

UNESCO Initiative: Astronomy and World Heritage

**Odyssey of Human Creative Genius:
From Astronomy Heritage
to Space Technology Heritage**

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Space Astronomy and Space Technology: Background

Historical Highlights

- Astronomy was one of the most important science in the ancient world.
- It was rooted in naked eye observations and primitive stony instruments for astrometric measurements to determine positions of the Sun, Moon, planets and some stars what had both practical and sacral meaning.
- That is why the majority of archaeo-astronomical monuments are simultaneously observatories and sanctuaries, with burials and altars.
- An interest to the investigation of ancient monuments as instruments for astronomical observations has significantly grown in recent decades.
- Since the 1981, the Oxford conferences organized by the International Steering Committee are called every 3 years.
- European Society for Astronomy in Culture (SEAC) dealing with the problems of archaeo-astronomy hold scientific conferences yearly.
- International Society for Archaeoastronomy and Astronomy in Culture (ISAAC) was founded in the USA in 1995.
- In Russia, the first conference on the archaeoastronomy was held in 1996 in Moscow, followed by the SEAC conference “Astronomy of ancient civilizations” during JENAM meeting in 2000 and International symposium “Astronomy 2005 – modern state and prospects” in 2005.

UNESCO Initiative “Astronomy and World Heritage”

- Throughout the years UNESCO have been working hard to preserve the humankind achievements, astronomy included, as the World Heritage.
- The breathtaking monuments of ancients civilizations like Decorated Grottoes Of The Vézère Valley (France), Stonehenge (Great Britain), Lines of Nasca (Peru), Pyramids in Giza (Egypt), Temple Of Heaven (China), Ulug Beg Observatory in Samarqand (Uzbekistan) to mention a few were recognized, which also bear invaluable educational mission.
- In 2003, the UNESCO World Heritage Centre (WHC) set up the new project to reveal and preserve the objects of archaeoastronomy of historical and cultural value all over the world.
- The First International Meeting of experts “Archaeoastronomical objects and observatories” organized by the WHC and Regional European Bureau on Science was held in 2004 in Venice, Italy.
- The strategy of thematic program “Astronomy and World Heritage” and general criteria of selection of arhaeoastromical objects/observatories were considered including: i. Objects situated or related to celestial objects or astronomical events; ii. Images of the sky and/or of celestial objects and astronomical events; iii. Observatories and instruments; iv. Objects closely connected with the history of astronomy.

Space Exploration: Baseline

- Space exploration manifested the new great milestone of the human civilization. It made possible observations in the whole wavelength and also, direct *in situ* measurements in other worlds.
- The Astronomy World Heritage Initiative should encompass various facilities involving those related to space exploration.
- Basically, great breakthroughs of the modern astronomy were achieved due to space born instruments and planetary space missions.
- Indeed, space astronomy ensured the most significant progress in astrophysics gaining invaluable knowledge about space objects and the Universe as a whole, thus broadening up tremendously the human horizons.
- **It is therefore prerequisite to include Space Astronomy as an important segment of the Astronomy World Heritage.**

The Venue

- The project technological heritage connected with space exploration is addressed as a logic extension of the Astronomy World Heritage Initiative because it is intrinsically related with the most important breakthroughs in space science and it is rooted in space technology.
- The idea was put forward at the Astronomy World Heritage meeting held in Kazan, Russia in August, 2009 (ASTROKAZAN'2009) and supported by French side, subject to further discussions and clarifications.
- The first step towards the goal has been undertaken in the D. De Vorkin and author paper "Space Achievements as World Heritage" published in the *Heritage Sites of Astronomy and Archaeoastronomy in the context of the UNESCO World Heritage Convention: A Thematic Study* (C. Ruggles and M. Cotte authors/editors), ICOMOS-IAU, Feb. 2011, Ch. 15.
- A general understanding is that **the proposed segment of Space Astronomy/Technology World Heritage should have an international significance in terms of the human beings tight relationships with sky.**
- Obviously, international team of specialists should be further involved in the process of collecting respective materials/documentation and writing proposals to accommodate Convention on the World Heritage.

Synopsis

- **2005**: Round-table discussion in the Russian Academy of Sciences aiming to define a core of the Thematic Initiative on heritage of science and technology.
- **2007**: 50th anniversary of the Sputnik « *Fenêtres sur le Cosmos: Spoutnik et l'Aube de l'Age Spatial* » organized at the French Senate by ESA/CNES, Paris, France. Thematic research proposal «Odyssey of human creative genius: towards protection of space technological heritage connected with space exploration».
- **2009**: International Conference on "Astronomy and World Heritage: Across Time and Continents", Kazan, Republic of Tatarstan, Russian Federation. **RESOLUTION**:
 - Preliminary definition of types of technological sites and facilities connected with space exploration;
 - The clearly defined landscape designed and created intentionally by man and intrinsically associated with the Launch Pad and the related structures development;
 - The most prominent parts of space networks specially designed and built for manned flights;
 - Historical sites where the concepts of space flight were pioneered and original space vehicle designs were tested.

Synopsis (cont.)

- **2010: ICOMOS/IAU Thematic Study on Heritage of Astronomy, Cairo, Egypt.** 'Space heritage' preliminary definition:
 - heritage related to the process of carrying out science in space;
 - heritage related to manned space flight/exploration;
 - human cultural heritage that remains off the surface of planet Earth.
- **2011: International Seminar on Heritage of Astronomy. Institute of Astrophysics Paris, France.** "Ground Space Facilities and Launch Pads (Cosmodromes)". Discussion on tentative proposal of fixed sites and facilities pertaining specifically to space astronomy and/or generally to space science.
- **2012, July 4: UNESCO World Heritage Committee, St.-Petersburg, Russia:**
 - Preliminary endorsement of Space Astronomy as a segment of Astronomy Heritage and basically, as a segment of Space Technology Heritage.
 - Recommended to set up International Working Group under UNESCO umbrella in order to discuss the main issue and develop proposals how to progress with Space Technology Initiative and to accommodate Convention on the World Heritage
 - Resolution quoted (next slide).

Extract of the Decision 36 COM5D adopted at the 36th Session of the World Heritage Committee (RF, 2012)

- **The World Heritage Committee:**
“Also welcomes financial and technical support provided by State Parties and the International Astronomical Union for Thematic Initiative “Astronomy and World Heritage”, since 2003 and also encourages cooperation between the UNESCO World Heritage Centre, specialized agencies and relevant interdisciplinary scientific initiatives towards the elaboration of a Global Thematic Study on Heritage of Science and Technology, including studies and research on technological heritage connected with space exploration.
- Further encourage States Parties, international organizations and other donors to continue to the thematic programmes and initiatives and also requests an updated report on Thematic Programmes to the World Heritage Committee at its 38th session in 2014”.

**From MOU, *28th IAU General Assembly*
*Beijing, China, August 24, 2012:***

IAU expresses its continuing support to the UNESCO Thematic Initiative “Astronomy and the World Heritage” and in response to the UNESCO promotion, is willing to further extend this Initiative over Space Science and Technology with main focus placed on Space Astronomy and relevant facilities.

WHC Initiative to set up WG on Space Technology Heritage



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The Culture Sector World Heritage Centre

To : **Permanent Delegations of all States Parties to the World Heritage Convention**

National Commissions for UNESCO

**Advisory Bodies of the World Heritage Committee
(ICOMOS, ICCROM and IUCN)**

Ref: CLWHC-12/14/AWH/AS

30 JUL 2012

Subject: **Implementation of the UNESCO Thematic Initiative "Astronomy and World Heritage"**

Madam/Sir,

I would like to inform you that following the World Heritage Committee's Decisions **28 COM 9**, **29 COM 5.1**, **32 COM 10A**, **34 COM 5F.1** and **35 COM 9C**, adopted respectively at its 28th (Suzhou, 2004), 29th (Durban, 2005), 32nd (Quebec City, 2008) 34th (Brasilia, 2010) and 35th (UNESCO, 2011) sessions, a series of activities were carried out within the framework of the Thematic Initiative "Astronomy and World Heritage". The progress report on its implementation has been presented to the attention of the World Heritage Committee at its 36th session (St. Petersburg, 2012). All relevant information regarding the Initiative is available at the following address:

The World Heritage Committee, at its 36th session, has encouraged cooperation between the UNESCO World Heritage Centre, specialized agencies and relevant interdisciplinary scientific initiatives towards the elaboration of a Global Thematic Study on Heritage of Science and Technology, including studies and research on technological heritage connected with space exploration (Decision **36 COM 5D** in Annex I).

In the light of this Decision, the World Heritage Centre would like to identify all main actors concerned in order to enhance international cooperation and to define new partnerships.

Two working groups were already created within the framework of this initiative - an International Working Group on Astronomy and World Heritage chaired by Prof. Clive Ruggles (<http://www2.astronomicalheritage.org/>) and a first expert Working Group on technological heritage connected with space exploration chaired by Prof. Mikhail Marov, Academician of the Russian Academy of Science.

By the present, we are inviting all States Parties to update the contact information of the national Focal Point and to provide the World Heritage Centre with the name of the institution which will be responsible, in coordination with the World Heritage Centre, the Advisory Bodies and the above-mentioned Working Groups, for the implementation of the Initiative at the national level (see form in Annex 2).

With many thanks in advance for your kind cooperation and interest in the implementation of the World Heritage Convention, please accept, Madam/Sir, the assurances of my highest consideration.


Kishore Rao
Director

cc: - Advisory Bodies of the World Heritage Committee
- International Astronomical Union (IAU)
- Specialized Agencies (ESA, Roscosmos, NASA)
- WHC/IAU Working Group on Astronomy and World Heritage
- First Working Group on Space Technological Heritage
- Science and Technology Expert Working Group
- Participants in the side-event on "Astronomy and World Heritage"

UNESCO Endorsement of Space Technology Heritage Initiative



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Space Technological Heritage, UNESCO
Thematic Initiative "Astronomy and World
Heritage" (AWH)
Chairperson, Committee on Heritage of
K. Tsiolkovsky (RAS)

Via

Permanent Delegation of the Russian
Federation to UNESCO
UNESCO House

Ref. : CLT/WHC/5322/RU

20 JUL. 2012

Subject: Implementation of the Thematic Initiative "Astronomy and World Heritage"

Dear Prof. Marov,

I was very honored to meet you during the roundtable, organized at the initiative of Prof. Stepanov, Director of the Pulkovo Observatory, Russian Academy of Sciences, during the 36th session of the World Heritage Committee (St. Petersburg, 2012), and dedicated to the elaboration of a Global Thematic Study on Heritage of Science and Technology, including studies and research on technological heritage connected with space exploration, as requested by the World Heritage Committee.

I wish to express my sincere gratitude for your involvement and participation in the launching of this new study within the framework of the UNESCO Thematic Initiative "Astronomy and World Heritage".

As you are aware, a number of decisions regarding development of innovative strategic approaches in the implementation of the *World Heritage Convention* were taken by the World Heritage Committee at its 36th session. Among them, the first Committee's decision on technological heritage connected with space exploration is indeed highly symbolic. I would like to underline the very active role the high-level Russian specialists play in promotion and support of this new initiative.

I noted in your presentation during the above-mentioned round-table important proposals and suggestions regarding the framework and partnerships which should be established towards the implementation of this Committee's decision.

You may be assured that UNESCO accords high value to the creation of partnerships with the leading institutions, specialized agencies, such as "Roscosmos" and innovation centers, such as for example "Skolkovo" established in the Russian Federation, on the base of new initiatives launched and supported by the Russian Federation during the Committee.

I am confident that under your chairmanship and with involvement of all specialized agencies, institutions and centers concerned, this study on technological heritage connected with space exploration will be the start to our common flagship activities.

With many thanks in advance for your kind cooperation and interest in the implementation of the *World Heritage Convention*, please accept, dear Professor, the assurances of my highest consideration.

A handwritten signature in black ink, appearing to read 'F. Bandarin', with a long horizontal flourish extending to the right.

Francesco Bandarin

cc: Prof. Y. Osipov, President, Russian Academy of Sciences
Mr. G. Ordzhonikidze, Secretary-General, National Commission of the Russian Federation for UNESCO
Mr. I. Makovetskiy, President of the Russian World Heritage Committee
Dr O. Dluzhnevskaya, Focal Point for "Astronomy and World Heritage" in the Russian Federation
UNESCO Moscow Office

Space Astronomy and Space Technology: A Synergy

Historical Space Achievements

- Basically, there is a synergy between Space Astronomy and Space Technology, the latter serving a driver to progress with astronomy.
- Space Heritage Initiative can be further extended to many historically important achievements in space science and technology spin offs.
- Manned flights aiming to permanent human habitant in space and follow up extension through the Solar system serves as brilliant examples of Space Science and Technology Synergy.
- Among the firsts to be considered as Space Technology Heritage one might suggest Yu. Gagarin orbital flight capsule VOSTOK and Gagarin space suite; Apollo 11 lander EAGLE and N. Armstrong space suite;.
- Also in the list could be the first orbital stations Salyut, Skylab and MIR which paved the road to the International Space Station (ISS), and several generations of space launchers including Space Shuttle and Buran.

Virtual Against Material Space Objects: How to Commemorate

- The key question is **how** to utilize and/or commemorate **material artifacts** in space being after launch rather virtual than tangible objects.
- The bottom line is that, alongside with the valuable sites, monuments, observatories and instruments, outstanding objects operated in space are to be listed as **significant material artifacts** among historically important astronomical facilities.
- Our task is therefore to find out a **consistent approach** of the legacy of various human artifacts and activities in this particular field of Astronomy which is intimately related with Space Technology development to be recognized as the World Heritage.
- Obviously, besides **virtual world recognized space objects** selected and accepted by international bodies (IAU, ICOMOS, etc.) **mock ups of astronomical and planetary spacecraft** preserved in the ground space facilities and/or museums could be commemorated and assigned as UNESCO Space World Heritage.

Tangible and Intangible Objects

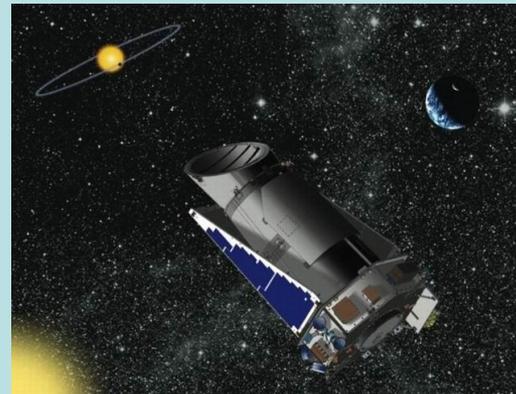
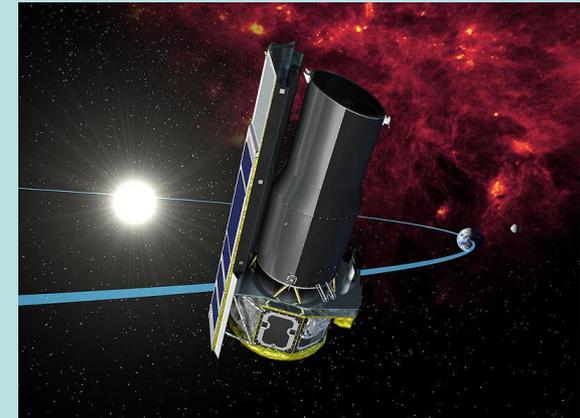
- The key question is **what and how** to recognize and commemorate space or space related objects and distinguish between tangible and intangible objects.
- The bottom line is how to select alongside with the historically important astronomical observatories the most valuable space facilities , sites, monuments and also significant **material artifacts** as outstanding space objects.
- The goal is therefore to find out a **consistent approach** of the legacy of various human artifacts and activities in this particular field of astronomy which is intimately related with space technology development to be recognized as Space World Heritage.
- Obviously, besides the ground space facilities the most **outstanding space objects** such as astronomical and planetary spacecraft recognized by such international bodies as IAU, ICOMOS, etc. could be in the short list of Space technology Heritage.

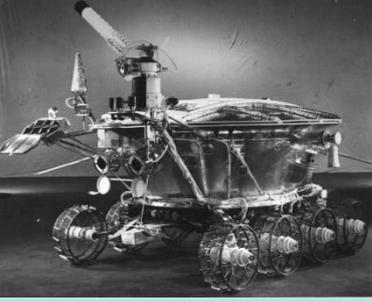
Space Facilities and Launch Pads (Cosmodromes)

- Space Facilities where recognized spacecraft were designed and manufactured and Launch pads (cosmodromes) are considered as an important part of the overall space infrastructure.
- They ensured development and launch of spacecraft and thus are to be regarded **historical cornerstones of space exploration**.
- Examples are: OKB-1 (RSC “Energiya”), NPO-Lavochkin, Jet Propulsion Laboratory (JPL), Johnson Space Flight Center (JSFC), Bayconour Space Center, Cape Canaveral Space Center, Koru Launch Pad.
- One should bear in mind however, existed formal restriction to announce space ventures/cosmodromes’ buildings/objects as UNESCO World Heritage, **subject to further negotiations**.
- To start with, a part of these facilities and/or cosmodromes infrastructure of exceptional historical value could be suggested to resolve the problem.

Provisional List of Astronomical Space Observatories

- As an example, we address several astronomical space vehicles equipped with excellent on board instruments of an outstanding value to astronomy.
- These are, e.g. Hubble Space Telescope, Quant, Chandra, WMAP, Spitzer, Planck, Kepler, etc., to mention a few.





Provisional List of Lunar and Planetary Space Vehicles



- Many spacecraft of historical value (both orbiters and landers) provided close up views of other worlds.
- They greatly contributed to the planetary exploration and opened up the new Solar system - our closest space environment.
- Examples are:
 - Luna 9, the first soft landing on the Moon surface;
 - Eagle capsule of first manned landing on the Moon with astronauts N. Armstrong and B. Oldrin within APOLLO program;
 - the first automatic lunar soil return with Luna 16 and the first Moon rover Lunokhod 1;
 - the first landers on Mars with Mars 6 and Vikings 1 & 2;
 - the first space vehicles for Venus exploration with Venera 4 & 8;
 - the first detailed study of outer planets, their satellites and rings with space vehicles Voyager 1 & 2;
 - the first entry in the Jupiter atmosphere with Galileo probe;
 - the first landing on Titan with Huygens lander as a part of Cassini-Huygens mission.

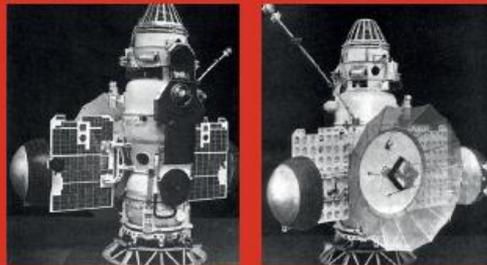
Space Technology Heritage in Publications: An Example

FIRST ON THE MOON, FIRST ON VENUS, FIRST ON MARS

The Soviet robotic space exploration program began in a spirit of bold adventure and technical genius. It ended after the fall of the Soviet Union and the failure of its last mission to Mars in 1996. *Soviet Robots in the Solar System* chronicles the scientific and engineering accomplishments of this enterprise from its infancy to its demise. Each flight campaign is set into context of national politics and international competition with the United States.

Together with its many detailed illustrations and images, *Soviet Robots in the Solar System*

- presents the most detailed technical description of Soviet robotic space flights
- provides a unique insight into programmatic, engineering, and scientific issues
- covers mission objectives, spacecraft engineering, flight details, scientific payload and results
- describes in technical depth Soviet lunar and planetary probes



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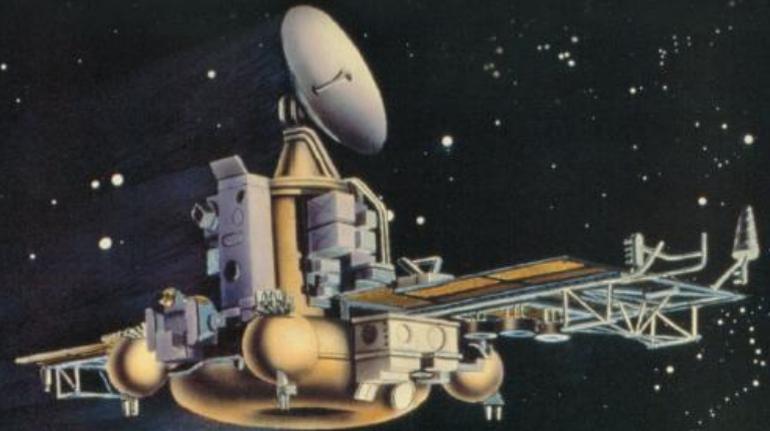
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SOVIET ROBOTS IN THE SOLAR SYSTEM

Mission Technologies
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Extraterrestrial Material/Lunar Soil

- Reconstruction of Solar system origin and evolution is intrinsically related with the detailed study of matter of extraterrestrial origin.
- This is a challenging goal to deliver extraterrestrial matter for in-depth study in the ground labs, the first step along the track being lunar soil returned by APOLLO and LUNA missions.
- These samples gave us unique information about the Earth-Moon system.
- The main bulk of samples is preserved in Johnson Space Flight Center, Houston, USA, and in Vernadsky Institute, Moscow, Russia.
- **These samples represent the real accomplishments of the human beings and they could be accepted as UNESCO Space World Heritage.**

Proceedings/Manuscripts of Space Pioneers

- In the venue of important topics selected as space legacy Proceedings and/or Manuscripts of space pioneers could be considered.
- This particular aspect of the Astronomy/Space World Heritage is addressed with a caveat to meet the criteria of the World Heritage Convention.
- One may suggest to list Konstantin Tsiolkovsky, Hermann Oberth, Robert Goddard, Yuri Kondratyuk, Serge Korolev, and Verner von Braun among space pioneers.
- The respective archives are pertinent to select out necessary documents, publications, etc. in an appropriate format.
- There should be a rather strict regulations while soliciting UNESCO patronage over these documents.

The First Step: How to Start?

The Case Study: Baikonur

- We are keen to see solid progress towards understanding the principal concepts underlying such a complex topic like space technology heritage. which, can be accomplished step by step approach in the context of this gradual development.
- A real case study on Baikonur should satisfy the basic standards concerning tangible evidences of sites and/or objects to be selected as cultural entities of the world recognized value. Historically it was the first linking mankind with the skies.
- Unfortunately, until recently no special guideline has been proposed by interested countries in order to satisfy the above requirements, as well as criteria for space science and technology sites/artifacts selection to accommodate UNESCO WH standards.
- Obviously, alongside with the inventory and historical development description, management issues are to be addressed as the most critical in terms of the justification for inscription. They include comparative analysis, integrity-authenticity, criteria under which inscription might be proposed, suggested statement of OUV, etc., which are vital in the study.
- In the comparative analysis approach, besides Baikonur, Kennedy Space Flight Center (KSFC) of similar historical value could be considered as an option. Likewise Baikonur, it has many world recognized achievements. However, Baikonur has a priority as the site holding historical facilities provided the First artificial satellite launch and Gagarin flight which manifested the great breakthrough in the human civilization and opening space era.

Baikonur: Credibility

Baikonur is one of the most advanced possessions of space era and it occupies historically important position in the human culture. Its recognized achievements and credibility fully satisfies to the World Heritage Convention (<http://whc.unesco.org/en/guidelines>) stating in an Article 49 that “Outstanding Universal Value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity” and also “represent a masterpiece of human creative genius” (ibid, Article 77i).

Baikonour: An Inscription

- Baikonour cosmodrome is a huge area with numerous launch pads and facilities in its infrastructure as it was described in the previous section, which has been dramatically extended since those historical the first satellite and Gagarin flights. In order to satisfy integrity-authenticity requirements.
- It is suggested to extend UNESCO patronage over only a small part of the overall Baikonur site/infrastructure - the famous "Launch pad № 2" known as "Gagarin's start site". In addition to the Gagarin's start site, two small cottages "Gagarin" and "Korolev" where the first cosmonaut and Chief Designer stayed overnight before the historical flight, could be suggested.
- Following WH Convention (1972) is based upon tangible evidences. Gagarin's launch pad is in place and operational. The start's facility is integrated in terms of the capable space technologies used for testing and launch of manned craft. Many cosmonauts and crews have been launched since the Gagarin first flight.
- Also, in the sense of state of integrity, it is justified that no eventual lacks or partial demolition occurred since the Gagarin time.

Baikonour: Authenticity

- The facility authenticity is undoubted and well documented including historical archives available. Commemoration of the historical events related to the launch pad is inscribed on the stone plate erected in site besides the pad.
- While original launch pad and close environment were partially reconstructed incorporating modern equipment that did not influence authenticity.
- The Gagarin and Korolev cottages have been repaired but did not experienced any changes including the former furniture and personal belongings. The places fully preserved the tangible attributes of the history and can be commemorated as the UNESCO WH.
- Thus the Gagarin's start site and cottages satisfy criteria under which inscription might be proposed, as well as suggested statement of OUV.
- Their recognition as WH seems will not impose political obstacles despite the fact that Baikonur is under international Russia-Kazakhstan joint jurisdiction. Some important issues are to be negotiated by Roscosmos including managerial aspects of the Initiative implementation.

Conclusions

- Space Astronomy and Planetary Exploration ensured the most significant progress in gaining knowledge about Solar system and the Universe thus **broadening up tremendously the human horizons.**
- Basically, there is a synergy between **Space Astronomy** and **Space Technology**, the latter serving a driver to progress with astronomy.
- It is therefore prerequisite to include **Space Astronomy /Technology** represented by astronomical spacecraft and probes as an important segment of the **UNESCO Astronomy World Heritage** (Joint Russian-French proposal).
- A **consistent approach** to the legacy of space facilities and human artifacts is proposed to be developed and recognized as **Space Technology Heritage.**
- **Launch pads** and ground based **space facilities** could be selected to start with accepting the proposed **Space Heritage Initiative.**
- The Initiative could be **further expanded** to other historically important achievements in **space science and technology** involving the first manned flights and space habitant.
- International Working Group under UNESCO umbrella is to be set up in order to discuss the main issues and develop proposals how to progress with Space Technology Initiative and to accommodate Convention on the World Heritage.