

# "Design, Development, Manufacturing and supply of Pneumatic Suspension Control System for Air Defence Gun."

## BACK GROUND

Gun Carriage Factory (GCF) Jabalpur is a premier weapon production unit of Advanced Weapon and Equipment India Limited (AWEIL), working under the Ministry of Defence, Govt. of India. Currently GCF is producing medium & large caliber weapons. GCF is developing new Air Defence (AD) Gun for Indian Army. In this regards, GCF needs to develop Axle System for Air Defence Gun which will give towing capability to the gun.

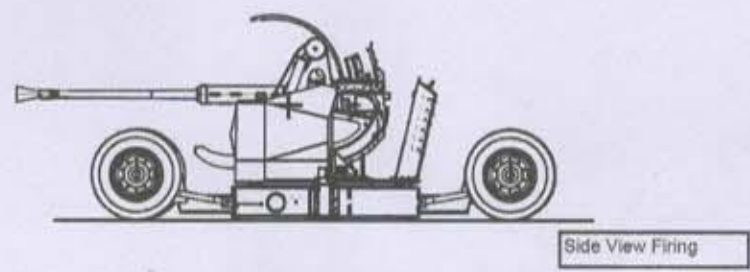
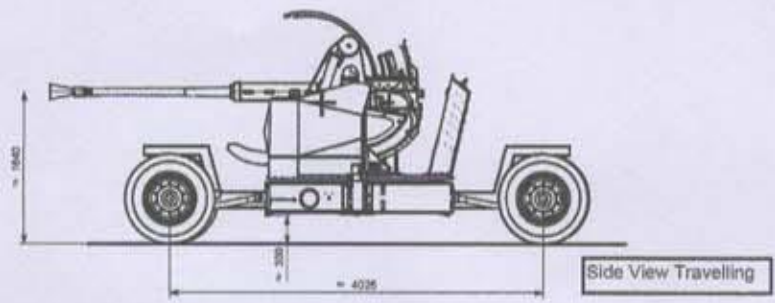
## PROBLEM STATEMENT

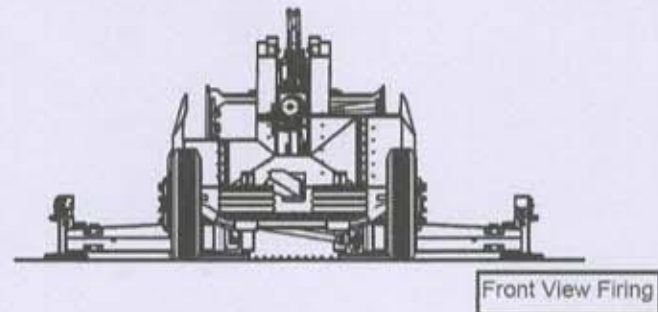
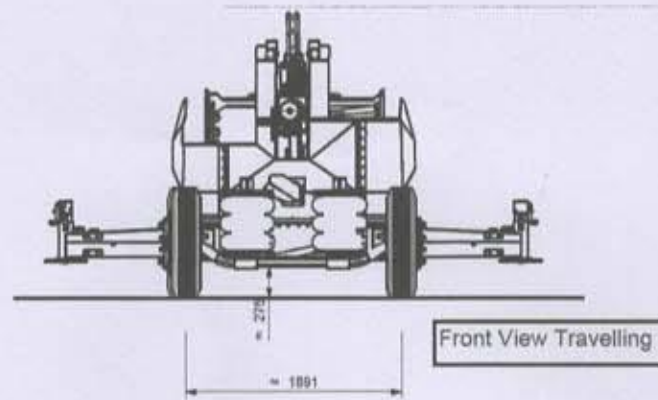
There is a need to design the axle system of Air Defence Gun due to following requirement:

**Stability:** Air defence gun is highly accurate gun which neutralizes air target at speed 500m/sec and at a distance of 4000m. To engage the target at such speed and distance the gun should be stable and rigid which is achieved by resting the gun platform on ground (off-wheel) and pegged with ground.

**Mobility:** The gun is towed on metalled road at a speed of 70 km/hr and off road condition 15 km/hr in all type of terrain such as mountains, deserts, river beds etc. for this gun is to be on-wheels.

Due to this high stability and mobility requirement gun has to change its position from on-wheel to off-wheel and vice a versa regularly as shown in picture.





One of the major part of the axle system is suspension system. The suspension system gives gun the capability for on-wheel to off-wheel conversion and vice a versa with in short time. GCF selected the air suspension for this application. Now there is a need to design, develop and supply of pneumatic suspension control system for this air suspension.

Following are the major specification\* parameters of gun related with suspension system.

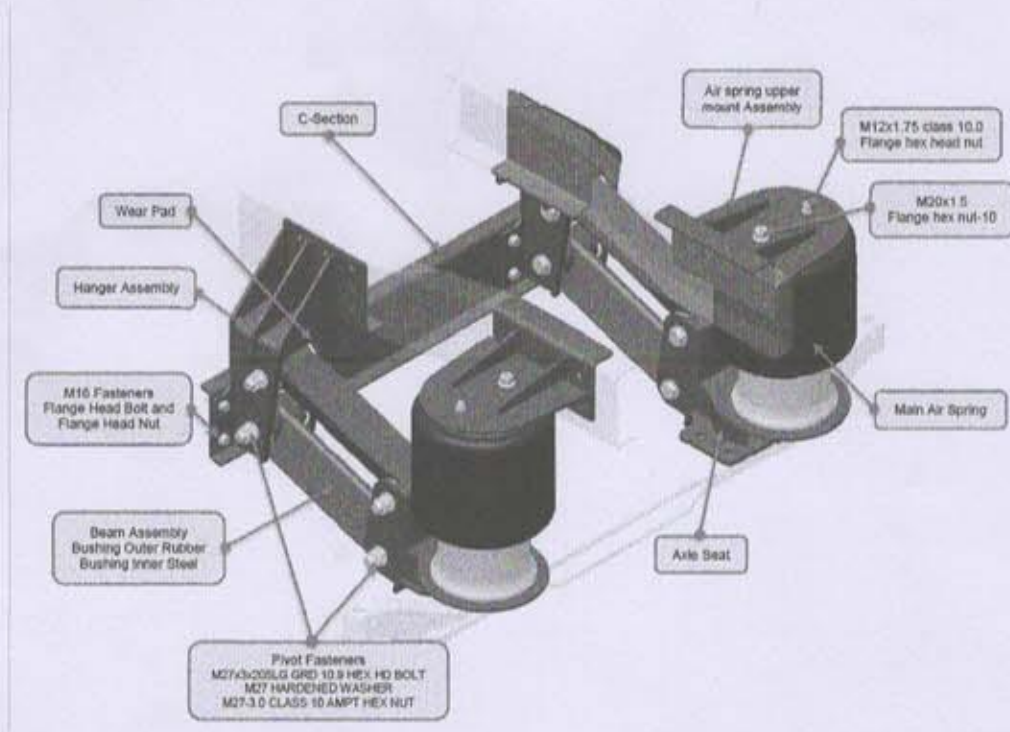
- a. Ground Clearance during travelling: 270mm (minimum)
- b. Change time between on-wheel to off-wheel and vice a versa: 8 min. (maximum)
- c. Tyre size to be used: 9.00-20 or 10.00-20
- d. No. of axles: 2 (as shown in figures)
- e. Total no. of wheels: 4 (as shown in figures)
- f. Gross weight of equipment: 8 ton
- g. Towing speed on metalled road: 70 km/hr.
- h. Towing Speed off road condition 15 km/hr.
- i. One air spring cubic capacity: 23 liters approx.

\* Above specification may change as these parameters are under validation.

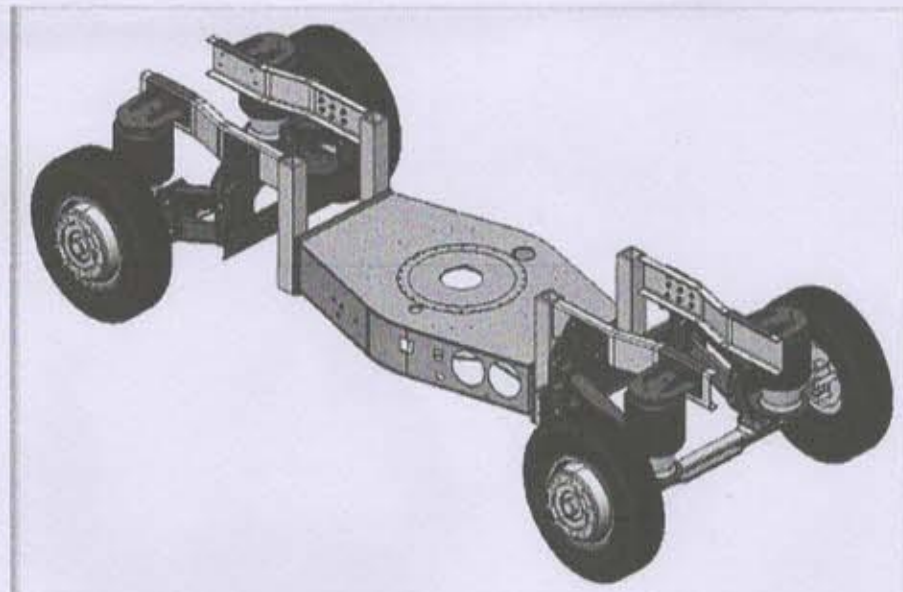
## OBJECTIVES

Following are the objectives of this design, development, manufacturing and supply of pneumatic suspension control system:

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1. To meet the requirement of on-wheel and off-wheel functionality of the gun, GCF selected the lift axle suspension manufactured by TATA Autocomp Hendrickson Suspensions Pvt. Ltd Pune as shown in the figure



2. General arrangement of the lift axle on the gun is shown below



3. The lift axle suspension uses air spring (bellows) as shown in the figure. Bellows require pneumatic power for operation and precise control of up-down movement.
4. The pneumatic system should be capable of charging the air suspension system to raise the gun above ground (on-wheel) to maintain a certain ground clearance suitable for on road and off-road travelling.

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- 5. The pneumatic system should be capable of discharging the air suspension system such that gun should rest on ground (off-wheel) and there should be no load on tyres during firing.
- 6. There should be quick change from off-wheel to on-wheel and vice a versa.
- 7. There should be compressor, air reservoir, valves, sensors, switches, interlocks, air lines, control system etc. to meet the objective.

### Pre-Qualification Criterion

- 1. Firms which are working in the field of hydraulic system or pneumatic system is eligible to quote.
- 2. Firm should be an Indian Registered Company with minimum average turnover of 1 Crores in last 3 Years.
- 3. Firm will provide case studies/write up for of at least 02 project completed in the past 02 years. Firm will self-certify the share of work completed by firm in that project. Complete customer detail, purchase order copy, end user (if known) should be shared.
- 4. Firm should have CADD software for designing work.
- 5. Firm should have CAE software that should broadly include CFD, FEM, MBD etc. Firm can have collaboration for the analysis part of the project.
- 6. Capacity assessment of the firms will be done to ascertain the capability of design, development, manufacturing and supply of such system.

### SCOPE OF WORK

- 1. Design, development, manufacturing and supply of two set of pneumatic suspension control system along with all equipment for operation of pneumatic system.
- 2. Control and Pneumatic system should be complete and ready to fit on the gun chassis. One set of fully assembled pneumatic system should include:
  - j. Compressor of required capacity (compressor will be mounted on Power Plant which is in GCF scope).
  - k. Air reservoir (pressure tank) for quick delivery of air as and when require.
  - l. Air filtration and air dryer system.
  - m. Air lines for the complete system.
  - n. Sensors for feedback on ride height, on-wheel and off-wheel position etc.
  - o. Switches for operating the mechanism.
  - p. Valves to regulate the air in the suspension and controlled air flow during charging and discharging of suspension.
  - q. PLC system to control the flow rate and flow direction of air supply as per required operation selected by operator.
  - r. Pressure gauges where ever require.

- s. All hardware items, rubber bushings, dampers, connectors etc.
3. Change from on-wheel to off-wheel and vice a versa should be air powered and operated through selection button by operator.
4. Capacity of air reservoir should be approximately 20 liters in additional to what is require for pneumatic system in order to use same reservoir for other gun function such as brakes, tyre inflation etc.
5. Pneumatic pipe line coming out of reservoir should be given tapping point for brake system operation and tyre inflation air take off.
6. All parts design should be optimized through strength analysis.
7. Firm will do durability optimization of the component and assemblies. Predicted life of components, sub-assemblies etc. should be defined in term of time span (self-life) or kilometer of travelling.
8. Design should be MIL grade it should be able to perform in dusty, rainy etc. conditions.
9. Most of the components should be commercially available. For make to order components materials suggested for manufacturing should be from Indian standard (IS) and where ever Indian Standard not existing other international standard like BS, ISO, EN, ASTM can be suggested.
10. Operating temperature of the system is -20 deg. to +50 deg. Altitude is up to 5000m in high altitude area.
11. Storage temperature of the system -30 deg. to +50 deg.
12. Supply of CAD Models, motion study.
13. Preparation and supply of maintenance documents, ISPL, parts catalogue, animation videos etc.
14. Firm to remain involved during GCF trials of the system any gaps or faults should be improved by the firm.
15. Any Spare require for trouble free operation during trials should be provided by firm.
16. Test the functionality of the system at firm's facilities before supply.
17. Main parts of the pneumatic system should be commercially available to maintain the availability of spares at all time and all parts of India.
18. Chassis transportation (if require) between GCF Jabalpur and firms work for fitting and assembly purpose will be borne by the firm.

## DELIVERABLES

1. Functional Demonstration of the designed system before delivery.
2. Supply of 02 set of pneumatic system.
3. Following Documents of the system should be provided in digital editable format.
  - a. Maintenance manuals.
  - b. Operator manual describing functioning, operation.

- c. Part catalogue with exploded isometric views of assemblies.
  - d. CAD Models for GCF use.
  - e. Line diagrams, circuit diagram.
  - f. List of spares.
  - g. Animation video of pneumatic system working.
4. Fitment and functional trials of 02 sets of system
  5. Spare support during trial and testing.

### PAYMENT TERMS

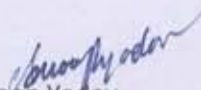
Sl.No.	Activity	Delivery Schedule	Payment Percentage
1	Satisfactory Supply, fitting, assembly, functional demonstration, road trial, functional trial of one system on the Gun.	D+75 days	30%
2	Satisfactory Supply, fitting, assembly, functional demonstration, road trial, functional trial of second system on the Gun.	D+105 days	30%
3.	Supply of all documents, CAD Models	D+120 Days	30%
4.	Correction of any faults observed during trials. Correction in the documents if any desired by GCF.	D+150 Days	10%

### TERMS & CONDITIONS

1. Complete confidentiality shall be maintained by Vendor during and after the project.
2. Design and delivered system should not bound by any third party IPR regulations.
3. The design evolved during this exercise and under this project should not be used for any other organizations for the same purpose (Air Defence Gun) for next 20 years.
4. In compliance to Government of India Preference to Make in India Order-2017, minimum local content should be 70%.

  
Amit Kumar

Jt.GM/ODC-2

  
Anoop Yadav

JWM/ODC