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[Independent Cultural Institution – the Innovation Centre Mill of Knowledge]

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A DETAILED DESCRIPTION OF THE SUBJECT OF THE CONTRACT

MODERNISATION OF THE EXHIBITION

‘ON THE REVOLUTIONS’

PART I — GENERAL REQUIREMENTS

Basic information on the intended use and location of the exhibition in the exhibition area and description of the object of the contract.

The Innovation Centre Mill of Knowledge (CNMW) is an independent cultural institution founded by the commune of the city of Toruń. It is located in the historical part of the so-called Richter Mills, which date back to the 1940s. The building consists of two parts – the former mill and grain elevators having 8 and 10 floors respectively, wherein the CNMW occupies 6 and 7 floors respectively. The remaining two floors of the mill, in which the exhibitions will be located, have been assigned for the needs of another institution. The Centre’s location in historical buildings of Toruń will determine the character of permanent exhibitions presented there: ‘On the Revolutions’, ‘River’, ‘Surviving’, ‘...it’s so simple’, ‘Ideas’, “Each exhibition is presented in a separate space and on a separate floor. All exhibitions are made available to visitors on one ticket. As part of the subject of the order, the Contractor shall modernise the exhibition ‘On Revolutions’ presented in the CNMW. This exhibition is located on the first floor of the building, next to the central exhibit of the CNMW - ‘The Foucault Pendulum’.

1 Basic information

1.1 Subject matter of the order

The subject of the order is the modernisation of the exhibition titled ‘On the Revolutions’, hereinafter referred to as the Exhibition, available continuously at the Innovation Centre Mill of Knowledge from 9 November 2013. The Exhibition currently consists of 29 stations or elements of fixed installation. The modernisation of the Exhibition aims at replacing outdated or obsolete stations

with new ones and renovating the remaining stations and space. The order shall provide for the creation of 11 new stations and 2 new, independent elements of the exhibition design, renovation or rebuilding of 14 stations, and elimination of two wall stations and two elements of fixed installation. The modernised Exhibition will consist of 25 educational stations and will be equipped with new elements of design. Within the framework of the order, the Contractor will also disassemble and utilize parts of old stations and elements of the arrangement, as well as perform renovation works of the exhibition space, design and make a new information panel about the Exhibition and display messages to all stations of the modernised Exhibition.

In the exhibition space, next to the view gallery (mezzanine banister) there is a multimedia station which supplements the 'Foucault's Pendulum' exhibit. This station should be left in the same place after the modernisation of the Exhibition is finished.

1.2 The audience of the Exhibition

The Exhibition is addressed to individuals, families and organized groups, children of pre-school age, children and youth in school age and adults. Young people up to 13 years of age will stay in the exhibition area under adult supervision. Organized groups will stay in the exhibition area only with group chaperones.

1.2 Characteristics of the Exhibition

The subject matter of the current Exhibition is connected on the one hand with rotational motion and its practical applications and related phenomena, such as the occurrence of inertia in rotating reference systems, and on the other hand with the construction of the Solar System and exploration of the Cosmos. The Exhibition presents exhibits that demonstrate the operation of simple machines using rotational motion, such as wheels, gears and pulleys. Rotational motion and the wheel are treated as a reference to the revolutionary work by Nicolaus Copernicus 'De revolutionibus...' and to the dominant exhibit of the Innovation Centre Mill of Knowledge - the Foucault Pendulum. The Copernican tradition, which is still alive in Toruń, is reflected in the exhibits that present contemporary methods of searching for planets and the construction of the Solar System. After the modernisation, the subject of the Exhibition will not change significantly, but some of the exhibits will be replaced or modernised, and the subject of space exploration will be more visible at the Exhibition.

1.3 Elements of the Exhibition

The modernised Exhibition will include the following elements:

- stations
- exhibition messages and the information panel about the exhibition
- design elements of the Exhibition
- the contents of the Exhibition
- the application for remote management of the media at the Exhibition

1.3.1 Stations

The current Exhibition consists of interactive hands-on stations, multimedia stations and mixed-type stations, which combine both elements. All stations have display messages. The new stations will be either hands-on stations or mixed-type stations (hands-on with multimedia elements).

1.3.1.1 Hands-on stations

The Ordering Party provides for most of the new stations to be hands-on stations, i.e. apart from intellectual involvement they will require physical or sensual operation of the users in order for them to achieve the desired effect. The main purpose of these stations is to stimulate the visitors' thought and creative processes. Some of the hands-on stations may require the application of additional fixtures and fittings for the sake of the visitors' safety.

1.3.1.2 Mixed type stations

The Ordering Party provides for mixed-type stations (hands-on + multimedia or design + multimedia), which will be used for the presentation of selected issues. In such stations, AV elements will be used, such as computers for sound or/and image reproduction, headphones, monitors, etc.

1.3.1.3 Station interactivity types

All the stations to be placed at the Exhibition will be interactive. New stations which meet this requirement will be considered as such if they represent at least one of the following types of interactivity:

- manual: station requiring the work of hands;
- motor: station requiring the movement of the whole body and motor coordination;
- sensory: station requiring the use of senses (e.g. sight, touch, smell, etc.);
- intellectual: in order to act properly, the station uses visitors' knowledge and, above all, requires intellectual activity.

1.3.2 Exhibition messages and an information panel about the Exhibition

The Contractor will prepare a new system of graphic identification for the Exhibition and design a new appearance of exhibition messages for all the stations. The Contractor shall place an information panel with the exhibition description at the entrance, near the wall with the exhibition logo or in its immediate vicinity. The content of the exhibition description shall be prepared by the Ordering Party in agreement with the Contractor, after the final content of the stations, their names and functionalities have been agreed on.

Each station will be accompanied by an exhibition message in the form of a verbal and/or graphic instruction. Exhibition messages on the stations should facilitate the use of the station. Depending on the type and subject matter of the station, the message may be integrated into it or free-standing. Some exhibits will use the present content of display messages, while for others new content will be created.

The messages should be prepared in Polish and English and in Braille for the blind, and should include:

- a. the name of the station,
- b. instructions for visitors to use the station / perform the task (step by step),
- c. additional information and interesting trivia to supplement it, explanation of the presented issues (depending on the subject matter of the station).

The content of exhibition messages must be understandable in terms of the information contained and the length/volume of the text, and must encourage the visitors to use the station. Furthermore, the messages have to be prepared in such a way as to enable the Ordering Party to modify the content later on (if there is such a need).

1.3.3 Design elements of the Exhibition

Apart from exhibition stations and messages, the modernized exhibition space will feature two new, independent elements of the exhibition design, as well as smaller elements of space design in the form of light points or light strips, painting of walls, wall graphics, etc. The Contractor should choose smaller elements of the design in such a way as to make the appearance of the modernised Exhibition uniform and integrate the new stations into the current design concept.

1.3.4 The application for remote management of the multimedia at the Exhibition

The Exhibition features an application for remote management of hardware and multimedia content (EXMAN). The Contractor shall modernise the old one or create a new multimedia management application, removing the eliminated elements and adding new multimedia elements to the Exhibition.

1.3.5 The contents of the Exhibition

The contents of the Exhibition shall be prepared by the Contractor's team of specialists in consultation with the Ordering Party. The contents of the exhibition may include texts, photographs, games, quizzes, audio recordings, animations, films, etc. The contents shall be created by the Contractor for the purposes of the exhibition or, if it is necessary to use ready-made contents in the form of photographs, audio recordings, films, fragments of texts, the Contractor shall purchase and provide the Ordering Party with the rights to use such contents for an indefinite period of time at the Exhibition. The Exhibition will be made available to visitors for a charge, so the purchased licenses must allow for charging fees for the presentation of the content covered by them.

1.4 Technical description of the building

The building where the Innovation Centre Mill of Knowledge is located is an adaptation of mills and grain elevators built in the 1940s, at 5 Łokietka St. and 8-10 Dworcowa St. in Toruń. The building consists of two functional parts which are used by two different users: The Innovation Centre Mill of Knowledge and the Toruń Technological Incubator. The design of the Innovation Centre Mill of Knowledge is organised across the seven-storey exhibition space (in the former grain elevator - building 'E', see section T_A_W_P_01, axis 7-10) and popular science studios (in a part of the former grain mill - building 'D', see section T_A_W_P_01, axis 1-6) divided by a passage zone (two staircases and an elevator complex). The Toruń Technological Incubator occupies the top, eighth floor of the grain elevator (building 'E') and the top two floors of the mill (building 'D'). The third storey is twice as high.

The building in its part over the ground is in the form of a rectangle with sides sized 29.6 m and 37.3 m. It is based on a reinforced frame structure, and supported by reinforced pillars, rectangular in cross-section and their transverse diameter varying on particular floors. On the level of ceilings there are ceiling joists with a characteristic change (increase) in their height near the supports. The floor slab with the reinforcement is 12 cm thick (15 cm on the flat roof). The 15 cm thick roof plate is designed to shift the weight from the air-conditioning devices. On the roof plate, above a number of

inlets, there is a space provided for a steel structure turret, where the Foucault Pendulum will be hung. The ceiling's live load in the exhibition part is 5.0 kN/m^2 , while the roof's live load equals 3.0 kN/m^2 . The dimensions of the external door opening leading to the main hall are 216.5 cm in width and 250 cm in height. Behind it there is another door opening with dimensions of 195 cm in width and 250 cm in height (see ground floor projection T_A_W_R_01.).

The exhibition 'On the Revolutions' is located in the exhibition area (building 'E') on the first floor.

1.4.1 The exhibition space

The exhibition 'On the Revolutions' will occupy approximately 320 m^2 of exhibition space on the first floor together with the Exhibition hall of 102 m^2 . In the central point of the space there is a 157 m^2 hole in the ceiling, surrounded by banisters made of laminated glass with a handrail at the height of 1.10 m, protecting the zone in which the Foucault's Pendulum will be exhibited (see the T_A_W_R_02 floor plan). The height between the floor and the ceiling in the exhibition space on the first floor is 2.53 m on the southern side (from the room entrance side) and under the ceiling beams, and 2.93 m on the northern side, however, due to finishing and design works this height may be slightly changed.

The dimensions of the entrance openings leading from the passage vestibules to the exhibition room are: 180x200 cm and 90x200 cm. Metal joinery of the internal doors leading to the exhibition space is made of aluminium profiles (colour RAL 9003), filled with translucent glass.

The floor in the exhibition space is made of granite slabs. Brick walls filled with polyurethane foam, strengthened with reinforced concrete wall from the inside. The interior has been thermally insulated with low density foam concrete slabs - multipore. There are no window openings in the entire exhibition space. In the central part of the first floor there are two reinforced concrete columns 80x80cm in diameter. Suspended ceiling systems made of plates with perforated core of mineral fibre and a coating of acoustic fleece (THERMATex ACOUSTIC) (thickness of the plates – 19 mm). At the walls and around the pendulum zone there is a suspended ceiling system made of G-K boards (thickness of the board 1 x 1.25 cm), on CD 60 ceiling profiles, UD 30 side profile.

1.4.2 Utilities

1.4.2.1 Electrical installations

The internal electrical installation will be laid on the first floor on the walls and on both reinforced concrete columns (in 18 spots in total) where 2P+Z 230V sockets will be installed (see installation of sockets R_03 projection). In addition, similar sockets will be installed throughout the exhibition space in 20 UDH3 floor boxes with HBKK Q06 cassettes. The floor sockets will be powered from the rooms below. At 6 spots on the wall three-phase sockets (400 V) will be installed. In addition to these sockets, RJ-45 computer sockets will be available in 12 places on the wall and in all floor boxes.

General sockets are mounted at the height of 0.3 m, 3-phase sockets 400V at the height of 0.5 m, and in bathrooms and utility rooms at the height of 1.1 m with protective zones of 60 cm from the edge of the bath or shower. The socket circuits are protected with residual current devices ($\Delta I = 30 \text{ mA}$).

1.4.2.2 Lighting

The lighting level applicable in the exhibition space of the building is the working plane, i.e. the height of 0.85 m from the level of the floor, with the intensity of about 400 lx. The lighting system

control has also been designed. The exhibition's control cabinets are situated in the technical room on the eastern side (see lighting installation, projectionR_04). Moreover, the building provides for LED emergency lighting of small intensity.

1.4.2.3 Water and sanitary installations

There are no water intake points within the 'On the Revolution' Exhibition zone, but they are located in adjacent rooms on the ground floor in the main hall.

There is no distribution of horizontal water and sewage pipes on the first floor. Vertical supply pipes will be laid in enclosed vertical service shafts or wall furrows together with hot water and air circulation systems. The projection of the water and sewage system on the first floor of the building is presented in the drawing INST_PW_01.

1.4.2.4 Ventilation and air-conditioning systems

Mechanical intake and exhaust ventilation with air-conditioning of the rooms. The core of the system shall consist of three roof air handling units and one suspended air handling unit in the attic, directing the outside air to proper rooms. The installation of ventilation in the whole exhibition space has been designed as an installation with a laminar flow, with the use of skirting displacement flow diffusers. Such a system is aimed at eliminating the influence of ventilation air movement on the work of the exhibits. The projection of the ventilation and air conditioning system on the first floor is shown in the drawing T_S_W_S_02.

Fan-Coil ceiling and wall air conditioners with air cooling option will be used in office rooms, conference rooms and computer rooms. The server rooms, on the other hand, will be equipped with an indoor air cooling system using freon systems.

1.4.3 Furthermore, the building provides for the following installations, systems and devices:

- SAP fire alarm system;
- DSO voice alarm system;
- BMS automatic ventilation and building management system;
- intrusion detection system [IDS], access control system, surveillance TV [CCTV];
- installation of a structural network (computers, telephones, network devices and a switchboard).

There are plans for distributing the WiFi network, which will be available in the building, excluding exhibition rooms (exhibition space), using ceiling Access Points. Network devices are required to comply with the IPv6 communications protocol.

1.4.4 Conditions of conducting works in the building

During the execution of the 'On the Revolutions' Exhibition, the Contractor must not in any way violate the structure, installations, previously performed design and finishing works, etc. The Contractor shall be liable for any damage that may arise during the performance of the subject of the order, even if they are revealed at a subsequent time, but were caused by the Contractor's actions. When performing the subject of the order, the Contractor shall be obliged to execute it in accordance with Polish regulations, including fire protection and safe use of the facility, health and safety rules and standards. **Before commencing the modernisation of the Exhibition, the Contractor**

shall be obliged to check all the necessary dimensions in real. All sections, projections and drawings mentioned in the text are included in **Attachment No. 1** to this document.

2 Description of the object of contract

2.1 Designs

- 2.1.1** Providing the Ordering Party with access to the application that enables management of the exhibition design and communication between the Contractor and the Ordering Party.
- 2.1.2** Creating and providing the Ordering Party with a schedule of works at the Exhibition, in particular disassembly and disposal of the liquidated elements of the Exhibition, renovation of the exhibition space and the remaining stations as well as the creation of new stands and elements of the exhibition design.
- 2.1.3** Creating and providing the Ordering Party with a detailed description of the renovation works in the exhibition space and the renovation of the remaining stations.
- 2.1.4** Creating graphic and working designs of new elements of the Exhibition and delivering them to the Ordering Party, in particular:
 - 2.1.4.1** Creating graphic and working designs of new stations and delivering them to the Ordering Party,
 - 2.1.4.2** Creating graphic and working designs of new Exhibition design elements, and delivering them to the Ordering Party;
- 2.1.5** Creating a graphic design of the whole space of the modernised Exhibition and delivering it to the Ordering Party.
- 2.1.6** Creating and providing the Ordering Party with a graphic design of the exhibition information panel and a draft of the exhibition message, including the name of the station, instructions for the visitors to use the station/to perform the task (step by step), as well as additional information and trivia concerning the presented issues.
- 2.1.7** Creating and providing the Ordering Party with a preliminary graphic design and preliminary scenarios of texts and scripts for multimedia applications in mixed-type stations.
- 2.1.8** Creating and delivering the updated visualisations of the stations together with exhibition messages and the visualisation of the whole Exhibition, presenting the Exhibition from each side, during the day and at night, on the basis of designs mentioned in clauses **2.1.4**, **2.1.5**, **2.1.6** and **2.1.7** after their final acceptance by the Ordering Party in the electronic form with the parameters which enable the creation of printouts in B2 format without deterioration in their quality.
- 2.1.9** Providing the Ordering Party with detailed information about the modernised or newly designed multimedia management system of the Exhibition.
- 2.1.10** Handing over a cost estimate including the prices of Exhibition's elements mentioned in clause **1.3.** and all the other costs necessary to execute the subject matter of the order (after the final acceptance of the designs by the Ordering Party) to the Ordering Party.
- 2.1.11** Providing the Ordering Party with the information concerning the yearly operating cost of the Exhibition.
- 2.1.12** Handing over a list of all spare elements meant for all stations, together with their quantity, to the Ordering Party.

2.2 Execution of works, delivery and installation of the Exhibition's elements

- 2.2.1** Execution of works related to disassembly and disposal of the liquidated Exhibition elements.

- 2.2.2** Execution of works related to the renovation of the exhibition space and the modernisation and renovation of the remaining stations.
- 2.2.3** Execution of new elements of the Exhibition, in particular:
- 2.2.3.1** Creating exhibition messages for all the stations, which consist of information boards blended in with stations or infographics placed on the stations, in such places that do not cause interference with functionality, containing:
- a.** the name of the station in Polish and English,
 - b.** instructions for the visitor to conduct an experiment (step by step) in English and Polish,
 - c.** description of the observed phenomenon in Polish and English,
 - d.** brief information about the station in Braille
- 2.2.3.2** Creating applications designed for mixed-type stations, which feature the content prepared by the Contractor under the supervision of the Ordering Party. In particular, for each of these stations it is necessary to:
- a.** create all the applications used at the station together with presentations and other means of multimedia messaging used together with their script and a specification of their content,
 - b.** create graphic designs of the applications, presentations, animations and other means of visual message,
 - c.** create text content used in the applications.
 - d.** purchase the right to use all materials not created by the Contractor for the purposes of the stations (i.e. photographs, films, broadcasts, etc.) at the Exhibition.
- 2.2.3.3** Execution of new stations, elements of the design and information panel about the exhibition according to the designs listed in clause 2.1, accepted by the Ordering Party.
- 2.2.3.4** Modernisation or creation of a new application for remote management of the exhibition multimedia.
- 2.2.4** Testing of all the Exhibition's elements at the Contractor's premises in the presence of the Ordering Party's representatives and making necessary changes on the basis of the test results.
- 2.2.5** Testing all the elements of the Exhibition (on selected groups of target audience) and removing any faults arising from these tests.
- 2.2.6** Delivering all exhibition elements that have been tested and approved by the Ordering Party, i.e.: exhibition messages, stations, elements of space arrangement and Exhibition content to the Ordering Party's main office
- 2.2.7** Providing the complete software for the multimedia stations, together with texts, animations, films, sound files, games and other multimedia software used in them, which have been approved by the Ordering Party, in the form allowing for the change of software, as well as for adding new films and animations. The Contractor should deliver, in particular:
- a.** a list of all applications used at the stations together with presentations and other means of multimedia messaging used, together with the specification of their content,
 - b.** graphic designs of the applications, presentations, animations and other means of visual message,
 - c.** all texts, photographs, films, programmes, animations, games, quizzes, etc. used in electronic form on a CD or DVD,

- d. all the computer programmes created for the purposes of the Exhibition together with source files in electronic form on a CD or DVD,
 - e. all the other elements of the presentations created with the use of means of multimedia messaging in electronic form on a CD or DVD.
- 2.2.8** Providing the Ordering Party with the content of exhibition messages, texts, pictures, graphics and applications including the elements required in clause **2.2.3**, in order to obtain their acceptance and make necessary changes on the basis of the Ordering Party's observations.
- 2.2.9** Installation, start-up and integration of all the Exhibition's elements, referred to in clause **2.1**.
- 2.3 Delivery of spare parts, post-completion documentation and training of the staff**
 - 2.3.1** Delivery of spare parts which can be used for repairs (referred to in clause **2.3.3**. made during the warranty period by trained employees of the Ordering Party.
 - 2.3.2** Delivery of all consumables for the particular elements of the Exhibition for the first six months of its displaying, beginning from the day on which it would be received by the Ordering Party, the Innovation Centre Mill of Knowledge.
 - 2.3.3** Creating documentation of the Exhibition and delivering it to the Ordering Party. The documentation should include at least the following information (post-completion documentation):
 - a. a list of Exhibition's elements (messages, stations, elements of the design, content),
 - b. station names together with their location within the exhibition space,
 - c. purposes of the stations,
 - d. graphic and working design of the modernised Exhibition and its individual elements
 - e. a detailed manner of functioning of the particular stations,
 - f. a detailed description of the phenomena/subject matter presented at the particular stations,
 - g. a number of people who can use one station at the same time,
 - h. detailed information concerning the media and consumables necessary for the proper functioning of the stations,
 - i. a list of repairs which can be made during the warranty period without prejudice to the warranty conditions by the employees of the Innovation Centre Mill of Knowledge, trained by the Ordering Party.
 - 2.3.4** Creating an operating manual, rules of control, service and maintenance of particular elements of the Exhibition in Polish, in paper and electronic form, as well as warranty cards and delivering them to the Ordering Party.
 - 2.3.5** Handing over the results of tests referred to in clause **2.2.5** to the Ordering Party.
 - 2.3.6** Transfer of software licence, including the application for remote managements of the Exhibition multimedia, and copyrights to the application, photos, graphics, drawings, texts, films and animations as well as other software and creations used in all the elements of the Exhibition, to the Ordering Party.
 - 2.3.7** Handing over of a declaration that the subject matter of the order conforms with the applicable regulations and standards to the Ordering Party; the elements of the Exhibition and of the design must meet European safety standards, whereas all the materials and devices used for their manufacture must have proper declarations of conformity proven by the CE marking, or declarations which are equivalent to them.

- 2.3.8** Transfer of copyrights to the subject matter of the order to the Ordering Party under the terms and conditions defined in the contract.
- 2.3.9** Training of the Innovation Centre Mill of Knowledge employees in the scope of management, inspection, maintenance, servicing of the Exhibition to the extent enabling the workers to make repairs referred to in clause **2.3.3**, also during the warranty period. Training for a group of up to 20 people will be conducted in the Ordering Party's seat in Polish or English on the date agreed with the Ordering Party before the end of the contract.

PART II — SPECIFIC REQUIREMENTS

3 Requirements concerning the Exhibition design

- 3.1** The exhibition spaces should be arranged in a comprehensive manner, so the entire wall, floor and ceiling surfaces are available, in which new stations should be installed, the remaining stations and relevant elements of the design, such as wall graphics or lightweight partition walls, furniture, lamps, light strips, etc., should be arranged. The elements of the design must form the background and complement the stations and form a coherent whole with them. Two independent elements of the exhibition design have been described by the Ordering Party, and the final selection of the smaller elements of the design will depend on the Contractor, who will design them so as to achieve the effect of a coherent, visually attractive space of a modernised exhibition.

4 Requirements concerning the content of the Exhibition

- 4.1** The content of new stations at the Exhibition must be prepared by the Contractor in cooperation with the Ordering Party. If necessary, the contents of the remaining stations will be updated and changed by the Contractor in cooperation with the Ordering Party. The texts must contain scientific facts and educational content and must not contain explanations of phenomena that are contrary to scientific knowledge. Fairy tale, quasi-scientific content or content violating moral norms cannot be introduced to the text content of the Exhibition. The graphical presentation of all contents must be consistent with the adopted design concept.
- The choice of content presented at the stations and the narration method used must be adapted to the audience from about 10 years of age, i.e. accessible, but without omitting the basis of knowledge in the form of conceptual apparatus or literature on the subject, characteristic for the presented field. The whole content of must be presented in a readable and organised way.
- 4.2** All stations shall be provided with exhibition messages in the form of verbal or graphic instructions. Exhibition messages must be placed in such a way as to be visible to visitors. The Ordering Party allows for a possibility of changing the content of the messages in the later period of its activity, which is why they have to be made in a way that their replacement or modification does not interfere with the stations. The Ordering Party requires that the Contractor provides the exhibition messages also in electronic form to enable subsequent modifications of their content.
- 4.3** The exhibition messages must be available to visitors in Polish and English, as well as in Braille.

5 Requirements concerning the elements of the Exhibition

- 5.1** All new elements of the Exhibition which are the subject of this order should be created especially for the Innovation Centre Mill of Knowledge and form a visually coherent whole with the elements to be renovated.
- 5.2** All stations should be designed so that visitors have no problem with understanding how to use them (they should be intuitive in use, and their use in accordance with the instructions should be attractive enough to avoid attempts at using the exhibit in any other way).
- 5.3** All the stations must be interesting enough for the visitors to focus their attention for longer than just a short moment and encourage them to interact.
- 5.4** The exhibition elements must be designed in such a way that their reception by people with various disabilities is as complete as possible.

6 Technical and operating conditions

- 6.1** It is assumed that the Exhibition can be visited daily by about 2000 people, including people with different types of disabilities. The aforementioned information is to be taken into consideration when planning the Exhibition in terms of technical and operating conditions.
- 6.2** Elements of the exhibition have to be durable and resistant to the visitors' actions:
 - a.** they have to operate smoothly despite their daily multiple mass use;
 - b.** they must be visitor-proof and designed to be intuitive and easy to use in accordance with the instructions;
 - c.** they have to be easy to clean, in particular in case of being scribbled with a marker pen, pen, paint, etc.;
 - d.** they should be resistant to unintentional and inaccurate actions of visitors.
- 6.3** The contents of the Exhibition must meet the EU standards concerning lights and lighting, also with regard to the workplace. The lighting sources ought not to dazzle the visitors or put their eyesight at risk. In order to allow for a more complete reception of the Exhibition's contents and in view of the partial lack of natural lighting of the exhibition space, individual lighting of the Exhibition's elements ought to be designed. The lighting is to expose the most important elements of the Exhibition, both the stations and the design elements, yet it cannot hinder the usage of the stations.
- 6.4** Elements of the Exhibition have to be made in such a way so that staying in the Exhibition's space will not expose the visitors to danger and so that the elements can be used safely also by untrained persons and without the help of the maintenance staff.
- 6.5** It is necessary to ensure unobstructed passageways between the Exhibition's elements, which ought to be accessible also for the disabled on wheelchairs.
- 6.6** The materials used for making the Exhibition's elements must have safety approvals and meet European standards for facilities of this kind, they must be wear-resistant, washable and easy to maintain. The materials and technical solutions used for making the Exhibition's elements, as well as possible operating materials ought to be ecological and energy efficient.
- 6.7** Maintenance of the exhibition's elements ought to be possible to be carried out by the Ordering Party with no external help.
- 6.8** All doors, cabinets and small doors fitted as parts of the Exhibition's elements, protecting the equipment installed inside, made for the management or servicing of the Exhibition's elements ought to be equipped with locks and keys. The Contractor will hand over the keys, together with a spare set, to the Ordering Party.

- 6.9** The operation of the Exhibition (all its elements at the same time) must meet the standards concerning the level of noise in workplaces and public utility places.
- 6.10** It is necessary to provide for the production of spare parts which can be used for repairs (referred to in clause 2.3.4.) made during the warranty period by trained workers of the Ordering Party, for each element of the Exhibition.
- 6.11** It is necessary to provide for the protection of consumables for a six months' activity of the Exhibition, from the day it is open to visitors.
- 6.12** The Ordering Party requires that all the movable elements of the stations or the elements of design have magnetic stripes or stickers that protect against theft, compatible with the system of anti-theft gates installed in the building where the Exhibition is displayed.

7 Requirements for the Exhibition Design Management and Remote Exhibition Management Application

- 7.1** The Contractor shall provide the Ordering Party with access to the application that enables

management of the exhibition design and communication between the Contractor and the Ordering Party, allowing at least:

- Logging to the application from the browser level, after authentication using a secure encrypted connection. The communication between the modules operating in the local network and the Internet must be carried out using secure mechanisms for encrypting the transmitted data and authorising the users.
- Providing the Ordering Party with designs, elements and contents of the exhibition in electronic form in order to make changes to them, submitting comments and acceptance by the Ordering Party; Information concerning each of the elements and contents of the exhibition should be stored in separate folders; it should be possible to mark the following design statuses: Contractor's Suggestion, Changes in Progress, Approved by the Ordering Party, with the indication of the history of changes (date, time, person making the changes).
- Adding comments in text and graphic form by authorized employees of the Ordering Party and the Contractor to graphic designs, executive designs, texts, films, applications, graphics and all multimedia solutions for all elements of the Exhibition.
- Generating a list of entries and comments for a selected element or exhibition content in a legible form (containing date, time, person making the change, content of the change). The lists are to be generated in pdf formats and in an editable version with the possibility of saving them to disk.
- Automatic notification of the Ordering Party by e-mail about changes, entries

and comments posted in the application. The mechanism is to send all information about the introduced changes in the application, i.e. date, person making the changes and content to the e-mail address.

- Creation of a backup copy of the application with all its content, automatically and on request.

the Ordering Party requires that the Contractor provide the Ordering Party with a license for unlimited use of the application and the platform on which it was placed.

7.2 The Contractor should modify the existing application or provide the Ordering Party with a new application enabling remote management of the exhibition.

The system shall be based on the application which the Contractor will install on the Ordering Party's server. The system should consist of two modules: administrator and exhibition management. The modules are to be accessed from the browser level upon the authentication by means of an encrypted connection.

A. General system requirements:

- Location in the existing infrastructure (server room).
- The system must have a Polish-speaking user interface.
- The system must have a built-in register that allows users to register their loggings and activities.
- The system must be able to generate statistics related to its work.
- The system must have authentication and authorization mechanisms based on the central authorization system.
- The communication between the modules operating in the local network and the Internet must be carried out using secure mechanisms for encrypting the transmitted data and authorising the users.
- The system must have a mechanism for creating security copies automatically and on demand.
- The system must operate on the basis of the client-server architecture.

The Ordering Party requires the Contractor to provide the Ordering Party with a licence for unlimited use without a restriction on the number of exhibits to be handled.

B. The Administrator module is to enable:

- User rights management, in particular granting access rights to the system modules.
- Changing the configuration settings of multimedia exhibits.
- Creation of backup copies of configuration files to all multimedia stations.
- Creation of backup copies of all multimedia applications, other multimedia and the content contained therein.
- Remote installation and software update for each multimedia station.
- Remote viewing of the currently displayed image at a selected multimedia station.
- Automatic switching on and off of one computer or a group of computers in multimedia stations at a specified time.
- Preview and change of text, graphics and film content contained in all multimedia applications.
- Monitoring of the work of a multimedia station or a group of stations (including informing the administrator about work - logging in, logging out, restarting, attempts by an external user to interfere with the operating system).
- Monitoring of computer parameters in multimedia stations and their elements (i.e. temperature, S.M.A.R.T., etc.).
- Adding new multimedia stations with Windows, Linux to the system, with the possibility of the following functions: switching on, off, restarting, remote desktop based on the VNC system.

- Generating statistics on the use of multimedia applications (popularity of multimedia materials, applications or their options, media playback time).
- Remote restarting, turning on and off of each multimedia station.
- Protection of computers against unauthorized interference in the operating system of multimedia stations (hiding a taskbar, locking shortcuts, desktop lock, hard drives lock).
- Defining which executable applications or their parts of fragments the user can run.

C. The Exhibition Management Module is to contain/enable the following:

- Log of events and errors recorded during the operation of all multimedia applications (date, station name, information on the lack of connections, restarting, shutdown, turning on, configuration updates, changes of all types of content contained in applications).
- Creation of a weekly exhibition work schedule together with the exceptions for the entire exhibition.
- Remote restarting, turning on and off of each multimedia station.
- Preview of text, graphics and film content contained in all multimedia applications.

8 Multimedia equipment and application requirements

Minimum requirements for the different types of multimedia equipment and applications indicated in the following station specifications:

1. Multimedia touch-screen display integrated into station E.04:
 - a. monitor brightness min. 300cd/m²,
 - b. viewing angles at least 178° (vertical) and 178° (horizontal),
 - c. touch pad with durability according to IEC 60950-1 standard - complying with the falling ball impact test
 - d. number of touch points min. 5,
 - e. min. 1920x1080,
 - f. diagonal 32",
2. Multimedia touch-screen display integrated in the E.09 station, which reacts to touch (soft meteorite-ball impact) by displaying appropriate images in these places:
 - a. monitor brightness min. 300cd/m²,
 - b. viewing angles at least 178° (vertical) and 178° (horizontal),
 - c. touch pad with durability according to IEC 60950-1 standard - complying with the falling ball impact test
 - d. number of touch points ensuring proper operation of the station.
 - e. min. resolution 4K and diagonal min. 65",
3. Large multimedia display with lockable touch function for displaying texts and photos to the E.11 station:
 - a. monitor brightness min. 300cd/m²,
 - b. viewing angles at least 178° (vertical) and 178° (horizontal),
 - c. min. resolution 4K and diagonal min. 50".

4. Computers - central units for multimedia stations E.04, E.09 and E.11:
 - a. the parameters of the central unit must be selected so that they are universal for at least 7 years and do not require the replacement of elements,
 - b. the processor must score the minimum of 6000 points in the PassMark test from <http://cpubenchmark.net>, rated thermal power not greater than 35W,
 - c. sound pressure at a distance of 50 cm from the station not greater than 30dBa,
 - d. hardware h.265 codec support,
 - e. support for display resolution 3840 × 2160,
 - f. power supply with efficiency of at least 80 PLUS Silver.
5. Equipment for the storage, reproduction and listening of sound files for the E.02 station:
 - a. computers or modules that offer the possibility of uploading sound files and adjusting sound parameters through computer network,
 - b. headphones - designed for use in interactive stations of museums and science centres, mounted in a way that allows an easy exchange.
6. The parameters and types of applications created for the exhibition must be selected so that they can be updated for the minimum of 7 years.
7. AV equipment must be covered by a warranty not shorter than the warranty period for the entire exhibition or the manufacturer's warranty, if longer.

9 Requirements regarding the disassembly and disposal of old stations

9.1 The Contractor's task shall be to disassemble all the elements of the seventeen stations indicated in item 9.2 and marked in figure W.1 (exhibition plan before modernisation), included in **Attachment No. 2** to this document, after they have been shut down by the Ordering Party and the elements that the Ordering Party intends to leave for use in accordance with its own needs have been disassembled. The Contractor shall disassemble the exhibits into parts, which he shall then remove from the exhibition space and organize and pay for their disposal.

9.2 List of exhibition stations and design elements to be disassembled and disposed of.

No.	Name of the station or design element
U.01	Tellurium
U.02	The Solar System
U.03	Gear Puzzle
U.04	Circle Puzzles
U.05	Gyroscope Rodeo
U.06	Playing in the Capsule - a High Altitude Balloon
U.07	Playing in the Capsule - Designing Planets
U.08	Playing in the capsule - Space Passage
U.09	Playing in the Capsule - a Lander
U.10	Mars Rover

U.11	Take a Sample
U.12	Space Station - Walls
U.13	Spectroscopic Helmets
U.14	Vacuum
U.15	Radioactivity
U.16	Ready to Dock
U.17	Multimedia Modules with Broadcasts

10 Requirements for the renovation of space and modernization of the existing stations

10.1 List of exhibition stations and elements to be renovated and modernised, marked on drawings W.1 (exhibition plan before modernisation) and W.2 (proposed exhibition plan after modernisation), included in **Attachment No. 2** to this document.

No.	Name of the station or design element
R.01	The walls of the Exhibition Space
R.02	Centrifugal Force
R.03	Coriolis Force
R.04	Work in Full Swing
R.05	Machinarium
R.06	Tug of War
R.07	Balance Beam
R.08	Gear Wrestling
R.09	Why was the Wheel Invented?
R.10	If not the Wheel, then what?
R.11	Hamster Wheel
R.12	Methods of Searching for Planets
R.13	Transits

10.2 Detailed requirements for exhibition stations and elements to be renovated and modernised. Photographs of the exhibition space and the stations for renovation can be found in

Attachment No. 3 to this document. All the stations are located in the space of the modernised Exhibition and their location is marked on the W1 drawing (plan of the Exhibition before modernisation), which is included in the **Attachment no. 2** to this document.

No.	Name	Requirements	Notes
R.01	Walls	The Contractor shall renovate the exhibition space by repairing and painting the walls before placing the designed elements of the arrangement (graphics, lighting elements, panels).	The Contractor shall leave the exhibition logo unchanged
R.02	Centrifugal Force	The Contractor shall clean/revitalise the exhibit and replace the exhibition message	A movable station - it is possible to move it to a different spot

R.03	Coriolis Force	The Contractor shall clean/revitalise the exhibit and replace the exhibition message	A movable station - it is possible to move it to a different spot
R.04	Work in Full Swing	The Contractor shall clean/revitalise the exhibit and replace the exhibition message	The station will remain in its present spot
R.05	Machinarium	The Contractor shall clean/revitalise the exhibit and replace the exhibition message	The station will remain in its present spot
R.06	Tug of War	The Contractor shall clean/revitalise the exhibit, replace the ropes, replace the exhibition message	A movable station - it is possible to move it to a different spot
R.07	Balance Beam	The Contractor shall clean/revitalise the exhibit, replace the seats, replace the exhibition message	A movable station - it is possible to move it to a different spot
R.08	Gear Wrestling	The Contractor shall clean/revitalise the exhibit and replace the exhibition message	A movable station - it is possible to move it to a different spot
R.09	Why was the Wheel Invented?	The Contractor shall clean/revitalise the exhibit, replace the surface on which the wheels move, stabilise the exhibit and replace the exhibition message	A movable station - it is possible to move it to a different spot
R.10	If not the Wheel, then what?	The Contractor shall clean/revitalise the exhibit, replace the vehicles, replace the exhibition message	A movable station - it is possible to move it to a different spot
R.11	Hamster Wheel	The Contractor shall clean/revitalise the exhibit, replace the wheel sheathing, replace the exhibition message	The station will remain in its present spot
R.12	Methods of Searching for Planets	The Contractor shall clean/revitalise the exhibit	A movable station - it is possible to move it to a different spot
R.13	Transits	The Contractor shall clean/revitalise the exhibit	A movable station - it is possible to move it to a different spot

11 Requirements for new stations and design elements of the Exhibition

11.1 List of new stations and independent design elements of the Exhibition, marked as W.2 in the drawing (proposed plan of the Exhibition after modernisation), included in **Attachment No. 2** to this document.

No.	Name of station
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E.01	The Big Dipper
E.02	Music of the Cosmos
E.03	Tellurium
E.04	Who is Obscuring the Moon?
E.05	Gravitation
E.06	Black Hole
E.07	Light or Heavy?
E.08	Rocket Competition
E.09	The Fall of the Meteorites
E.10	Orbital Speed
E.11	Nebulae

No.	Name of the independent design element
A.01	Spacecraft
A.02	Astronaut

11.2 Detailed requirements for new stations and design elements of the Exhibition

E.01	The Big Dipper
Location	The installation suspended from the ceiling in an empty space next to the mezzanine of the first floor.
Objective	Using a science&art type exhibit, the Visitor will learn about the arrangement of the stars of the Big Dipper and will see that they form a familiar drawing only if we look at the arrangement from the side of the wall with station E.02.
Size of the station	The installation should take up all available space between the mezzanine railings and the Foucault pendulum basin, as well as between the first floor ceiling and the ground floor ceiling level. The distance between the installation elements and the railings should be large enough to prevent the Visitors from touching them.
Elements and requirements	<p><u>The station should enable:</u></p> <ul style="list-style-type: none"> – understanding that the stars that make up the constellations can be located at different distances from the Earth, – self-examination of what the same object (constellation model) looks like when we look at it from different angles, – combining science and fun by finding a place from which the model of the Big Dipper system looks the same as when we look at the real constellation from the surface of the Earth. <p><u>The station consists of the following elements:</u></p> <ul style="list-style-type: none"> – A model of the system consisting of eight models of stars (illuminating with the use of, e.g., white LEDs), suspended from the ceiling at distances corresponding to the actual distance, in a scale where 1 metre corresponds to the distance of 10 light years. At this scale, the farthest star of the scale should be 12.3 m from one of the

	<p>observation points, the nearest - 7.8 m, and the span of the stars should not exceed 6.0 m in a direction perpendicular to the direction of vision. If necessary, the scale may be changed minimally so that no 'star' can be reached by hand from the mezzanine. The stars shall be named in such a way that, on the one hand, the names do not obscure the image and, on the other hand, they are visible from different sides.</p> <ul style="list-style-type: none"> – 5 observation stations in the form of a circular disc with a hole through which the arrangement of 'stars', located next to the mezzanine railing, is to be viewed. The discs should be numbered in such a way that it is possible to give a simple answer to the question: through which of them the Big Dipper can be seen as from the Earth. It is necessary to ensure good visibility of the 'star system' from each observation stand at standard lighting of other exhibition stations (it may be necessary to use additional elements, e.g. panels that form the background for the model).
Use	When we look at the night sky we think that the stars visible in it are at the same distance from us, differing only in brightness. In fact, the stars we see with the naked eye in the sky are scattered around our Galaxy and their distances from the Solar System are not the same. For this reason, the shapes of the constellations known to us look completely different when we look at them from a different angle. In practice, our ability to see 'from the side' is limited to the change in the position of the Earth during its motion around the Sun, which is insignificant in cosmic scale.
Notes	A display message should be placed in the vicinity of the station, including additional information on the subject of the station and interesting facts.
E.02	Music of the Cosmos
Location	Wall behind the mezzanine (spot where the liquidated U.01 and U.02 stations once stood)
Objective	<u>Mixed type station</u> The station will be a place of relaxation for the Visitors and a place from which the whole exhibition space will be observed and the visitors will be able to listen to programmes with the 'sounds' of the Cosmos.
Size of the station	The station will take up the entire space behind the mezzanine (width 15-16 m, height 2.8 m).
Elements and requirements	<p>The station consists of the following elements:</p> <ul style="list-style-type: none"> – A panel with a graphic/wall painting depicting a supposed map of the Milky Way seen from above at an angle, based on photographs of our galaxy and knowledge of the structure of other similar galaxies that have been photographed with space telescopes. The

	<p>appearance of the map must reflect the current state of astronomical knowledge about how our galaxy is built. The map should show the elements (Sagittarius A black hole in the centre of the galaxy, the known arms of the Galaxy, the Solar System, if possible in the assumed scale - the star closest to the Sun - Proxima Centauri, the oldest star in our galaxy, other characteristic or interesting objects in our galaxy).</p> <ul style="list-style-type: none"> – 5 stations with audio recordings accessible to the Visitors via headphones that can be removed from the wall, and the adjacent buttons that activate the recordings (players, power supplies, etc. should be hidden behind the panel within the installation, providing access to them in the station). The installation should be concealed in the panel (not visible to the Visitors, but easily accessible for technical purposes). – 15 recordings of the ‘sounds’ of the Cosmos or programmes related to space travel (the Ordering Party is in possession of thirty recordings of various qualities, which the Contractor may use, but must first check if the quality of the recordings is sufficient and the format available for use in the new station. If necessary, the Contractor shall provide new recordings). – Seats - benches/puffs placed close to the audio recordings under the panel and attached to it. The seats should not be too large - they must allow wheelchair users to move freely by the panel wall.
Use	Visitors, sitting on a bench, put on their headphones and start the selected recording using one of the three buttons next to each of the seats. Three different recordings are available for each seat.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station as well as the trivia; it should also be adapted to be used by blind people (in Braille).

E.03	Tellurium
Location	Near station E.02 on the left side of the mezzanine from the entrance to the Exhibition near the liquidated station U.01.
Objective	Visitors will observe the movement of the Earth around the Sun and around its axis, and the Moon around the Earth.
Size of the station	A station with the diameter of 1.0 to 1.2 m and height of about 1 m, accessible to both wheelchair users and small children.
Elements and requirements	<p>The station consists of the following elements:</p> <ul style="list-style-type: none"> – A round base/frame to which the visitor can approach freely from either side, also in a wheelchair. – The installation is located in the recess of the table, showing the

	<p>arrangement of the Sun, Earth and the Moon. The installation will be covered with a transparent dome. The installation will consist of: a fixed, illuminated, model of the Sun and the Earth moving around the Sun, and around its axis, with the Moon orbiting the Earth. The surfaces of celestial body models should, as far as possible, reflect their actual appearance and colours. The movement of the Earth and the Moon should be initiated by the Visitor by pressing the button at the edge of the table. The relative sizes of the celestial bodies and the distances between them shall not reflect the true scale of magnitude and distance. They should be selected so as to give an approximate indication of the size/distance ratio and to make the model look spectacular.</p> <ul style="list-style-type: none"> – Photos/graphics showing the area around the Solar System placed at the bottom and walls of the installation basin and as a background for the installation. – If necessary (if the illumination of the Sun is not sufficient to observe the station), additional, delicate illumination of the basin should be designed, e.g. by means of a LED strip located under the top edge of the table.
Use	The visitor walks up to the table with the installation and presses the button to initiate the movement of the Earth and Moon and watches.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station as well as the trivia; it should also be adapted to be used by blind people (in Braille).

E.04	Who is Obscuring the Moon?
Location	Near station E.02 on the right side of the mezzanine from the entrance to the Exhibition.
Objective	<u>Mixed type station</u> Visitors will get acquainted with the phases of the Moon and the cause of their formation. The aim of the station is to show that the phases are not the result of the Moon being covered, but the result of looking at it from different directions.
Size of the station	A cylinder-shaped station with the diameter of approx. 1.0 m and height of about 1.8 m, accessible to both wheelchair users and small children.
Elements and requirements	It is quite common to believe that the Earth's shadow is responsible for the phases of the Moon. Understanding the fact that they are caused by the Moon being illuminated from a different direction than the direction of observation is much easier after getting acquainted with a well-prepared model. Such a model requires an almost perfect darkness in the room where the demonstration takes place, i.e. it requires a darkroom to which the Visitor can look from the outside.

	<p><u>The station should enable:</u></p> <ul style="list-style-type: none"> – understanding that the phases of the Moon are not in fact caused by the Moon being covered by any object, – independent examination of which positions of the Earth - Moon - Sun system are responsible for specific phases, – a combination of science and fun through a game consisting in guessing the position of the Moon on the basis of randomly selected phases. <p><u>The station consists of the following elements:</u></p> <ul style="list-style-type: none"> – A darkroom, containing a small sphere with a matt surface symbolising the Moon (diameter 4-8 cm), placed at the height of approx. 1.4 m, and a light source imitating a beam of the Sun which is as narrow as possible (a small but powerful lamp with a very narrow beam). The whole structure shall have a black internal surface which absorbs light as well as possible. The light of the lamp is intended to illuminate the Moon, but to disperse to almost zero in its surroundings. <p>In the side walls of the main cylinder with the Moon, between ten and twenty eyeholes with flat glass and rubber eye shields should be made. The eyeholes should have the feature of being easily covered and uncovered. Their arrangement should be as follows: on two levels (for children at 1.1 m, for older children at 1.4 m), every 30 degrees around the Moon.</p> <ul style="list-style-type: none"> – A touch screen with an educational game. The screen should show the Moon in the sky in a random phase, and should show its movement in the sky, as well as its position in relation to the Sun and the time of day (brightness of the sky). A drawing should be placed next to it showing the Earth, the direction of the Sun rays and the Moon in different positions around it to choose from. The player's task is to select, on the basis of the observations made at the station, the position of the Moon corresponding to a given phase.
Use	Visitors approach the station, look through the eyeholes, observe the illuminated model of the Moon at different angles and on this basis conclude what the phases of the Moon observed from the Earth are caused by.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station (sequence of the phases of the Moon, including their names).

Location	In the vicinity of the A.01 spacecraft
Objective	Visitors will get acquainted with the issue of free fall in the conditions of earth gravity by conducting a classic experiment with the Newton Tube on their own.
Size of the station	Approx. 1 m, 1 m, 1.5 m (length, width, height)
Elements and requirements	<p>The station consists of the following elements:</p> <ul style="list-style-type: none"> – a transparent tube (Newton's Tube) approximately 10-15 cm in diameter and 1-1.2 m long, closed on both sides and mounted in such a way that it can be rotated freely by 180 and 360 degrees to allow the objects placed inside the tube to fall freely: – a feather, a paper ball and a metal ball, – a vacuum pump enabling air to be pumped out of the tube, operated by the visitor by means of a button.
Use	The Visitor's task is to compare the pace with which a paper ball and a metal ball, which move inside a transparent Newton Tube, fall down. The experiment is carried out first in standard environment - with air and then after the air is pumped out.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station (the issue of free fall, gravitation force, the law of universal gravitation); it should also be adapted to be used by blind people (in Braille).

E.06	Black Hole
Location	In the conventional space of the A.01 spacecraft
Objective	Visitors will get to know the movement of bodies in the gravitational field. The visitor will be able to examine what shape the paths of planets, comets and meteors can take, and, in particular, to find an answer to the question why comets appear and then disappear, often for many years.
Size of the station	A station with the diameter of approx. 1.6 m and height of about 1 m, accessible to both wheelchair users and small children.
Elements and requirements	The vast majority of objects orbiting the Sun move along ellipses with the Sun being one of the foci. The gravitational funnel allows to experimentally examine the behaviour of bodies in a gravitational field with little reservation: in space they do not encounter any resistance force, which allows the maintenance of stable orbits for thousands of years. In the model of mechanical gravitational funnel it is impossible to completely remove the resistance of motion, hence we have a constant but slow loss of energy. This ultimately leads to the body falling into the central hole, which corresponds to the fall to the surface of the body that produces the given gravity funnel.

	<p><u>The station should enable:</u></p> <ul style="list-style-type: none"> – examination of the dependence of the body trajectory on the speed given at the starting moment, – observation of the effect of significant acceleration of bodies when approaching the centre of the funnel and slowing down when moving away from it, – generalisation of conclusions for situations in which the central body may be the Earth, Moon, other planet, black hole instead of the Sun, – a combination of science with fun by releasing balls from different places in different ways and observing the effects. <p><u>The station consists of the following elements:</u></p> <ul style="list-style-type: none"> – A round base/frame to which the Visitor can approach freely from either side, also in a wheelchair. – A funnel, not less than 1,5 m in diameter, hyperbolic in section, mounted in a table in such a way that the upper edge is not more than 0,8 m above the floor. Below the funnel, inside the station, a small rotating cone (10-15 cm high and with 70-80% of the funnel diameter) must be fitted. The cone at rest should allow the balls falling into the funnel to roll down into the narrow gutter surrounding the station. The Contractor should solve the problem of other objects thrown in by the visitors (papers, coins, etc.) collecting under the funnel by creating a technical possibility of periodical cleaning of the cone and gutter by the staff. – Three small ramps for releasing balls. The ramps should be firmly fixed to the surface of the funnel and placed next to each other, and the balls rolling off them should hit the surface of the funnel perpendicularly to its radius. The centre of the ramp should give the ball a velocity giving it an almost circular orbit, the bottom - strongly elliptical, with the starting point being the aphelion, and the third - slightly elliptical, with the starting point corresponding to the perihelion, but in such a way that the ball in the opposite position does not leave the funnel. All three ramps shall be mounted at such a distance from the edge of the funnel that the balls from the top two ramps do not hit the ramps after one rotation of the funnel. – The Contractor shall supply 100 balls.
Use	Visitors approach the station, take a ball from the gutter in the casing, select a ramp for releasing the balls, throw the ball and observe its movement.
Notes	In the vicinity of the station an exhibition message containing additional information on the subject of the station should be placed (two drawings, one showing how the trajectories of the balls would look like at this station if it were not for the resistance to movement, and against this background, in a different colour, the actual trajectories, and the other

		picture showing the trajectories of the most famous comets against the background of planet trajectories); it should also be adapted to be used by blind people (in Braille).
E.07		Light or Heavy?
Location		In the conventional space of the A.01 spacecraft
Objective		Visitors will find that while the weight of the ball on the Moon is 6 times less than on Earth, its mass does not change.
Size of the station		A station with the dimensions of approx. 1.8 m, 1.2 m, 1.6 m (width, depth, height), accessible to both wheelchair users and small children.
Elements and requirements		<p>Bodies carried from the Earth to other planets, or moons, may have a completely different weight in a new place than on the Earth, but their mass does not change. In practice, this means that while lifting a sphere of 12 kg on the Moon is more or less as difficult as lifting an object of 2 kg on Earth, the acceleration of a sphere on a horizontal track is as difficult on the Moon as on Earth. As a result, lifting a medicine ball on the Moon will be a trifle, but kicking it will hurt just as much as it does on Earth. In the case of large and massive planets, the weight can be greater than on the surface of the Earth. At the same average density of a planet or moon, the gravity force on its surface is proportional to its radius, so basically the smaller the celestial body, the less weight the objects placed on its surface have.</p> <p><u>The station should enable:</u></p> <ul style="list-style-type: none"> – studying the differences in the weight of bodies placed on Earth, the Moon and Mars, – observing that pushing the same ball is as difficult on the Moon or Mars as it is on Earth, – understanding that the force needed to lift the body depends on the place of measurement, while the difficulty of accelerating the body does not depend on it. <p><u>The station consists of the following elements:</u></p> <ul style="list-style-type: none"> – Robust and stable scaffolding with a casing that enables hanging three balls weighing a few kilograms next to each other. It should be possible to push back and raise each of the balls, but the motion should be limited to short distances (max. 0.3-0.5 m). Each ball should be mounted on a strong line hidden in the casing. It is the Contractor's responsibility to construct an efficient station mechanism allowing for independent lifting and pushing of balls. It can be achieved in the following way: inside the casing, mount pulleys with good quality bearing, and at the other end of the line, objects being the counterweight to the balls. The first ball labelled 'on Earth' should have the counterweight of maximum lightness,

	ensuring only the disappearance of the excess line on which the ball hangs, when it is lifted. The second counterweight to the ball labelled 'on Mars' should have a mass equal to 62% of the ball mass, and the third counterweight to the ball labelled 'on the Moon' should have the mass equal to 84% of the ball mass. The counterweights should affect balls only when they are lifted (change in height), 'reducing' the weight of balls 'on Mars' and 'on the Moon' respectively, but should not cause differences when pushing balls horizontally.
Use	The visitor walks up to the station and tries to lift each of the three balls and then push them away one by one. The visitor observes which of the activities makes a difference, and in which all the balls behave in the same way.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station (information showing how much a body would weight on a given planet, or the Moon as a percentage of the weight on the Earth. The list should include selected planets of the Solar System, moons, asteroids and, as an interesting fact, particularly dense celestial bodies); it should also be adapted to be used by blind people (in Braille).

E.08	Rocket Competition
Location	In the conventional space of the A.01 spacecraft
Objective	The station is primarily intended as fun for the visitors, and it will also allow them to understand the principle of how a jet engine works.
Size of the station	Minimum dimensions allowing the observation of rocket movement.
Elements and requirements	<p>The station consists of the following elements:</p> <ul style="list-style-type: none"> – A base of the table which the Visitor can approach freely from either side, also in a wheelchair. – the launch platform placed on the table along with two places for launching pneumatic rockets, – two pneumatic rockets - one faster and the other slower, differing in appearance (colour, size, weight, construction details, markings), – two pipes - rocket guides, mounted at the appropriate angle to the table surface, enabling the rockets to be launched, – two pumps that allow air to be injected into the 'air engines' of the rockets, – a mechanism for releasing the rockets activated by the Visitors, – a mechanism that allows the automatic return of the rockets back to the launch platform, – The Contractor will provide two rockets for the basic set and two

	spare ones.
Use	Visitors approach the launch platform where two rockets are placed, pump the air to the rocket engines with the help of pumps, release the rockets and then observe their movement.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station (the principle of how a jet engine works); it should also be adapted to be used by blind people (in Braille).
E.09	The Fall of the Meteorites
Location	In the conventional space of the A.01 spacecraft
Objective	<u>Mixed type station</u> The station will be used by the Visitors primarily for fun, and it will also allow them to learn about the topics related to the so-called 'impact events', i.e. collisions of meteorites with the surface of planets and other celestial bodies.
Size of the station	Approx. 1.2m, 1.2m, 1.8m (length, width, height)
Elements and requirements	<p>The station consists of the following elements:</p> <ul style="list-style-type: none"> – a sunken table onto which meteorite-balls will fall, – station casing in the form of three high walls, placed around the table, – a touch screen with an application, placed on the wall opposite the station for the Visitor, – an application that reacts to contact with the ball, the appearance of an explosion image and a collision crater on the surface displayed on the screen of the planet/moon, – graphics of outer space placed on the walls of the station casing, – lightweight, soft meteorite-balls in the amount of 200.
Use	The visitor approaches the station, takes a meteorite-ball in his hand and throws it at the touch screen. Then the visitor observes the image on the screen.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station (additional information on how planet surfaces are formed through collision with other celestial bodies, frequency of such events on Earth, examples of such events in the history of Earth); it should also be adapted to be used by blind people (in Braille).
E.10	Orbital Speed
Location	In the conventional space of the A.01 spacecraft or in its immediate vicinity

Objective	Visitors will learn about the speed required by a spacecraft to overcome the force of gravity and be launched into orbit.
Size of the station	Selected in such a way as to obtain the highest curve (ball trajectory) possible in the room.
Elements and requirements	<p>The station consists of the following elements:</p> <ul style="list-style-type: none"> – two tables - starting points, set at such a distance from each other as to connect the bases of the curve(ball trajectory), – two ball launchers of adjustable power, allowing the ball to be given different initial speed, placed at starting points on both tables, so that it is possible to give initial speed to the ball placed on one of the tables at a given moment and push it inside the track to the other table, – a stable, transparent tube - the track for the ball, with markers placed approximately every 0.5 m, which enable the height of the ball to be checked, – a ball was placed inside the tube at one of the starting points.
Use	The Visitor's task is to find the lowest speed which is necessary to shoot the ball in order to go over the highest point of the curve and fly to the other side. If the speed is too low, the ball is shot up and then moves back to the starting point. Visitors can test different values of the initial speed and observe the height at which the ball will rise - this is done by means of markers placed on the track.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station (the first cosmic velocity - orbital speed, second, third and fourth cosmic velocity); it should also be adapted to be used by blind people (in Braille).

E.11	Nebulae
Location	In the conventional space of the A.01 spacecraft
Objective	The Visitors will observe spectra of luminescent gases and learn the causes of the formation of cosmic, colourful, luminescent clouds of gases called nebulae.
Size of the station	Approx. 1.2m, 1.2m, 1.5m (length, width, height)
Elements and requirements	<p>The station consists of the following elements:</p> <ul style="list-style-type: none"> – a table with a container/chest placed on it, containing spectrum tubes (Plucker type) with five luminescent gases (helium, hydrogen, argon, neon, krypton) and appropriate instrumentation (power supplies) and holes for observing luminescent gases in tubes, – an eyepiece enabling the observation the spectra of luminescent gases, fixed to the table by means of a cable,

	<ul style="list-style-type: none"> – a multimedia display (built into the wall of the A.01 spacecraft as a window into outer space) displaying photographs of the most beautiful nebulae together with the overlay placed on them in the form of information about a given object and the way of taking photographs, – the Contractor will provide a spare set of spectrum tubes together with power supplies and a spare eyepiece.
Use	The Visitor observes luminescent ionized gases and photographs of nebulae and obtains information and interesting facts about the displayed images.
Notes	An exhibition message should be placed near the station, including additional information on the subject of the station (basic information about the formation and types of nebulae); it should also be adapted to be used by blind people (in Braille).
A.01	Spacecraft
Location	The space remaining after the liquidated exhibits, on the right side of the mezzanine looking from the side of the entrance to the exhibition.
Objective	A separate element of the arrangement will serve as a place for stations E.06, E.07, E.08, E.09, E.10, E.11, combining them thematically with space travel, and at the same time will be an attractive element of the arrangement of the entire space.
Sizes	Enabling free positioning of stations E.06, E.07, E.08, E.09, E.10, E.11 and element A.02 in the conventional space of the spacecraft.
Elements and requirements	Futuristic, conventionally arranged space of the spacecraft, will replace the liquidated exhibits U.05, U.06, U.07, U.08, U.09, U.10, U.11, U.12, U.13, U.14, U.15, U.16. This space should be separated by means of a marking on the floor (conventionally mark the walls of the ship, e.g. in the form of a sticker and a wall, a panel with graphics depicting the interior of the spacecraft with a window into outer space (station E.11 element), navigation bridge, instruments, indicators, etc. The surface of the wall around the ship should be arranged as a background for the ship and glued with a photo wallpaper depicting outer space. Stations E.06, E.07, E.08, E.09, E.10, E.11 and A.02 will be instruments or equipment of the ship and their appearance should therefore be in harmony with the ship's decor.
Use	Visitors use the stations located within the spacecraft, take photos by the A.02
Notes	The spacecraft will have a name given with the appropriate hash tag for the purposes of promoting it through social media, the wording of which will be given by the Ordering Party during the implementation of the

	<p>order. The Contractor shall design the logo of the ship in the form of a graphic symbol. The logo and name of the ship should appear in various places in the ship's space, in graphics with decoration and at the stations. A panel with imaginary information about the ship, including logo, name, current captain, destination, type, range, tonnage, travels etc., should be placed on the wall of the ship. The panel should also contain information about the ship in Braille.</p>
A.02	Astronaut
Location	In the conventional space of the A.01 spacecraft against the background of the spacecraft's wall
Objective	Group photo of the family to be placed on the Internet
Sizes	Approx. 1 m, 0.5 m, 1.9m (length, width, height)
Elements and requirements	<p>Installation elements:</p> <ul style="list-style-type: none"> – a figure of an adult astronaut in a full space suit, with an opening for the head, placed behind a transparent helmet - about 180 cm tall – a figure of the astronaut's child in a full space suit, with an opening for the head, placed behind a transparent helmet: about 150 cm tall, – stairs placed behind the figures, allowing younger people and smaller children to pose, – Polish flag held in hand by the large astronaut, stretched on a frame.
Use	The Visitors stand behind the figures, place their heads in the holes in the helmets and pose for photos.
Notes	The logo and name of the ship should be placed on the space suits, and a panel with instructions for posing should be placed nearby.