

## INVITATION TO QUOTE (ITQ)

**Project: Third phase of Central Asia Regional Links Programme (CARs-3)**

**To: All interested Suppliers,**

**Date: 29 October 2024.**

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**Dear Supplier,**

The Kyrgyz Republic has received a financing from the World Bank and intends to apply the proceeds of this financing to eligible payments under the contract for which this Invitation to Quote is issued.

1. The World Bank Projects Implementation Unit invites your company to submit your price quotation for the supply of the following goods:
  - Aviation training stands
  - Training complexes for flight simulation and aircraft maintenance

*Information on technical specifications and form of price quotation are attached herewith.*

2. You must quote for each particular unit of goods for Lot under this invitation. Price quotations will be evaluated for all units together and contract awarded to the firm offering the lowest evaluated total cost of all units.
3. Your price quotation shall be submitted **on 18 November , 2024, 4 p.m. at the latest** by special delivery or electronically at the following address:

**World Bank Projects Implementation Unit**  
**42 Isanov Street, Room 605, 6/F, MOTC, Bishkek, 720017**  
**Kyrgyz Republic**  
**Phone: +996 312 314275**  
**E-mail: [carswbpiu@gmail.com](mailto:carswbpiu@gmail.com)**

4. The price quotation should be submitted as per the provisions of the Invitation to quote and in accordance with the attached Contract. The attached “Terms and Conditions of Supply” is an integral part of the Contract.
5. **Prices:** The prices shall be indicated in Kyrgyz Som and include all delivery charges, VAT, custom duties and taxes applicable for goods imported in Kyrgyz Republic.

6. **Quotation Evaluation:** Quotations determined to be substantially responsive to the technical specifications will be evaluated by comparison of their prices. The Contract will be awarded to the quotation offering the lowest evaluated responsive quotation and that meets the required standards of technical specifications. The Supplier shall sign a Contract as per attached form of contract. If the Supplier decides to withdraw his price quotation and rejects to sign a Contract in case of its award will be excluded from the list of potential suppliers for the Project for a period of two years.
  
7. **Validity of the quotation:** Your quotation should be valid for a period of sixty (60) days from the deadline for submission of quotation indicated in clause 3.

Please confirm the receipt of this invitation to quote and whether you will submit the price quotation or not.

Sincerely,

B. Bazaraliev  
Deputy Minister

## FORM OF CONTRACT

**THIS CONTRACT for supply of goods № \_\_\_\_\_ is concluded on \_\_\_\_\_, \_\_\_ 2018, between the World Bank Investment Projects Implementation Group of the Ministry of Transport and Roads of the Kyrgyz Republic (hereinafter referred to as “the Purchaser”) on the one part and \_\_\_\_\_ (hereinafter referred to as “the Supplier”) on the other part.**

WHEREAS the Purchaser has accepted the Bid by the Supplier for the supply of goods under Contract at the sum of \_\_\_\_\_ ( \_\_\_\_\_ ) hereinafter referred to as “the Contract Price”.

NOW THIS AGREEMENT WITNESSES as follows:

1. The following documents shall be deemed to form and be read and construed as part of this Contract:
  - Invitation to Quote;
  - Terms and Conditions of Supply;
  - Technical Specifications.
2. The Supplier hereby concludes a Contract with the Purchaser to execute and complete the supply of goods under the Contract and remedy any defects therein in conformity with the provisions of Contract.
3. The Purchaser hereby covenants to pay the Contract Price in accordance with the Annex “Terms and Conditions of Supply.”

**Signature and seal of the Purchaser:  
FOR AND BEHALF OF**

**Signature and seal of the Supplier:  
FOR AND BEHALF OF**

\_\_\_\_\_  
**Name of Authorized Representative**

\_\_\_\_\_  
**Name of Authorized Representative**

## Terms and Conditions of Supply

Project Name: **Third phase of Central Asia Regional Links Programme (CARs-3)**

Purchaser: World Bank Projects Implementation Unit, MOTC KR

### Price Table:

Description of goods		Technical specifications of goods	Delivery time (week)	Quantity (in pcs)	Unit price	Total price
<b>Aviation training stands</b>						
1	Aircraft piston engine trainer			1		
2	Aircraft Ice and Rain Protection System Trainer			1		
3	Aircraft Hydraulic System Trainer			1		
4	Small-sized wind tunnel trainer			1		
5	Aircraft Gyroscope Trainer			1		
<b>Training complexes for flight simulation and aircraft maintenance</b>						
1	Desktop flight simulator			1		
2	Computer-based training system for theoretical training of engineering and technical personnel (CBT - Computer Based Training)			1		
	<b>Total</b>			<b>7</b>		

1. **Fixed Price:** the contract price is fixed and includes all delivery, VAT, customs duties, and import taxes for goods shipped to the Kyrgyz Republic. The price is non-negotiable and will not change during contract execution.
2. The Purchaser reserves the right at the time of Contract signing to increase or decrease the Quantity of procured goods by 15 % without causing any changes to the unit prices or other provisions of the Contract.
3. **Delivery Schedule:** The delivery should be completed within one hundred (100) days from the date of Contract signing
4. **Applicable Law and Disputes Resolution:** The Contract shall be interpreted in accordance with the laws of the Kyrgyz Republic.
5. **Payment:** 100 % should be made within 10 days after signing the **Statement of Acceptance and Transfer** along with submission of all supporting documents for the payment by the Supplier.
6. **Warranty:** Goods supplied by the Supplier should be covered by Supplier's warranty that will be valid for 12 months from the date of signing the **Statement of Acceptance and Transfer** of goods.
7. **Packaging and Marking Instructions:** Supplier shall provide standard factory-furnished packing of goods required for to prevent their damage or deterioration during transit to their final destination.
8. **Defects:** Defects shall be corrected by the Supplier without any cost to the Purchaser within 30 days from the date of notice by Purchaser.
9. Supplier is responsible for providing insurance in accordance with the laws of the Kyrgyz Republic. Insurance shall cover compensation for loses or damages incurred.
10. The Supplier shall permit the World Bank and/or persons appointed by the World Bank to inspect all accounts and records and to have such accounts and records audited by auditors appointed by the World Bank.
11. If it becomes known to the Purchaser that the Supplier is involved in corrupt, fraudulent, collusive, coercive or obstructive practices during the contract award or contract performance, the Purchaser may terminate the Contract by sending a 14-day prior notification to the Supplier. For the purposes of this clause:
  - "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
  - "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
  - "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

- “coercive practice” is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
- “obstructive practice” is (1) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede the World Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or; (2) acts intended to materially impede the exercise of the World Bank’s inspection and audit rights.

12. **Force-Majeure:** The Supplier shall not be responsible for suspension of contractual obligations as a result of an event of Force-Majeure. For purposes of this clause, “Force-Majeure” means an events beyond the control of the Supplier and not involving the Supplier’s fault or negligence and not foreseeable. Such events may include, but not restricted to wars or revolutions, fires, floods, epidemics, quarantine restrictions. If a Force-Majeure situation arises, the Supplier shall promptly notify the purchaser in writing of such condition and the cause thereof.

13. **Failure to Perform:** The Purchaser may cancel the Contract if the Supplier fails to deliver the Goods, in accordance with the above terms and conditions.

Name of Supplier: .....  
 Authorized Signature: .....  
 Place: .....  
 Date: .....

Required Technical Specifications.

- See annex 1 for detailed Technical Specifications

The Supplier shall confirm the compliance with the abovementioned requirements. **(in case of deviations, the Supplier shall indicate such deviations).**

**Annex: Technical specifications**

**FORM OF QUOTATION**

Date: .....

To: World Bank Projects Implementation Unit, MOTR KR  
42 Isanov Street,  
Room 605, 6<sup>th</sup> floor, MOTC  
Bishkek 720017,  
Kyrgyz Republic

We offer to execute the Contract for supply of goods № \_\_\_\_\_ in accordance with the **Terms and Conditions of Supply** accompanying this Quotation for the Contract Price of \_\_\_\_\_ (*amount in words and numbers*) (\_\_\_\_\_).

We propose to complete the delivery of Goods described in the Contract within a period of \_\_\_\_\_ week(s) from the Date of Contract Signing.

This Quotation and your written acceptance will constitute a binding Contract between us.

We hereby confirm that this Quotation complies with the Validity of the Quotation required by the Invitation to quote.

Authorized Signature: .....

Name and Title of Signatory: .....

Name of Supplier: .....

Address: .....

Phone Number: .....

**Technical Specifications**  
**Specifications for the procurement of equipment for the Air Transport Laboratory of the Kyrgyz Aviation Institute under the "Third Phase of the Central Asia Regional Links Program" (CARs-3), Component 2 "Aviation Safety and Service Provision"**

Part 1: General requirements

- All supplied equipment must be NEW, in factory packaging, and must not have been used prior to delivery to the Buyer.
- The Supplier must indicate the year of manufacture for each equipment unit and/or product in the proposal, and the year of manufacture should be 2021 or a more recent year (e.g., 2022, 2023, 2024).
- All equipment must be delivered intact, in factory packaging, to the designated location.
- The supplier guarantees that the supplied equipment will be supplied and installed by the supplier on a turnkey basis, if applicable.
- The equipment must be suitable for use inside the classrooms.
- The equipment (if applicable) must be suitable for operation with the 220V, 50Hz electrical power supply available in Kyrgyzstan.
- The Supplier must provide a detailed specification of the equipment and the supplied product in the proposal, including operational and maintenance manuals in Russian or English language.
- The Supplier guarantees the reliable and proper functioning of the software and equipment for a minimum of 12 months from the delivery date. During this period, Supplier will be responsible for providing all types of technical support and equipment servicing, including replacement and modification of equipment or its parts, at its own expense.
- The supplier affirms that updates to the documentation and software of the purchased equipment are provided for at least five years free of charge.
- The supplier provides licenses for software equipment on a perpetual basis.

Documentation:

- The bidding participant must provide documentary evidence that the offered goods comply with the technical requirements, including:
  - i) A properly completed form attached along with the technical specifications, where the proposed parameters must be filled in accordance with the requirements. Only lots where all equipment fully complies with all technical specifications will be considered.
  - ii) Technical passport for each type of equipment or other document reflecting information about the product, operating conditions, as well as technical characteristics and parameters.
  - iii) Brochures, technical instructions or operation manuals for each type of equipment.

Spare parts:



- The Supplier (if applicable) provides a minimum set of spare parts and components free of charge necessary for the uninterrupted operation and use of the equipment for a minimum of 12 months from the delivery date.

Servicing and Training:

- Adequate briefing and/or training for the operating personnel of the Agency should be provided at the delivery site. Conducting briefing and/or training is the responsibility of the Supplier and should be provided free of charge. Instruction and/or training may be provided remotely online.

Acceptance Testing:



- All equipment must undergo acceptance testing at the delivery location by the Recipient and the Supplier. After satisfactory testing, three-way acceptance transfer acts (between the Supplier, the Customer, and the Recipient) should be issued.


- The Bidder must propose conducting the acceptance testing procedure on the Recipient's premises.

- Acceptance testing includes the following:

- i) Verification of the provided quality control documents.
- ii) Checking the completeness of the equipment set at the delivery site, including instructions and operation guides;
- iii) Verifying the functionality and condition of the equipment and its components at the delivery site;
- iv) Assembly/disassembly Inspection of equipment components (if applicable).
- v) Operation for 1 hour at the specified and prepared location by the Recipient.

## Part 2. Special requirements for equipment

	Aviation training stands (Photos are for illustrative purposes only)	Parameters	Qty	Proposed Parameters	Remarks
1	<p>Aircraft piston engine trainer</p> 	<ul style="list-style-type: none"> <li>- internal combustion engine of the ROTAX-912 series.</li> <li>- engine crankcase with a functioning piston group;</li> <li>- camshaft and valve block;</li> <li>- a gearbox that transmits the crankshaft revolutions to the propeller rotation axis;</li> <li>- electric motor and control unit to drive the engine;</li> <li>- attachments simulating engine components such as carburetors, oil distribution pump, ignition unit with armor wires and spark plugs.</li> <li>-The model is driven by an electric motor.</li> <li>- RPM control is carried out by means of a control unit connected to the program complex.</li> <li>-The engine layout is supplied as part of the program complex for studying the internal structure and operating principles with the help of a computer.</li> <li>- maximum dimensions DxShxB(mm): not less than 1600x800x800.</li> </ul>	1		
2	<p>Aircraft Ice and Rain Protection System Trainer</p> 	<p>Operating full-featured simulator made of assemblies and units of aircraft de-icing system and rain protection system.</p> <p>Power supply: 220-240, 50 Hz.</p> <p><b>Pneumatic de-icing system:</b></p> <ul style="list-style-type: none"> <li>- Anti-icing duster/pouch;</li> <li>- vacuum pump, partubki and accessories.</li> </ul> <p><b>Propeller de-icing system with electric heating:</b></p> <ul style="list-style-type: none"> <li>- electric de-icing timer</li> <li>- shortened screw, blade, brush block, indicators.</li> </ul> <p><b>Electrically heated windshield system:</b></p> <ul style="list-style-type: none"> <li>- airplane windshield with internal electric heating</li> <li>- elements, windshield temperature regulator.</li> </ul> <p><b>Windshield washing system with alcohol:</b></p> <ul style="list-style-type: none"> <li>- windshield</li> <li>- alcohol tank/regulator/pump, atomizer</li> </ul> <p><b>Windshield wiper system:</b></p> <ul style="list-style-type: none"> <li>- electric drive motor, actuator, wiper assembly.</li> </ul> <p>Electrically heated pitot tube system:</p> <ul style="list-style-type: none"> <li>- <b>Pitot tube for airplanes with electric heating elements.</b> Maximum dimensions DxWxH(mm): not less than 2000x500x1800;</li> <li>- weight of the complex (gross), kg: not more than 50kg.</li> </ul>	1		

3	<p>Aircraft Hydraulic System Trainer</p> 	<p>All elements and devices are fully functional. Operation from the network voltage of at least 220V, frequency 50 Hz</p> <p>Composition:</p> <ul style="list-style-type: none"> <li>- hydraulic system tank</li> <li>- hydraulic pump of the main hydraulic system</li> <li>- mechanism of the system of modeling the process of loading the wheel stand mechanism by the advancing air flow</li> <li>- compressor of the system of modeling the process of loading the mechanism of the wheel strut with the incoming flow of air</li> <li>- landing gear strut with kinematic mechanism;</li> <li>- wheel rotation motor</li> <li>- a brake mechanism with a hydraulic braking cylinder;</li> <li>- parking brake accumulator</li> <li>- landing gear release / retraction hydraulic cylinder</li> <li>- hydraulic cylinder for opening the locking mechanism</li> <li>- pressure gauges and pressure sensors to monitor pressure at various points of the hydraulic system</li> <li>- wheel speed sensors for braking torque</li> <li>- control valves and distributors</li> <li>- connecting lines and changeover valves to simulate hydraulic system malfunctions</li> <li>- All relevant ancillary components, connectors and piping</li> <li>- electronic control and monitoring unit of hydraulic system parameters and braking torque with ADC board for communication with a computer</li> <li>- low-noise compressor</li> <li>- laptop released no earlier than 2022 with Intel Core i3 processor or higher, software included</li> <li>- hydraulic oil;</li> <li>- description of laboratory works</li> <li>- operation manual.</li> <li>- passport</li> <li>- dimensions: Minimum: 1200 mm (length) x 700 mm (width) x 1800 mm (height)</li> <li>- hydraulic System and Control Mechanism Details: hydraulic system and mechanisms for landing gear extension/retraction and braking: Frame-mounted</li> <li>- braking control: manual</li> </ul>	1		
4	<p>Small-sized wind tunnel trainer</p>	<p>Present bench shall perform the following functions:</p> <ul style="list-style-type: none"> <li>- determination of the flow velocity in the working part of</li> </ul>	1		



the wind tunnel. (determination of wind speed with the help of air pressure receiver),



- determination of the field of dynamic and static pressures in the working part of the wind tunnel,
- (determination of the velocity diagram in a circular tube).
- Determination of the flow velocity using a Venturi tube,
- static pressure in a narrow section,
- measuring the dependence of air resistance on wind speed,
- drag coefficient: relationship between air resistance and body shape,
- influence of the wing leading edge on the aerodynamic characteristics of the wing,
- study of aerodynamic characteristics of a wing with retracted and released flaps,
- pressure curve on the wing profile,
- verification of Bernoulli's principle,
- pressure distribution over the surface of the body of rotation at subsonic flow velocities,
- moment characteristic of the model aircraft,
- experimental blowing of plastic models of airplanes of different aerodynamic schemes,
- study of pressure distribution on the surface of simple bodies (blowing of simple bodies of sphere and cone),
- study of aerodynamic forces acting on a wing with symmetric and asymmetric profile using erodynamic scales and measuring complex,
- pressure distribution over the wing surface using a drained model.
- maximum dimensions DxWxH(mm): not less than 2400x850x1550;
- weight of the complex (gross) not more than 220kg.

5 Aircraft Gyroscope Trainer

**Aircraft Gyroscope Trainer set is designed to teach the operational logic and system components of a magnetic compass.**


Features of the trainer:

- fully functional and configured like a typical aircraft magnetic compass
- provides imitation of comprehensive visual display of the aircraft's heading and position in relation to a desired course.
- combine the display functions of the standard Directional Gyro with VOR/LOC course deviation

		<p>indication.</p> <ul style="list-style-type: none"> <li>- the trainer should allow trainees to understand fundamentals of aircraft magnetic compass system and its components.</li> </ul> <p>Components of the trainer:</p> <ul style="list-style-type: none"> <li>Pictorial Navigation Indicator (HSI)</li> <li>Directional Gyro</li> <li>Flux Detector (The Magnetic Azimuth Transmitter)</li> <li>Slaving Accessory</li> <li>Digital instrument</li> <li>DC Power Box (220-240 220-240 V, 50 Hz)</li> <li>Circuit Breaker</li> </ul>			
<b>Training complexes for flight simulation and aircraft maintenance</b> <b>(Photos are for illustrative purposes only)</b>		<b>Parameters</b>	<b>Qty</b>	<b>Proposed Parameters</b>	<b>Remarks</b>
1	Desktop flight simulator 	<p>This complex consists of hardware and software modules built on a single software platform. The aviation simulator module contains a detailed virtual model of an aircraft (the list of supported aircraft is discussed separately) and can be used to teach the basics of piloting BITD (Basic instrument training device) as well as procedural testing of piloting skills for certain types of aircraft. The hardware and software package includes a set of:</p> <ul style="list-style-type: none"> <li>- a pilot's workplace with a chair on a steel frame;</li> <li>- the calculation unit integrated into the frame;</li> <li>- software (airplane, helicopter);</li> <li>- sound system with 3D sound;</li> <li>- vibration simulation device on the housing;</li> <li>- wide-format panel, 43-50" - 3 pcs;</li> <li>- basic controls for aircraft and helicopter</li> <li>- handle of the general pitch of the screw – 1 piece;</li> <li>- specialized pedals – 1 set;</li> <li>- main control knob – 1 pc .</li> <li>- steering wheel with engine control knob – 1 piece</li> </ul> <p>This complex should perform tasks for the preparation and acquisition of theoretical and practical knowledge, skills and abilities to perform piloting of aviation equipment:</p>			

		<ul style="list-style-type: none"> <li>- working out the procedures for preparing for takeoff using a virtual model of the cockpit of an aircraft;</li> <li>- development of aircraft piloting techniques;</li> <li>- development of basic motor skills of aircraft - type aircraft control;</li> <li>- development of basic helicopter - type aircraft control skills;</li> <li>- study of the main theoretical aspects and working out a standard flight "by the box"</li> </ul> <p>Features of the complex:</p> <ul style="list-style-type: none"> <li>- built-in script and task editor;</li> <li>- work in multi - user mode with the possibility of flying in the same aircraft with an instructor;</li> <li>- interactive 3D 6dof cabins with the ability to control mouse or physical controls for most aircraft. accurate flight models, detailed systems and authentic sounds;</li> <li>- realistic virtual cabin environment with operational instrumentation;</li> <li>- availability of rich documentation and a system for flight training;</li> <li>- support for changing the time of day and different weather conditions.</li> <li>- support for additional touchscreens and flexible configuration of the virtual cockpit</li> <li>- full support for virtual reality systems</li> </ul> <p>The software of the complex must be specialized software pre-installed on a personal computer, as well as on specialized media. The software part of the simulator is based on an extended professional version of the DCS X-Plane or MFS-20 core with pre-installed scenarios and aircraft models. The complex supports a system of advanced methods for modeling the physical model of the aircraft, which allows you to simulate various aerodynamic effects at a higher level, such as stall, rocking from wing to wing, corkscrew, etc. The complex should support advanced modeling of behavior on the ground — realistic physics of inertia forces, sliding, shock absorbers, braking system.</p> <p>The software consists of modules:</p> <ul style="list-style-type: none"> <li>- a module for learning the basics of piloting in the form of interactive training tasks with interactive tips and text explanations;</li> <li>- direct piloting module;</li> </ul>			
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		<ul style="list-style-type: none"> <li>- script and flight task editor module;</li> <li>- the module of online help on the design and device of the aircraft.</li> </ul> <p>The list of skills practiced on the simulator:</p> <ul style="list-style-type: none"> <li>- study of the purpose and principle of operation of the flight navigation equipment of the aircraft;</li> <li>- working out the take - off procedure:</li> <li>- engine start, pre-flight procedures;</li> <li>- taxiing;</li> <li>- takeoff.</li> <li>- testing flights on the "box";</li> <li>- working out the landing procedure;</li> <li>- working out night flights.</li> <li>- working out special cases in flight</li> </ul> <p>The composition of the hardware part of the complex: A PC built into the frame for the execution of the software part of the complex and visualization of the flight process, with the characteristics:</p> <ul style="list-style-type: none"> <li>- processor: at least 16 stream with a frequency of up to 4.4ghz;</li> <li>- RAM: at least 32 GB DDR4;</li> <li>- storage: at least NVME 480 GB and HDD2000 GB;</li> <li>- video card: DX12 compatible with 8GB memory capacity;</li> <li>- power supply unit with a capacity of at least 650W;</li> <li>- operating system – preinstalled windows at least 10th family;</li> <li>- uninterruptible power supply.</li> </ul> <p>Steel space frame with fixed pilot's seat, with characteristics:</p> <ul style="list-style-type: none"> <li>- built-in screen sizes: 43-50 inches.</li> <li>- dimensions no more than 1900x800x1700 (excluding the size of the screens)</li> <li>- housing: welded frame made of 40x80 mm and 30x30 mm profile</li> <li>- outer skin – metal, composite</li> <li>- built-in PC installation compartment</li> <li>- built-in 5.1 speaker system</li> <li>- adjustable suspension for TV</li> <li>- built-in feedback system with sound and vibration effects</li> </ul> <p>Large-format panel for visualization of the flight process</p> <ul style="list-style-type: none"> <li>- screen diagonal – from 32 to 55 inches, 3 pcs.</li> </ul>			
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		<p>A set of physical controls, on the frame:</p> <ul style="list-style-type: none"> <li>- Engine control knob (ROOD) – double;</li> <li>- Airplane control knob (RUS);</li> <li>- the number of axes is at least 10;</li> <li>- the number of switches is at least 28.</li> </ul>			
2	<p>Computer-based training system for theoretical training of engineering and technical personnel (CBT - Computer Based Training)</p> 	<p>The virtual training complex allows you to carry out a number of research and practical work related to the direct study of the aircraft design, as well as the main activities for its pre-flight maintenance.</p> <p>The list of studies and works that the complex provides:</p> <ul style="list-style-type: none"> <li>- study of the aircraft structure, decomposition, study of the structure of the main building blocks.</li> <li>- study of the aircraft's power supply system and avionics.</li> <li>- study of the current regulations for scheduled and periodic maintenance of the aircraft.</li> <li>- study of the aircraft engine design.</li> <li>- practical work on conducting aircraft ground handling operations.</li> </ul> <p>- the general composition of the complex:</p> <ul style="list-style-type: none"> <li>- the mobile calculation unit of the simulator (ARM) on the rack for reproducing three-dimensional graphics - 1 pc.</li> <li>- virtual reality playback device – 1 pc.</li> <li>- the software of the complex on a USB drive – 1 pc.</li> <li>- resource launch module</li> <li>- resource module "Conducting operational forms of maintenance with an aircraft at a transit airport using the example of a Boeing 737NG"</li> <li>- user's Manual - 1 pc.</li> <li>- the passport of the complex is 1 piece.</li> <li>- the mobile calculation unit of the simulator (APM) on the counter. Specifications:</li> </ul> <p>Processor: processor frequency: at least 3.5 GHz, number of threads – at least 12,</p> <ul style="list-style-type: none"> <li>- RAM: memory capacity - at least 12 GB; memory type DDR4;</li> <li>- drive: SSD, capacity – at least 240 gb;</li> <li>- power supply unit with a capacity of at least 500W;</li> <li>- video adapter with at least 4 GB of memory type: gddr6</li> </ul> <p>- the personal computer package also includes:</p> <ul style="list-style-type: none"> <li>- MFIs with a diagonal of at least 40 inches</li> <li>- mobile stand- base for the simulator – material steel, dimensions: at least 600x1400x450</li> </ul>			



		<ul style="list-style-type: none"> <li>- the keyboard is wireless;</li> <li>- the mouse is wireless;</li> <li>- virtual reality helmet for working with the complex in VR mode, with characteristics:</li> <li>- resolution (per eye): at least 2100 x 2100;</li> <li>- adjustment of the interpupillary distance: from 58 to 68 mm</li> <li>- viewing angle: at least 100°</li> <li>- headphones: built-in</li> </ul> <p>Sensors: accelerometer, gyroscope, proximity sensor</p> <ul style="list-style-type: none"> <li>- PC connection: USB 3.1</li> </ul> <p>The software of the complex is on a USB drive and consists of two modules:</p> <p>The software module for launching resources is a cross-platform software that allows you to collect information about installed educational complexes and visual aids on a computer. The software module must have a personal account in which the Customer can log in using a unique login and password generated by the supplier.</p> <p>The software module should allow you to start and stop software products that run in the background.</p> <ul style="list-style-type: none"> <li>- functional requirements:</li> <li>- the software launcher must have localization. The main languages are Russian and English.</li> </ul> <p>The software launcher must be able to run on the linux or Windows operating system.</p> <p>The program interface contains functional sections for managing the complex , including:</p> <ul style="list-style-type: none"> <li>- the section implementing the functionality of the personal account "personal account".</li> <li>- the "contacts" section.</li> </ul> <p>The resource module for ensuring the functioning of the virtual educational complex should contain graphical information, three-dimensional models of the environment and equipment. The program should allow you to carry out work according to the methodological recommendations. This module should contain an interactive graphical demonstration of the general location and composition of the aircraft's equipment and systems, as well as allow you to study its design, device and main stages, and procedures for its operational maintenance, including meeting and release. The module should be able to be installed and activated at 10 workstations.</p>			
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		<p>The software implements detailed three - dimensional models of the following structural elements of the aircraft:</p> <ul style="list-style-type: none"> <li>- center plane</li> <li>- bow compartment</li> <li>- front landing gear compartment</li> <li>- the cockpit</li> <li>- aircraft cabin</li> <li>- wing</li> <li>- rear cargo compartment</li> <li>- mMain electronics compartment</li> <li>- avionics</li> <li>- antenna-feeder system</li> <li>- power supply system</li> <li>- engine pylons</li> <li>- keel</li> <li>- stabilizer fairing</li> <li>- stabilizer</li> <li>- eevator</li> <li>- on- board maintenance system</li> <li>- the software consists of:</li> <li>- module "Aircraft design study"</li> <li>- module "Studying the power supply system and avionics of an aircraft"</li> <li>- this module presents three-dimensional models of the following components:</li> <li>- conditional module with antenna-feeder system tracing</li> <li>- conditional module with tracing of the power supply system</li> <li>- conditional model "communication systems"</li> <li>- conditional model "navigation systems"</li> <li>- module "Practical work on conducting operational maintenance of an aircraft". Work with this module is carried out in two modes:</li> <li>- the mode of demonstration and study of maintenance procedures.</li> <li>- the mode of practical work using a virtual reality helmet.</li> <li>- technological operations performed during the operational maintenance of the aircraft power supply system, presented in the module:</li> <li>- external inspection of aircraft antennas</li> <li>- external inspection of power supply system units and units</li> <li>- testing the operability of power supply systems from an</li> </ul>			
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		<p>airfield power source</p> <ul style="list-style-type: none"> <li>- requirements for the functionality of specialized software:</li> <li>- the operation of the application in VR mode is organized within the same window application, without running separate software with automatic detection of the type of input device and mode of operation.</li> </ul> <p>The operation of the VR mode of the software must be provided by means of a native execution environment for the device without connecting external modules.</p> <p>The software implementation of the virtual reality mode should be based on open standards, in accordance with the OpenXR paradigm.</p> <ul style="list-style-type: none"> <li>- support desktop mode and keyboard and mouse control and virtual reality mode.</li> <li>- control and navigation in the program must be carried out both with the mouse and with the help of a virtual reality kit in stereoscopic mode using controllers</li> <li>- the software interface must work if users who are not qualified users of a personal computer work on it.</li> </ul> <p>The software should allow you to visually demonstrate the structure of the selected mechanism or object.</p> <p>Interactive hints and descriptions should be implemented for all elements of the three-dimensional model.</p> <p>The software should include a technical support component that provides interactive search and access to documentation containing multimedia descriptions of work in the form of electronic manuals, with texts, drawings and drawings.</p> <p>The complex should provide high real-time performance and 3D visualization through direct3d.</p> <ul style="list-style-type: none"> <li>- the ability to run on modern 64-bit operating systems with direct3d API support</li> </ul> <p>The following graphical advantages should be implemented in the virtual training complex, optimizing performance and improving the quality of displaying virtual objects in real time:</p> <p>Anisotropic filtering (a method to improve the quality of texture mapping on the surfaces of three-dimensional objects and improve image detail);</p> <ul style="list-style-type: none"> <li>- hardware tessellation (a method of increasing the triangles of a polygonal grid in accordance with the directions of the surfaces of three-dimensional objects);</li> </ul>			
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		<p>- dynamic change in the level of detail (a method for optimizing the detail of three-dimensional objects depending on their location relative to a virtual viewpoint);</p> <p>physically correct rendering (an image creation method based on the physically accurate interaction of light with the surfaces of three-dimensional objects having various specified physical properties);</p> <p>Global illumination (a method of realistic imitation of light, taking into account the multiple reflection of light rays from the surfaces of three-dimensional objects);</p> <p>- global shading algorithm (a method for generating diffuse illumination by edge shading the space of visible three-dimensional objects);</p> <p>The algorithm of full-screen smoothing (the method of smoothing the "gradation" of the image of a set of simultaneously displayed objects);</p> <p>Extended dynamic range of visualization (a method of adaptive brightness change of three-dimensional objects under different lighting conditions, close to the range of human vision);</p> <p>Tonal compression (a method of reproducing images with a wide dynamic range to display devices with a narrow range).</p> <p>- operating instructions for the virtual software package (in electronic and printed form, A4 or A5 format) – 1 pc.</p> <p>- passport of the complex in printed form (A5 format) - 1 pc.</p>			
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