

## Scope of work of AALS for 155mm Mounted Gun System

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### **Introduction:**

Gun Carriage Factory (GCF) Jabalpur, Madhya Pradesh is a unit of AWEIL under the Department of Defence Production, Ministry of Defence. The Gun Carriage factory is a pioneer in weapons and armament development. GCF is in the process of design and development of various types of artillery guns. A vehicle mounted 155 mm artillery gun is being developed by GCF on 8x8 Tatra vehicle. GCF requires an Automatic Ammunition Loading system (**AALS**) for picking of the shells from the vehicle platform and loading it on to the gun. This action must be carried out with a specified speed during firing of the gun, also ammunition shell has to be picked up from picking location and precisely placed on the loading location. A crane with all electric is required to carry out this operation.

Herein after system will be referred as **AALS** in this document.

### **1. Project Overview**

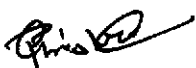
The objective of this project is to design, develop, and implement an AALS for efficient and safe loading of ammunition in the mounted gun system. AALS will be specifically tailored for vehicle-mounted gun system. The system will automate the process of ammunition loading, reducing manual labour, improving operational efficiency, and ensuring accurate and reliable loading operations, thereby enhancing operational efficiency, reducing crew workload, and improving overall combat readiness. AALS will be ensuring the flawless operation during combat or training scenarios.

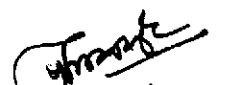
### **2. Price Estimation by vendor**

Interested firm may visit to GCF prior to submit any commercial and technical offer. GCF team will illustrate the system and operational requirement of AALS to the firm. This will help the vendor to estimate the price of system and understand the technical requirement of AALS.

### **3. General Requirements**

- a. Vendor shall be involved in the integration and testing of the Electrical/Electronics system on the Artillery Guns/tank Guns or had developed Electrical/Electronics based systems for Indian Army/Navy/Air Force/other Defence establishments.
- b. Vendor should provide power consumption data for nominal and maximum rating in different modes of operation.
- c. The vendor is responsible for ensuring the performance as per the specifications given in the purchase order when system installed on the High Calibre Gun during operation.
- d. The firm will be required to make a technical presentation followed by the demonstration.
- e. The vendor should test the system as per ATP during Factory Acceptance Test (FAT) prior to shipment of items and provide detailed Acceptance Test Report (ATR). The ATP will be approved by GCF before the commencement of testing. The item will be dispatched after Pre-Delivery Inspection (PDI) at vendor's premises.
- f. Draft ATP has been attached as **Annexure A**.
- g. The vendor must submit a compliance matrix with respect to all the below mentioned specification & requirements for vetting by the Technical Evaluation Committee.
- h. A **Non Disclosure Agreement (NDA)** will be signed with the vendor after placement of PO.

  
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4. AALS System Requirements

- a. **Integration with Vehicle:** The AALS should be seamlessly integrated into the vehicle-mounted gun system, considering factors such as available space, weight limitations, and power supply.
- b. **Operational Efficiency:** The AALS should optimize the handling and loading processes, reducing manual intervention, and minimizing the time required for ammunition handling, feeding, and loading operations.
- c. **Compatibility:** The AALS should be compatible with the 155x52 Cal of Gun system for which it is designed to load ammunition. It should be capable to load different type of 155 mm NATO ammunition.
- d. **Safety Measures:** The AALS must incorporate robust safety features, such as fail-safe mechanisms, sensors, interlocks, and emergency stop functions, to prevent accidents and ensure safe operation.
- e. **Ammunition Handling:** The AALS should be capable of handling and loading ammunition from designated storage container/magazines or from other vehicle. It should accommodate various types of 155 mm NATO ammunition such as **HE M107, HE ERFB BB & BT, SCREENING SMOKE, ILLUMINATING** etc.
- f. **Loading Flexibility:** The AALS should support efficient and quick loading of ammunition into the gun system, accommodating various loading configurations and ammunition types.
- g. **Loading Speed and Accuracy:** The system should optimize loading speed while ensuring accurate alignment and positioning of ammunition for proper insertion into the Loading tray. System must be capable to load 03 rounds in less than 30 seconds, it is stringent fire requirement.
- h. **User Interface:** The AALS should have an intuitive and user-friendly interface for operators to monitor and control the loading process. It may include touchscreens, buttons, or control panels.
- i. **Loading Capacity:** The system should have the capability to handle a 50 kg shell in per loading cycle, taking into consideration the requirements of the specific firing mode e.g., Burst, intense and sustained.
- j. **Integration:** The system should be integrated with the existing infrastructure, including weapon systems, equipment interfaces, and control systems, to enable seamless operation and communication.
- k. **Redundancy:** In event of any failure system should be capable to operate in manual mode also. Manual operation will be redundant feature of system. If power fails system can be brought to home position by human effort to maintain shoot and scoot feature of MGS.
- l. **Reliability and Durability:** The system should be designed to withstand the rigors of vehicle-mounted operations, including vibrations, shocks, and environmental conditions.
- m. **Maintenance and Serviceability:** The AALS should be designed for ease of maintenance, with provisions for routine inspections, repairs, and component replacement, considering the vehicle-mounted nature of the system.
- n. **Environmental Considerations:** The AALS should be designed to withstand challenging environmental conditions, including temperature extremes, vibrations, shocks, and dust or moisture exposure.

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5. Technical Data-

Sl. No	Specification	Parameter	
1	Weight of Ammunition to be handled	50 kg	
2	Type of System	Electric	
3	Mounting	Gun/Vehicle mounted	
4	Maximum Reach	1300mm or as suited to system recommended by vendor	
5	Time to Pick and Place & Retract 01 shell	Less than 10 Seconds	To Maintain Burst fire rate
6	No of Operations	3 Shells to be loaded in less than 30 Seconds	
7	Type of Gripper	Electric	
8	Transportation	AHS to be stowed and locked during transit	
9	Degrees of Freedom	3 (3 Arms)	
10	Environmental Requirements	As per MIL 810 G and MIL 461 F	JSS 55555 as applicable for Military Ground Vehicle (L3 category of Class L may applicable)

6. Project Deliverables:

- a. **System Design:** Detailed technical specifications and architectural design for the AALS, including loading mechanisms, ammunition handling components, control interfaces, and safety features.
- b. **Software Development:** Development of customized software to control and manage the AALS, including user interfaces, loading sequences, safety protocols, and integration with existing systems.
- c. **Hardware Implementation:** Procurement, installation, and configuration of all necessary hardware components, including loading mechanisms, sensors, control panels, and safety systems.
- d. **Testing and Validation:** Rigorous testing of the AALS to ensure functionality, safety, and performance in various loading scenarios. This includes compatibility testing, speed and accuracy testing, and user acceptance testing.
- e. **Training and Documentation:** Provision of comprehensive training programs for system operators and maintenance personnel. Additionally, preparation of detailed user manuals, maintenance guides, and technical documentation for future reference.
- f. **Deployment and Commissioning:** Installation, configuration, and commissioning of the AALS, ensuring its seamless integration with the existing infrastructure and successful loading of ammunition.
- g. **Post-Deployment Support:** Provision of post-deployment support, including troubleshooting, bug fixes, and software updates during an agreed warranty period.

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h. **Trial Support-** Support must be extended for internal as well user trials (firing and other trials)

**7. Responsibilities:**

a. **Vendor:** The vendor will be responsible for the design, development, implementation, testing and integration of the AALS, as well as providing training and documentation. **Format of drawings/Design data should be in (.dwg) format (Autocad 2017 or lower version). All the 3D models should be compatible to NX version 1980 or lower. All the drawings/ 3D models made will be a property of GCF Jabalpur.**

b. **GCF Jabalpur:** The GCF will be responsible for providing the necessary infrastructure, facilities, and access to relevant weapons or equipment for the successful implementation of the AALS. GCF will also collaborate closely with the vendor, providing input, feedback, and approvals throughout the project lifecycle.

8. **Acceptance Criteria-** A pre dispatch inspection by GCF will be carried out at vendor facility to certain the quality of items offered by vendor.

After integration of AALS on MGS a detailed functional check including firing will be carried out to ascertained requirements. Functional test will be arranged by GCF and vendor has to be present at various location during functional checks.

**Classification of Test (For PDI)**

Following tests are to be conducted on all the units, i.e., 100%.

a. Visual Inspection.

**Test Procedure (For PDI)**

a. *Visual Inspection*

All assemblies, items and components tendered for inspection shall undergo.

Check for:

- i. Completeness of the assembly as per the main assembly drawing and its details.
- ii. The quality of workmanship and finish. The workmanship should be of high order and the finishing should be smooth and without any sagging and drips.
- iii. Correct and rigid assembly of actuators, cylinder, shell, spring, screws, washers, nut, clamp, gasket etc.
- iv. The uniform and reliable tightening of all fasteners.
- v. Reliable and rigid fitment of cylinder, shell, spring, indicator light, connector etc., is marked with proper identification marking as per assembly drawing.
- vi. Any mechanical damage to parts or assembly is not permitted.
- vii. Presence of any loose part/foreign matter in the assembly is not permitted.
- viii. Presence of any sharp corner in the assembly is not permitted. They should be blunted/rounded off.
- ix. Cleanliness of contact points, connector, and other electrical components.
- x. The overall dimensions of the assembly, mounting dimensions, and alignment of the mounting holes.
- xi. Punching and other marking mentioned as per assembly drawing to ensure the components are safe and free from tampering.

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- xii. Correct connection of wires to the terminals as per relevant wiring diagram and its security. Sagging of wire is not permitted. Wires can be bunched/clamped together using cable ties.
- xiii. The wires used are type approved and the gauge of wires are as specified.
- xiv. Cable terminations are provided with correct cable marker/sleeves as per wiring diagram.
- xv. Correct soldering of wires with terminals. Dry soldering is not permitted.
- xvi. The connector receptacle is to be provided with EMI gasket.
- xvii. Wherever EMI gaskets are provided the surface of the box should be free from paint.
- xviii. Proper mating of connectors with the receptacles.
- xix. The protective coating and surface finish of hardware's and assembly as per relevant component/assembly drawings.
- xx. Correct sealing of assemblies to prevent ingress of dust, dirt, moisture, oil, water etc.

**9. Other Terms and Conditions:**

- a. **Intellectual Property Rights (IPR):** "The IPR of the entire system developed under this contract will be property of GCF Jabalpur
- b. **Warranty:** Notwithstanding inspection & acceptance by GCF of the hardware under this contract or any clause concerning the conclusiveness thereof, OEM shall provide warranty for a period of **12 months** from the date of acceptance, that hardware is free from defects/failures due to workmanship, material, or manufacturing non-conformance. The OEM shall be responsible for any defect or failure of equipment provided in the Items, special tools, test and diagnostic equipment, maintenance, and unit exchange spares due to defective design, material, or workmanship. The repair and/or replacement of failed components and installation of repaired/replaced components shall be taken by the OEM on his own charge at the Site (GCF or Location of MGS). The OEM shall bear custom duty, freight charges and all other expenses involved in collection of defective components and equipment from the site, and transportation to the manufacturer's works in India and its return to site after repairs. Further, OEM should do any design modification required to any components or equipment because of failure analysis and modification shall be carried out free of charge. The OEM shall carry out all replacement and repairs under the warranty promptly and satisfactorily on notification of the defect by GCF immediately.
- c. **Materials and Workmanship:** The OEM shall be responsible for meeting the requirement of constructional details, materials & workmanship. All materials and workmanship shall be in every respect in accordance with the proven up-to-date best practice. All the components used in the construction of this supply shall be from fresh and present stock and not from older stocks. OEM shall provide necessary material certificate to this effect. 100% visual inspection of all components shall be carried out and the components/assemblies shall be free from any defect. Stage inspection should be carried out. All threaded fasteners should turn freely without jamming and to be lubricated wherever called for.
- d. **Product Support:** The OEM shall be required to confirm that he is able to provide product support in terms of maintenance, material, and spares for a period of minimum 20 years. The OEM must provide at least 2 Years notice to GCF before closing the

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production line to enable "LIFETIME BUY" of all the material & spares before closure of the production line. All upgrades & modifications carried out on the equipment during the life cycle must be intimated to buyer.

- e. **Payment Terms:** Payment will be done in 3 stages:
  - Stage I:** 45% payment will be done after receipt of item at GCF.
  - Stage II:** 45% payment will be done after successful integration of the system on the Gun.
  - Stage III:** Remaining 10% payment will be done after successful firing and other trails.

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Annexure A

Acceptance Test Procedure (ATP)

The Ammunition Handling System (AHS) will be tested and delivered to the customer as per Factory Acceptance Test (FAT).

The test Procedure will be formulated in detail by the vendor and should be finalized in consultation with the indenter.

The FAT should cover the following:

1. Maximum angular travel for each of the actuating system
2. Max linear travel of the AHS arm (mm)
3. Dimensions after folding and stowing (LxBxH)
4. **Load test:** a) Load the integrated AHS with the rated load and lift the load to max height. Observe the functions of gripper and all actuators b) Repeat the load test with proof load
5. **Accuracy of positioning:** Check for accuracy of positioning for pick and place operations and for each of the commanded value.
6. **Travel time:** Check the time required for pick place of the ammunition as per specifications. Check for active time and dwell time for each cycle.
7. **Electrical System:** a) Under powered condition check for No load current drawn. b) Check for each of the operations as per control console commands c) Check current drawn at max load condition d) Check for failure modes and safety built-in
8. **Roadability Tests:** The roadability test will be conducted by the indenter on the actual vehicle and in installed condition to prove the integrity of design.

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