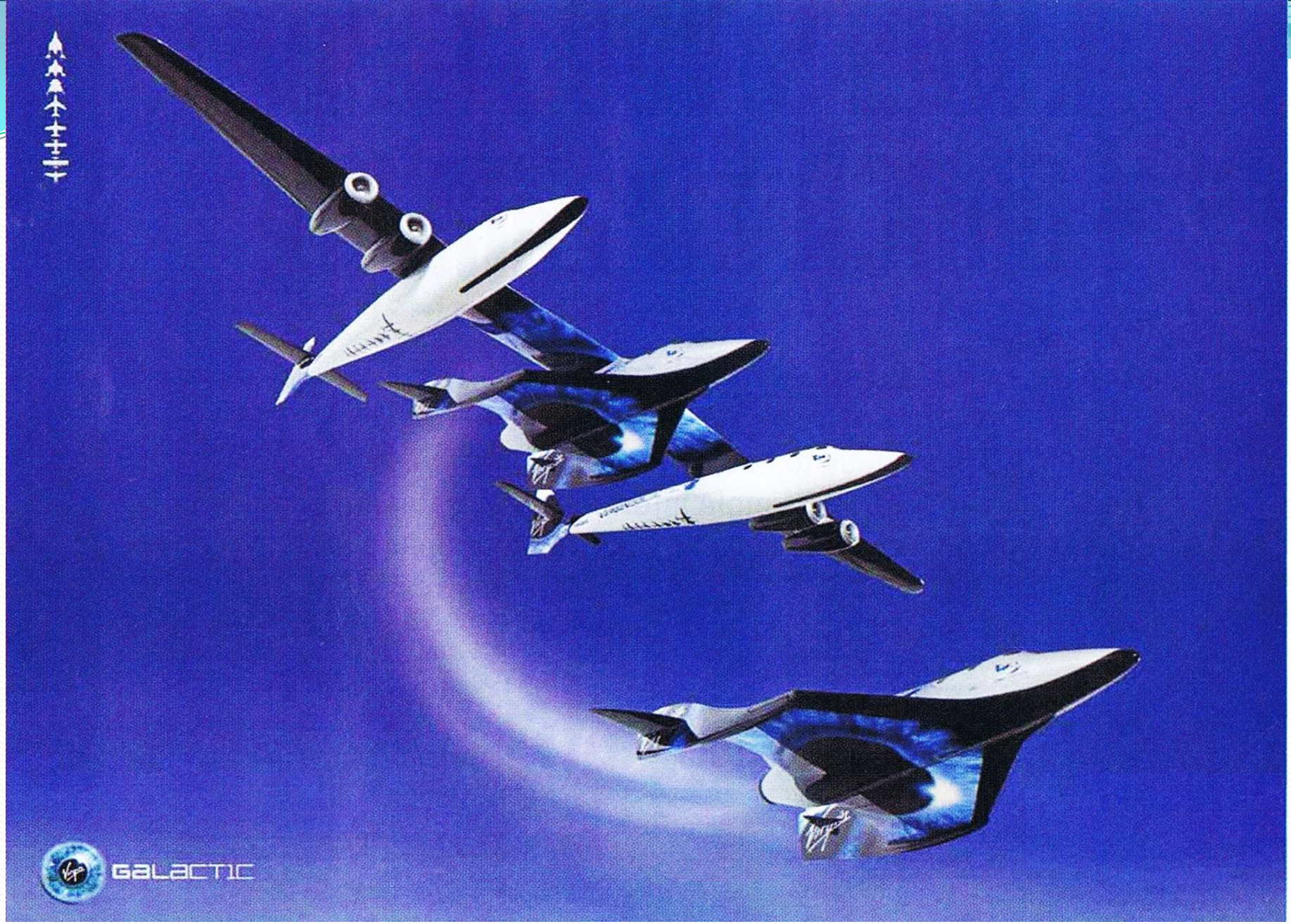
SELECTED TOPICS

Suborbital Flights

- It refers to the reusable suborbital vehicles to be commercialised soon by Virgin Galactic and by some other companies for carrying passengers ("suborbital tourism") or for research purposes
  - Suborbital means that the flight does not complete one orbit
  - June 2004: suborbital spaceplane *SpaceShipOne* became the first private manned vehicle that reached outer space

- There is currently no international regulation

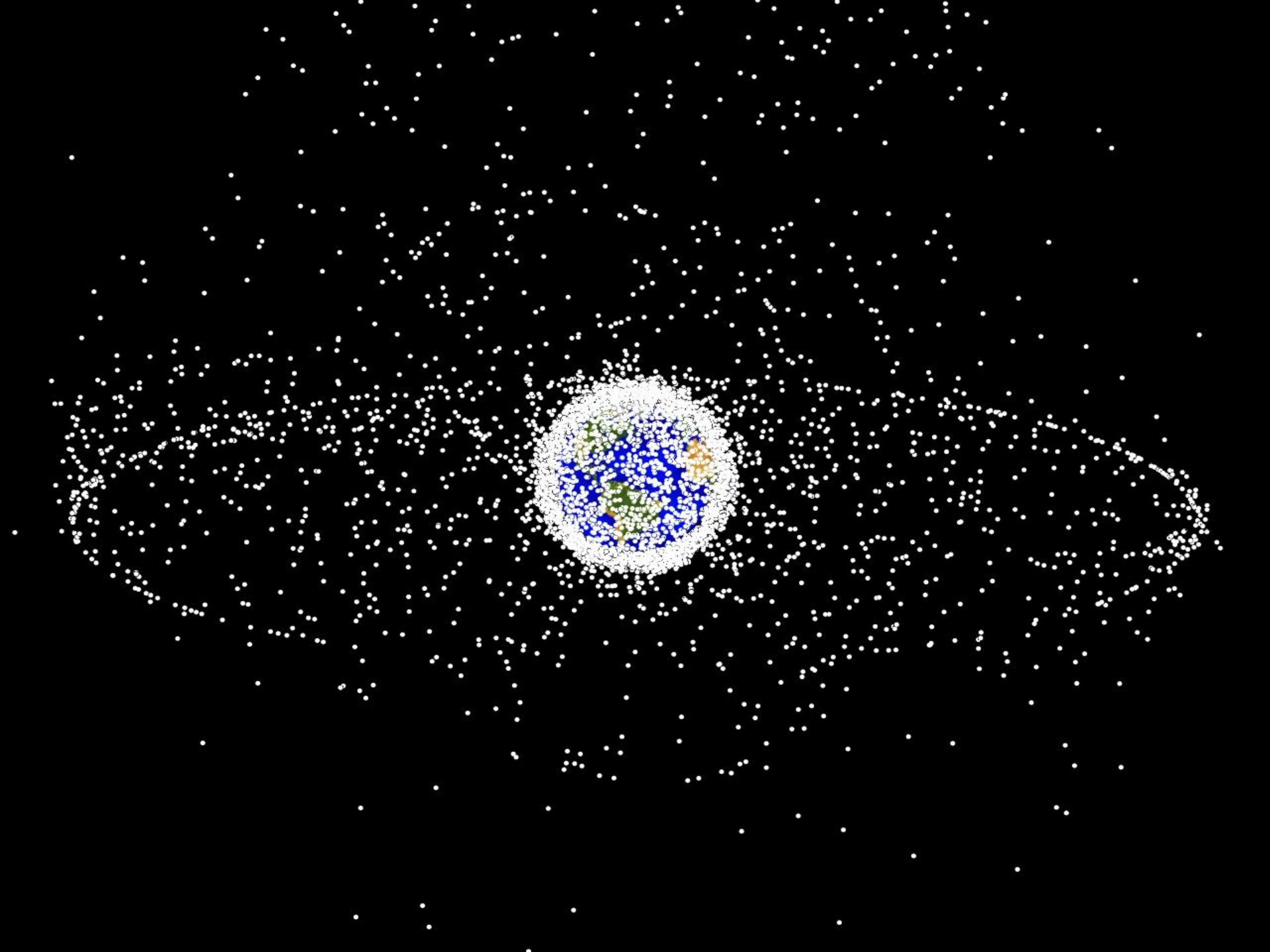
- At the national level, the USA enacted in 2004 a new law (the CSLAA) in order to authorise these flights, and in 2006 it also approved a series of safety rules for passengers of commercial spaceflights departing from US soil and licensed by the US Government



SELECTED TOPICS

Space Debris

- **The United Nations outer space treaties do not cover space debris**
  - They were drafted at a time (1960s and 1970s) when orbital debris was not considered a problem
  - In 1993, a first Recommendation was made by the ITU that at the end of their lifetimes, satellites in GEO should be moved to another (useless) orbit, in order to maintain GEO free of inactive satellites > The concept of "graveyard orbit" or "parking orbit" (~ 300 km above GEO) was born



SELECTED TOPICS

- **In the 1990s, a set of mitigation guidelines was developed by the so-called <u>Inter-Agency Space Debris Coordination Committee (IADC), a partnership of space agencies (including ESA)</u>**
  - They reflect the fundamental mitigation practices and standards of a number of national and international organizations
  - Introduced basic rules, such as removing inoperative satellites from GEO to a "graveyard orbit", and launching satellites to LEO with orbital lifetimes no longer than 20 years ("the 20-year rule")
  - They were adopted in 2001

SELECTED TOPICS

- **UN COPUOS adopted in 2007 its own set of guidelines addressed to all States members of the United Nations**

- These are basic recommendations intended to prevent the creation of new space debris
  > This new set of recommended guidelines are based on the IADC space debris mitigation guidelines
- Both series of guidelines (IADC and COPUOS) are voluntary for States > They are not binding under international law
- However, compliance level of these guidelines is high, particularly through the national (or domestic) laws of space faring nations

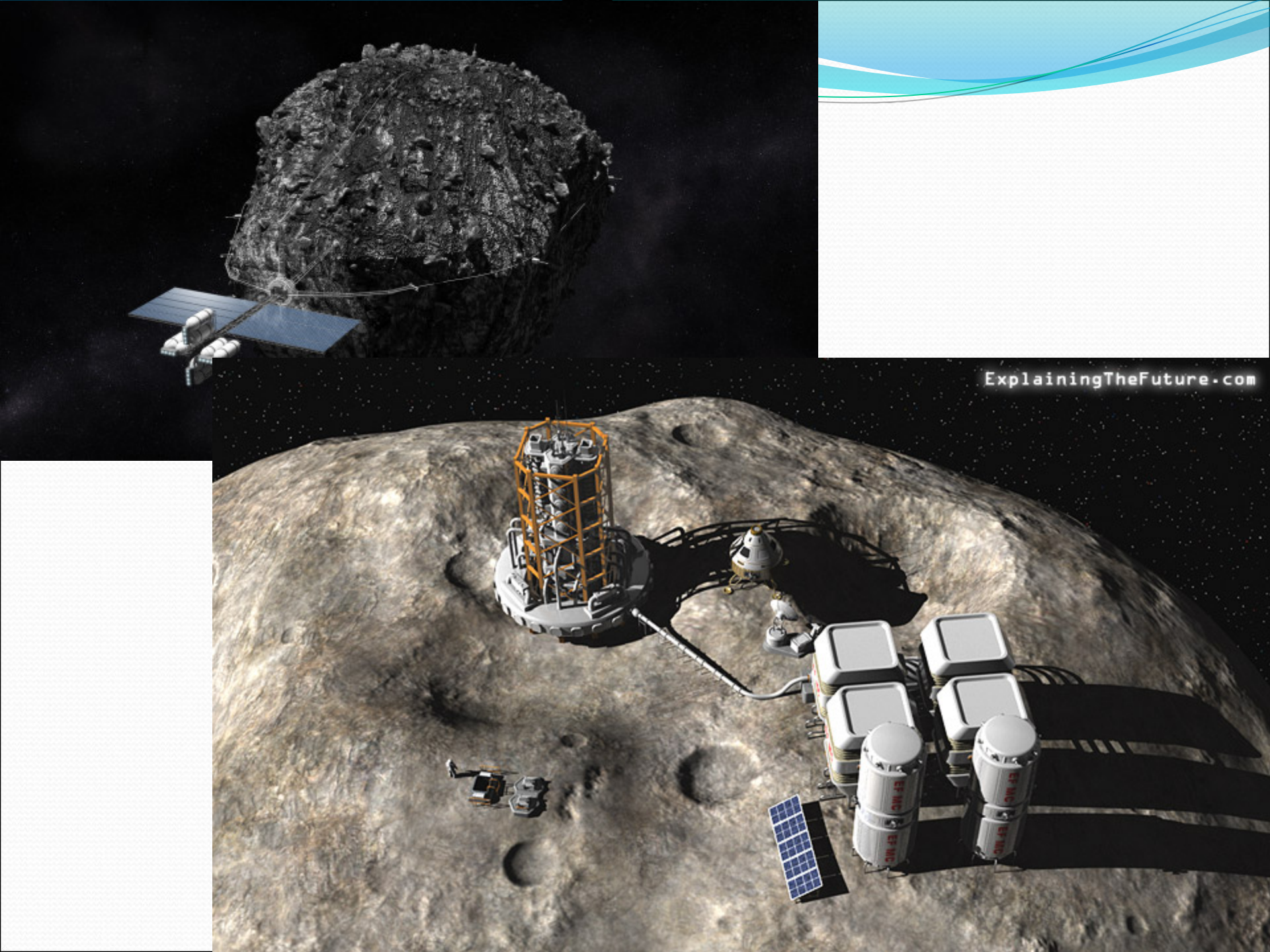
SELECTED TOPICS

- Short-term mitigation involves 1) minimizing the production of mission-related space debris during the planning phase; 2) preventing in-orbit collisions, 3) preventing in-orbit accidental break-ups, and 4) avoiding in-orbit deliberate explosions

- Long-term mitigation means end-of-life procedures that remove 1) inactive or decommissioned spacecraft, and 2) launch vehicle orbital stages, from LEO and GEO regions that are populated by operational spacecraft

SELECTED TOPICS
Lunar and asteroid mining

- Two US companies, Deep Space Industries and Planetary Resources, have announced their intention to exploit the natural resources (valuable metals, water) that are present in some asteroids
- According to Art. II Outer Space Treaty, celestial bodies cannot be appropriated by States
- If there is no State jurisdiction, it means that there cannot be private property either
  - Property is a private right that has to be recognized and backed by a public authority, i.e. a State or Government
  - So how can we legally exploit space resources?


ExplainingTheFuture.com

SELECTED TOPICS

- In November 2015, the US adopted a new commercial space law that includes a very controversial provision:
- It allows US citizens to appropriate the natural resources that they extract from celestial bodies, such as the Moon or asteroids
  - The law makes clear that the US is not claiming any sovereignty or property over these celestial bodies and assures that international law will be respected during their "mining"
- The International Institute of Space Law presented in Dec. 2015 a position paper stating that the US law is a possible interpretation of OST, albeit not the only one
- US law is better seen as a basis for further discussions

SELECTED TOPICS

International responses to NEO threats

- The potential threat of NEOs (remember Tunguska, Chelyabinsk) poses significant challenges:

  - Scientific: detection of all NEOs; monitoring for refining orbits; characterization and study of their physical properties (composition, consistency, etc)

  - Technical: deflection methods (towing, gentle deviation > preferred solutions but require long time; blast NEOs, with or without nuclear weapons > dangerous, last resort)

  - Legal and political: international coordination for NEO detection & monitoring; need for a unified Earth response to a confirmed NEO threat; the (currently illegal) use of nuclear heads in outer space; issues of international liability

SELECTED TOPICS

- Effective responses for the mitigation of threats from NEOs are best addressed internationally
- The UN is the only universal organization & COPUOS is the only global body with general space competences
- COPUOS Scientific and Technical Subcommittee has had the topic of NEOs in its agenda for many years:

  - Created a United Nations NEOs Action Team in 2001

  - The Action Team has set up in 2015 an International Asteroid Warning Network (IAWN), and a Space Mission Planning Advisory Group (SMPAG > chaired by ESA)

  - The U.N. has issued some recommendations for an international response to a NEO impact threat (2013)

SELECTED TOPICS

The International Telecommunication Union (ITU)

- Regulations for space communications are adopted in the framework of the ITU
  - The radio spectrum is a limited natural resource, and the technology is not yet so advanced that the entire radio spectrum can be used
  - Orbital positions in GEO are also seen as a limited natural resource
- The ITU plays an essential role to make possible space activities of all kinds, since space activities can only be carried out when no interference between the radio signals occurs

SELECTED TOPICS

- The ITU is in charge of distributing the available radio frequencies and the associated orbital positions
- There are periodically World Radio Communication Conferences (WRC, formerly known as WARC), and occasionally other Radiocommunications Conferences, which are called every few years whenever needed
- During these Conferences, all the ITU Member States reach an agreement on how to distribute the radio spectrum and allocate frequencies to specific services
- The resulting rules are incorporated as amendments to the Radiocommunications Regulations of the ITU (also known as *Radio Regulations*) that govern radio services
- They become international treaties and are therefore binding on all Member States of the ITU > worldwide

SELECTED TOPICS

Regulation of radio frequencies

- According to Article 1 of the ITU Constitution, the ITU will allocate the available radio frequencies, and will register the radio frequencies that are assigned to different users, in order to prevent interferences between the world radio communications systems
- Between the Conferences, for the daily management of the radio spectrum, the ITU has a body called “the Radio Regulations Board”, and a Registry called “the International Register of Frequencies”
- The basic rule for allocating radio frequencies: “first come first served” > The frequency is given to whomever requests it first

SELECTED TOPICS

- The registration with the ITU of orbital allotments and frequency assignments for space communications systems and their use does not provide any permanent priority for any individual country or groups of countries, and should not create any obstacle to the establishment of space systems by other countries
  - No one can claim sovereignty or ownership over any part of outer space. This principle applies also to radiofrequencies and to orbital positions in GSO
- If a system is not in place in a given number of years, the ITU filing for frequencies will expire, and the frequencies will be assigned to another system
  - Launch of first satellites of Galileo GNSS system had the goal of maintaining frequencies and orbits in favor of EU/ESA

SELECTED TOPICS

Regulation of space communications

- In the 1959 WARC, the ITU destined the first frequencies to space missions: it simply allocated certain frequencies that were not being used for terrestrial purposes
- In 1963, an Extraordinary Space Conference was held specifically for the task of allocating frequencies to space systems. In particular, the ITU adopted the operational use of certain radio frequencies for satellite telecommunications
- In subsequent Conferences, the ITU has allocated more and more frequencies and bands to new space systems and services (e.g. mobile communications, global positioning & navigation satellite services, etc)

SELECTED TOPICS
Protection of radioastronomy

- Traditionally, a number of radio frequencies that are not commercially useful and are interesting for science purposes have been allocated (i.e. reserved) to radio astronomy by the ITU in its Radio Regulations
- Certain radio services can transmit in these parts of the spectrum, as long as they do not interfere with science
  - For instance, WRC-2000 allocated to radio astronomers most frequencies between 71 and 275 GHz. These include three important windows where millimeter waves can get through the Earth's atmosphere to ground receivers
  - These are high frequencies that no satellites use yet. Any future use will have to be shared with radioastronomers

SELECTED TOPICS

Regulation of the Geostationary Earth Orbit (GEO)

- This is a specific orbit around the Earth that is particularly useful for several telecommunications services and for broadcasting services
- It is a circular, equatorial orbit that is located at approx. 35,800 km altitude above sea level
- When placed along this ring, any satellite will orbit the Earth in 24 hours > will appear as a “fixed” star (or as “stationary”) to observers from the Earth below
- Extremely useful also for meteorology and for Earth observation purposes
- As a result, there is a high demand for positions in GEO, both from international and national space organisations and from private operators

SELECTED TOPICS

- In 1971, the Geostationary Earth Orbit (GEO) was declared a limited natural resource by the ITU
- The legal regime governing this orbit and associated radiofrequencies is based on an equitable access for all States. At the same time, this regime ensures that the radio frequencies and the GEO positions are used rationally and efficiently
- The default rule applicable to the distribution of frequencies and positions in GEO is still the "first come first served" principle. However, for a number of key services and orbital positions, that principle was superseded by a new "a priori planning" rule that has been adopted by the ITU in GEO

SELECTED TOPICS

- "A priori planning" for GEO has been adopted by the ITU for two kinds of space systems: Broadcasting Satellite Services (BSS) in the Ku Band, and Fixed Satellite Services (FSS) in the C and Ku Bands
  - First, the planning for BSS was introduced in the World Radio Conference of 1977 for Regions 1 and 3 of the world (Europe/Africa, and Asia-Pacific); then, it was introduced in 1983 for Region 2 of the world (the Americas). In the Conference of 1988, *a priori* planning was extended to FSS in all Regions
- By pre-planning these services, all States of the world are ensured to have a certain number of frequencies and orbital positions, which are to be used under specific technical parameters

Some useful links for more info:

- http://www.unoosa.org/oosa/en/copuos/index.html
- https://cosparhq.cnes.fr/scientific-structure/ppp
- http://www.geekwire.com/2015/asteroid-riches-president-obama-signs-space-resource-bill-into-law/
- http://www.iislweb.org/docs/SpaceResourceMining.pdf
- http://www.space.com/6624-asteroid-threat-call-space-lawyers.html
- http://spaceref.com/asteroids/international-agreement-on-asteroid-threats-reached.html
- http://www.itu.int/en/Pages/default.aspx
- https://public.nrao.edu/news/pressreleases/astronomers-win-protection-for-key-part-of-radio-spectrum

You may contact me anytime for more information related to space law:

rafael.moro@orbspace.com
rmoroag@yahoo.es

THE END

THANK YOU FOR YOUR ATTENTION!