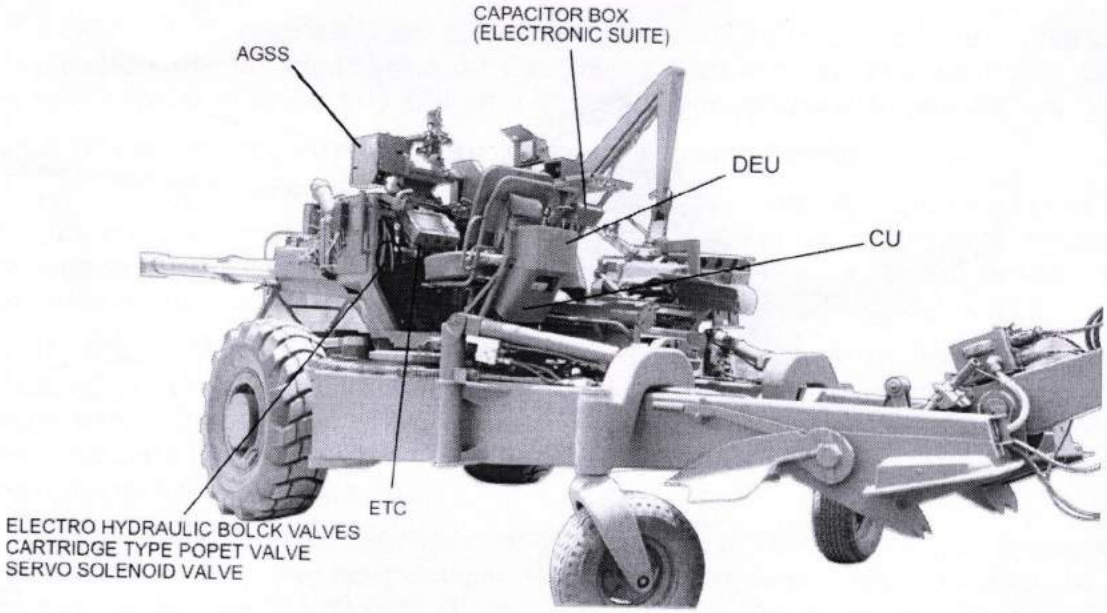
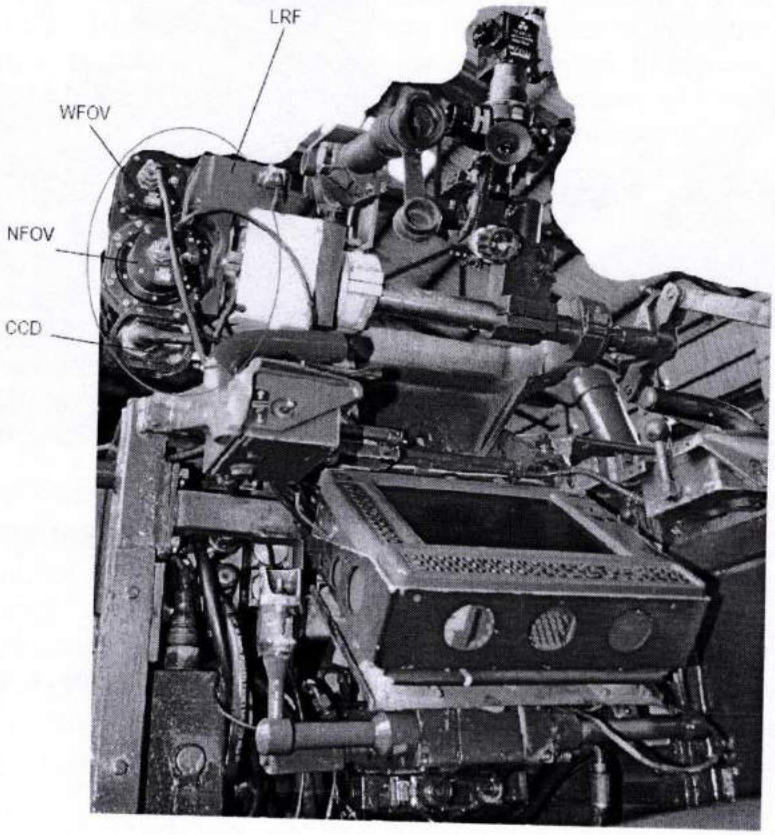
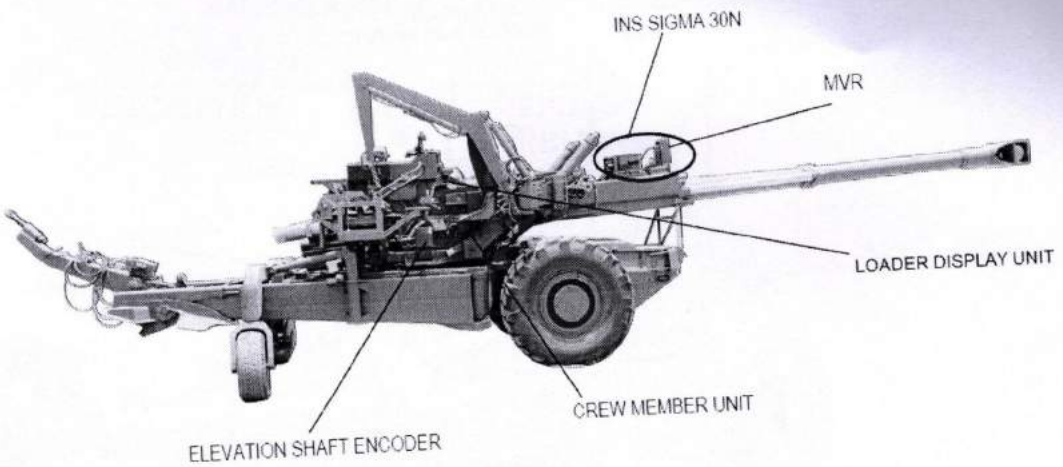
Open Tender for Electronic Suite



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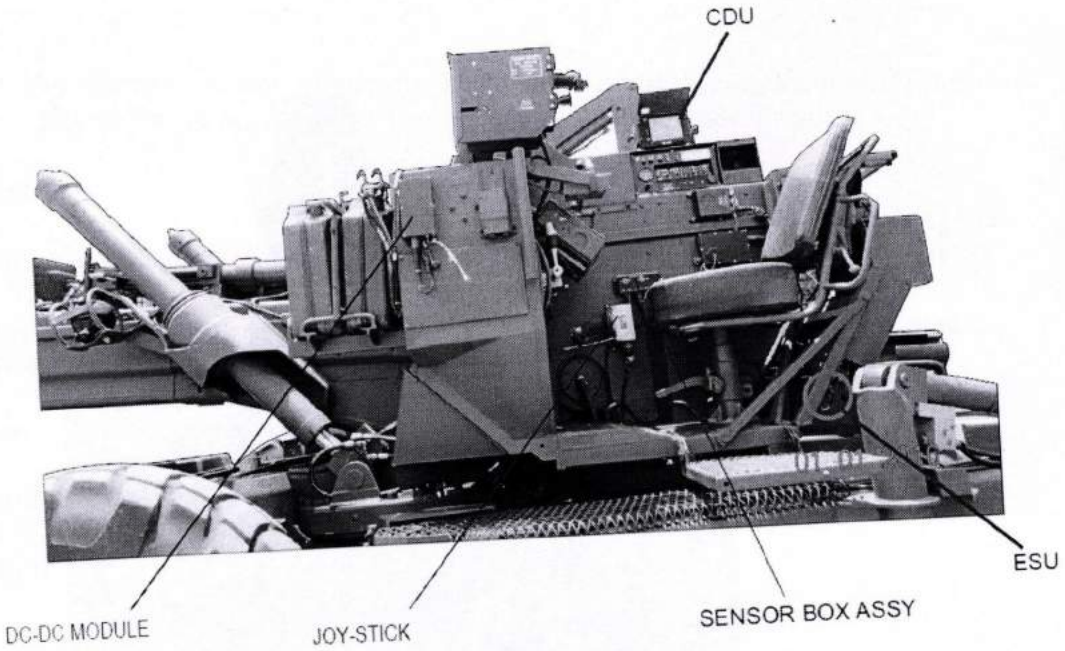
MVR
LOADER DISPLAY UNIT
CREW MEMBER UNIT
ELEVATION SHAFT ENCODER


CDU
ESU
DC-DC MODULE
JOY-STICK
SENSOR BOX ASSY

OPEN TENDER ENQUIRY

RFP for Electronic Suite for 155mm 52 Cal Towed Gun System of OFB

1. The GCF/OFB under Ministry of Defence, Govt. of India, intends to procure an electronic suite for its 155mm 52 Cal Towed Gun system. The electronic suite should consist of electronic add on features as per enclosed **Appendix – A**.

   This TE document consists of four parts as indicated below:

   [a] **Part – I** : The first part consists of the general requirements of the equipment , the time-frame for deliveries, conditions of usage and maintenance, requirement for training, and Warranty/Guarantee clauses etc. It includes the procedure and last date and time for submission of offers.

   [b] **Part – II** : The second part of the TE incorporates the aspects of QRs describing the technical parameters of the proposed equipment . The operational characteristics and features that should be met by the equipment are elucidated at **Appendix – A**. The SUPPLIER would be required to offer the equipment for trial evaluation.

   [c] **Part – III** : The third part of TE consists of the Commercial aspects of the Procurement, Payment terms, Performance guarantees, services to be performed by the SUPPLIER. It also includes standard contract terms along with special contractual condition, if any.

   [d] **Part – IV** : The fourth part defines the criteria for evaluation and acceptance, both in terms of technical and commercial parameters. A format as per **Appendix – E** has been enclosed for submission along with commercial offer to facilitate preparation for Comparative Statement of Tenders [CST] and identification of technically acceptable offers. Submission of incomplete format along with techno-commercial offer will render the offer liable for rejection.

2. The respondent to this TE should be designer of the complete integrated system. However he can source standard modules from other OEMs. The system offered should be a proven one on any 155 mm gun system all over the world. Documents to this affect are to be submitted to the tender bid.

PART – I : GENERAL REQUIREMENTS

3. Bids shall be accepted by electronic mode through our website: "https://ofbeproc.gov.in".

4. Tender fee and EMD, if applicable, should be submitted electronically. Till implementation of electronic payment system, they may be submitted at Gun Carriage Factory, Jabalpur on or before the tender opening date, but scanned copies must be attached with the online tender. The DD/Pay order should be in favour of "The General Manager, Gun Carriage Factory, Jabalpur" payable at Jabalpur

5. Corrigendum, if any, will be published on this website only, not in the newspapers.

6. The e-tenders will be opened on the specified opening date after which Tenderers can see all the submitted tenders online through their account. The detailed help is available on the website.

7. **Validity of Bids**: The Bids should remain valid till 09 months from the last date of submission of the Bids

8. **Bidding Procedure**: Bids are invited under single stage in two bid system. Only the Technical Bids would be opened on the time and date mentioned above. Price Bids of only those firms will be opened, whose Technical Bids are found compliant/suitable after technical evaluation is done by the Buyer. Date of opening of the Price Bids will be intimated in advance to the successful Bidders whose offers have been found technically acceptable.

9. **Forwarding of Bids** – Bids should be forwarded by Bidders under their original memo/letter pad with telephone numbers and complete postal & e-mail address of their office. Firms are required to furnish additional details like TIN number, VAT/CST number, Bank address with EFT Account, Sales Tax Commissioner Address & Income Tax Office Address etc.

10. **Language of documents**: All Design Engineering Data, Drawings, Manuals, Literatures, Documents etc. shall be in English/Hindi only and shall be as per standard engineering practice. If any other language is used along with English, the English version will be taken as authentic for any and all purpose. Only metric units and no other units shall be used in all drawing, documents etc.

11. **Clarification regarding contents of the TE**: A prospective bidder who requires clarification regarding the contents of the bidding documents shall notify to the Buyer in writing about the clarifications sought not later than one month prior to the date of opening of the Bids. Copies of the queries and clarifications by the purchaser will be sent to all prospective bidders who have received the bidding documents.

12. **Modification and Withdrawal of Bids**: A bidder may modify or withdraw his bid after submission provided that the written notice of modification or withdrawal is received by the Buyer prior to deadline prescribed for submission of bids. A withdrawal notice may be sent by fax but it should be followed by a signed confirmation copy to be sent by post and such signed confirmation should reach the purchaser not later than the deadline for submission of bids. No bid shall be modified after the deadline for submission of bids. No bid may be withdrawn in the interval between the deadline for submission of bids and expiration of the period of bid validity specified. Withdrawal of a bid during this period will result in Bidder's forfeiture of bid security.

13. **Clarification regarding contents of the Bids**: During evaluation and comparison of bids, the Buyer may, at its discretion, ask the bidder for clarification of his bid. The request for clarification will be given in writing and no change in prices or substance of the bid will be sought, offered or permitted. No post-bid clarification on the initiative of the bidder will be entertained.

14. **Rejection of Bids**: Tender is liable to be ignored if complete information is not given therein or if the particulars and data (if any) asked for in the schedule to the tender, are not fully filled in. Conditional tenders will be rejected.

Canvassing by the Bidder in any form, unsolicited letter and post-tender correction may invoke summary rejection with forfeiture of EMD.

15. **Right of Acceptance of Offer**: The purchaser reserves his right to accept or reject any offer without assigning any reason thereof. The purchaser does not pledge to accept the lowest or any tender and reserves the right of acceptance of the whole or any part of the tender or portion of the quantity offered and the tenderer shall supply the same at the rate quoted. Tenderer is at liberty to tender for the whole or any portion or to state in the tender that the rate quoted shall apply only if the entire quantity is taken from him.

16. The GCF desire that all actions regarding procurement of any equipment are totally transparent and carried out as per established procedures. The vendor is required to accept our standard clauses regarding agents / agency commission, penalty for use of undue influence and Integrity Pact, access to books of accounts, arbitration and laws that would be incorporated in the contract.

17. The TE is being issued with no financial commitment; and GCF reserves the right to change or vary any part thereof at any stage. GCF also reserves the right to withdraw TE should it be necessary at any stage.

18. **Patent Rights**: The vendor has to confirm that there are no infringements of any Patent Rights in accordance with the laws prevailing in the country.

19. **Earnest Money Deposit (Bid Security):-**

A. Bidders are required to submit Earnest Money Deposit (EMD) for amount of Rs ********** along with their bids. Bids received without EMD shall be summarily rejected without technical evaluation. The EMD may be submitted in the form of an Account Payee Demand Draft, Fixed Deposit Receipt, Banker's Cheque or Bank Guarantee from any of the public sector banks as per Form enclosed. EMD shall be in favou3r of "The General Manager, Gun Carraige Factory Jabalpur".

B. "EMD is to remain valid for a period of forty-five days beyond the final bid validity period. EMD of the unsuccessful bidders will be returned to them at the earliest after expiry of the final bid validity and latest within one month after the award of the contract. The Bid Security of the successful bidder would be returned, without any interest whatsoever, after the receipt of Performance Security from them as called for in the contract.

C. EMD is not required to be submitted by those Bidders who are registered with the National Small Industries Corporation (NSIC) or any Ordnance Factory in India.

D. The EMD will be forfeited if the bidder withdraws or amends, impairs or derogates from the tender in any respect within the validity period of their tender.

20. **Signing of tender**:

A. The tender should be signed by a competent authority holding power of attorney to handle such job on behalf of tendering firm and this fact must be stated explicitly.

B. Individual signing the tender or other documents connected with a contract must specify whether he signs as: (i) 'Sole Proprietor' of the firm or constituted attorney of such Sole Proprietor. (ii) A partner of the firm, if it be a partnership, in which case he must have authority to quote & to refer to arbitration dispute concerning the business of the partnership either by virtue of the partnership agreement or a power of attorney; (iii) Constituted attorney of the firm if it is a company.

C. In case of (a)(ii) above, a copy of the partnership agreement or general power of attorney, in either, case, attested by a Notary Public should be furnished or affidavit on stamped paper of all the partners admitting execution of the partnership agreement or the general power of attorney should be furnished.

D. In case of the partnership firms, where no authority to refer disputes concerning the business of the partnership has been conferred on any partner, the tender and all other related documents must be signed by every partner of the firm.

E. A person signing the tender form or any documents forming part of the contract on behalf of another shall be deemed to warrantee that he has authority to bind such other persons and if, on enquiry, it appears that the persons so signing had no authority to do so, the purchaser may, without prejudice to other civil and criminal remedies, cancel the contract and hold the signatory liable for all costs and damages.

21. The Technical Offer will be evaluated by a Technical Evaluation Committee [TEC] to confirm that the equipment being offered meets essential parameters, features as elaborated subsequently in this TE at **Appendix– A**. Offered Electronic Suite will be integrated with the Gun and its sub-systems for trial evaluation.

22. **Year of Production**: Supplies should be of latest manufacture, conform to the current production standard and should have 100% of the defined life at the time of delivery. Deviations, if any, should be clearly brought out by the vendor in the Technical offer.

23. **Delivery Schedule**: Delivery to GCF, Jabalpur within **12 months** from the date of contract and installation within **3 months** thereafter [**Total 15 months**] is desired. In case the above schedule cannot be adhered to, the tenderer should mention his proposed schedule clearly in the offer. The tenderer should also submit a BAR Chart in this regard showing detailed activities involved including supply of sub systems and their integration with the gun system and its time schedule.

24. **Warranty**: The goods supplied shall carry a warranty for 24 months from the date of acceptance or from date of integration whichever is later. Draft Warranty clause is given at **Appendix-B**.

25. **In Service Life**: The In-Service Life of the Gun fitted with electronic suite must be at least 15 years from the date of acceptance.

26. **Training of Crew and Maintenance Personnel**: It will be essential to provide training to the crews [user] and maintenance personnel of the components. This training is to be organised at GCF premises where the

integration is undertaken. The nature and extent of training proposed as also the subjects to be covered may also be indicated.

27. Firm is requested to quote in Indian Rupees only.

28. Pre-Bid conference will be held at GCF 3 weeks prior to tender opening date.

29. Vendors are requested to visit GCF and have discussions before quoting if the need arises.

PART – II : TECHNICAL PARAMETERS

30 **Operational characteristics and Features** : The broad operational and technical characteristics and features that are to be met by the equipment are elucidated at **Appendix – A** .

31 **Technical Offer** : The Technical offer must enable detailed understanding of the functioning and characteristics of the equipment as a whole and each sub-system independently. It must include the performance parameters as listed at **Appendix – A** and any other information pertaining to the technical specifications of the equipment considered important/relevant by the vendor. The technical offer should also include maintenance schedules to achieve maximum life and expected life of each assembly/sub-assembly [or LRU/SRU], storage conditions/ environment condition recommended and the resultant guaranteed in-service/ shelf life.

32 If there is any associated optional equipment on offer that should also be indicated separately along with the benefit that are likely to accrue by procuring such optional equipment. Should the vendor be contemplating any upgrades or modifications to the equipment being offered the details regarding these should also be included in the Technical offer.

33 **Technical Details** :

a] The Technical details should be factual, comprehensive and include specifications of the offered system/equipment against broad requirement listed in **Appendix – A** of TE.

b] Insufficient or incomplete details may lead to rejection of the offer. Mere indication of compliance may be construed as incomplete information unless system's specific technical details are available in the offer.

c] The technical offer should have a separate detachable compliance table as mentioned in **Appendix–E** stating specific answers to all the parameters as listed at **Appendix–A**. It is mandatory to append answers to all parameters listed in **Appendix–A**. Further the Check List [Compliance Certificate] as per **Appendix–F** to be filled by the tenderer and submitted along with the technical offer.

PART – III : COMMERCIAL ASPECTS

COMMERCIAL OFFER:

34 Commercial offer will be opened only of the vendors whose equipment is short-listed, after technical evaluation and accepted by T1EC. The Commercial offer must be firm, fixed and should be valid for **at least 9 months** from the date of opening of tender.

35 Vendors are requested to take into consideration the Payment Terms given at **Appendix – D** while formulating the Commercial Offers.

36 To assist the vendor in formulating the Commercial offer and to ensure that all aspects are covered, a suggested format is given at **Appendix – C.**

37 In the commercial offer, the tenderer shall include all elements of cost as per the scope of the supply and services specified in technical specification. The price shall be item wise in accordance with and as stated in the specification along with the integration of the system with mechanical up-graded Gun.

38 Revision in commercial or technical offer having impact on prices will not be considered after opening of technical offer.

39 Quoted Price should be in words and figure. Any discrepancy between words and figures, the price in words shall prevail.

TECHNICAL CAPACITY:

40. The tenderer has to certify that complete knowledge base for software including source code & hardware for the scope of work as per Appendix 'A' is available with the tenderer in the country. The tenderer can undertake repair of assemblies/subassemblies (LRUs/SRUs) within the country itself. Offers without this certification are liable to be rejected.

LEGAL CAPACITY:

41. The tenderer shall satisfy the purchaser that he is competent and authorised to submit tender and/or to enter into legally binding contract with the purchaser. To this effect, any person giving a tender shall render documentary evidence that his signature on the tender, submitted by him is legally binding upon himself, his firm or company as the case may be.

PART – IV: EVALUATION AND ACCEPTANCE CRITERIA

44. **Evaluation and Acceptance Process**:

a] **Stages of Evaluation**:

(i) Evaluation of vendor on the basis of documents supplied & criteria stipulated in tender document or by capacity verification by a team of officers.

(ii) Evaluation of offer on technical parameters.

(iii) Opening of commercial bid of the vendors successful in earlier stages.

(iv) Trial evaluation of the successful vendors in earlier stages.

b] **Criteria for Qualification of vendors**.

(i) The Indian Prime Bidder should have executed similar type of work (FCS) for tracked or towed 155mm, 45/52 Cal Artillery system in the past. Details of the same to be provided. Their system should have been found technically qualified for Artillery Gun Systems in any evaluation of DRDO (Ministry of Defence), trials of Indian Army against RFP or In Service with Armed forces globally.

(ii) Intellectual Property Right (IPR): IPR for the design and development of the FCS must be with the Indian Prime Bidder.

c] **Evaluation of Technical Proposals** :

Tender Evaluation will involve recording and analyzing the merits of each tender. The process will start with preparation of "Comparative Statement" incorporating the technical terms offered in TE and that sought from the vendor[s], analysis of the discordance and the impact of the same. A similar statement would be prepared in regard to deviations noticed in the delivery schedules, performance warranty, guarantee provisions acceptance criteria, etc. Comprehensive analysis of the technical offer will form the basis for subsequent decision. The purchaser has right to summarily reject any specified parameters not being complied by the vendor.

d] Internal Trial Evaluation/Acceptance Criteria of Electronic Suite developed by selected vendors.

A. **Stage-1**. PDI at firm's premises and Vendor certification for required parameters

B. **Stage-2.** Integration of Electronic Suite on the Gun at location specified by OFB and fitment and functional trial as per mutually agreed ATP.

C. **Stage-3**. Full Scale internal firing and other trials or User Trials as the case may be. (Refer para 45 below)

Ammunition expenses for trial of guns for all stages will be borne by the OFB/GCF.

45. Vendor to note that in case of equipment to be introduced in service, it is mandatory that it successfully clears all tests/trials/evaluations. The trial evaluation process comprises of the following phases:

a] User Trials / Functional Trials.

b] DGQA trials including Technical and Environmental Evaluation conducted as per the JSS – 55555.

c] Maintainability Evaluation Trial [MET].

d] EMI / EMC Evaluation.

46. For the shortlisted technically acceptable firm/firms, the commercial bids will be opened. The L-1 vendor will be offered to participate in the Development Programme for offering their product for integration & internal trial evaluation.

47. For any further orders of 155 mm Gun system with electronic suite, the successful vendor will be considered established by OFB.

48. The price of L-1 will be taken as base price for the future programme.

Appendix– "A"

TECHNICAL PARAMETERS

1.

The Electronic add-ons on the 155mm/52 Cal gun should be able to achieve the following objectives: -

i. Exploit complete range of the gun more than 40 Kms to impart capability to strike deep into enemy's territory.

ii. Autonomous gun for ease of handling and improved survivability.

iii. Support MRSI capability for greater destruction power, Rapid and accurate firing

iv. Unified sighting system for direct firing. Improved sighting system with night sight capability.

v. Compatibility to fire complete family of 155 mm NASCHEM, ERFB, ERFB/BB and Standard NATO ammunition.

vi. Automatic and manual Laying (Elevation &Traverse); original hydraulic laying system also to be retained/ improvised ensuring functionality.

vii. Provide Inter and Intra gun communication using Digital intercommunication system (DIS)

viii. The communication systems should be flexible and modular to integrate in-service communication system (Not part of this tender supply), subsequently during induction.

The need is for integration of following equipments: -

a. Ballistic Computer
b. Inertial Navigation System
c. Automatic Laying System
d. Optronic Sight for Direct Shoot
e. Loader Display
f. Muzzle velocity RADAR

2. Specification for electronic add-ons of 155 x 52 cal gun :

2.1 Scope Of Contract

Scope of contract on acceptance of Vendor's offer shall be: -

i] Design, development and supply of equipment as specified.
ii] Installation of the subsystem on the Gun at Location specified by OFB.
iii] To ensure completeness of the equipment, the Vendor shall include in his scope of supply, all Auxiliary items like cabling and such other items which are necessary for the satisfactory running of the system, though not included in this specification.
iv] During installation and trial, some additional items and replacement of a few items to meet functionality may be required. Vendor should confirm to supply such items, if so needed.
v. Some electronic add-ons (not in the part of current tender) are under development by OFB itself. Integration of these add-ons in the system will be additionally carried out by the vendor at no extra cost

2.2 Protection

Necessary suitable safety and interlocking devices shall be incorporated in the equipment to prevent any accident or damage to the individual components/assembly of the equipment, personnel and materials arising out of abnormal working conditions, leakage of high pressure fluid, electrical contact, high temperature, explosion etc.

All electrical and electronic equipment's should be housed in totally sealed e nclosed/panels (Minimum protection should be IP65 or better at gun-level).

2.3 Technical Parameters

The following parameters of the gun are to be met after integration with Automatic Gun Alignment and Pointing System (AGAPS):-

i. The sighting system will be unified for direct firing with night firing capabilities.

ii. The sights should be capable of being integrated with the fire control computers with facility for display of gun data and option of automatic/manual offset of sights on receipt of gun data from BCP.

iii. The hydraulic laying system will be modified so as to integrate with the Ballistic computer for auto laying. The speed of laying should be at least 19 - 20 mils per second (as supported by gun hydraulics system).

iv. Firing data must be visible by day and night.

v. Calculate data in engagement with MVR, it should have provisions to update the acquired MV for charge temp, weight of projectile and apply MV data.

vi. The on-board **Fire Control Computer** should be able to perform all ballistics and gun control functions and should have digital interface (Ethernet / RS422) to interface with **Project Shakti** existing Command and Control system available with the Indian Army. The on-board **Fire Control Computer** should be able to communicate (Data reception) with in service ETC available with Indian army. ICD for the same will be provided to the contract awardee. Integration will follow subsequently by the vendor.

vii. Accuracy for setting and laying will be as under

a) Electronics based (indirect sighting system)	:	±1.0 mil
b) Optronic sight	:	±1.0 mil
c) LRF	:	Min 300 m & upto 5 Kms Accuracy +/- 10 M or +/- 1.5%

2.4 Technical Specifications Of Electronic Modules To Be Supplied :

2.4.1Direct Aiming Sight (DAS).

Introduction

The Optronic Sight should be a compact, high-performance multi-function system capable of providing real-time video and will be used for acquisition of targets both in day & night and in adverse weather conditions. This system will be integrated on the Gun Cradle with 155 mm 45/52 calibre High-Calibre Advanced Gun. Main features of the Optronic Sight are given below:

Main features:

1. The Optronic Sight should be a multi-sensor sight comprising of a Thermal imager, Color day channel and an Eye Safe Laser Range Finder (ELRF) in a sealed unit.
2. An uncooled dual FOV Thermal imager sensitive in the 8 to 12 µm (LWIR) wave band.
3. A dual FOV day for WFOV and for the NFOV. In addition, digital video processing shall provide a motionless continuous zooming feature from the NFOV to WFOV.
4. An eye-safe laser range finder.
5. These three sensors (Day, IR and LRF) should be mounted on a mechanical

structure and bore-sight retention between the three sensors & the weapon barrel will be ensured in severe environmental conditions.

6. Complete Optronic sight, with all its sensors, will be mounted on gun cradle with help of soft-mount to absorb shock & vibrations that will also be designed & manufactured by the vendor.
7. All EO imagers should have provision for electronic bore-sighting individually.
8. All I/O electrical interfaces (power supply, video and data) with the external equipment or host system should be provided at the connector end. The connector should be of standard type and be available generally.
9. Weight should be less than 9 kg with ancillary equipment.
10. Video boresight for zeroing of Optronic Sight should be provided by the vendor.

Operation modes

The Optronic Sight should have following modes of operation:

- Normal Mode of operation
- Calibration mode of operation
- Degraded mode of operation (i.e. if IR or Day channel become faulty the Optronic Sight could work with the combination of one of sighting channel and ELRF in such condition).

Technical Specifications

***a)* Day Channel**

Day Colour video

The requirement of the day channel is to provide real-time colour video of the scene during Day time.

Specifications

Parameters	**Specifications**
Colour Day Cameras	CCD/CMOS
NFOV Day Camera: Field of View	≤3° x 2° (± 10 %)
WFOV Day Camera: Field of View ≥	≥12° x 9° (± 10 %)
Resolution	≥768 X 576 pixels (4:3 format)
Range	Recognition ≥ 5.5 km(NFOV) NATO Tank target 2.3m x 2.3 m
Observation capacity	NFOV: 100 m to infinity WFOV: 20 m to infinity
Sensitivity	10 to 10,000 lux

Image processing on the day channel :-

The day channel of the Optronic Sight should have the following image processing capabilities:

- Full-resolution digital motionless continuous zoom between the FOVs of two Day Cameras
- 8X Electronic magnification on top of the NFOV,
- Two gain and offset control modes:
  - Automatic Gain Control (AGC - The analysis window is the entire field of view)
  - Semi-automatic gain control (the operator adjusts gain and offset from the nominal positions defined by the AGC, in order to optimize them as to the area of interest)

***b)* Thermal (IR) Imager**

Thermal video

The requirement of the thermal imager is to provide real-time thermal video of a scene during night and day.

Specifications

Parameters	**Specifications**
Spectral bandwidth	8 - 12 µm (uncooled)
FOV	NFOV ≤: 5° x 4° (± 10 %) WFOV ≥: 13.6° x 10.2° (± 10 %) 8X Electronic zoom on top of the NFOV
Sensor Matrix	640 x 480 pixels
Observation capacity	NFOV: 100 m to infinity WFOV : 20 m to infinity
Range	Recognition ≥ 3 km (NFOV) NATO Tank target 2.3m x 2.3 m
NETD	WFOV<120 mK NFOV < 220 mK
FOV change duration	< 1 sec
Defective pixel	2 % of the sensitive area
Calibration	Automatically during the startup phase. Sight should have provision for calibration automatically (periodicity of 10 min or more) or manually from the On-Board Computer as per user selection.

Image processing on the thermal imager

The thermal imager of the Optronic Sight should have following image processing capabilities:

- 8X Electronic magnification on top of the NFOV,
- Polarity inversion of the image (black-hot, white-hot),
- Sharp contour enhancement,
- Two gain and offset control modes:
  - Automatic Gain Control (AGC),
  - Semi-automatic gain control (the operator will be able to adjust manually the gain and offset from the nominal positions defined by the AGC in order to optimize them as to the area of interest).

***c)* Laser Range Finder** :

Optronic Sight should include a diode laser based eye-safe LRF. This subsystem should be used to find range of a target being viewed through the IR or day channels. LRF should also indicate the presence of a second echo as well as the absence of echo. As per request from the On-Board Computer, provision of recording last three range measurements needs to be provided. It should be possible to access (via serial link) one or the other range or both of them in case of double echo and to choose any one of them to be taken into account.

Parameters	**Specifications**
Eye safe	1.55 μm
Typical range	Min 50m up to atleast 7500 m (2.3 m x 2.3 m NATO target, albedo
Range accuracy	≤ 5 m
Angular resolution	≤ 1 mils

2.4.2Reticules

The reticules in various FOVs of the Day and Thermal Channel should be generated and overlaid on the video signal being displayed on the screen. Reticules should be mil graduated (1 Mil Graduation). The reticule should be capable to measure vertically and horizontally atleast 10 mils.

2.4.3 On screen display

There should be a provision of generating text messages which can be overlaid in the video signal depending on the request from the host system, and could be displayed on screen.

2.4.4 Recording of pictures

There should be a provision of storing up to 100 fixed images upon request from the host system. The format of the recorded images can be JPEG format. Images can be downloaded through the serial link.

2.4.5 Fusion of day and Thermal channels

There should be provision of image fusion for day & IR channel videos.

2.4.6 Start-up time:

Day Channel ≤ 30 seconds LRF ≤ 45 seconds
IR channel ≤ 50 sec at ambient temperature.

2.4.7 Duration of video channels change

The time required to change from the IR channel to day channel and vice versa should be ≤ 3 second.

2.4.8 Provision of Bore-sighting

Provision of bore-sighting between the Line of Sight and Line of Fire should be available for calibration after fitment on the gun within 0.5 mils. This should hold for a change of operating temperature of ± 25°C with respect to at which it was bore sighted.

2.4.9 Harmonization Error

Day, night and LRF channels should be harmonized with respect to the mechanical reference of the Optronic Sight within 150 µrad mills in both planes after user harmonization. Vendor will provide certificate.

2.5 Interfaces

2.5.1 Electrical Interface

Optronic Sight should be equipped with a provision of electrical connector(s) for the video, power supply and serial link. All available signals should be insulated from mechanical ground (better than 30 Mohm under 50 VDC).

2.5.2 Power supply

The Optronic Sight should operate with following power supply specifications:
VDC steady state (18-32 volt range) according to MIL-STD 1275 B;

- Transients according to MIL-STD 1275B;

2.5.3 Data Interface

The Optronic Sight should have a provision of interfacing via bi-directional RS 422/Ethernet with on-Board Computer of Gun to provide ballistics offsets transfer to the Optronic Sight reticle as calculated by On-Board computer.

2.5.4 Analog Video output

The Optronic Sight should have a provision of video channel for both IR video and the day video based on a selection switch.

2.6 Dimensions and Weight

Expected Dimension: To fit the gun without affecting its functionalities

Weight: ≤ 10 kg with ancillary equipment

2.7 Electro-magnetic compatibility

Optronic Sight should meet the emission and susceptibility requirement of MIL-at least STD-461-E, applicable to Military Land System. Vendor will provide certificate of compliance at time of supply and will assist during trial in integrated condition.

2.8 Environmental Tests

The design of the Optronic Sight should cater for the severity of the environment as per JSS55555 given below. Matrix of Environmental tests shall be conducted as follows:

Sl. No.	Test	Remarks
1.	**Vibration test:** by sinusoidal wave with Frequency sweep of :- Range: 5 to 8 Hz, Const. displacement: ±6mm Range: 8 to 500Hz, Const. acceleration : ±15 m/Sec² (1.5g) Duration : 2 Hrs equally distributed in three mutually perpendicular axes followed by performance check. (without Transportation Case)	Clause 8.1 Test Sl. No. 14 of JSS 5855 (Table 4.28.2,1(b) Test No. 28 of JSS 55555)
2.	**Bump Test:** (without case) No. of bumps : 4000 ± 10 Peak acceleration : 250m/Sec² Pulse duration : 06 ms Repetition rate : 1-3 Bumps/Sec	Clause 8.1 Test Sl. No. 13 of JSS 5855. (Test No. 5 of JSS-55555)
3.	**Shock Test:** (without case) Peak acceleration 40 g with pulse duration 18 ms Six shocks in vertical direction	Clause 8.1 Test Sl. No. 15 of JSS 5855.
4.	**Drop Test :** No. of drops: 06 (packed condition). One drop on each face from the height of 30 cm on 15 cm thick sand bed	Test Sl. No. 15.4.1(e) of JSS 5855.
5.	**Sealing Test:** At pressure of 0.175Kg/cm² above atmosphere	Clause 8.1 Test Sl. No. 9 of JSS 5855. (Test No. 23

	(to show no leakage)	of JSS 55555) **Applicable only for hermetically sealed sights**
6.	**Low Temperature Test** Operation : (-) 20°C ± 3°C Duration: 16 Hrs, unit under test: OFF condition (Performance check during last 30 minutes of test)	Clause 8.1 Test Sl. No. 2 of JSS 5855. (Test No. 20 Condition -J of JSS 55555)

Sl. No.	Test	Remarks
7.	**High Temp Test** Operation : 55°C ± 3°C Duration : 16 Hrs Storage : 70°C ± 3°C Duration : 16 Hrs Unit under test : OFF condition (Performance check during last 01 hour of test)	Clause 8.1 Test Sl. No. 1 of JSS 5855 (Proc-6, Condition-M Test No. 17 of JSS-55555)
8.	**Damp Heat Test** Temp : 40°C± 2°C not less than RH 95% for 01 cycle 16 hrs	Clause 8.1 Test Sl. No. 3 of JSS 5855 (Test No. 10 of JSS 55555)
9.	**Rapid Temperature cycling Test (Thermal Shock)** Temp: + 55°C ± 3°C, RH not exceeding: 30% Duration : 3Hrs Then transfer to Low Temp : -20°C ± 3°C Duration : 3hrs Transfer time : 2 to 3 minutes No. of cycle: 1	Clause 8.1 Test Sl. No. 5 of JSS 5855. (Proc-1,Test No. 22 condition - A of JSS 55555)
10.	**Altitude Test** (unpacked & switched off condition) Temp : -20°C ± 3°C Pressure : 60 KPa Altitude : 4160 meters (Appx) Exposure time : 16 hrs	Test Sl. No.10 of JSS 5855. (Test No.3 Procedure - 1 Test Condition - L1 & Table No. 4.3-2 Test condition A2 of JSS-55555)
11.	**Tropical Exposure Test** Raising the temp from +20°C to +35°C in 3 hours Hold at temp : +35°C ± 3°C for 12 hrs Lowering the temp from +35°C to +20°C in 3 hours Then hold at temp : +20°C ± 3°C for 6 hrs, RH not less than 95% No. of cycles : 14 (01 cycle per day)	Clause 8.1 Test Sl. No. 4 of JSS 5855. (Test No. 27 Condition-B (14 Cycles)of JSS 55555)
12.	**Rain Test:** (Without Case) Spraying with clean water for 1 hour at static pressure of 200 KPa ±15% from eight shower heads. The consumption of water from each shower head shall be 450 liters ±10% per hour.	Clause 8.1 Test Sl. No. 8 of JSS 5855.

Sl. No.	Test	Remarks
13.	**Corrosion (Salt) Test:** Period of Spray : 02 hrs at Lab Condition followed by chamber condition of Temp: +35°C± 2°C, RH : 90-95% for 22 hrs Total 03 cycles Recovery : Cleaning with water and Drying for 01 hour at +55°C± 3°C followed by normal recovery of 2-4 hrs	For sealed equipment, A dummy unit may be used.
14.	**Dust Test:** Exposure to dust laden atmosphere at 40°C ± 3°C for 1 hour, RH not exceeding 50%	Clause 8.1 Test Sl. No. 16 of JSS 5855. (Test No. 14 of JSS 55555)
15.	**Solar Radiation** Keep the Eqpt at +25°C inside the chamber. Raise temp from +25°C to +55°C in 6 hours @ of 5°C/hrs. Then hold at : +55°C ± 3°C for 4 hrs Lower the temp from +55°C to +25°C in 10 hrs @ of 3°C/hrs. Recovery at Temp: +25°C ± 3°C for 4 hrs. Start Irradiation after lapse of 2 hrs from beginning of the test and continue for 8 hours, out of which 4 hrs at 55 ± 2°C, according to Fig.1(A) of IS : 10236 (Part -16)-1988. Total No. of cycles : 3	Sl. No. 11 of table-1, para-15.5 of JSS : 5855-11:2009 or Sl. No 15 of table-1 under para 5 of IS: 10236 (Part I)-1989 & para 6.1(a) & fig-1A of IS: 10236 (Part16)-1988
16.	**Altitude Test** (unpacked & switched off condition) Temp : -20°C ± 3°C Pressure : 60 KPa Altitude : 4160 meters (Appx) Exposure time : 16 hrs	Test Sl. No.10 of JSS 5855. (Test No.3 Procedure - 1 Test Condition - L1 & Table No. 4.3-2 Test condition A2 of JSS-55555)

Vendor will provide certificate of compliance at the time of supply will assist during trial on one set of Optronic sight.

These tests will have to be arranged by the OEM/Vendor at a Government accredited or NABL accredited test lab.

2.8.1 Measurements

A. Performance Measurements (Typical for guideline only)

Before and After Environmental tests, each Optronic Sight will be subjected to the following measurements:

- Horizontal FOV (WFOV & NFOV) on the day channel
- Modulation Transfer Function (MTF) at image center in WFOV in day channel @ 1 line pair/ mrad
- Modulation Transfer Function (MTF) at image center in NFOV in day channel @ 5.3 line pair/ mrad
- Harmonization Day WFOV/ day NFOV
- Harmonization Day NFOV/ IR NFOV
- Harmonization LRF/ IR NFOV
- Harmonization I R NFOV/ IR WFOV
- Harmonization IR NFOV/ Mechanical reference of the Optronic Sight
- Horizontal FOV (WFOV & NFOV) in JR Channel
- NETO in IR WFOV & IR NFOV
- Modulation Transfer Function (MTF) at image center in WFOV in IR channel
- Modulation Transfer Function (MTF) at image center in NFOV in IR channel
- Function of the day/ IR channel fusion
- LRF on a target at 5 km min.

Test setup/ accessories for the above tests to be arranged by the OEM.

B. B. Functional Tests (Typical for guideline only)

Functional tests will be consisting of the following operation/ verifications, after switch ON of the Optronic Sight in cool down of the thermal imager:

- Day WFOV operation on a outside scene
- Day NFOV operation on a outside scene
- Day Zoom operation on a outside scene
- Thermal WFOV operation on a outside scene
- Thermal NFOV operation on a outside scene
- LRF on a target at 1 km ± 0.5 km
- Calibration of the thermal channel

These tests will be performed using a control monitor and accessories supplied by the vendor. These functional tests sequence will be applicable whenever "functional test" is indicated in this document.

2.9.Supportability - Qualification, Maintenance & Manufacturing Capabilities & Facilities:

Offered Direct Firing Sight must have,

a) The Optronic Sight should be designed for easy maintainability and low Life-

Cycle Cost (LCC).

b) Technically qualified or introduced in service in Armed forces globally

c) The tenderer has to certify that complete knowledge base for software & hardware for the scope of work is available with the tenderer in the country. The tenderer can undertake repair of assemblies/ subassemblies (LRUs/ SRUs) within the country itself.

2.10 BITE (Built-In Test Equipment)

The Optronic Sight shall incorporate a BITE activated at switch-on (Power Built-In Test: PBIT). Main functional parameters of Optronic Sight are checked in real time (Continuous Built-In Test: CBIT).
The results of the BITE should be available on the RS 422 data link.
Various data should be recordable and available on the serial link (through a dedicated message) :

- Cumulated operation time;
- Number of ON/OFF of the Optronic Sight;
- Number of laser triggering;
- Number of IR FOV changes;
- Operations outside the specified temperature ranges.

2.11 Scope of Work

- Standalone Testing of Optronic Sight
- Support in Integration (Mechanical & Electrical) on Gun
- Support during field trials
- Conduct of ESS on the Optronic Sights
- Generation of FAT documentation: ATP and ATR
- Conduct of Factory Acceptance Test (FAT) on all the Optronic Sights at vendor premises
- Issuance of EMI/EMC test certificates for the design of the Optronic Sight
- Support for Environmental tests

2.12 Acceptance and Testing

The Optronic Sight for Gun will be tested as per the specifications given above for acceptance at vendor premises during FAT. The detailed acceptance procedure will be jointly worked out.

2.13 General

1. Vendor shall be involved in the integration and testing of the unit on the High Caliber Gun. Vendor will provide soft-mount for mounting of Optronic sight on gun cradle for high shock levels during firing.
2. Vendor should provide sight power consumption data for nominal and maximum rating in different modes of operation.
3. The vendor is responsible for ensuring the performance as per the specifications given in the purchase order, when installed on the High Caliber Gun during operation.
4. The OEM certificate should be provided as part of system supply.

5. Detailed technical specification including electrical ICD at assembly/ subassembly (LRU/SRU) level and communication protocol should be provided as part of system supply
6. 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.
7. The vendor must submit a compliance matrix with respect to all of the above specification requirements for vetting by the Technical Evaluation Committee

3. AGAPS (Inertial Navigation System)

3.1 Introduction:

Automatic Gun Alignment and Pointing System (AGAPS) is an inertial land orientation and navigation unit that provides 3D hybrid navigation and dynamic attitude references. AGAPS will be integrated with 155 mm 45/ 52 cal Towed Gun System (TGS) to perform the following functions.

a) Automatic measurement of position co-ordinates.
b) Orientation (with respect to North) of the weapon platform at the firing site without use of external reference.
c) Provide position, heading, attitude, velocity, waypoint information, status and time for navigational purpose.

3.2 AGAPS Architecture:

AGAPS should be a self-contained land navigator, dedicated to all wheeled/tracked military vehicles, which require high accuracy orientation and navigation with a dynamic attitude reference. AGAPS should consist of the following:

a) Digital Ring Laser Gyro (RLG) Inertial Navigation/ Fiber Optic Gyro (FOG) Unit (INU)
b) Set of Transducers for Vehicle Motion Sensor (VMS)
c) External GPS Receiver & antenna
d) Set of mating connectors for INU and GPS receiver
e) Mission Computer (Command and display Unit) (optional)

The system should autonomously perform the following main functions:

a) Self-levelling & azimuth self-alignment
b) 3D optimal navigation based on ZUPT (Zero Velocity Update) & VMS updates
c) Permanent attitude and heading reference
d) Position update

AGAPS should provide the operator and external equipment connected through a high rate RS422/Ethernet data link with the following data in real time

a) Angular rates
b) Vehicle attitude angles (heading, roll, pitch)

3.3 AGAPS Composition:

The important components of AGAPS are described hereafter.

3.3.1 Inertial Navigation Unit (INU):

The INU should compute the optimal inertial navigation. It should provide the mission computer and other equipment with the navigation and orientation information through RS data links.

The INU of AGAPS should include a inertial sensor block for measurement of angular rates and linear accelerations and electronic modules (for inertial sensors management and navigation computations).

The Digital Ring Laser Gyro (RLG) Inertial Navigation Unit (INU) should consist of:

a) Three Ring Laser Gyros. The mechanical based INS are not acceptable.
b) Three accelerometers

The INU should have the following connections dedicated to:

a) Power supply
b) RS422/Etherenet interface for User equipment
c) External GPS receiver.

A prism should be used on the INU housing to allow heading transfer and vehicle harmonization.

Power on of the INU should be driven through a discrete signal, which may be handled by the Mission Computer or by the Auxiliary Computer, which controls the system or a regular switch.

In addition, the INU should provide system status, alert and Built-In Test information. The INU should not require forced cooling and should be watertight.

Mission Computer (Command and Display Unit) (Optional)- INU will have mission computer (CDU) which will provide following data-

a) Alignment Command
b) Attitude Data
c) Aiming Data
d) Position Data
e) Navigation Data

f) Control and Commands for INU

Note: - Mission Computer must have Day and Night visibility including a shadow cover for sunlight

3.3.2 External GPS Receiver

External GPS receiver with antenna should provide the position data to INU in real time. There should be provision for powering on the GPS receiver and INU simultaneously.

3.3.3 Set of Transducers for Vehicle Motion Sensors (VMS) :

The VMS is composed of the provided Set of Transducers integrated with the wheel of the tower artillery gun system. The VMS should provide the INU with the vehicle movement data. The Set of Transducers should be powered by the INU and VMS data should be coded by the INU electronics. It should measure the rotation of a mechanical part which is driven by a magnetic excitation pulses from set of transducers.

3.4 Performance specifications:

The performance specifications of AGAPS for navigation and orientation is as under.

3.4.1 Navigation Accuracy

I)Position accuracy without GPS

i. Navigation accuracy with ZUPT (when required by the system):
   - aa. Position (X,Y) : 5 m (CEP) (for travelled distance D < 5 km) 2 m + 0.06% D (CEP) (for travelled distance D > 5 km)
   - ab. Position (Z) :2 m + 0.02% of travelled distance D(CEP)

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ii. Navigation accuracy without ZUPT (on roads and tracks):
   - aa. Position (X,Y) : 5 m (CEP) (for travelled distance D < 2 km) 2 m + 0.15% D (CEP) (for travelled distance D > 2 km)
   - ab. Position (Z) 2 m + 0.06% of travelled distance D (EP)

Position accuracy with GPS

GPS navigation accuracy is equivalent to the nominal case GPS accuracy as boundary

3.4.2 Orientation and attitude accuracy

a. Heading
   i. Initial error : <1 mils

ii. After one hour of navigation : < 0.5 mils

b. Attitude (pitch and roll)
i. Initial error :< 0.5 mils

Orientation & attitude accuracy are achieved when initial position accuracy is better than 500 m. INS to withstand minimum 40 g shocks for minimum 6 seconds

3.4.3 Alignment time:

a. Standard alignment: Alignment time must be less than 5 min for latitude lesser than 55°. For latitudes above 55°, the alignment time should not increase by more than the factor Cos(55°)/Cos(Lat), where "Lat" is the alignment latitude.
b. Alignment on move: It should be possible to carry out alignment on move without GPS aid. If the vehicle is in motion, AGAPS should use the VMS information and, when available, GPS data. The vehicle should be ready to move in 2 minutes. The alignment remaining time is doubled in motion. The maximum time for alignment on move should not be more than 10 minutes.
c. Stored alignment time must be less than or equal to 30 sec.

3.4.4 Operating limits and ranges:

a. Latitude
   i. Latitudes between ± 65° (nominal),
   ii. Latitudes between 65° to 80° S and 65° to 84° N (degraded).
b. Angular rate: < 4000/sec
c. The alignment is possible for attitude until ± 55°, (for both pitch and roll).
d. The nominal performance of alignment is achieved for attitude until ± 20°
   (for both pitch and roll).

3.4.5 External Interfaces:

a. Power supply: AGAPS system is powered through power connector. The Set of Transducers is powered by the INU.
b. Voltage: Nominal power supply of AGAPS INS should be *24 V DC. The power supply network is in accordance with MIL-STD-1275 D standard Authorized range: +18 to + 32 VDC. System should have capability of continuous operation at a bus voltage of 18-32 VDC
c. RS Interfaces: The system should be able to provide data on (RS 422/232/Ethernet). The high rate line should have data rate of minimum 50 Hz (one line for gun controller for servo

drive system as position feedback element) and slow rate line should have data rate of minimum 1 Hz (either for auxiliary console/ gun display or for tandem display).

d. Mating Connectors: Should be provided for allowing connection of the INU with all other LRUs (Mission Computer, Set of Transducers, external GPS receiver, GPS antenna). All connectors used in AGAPS system should be MIL C 39999 series III type.

3.4.6 Other requirements:

a) Co-ordinate system: WGS 84 and should be capable to display Indian Military Grid System (Lambert with Everest)

Note- Compatibility to any Military Grid system which will be used by Indian Army will have to be provided by the vendor.

3.5Reliability

3.5.1 The MTBF of INU should be ≥ 17000 hrs.

3.6 Environmental Specifications- As per JSS55555 applicable for Land and military systems

3.6.1 Qualification Tests- Electrical Environment Electromagnetic Interference Characteristics (EMI)

In accordance with norms at least MIL-STD-461E applicable for military Land system

3.6.2 Supportability Qualification, Maintenance & Manufacturing Capabilities & Facilities: Offered AGAPS must have,

a) Technically qualified or introduced in service in Armed Forces globally.

b) The tenderer has to certify that complete knowledge base for software & hardware for the scope of work is available with the tenderer in the country. The tenderer can undertake repair of assemblies/ subassemblies (LRUs/ SRUs) within the country itself.

3.7 BITE (Built-In Test Equipment)

The AGAPS shall incorporate a BITE activated at switch-on (Power Built-In Test: PBIT). Main functional parameters of AGAPS are checked in real time (Continuous Built-In Test: CBIT).

The results of the BITE should be available on the RS 422 data link.

Various data should be recordable and available on the serial link (through a dedicated message) :

3.8 Scope of Work

- Standalone Testing of AGAPS
- Support in Integration (Mechanical & Electrical) on Gun
- Support during field trials
- Conduct of ESS on all the AGAPS
- Generation of FAT documentation: ATP and ATR
- Conduct of Factory Acceptance Test (FAT) on all the AGAPS at vendor premises
- Issuance of EMI/EMC test certificates for the design of the AGAPS
- Support for Environmental tests

3.9 Acceptance and Testing

The AGAPS for Gun will be tested as per the specifications given above for acceptance at vendor premises during FAT. The detailed acceptance procedure will be jointly worked out.

3.10 General

1. Vendor shall be involved in the integration and testing of the unit on the High Caliber Gun. Vendor will provide soft-mount for mounting of AGAPS on Gun cradle for high shock levels during firing.
2. Vendor should provide sight power consumption data for nominal and maximum rating in different modes of operation.
3. The vendor is responsible for ensuring the performance as per the specifications given in the purchase order, when installed on the High Calibre Gun during operation.
4. .
5. The OEM certificate should be provided as part of system supply..
6. Detailed technical specification including electrical ICD, mechanical ICD and communication protocol should be provided along with the test report as part of system supply.
7. 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.
8. The vendor must submit a compliance matrix with respect to all of the above specification requirements for vetting by the Technical Evaluation Committee

4. Muzzle Velocity System The Muzzle velocity measurement system (on board), should be a computerized Doppler radar system, which measures the velocity of all standard 155mm projectiles at the muzzle end of a gun. MVR should be able to integrate with FCS of gun. It should be operated by 18 VDC to 32 VDC power source and should be supplied with suitable Bracket. It consists of the following units: -

Specifications

(a) Muzzle velocity range 150 m/s to 2000m/s

(b) Calibre	20 mm to 250 mm
(c) Accuracy	0.05% or 0.5 m/s
(d) Rate of fire	Min 15 Rds / minute
(e) Firing Detection operation.	Automatic arming, operator-free
(f) Antenna Gain	27dB
(g) Beam Width	7°

5. Fire Control/Ballistic Computer

Ballistic Computer with touch screen should be a ruggedized modular computing platform with following specifications:

It should be able to perform Ballistic Calculations for autonomous mode of Gun operation. It should be integrated with AGAPS. Necessary software for the ammunition (complete family of 155 mm ERFB, ERFB (BB), Rocket assisted and standard NATO Ammunition) to be developed by the firm. The range table will be provided by OFB/GCF and will be integrated in software developed by firm for autonomous operation. Software will be used through the Gun Tactical User Interface of Ballistic Computer.
It should be capable to perform the following functions: -

(a) Calculate data for engagement of target for in service ammunition under current production indigenously.
(b) In conjunction with the MVR, it should have provisions to update the acquired MV for charge temp, Input weight of projectile and apply MV data.
(c) Firing data must be visible by day and night.
(d) Compatibility with Project Shakti and it should be integrated during trials. (ref para vi of clause 2.3, Appendix A)
(e) Ballistic computer should be able to communicate with in service ETC available with Indian army (ref para vi of clause 2.3, Appendix A)
(f) It must have BITE to indicate the problem area by displaying the messages/signals for all the Electronic add ons.

It shall also handle communication with:

1. The Fire Control Computer at BCP of the user /Indian Army (ref para vi of clause 2.3, Appendix A)
2. The Laser Range Finder.
3. The Muzzle Velocity System.
4. The Barrel Temperature Sensor.

5. Provide digital interface (Rs422/Ethernet) for Radio Data communication unit in service with Indian Army. ICD will be shared to contract awardee.

Display units :

a) Size - >=10.4" Colour
b) Resolution - >=1024 x 768 (min)
c) Viewable angle - >=70°
d) Processor - Intel Core i7
e) Hard Disk - >=SSD 250 GB
f) Pointing Device - Built in pointing device
g) Touch Screen - Resistive/Capacitive
h) Internal Battery – 01 internal battery Li-Ion
i) RAM - Min 08 GB

Adequate contrast / brightness / sharpness for viewing during bright and sunny day light and Night to be provided. Ballistic computer will be with suitable mounting with protection against shock and heat and will have shadow cover. Protective front cover should be provided.

Fire Control Computer :

Inputs – Type and Projectile, Propellant, Fuse etc.
- Target location North co-ordinates, height
- Meteorological data
- MV [From MVR]
- Trajectory type [High / Low]

Output - Gun elevation
- Fuze setting
- Time of flight
- Absolute target height
- Trajectory maximum height
- Impact velocity
- Safety check against crest, no fire area
- Damage effect analysis
- UI for Auto Laying
- UI for Optronic sight
- UI for MVR

5.1 BITE (Built in Test equipment): The System must consist of BITE for Fault diagnosis to indicate the problem area by displaying the messages/signals for all the Electronic add ons.

5.2 Environmental Specifications- As per JSS55555 applicable for Land and military systems

5.3 Qualification Tests- Electrical Environment
Electromagnetic Interference Characteristics (EMI)

In accordance with norms at least MIL-STD-461E/F applicable for military

Land system

5.4 Supportability Qualification, Maintenance & Manufacturing Capabilities & Facilities: Offered Fire Control/ Ballistic Computer must be:

a) Indigenously developed (Using MIL/COTS Hardware) with complete control on software source code qualified or introduced in service in Armed Forces globally.
b) The tenderer has to certify that complete knowledge base for software & hardware for the scope of work is available with the tenderer in the country. The tenderer can undertake repair of assemblies/ subassemblies (LRUs/ SRUs) within the country itself.

5.5 Scope of Work

- Standalone Testing of Fire Control/ Ballistic Computer
- Support in Integration on Gun
- Support during field trials
- Conduct of ESS on the Fire Control/ Ballistic Computer
- Generation of FAT documentation: ATP and ATR
- Conduct of Factory Acceptance Test (FAT) at vendor premises
- Issuance of EMI/EMC test certificates for the design
- Support for Environmental tests
- Training
- Software code essential for testing hardware should be offered by vendor so that user can utilize it and do trouble shooting.

5.6 Acceptance and Testing

The Fire Control/ Ballistic Computer for Gun will be tested as per the specifications given above for acceptance at vendor premises during FAT. The detailed acceptance procedure will be jointly worked out.

5.7 General

1. Vendor shall be involved in the integration and testing of the unit on the High Caliber Gun.
2. Vendor should provide power consumption data for nominal and maximum rating in different modes of operation.
3. The vendor is responsible for ensuring the performance as per the specifications given in the purchase order, when installed on the High Calibre Gun during operation.
4. The firm will be required to make a technical presentation followed by the demonstration.
5. 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.
6. The vendor must submit a compliance matrix with respect to all of the above specification requirements for vetting by the Technical Evaluation Committee

6. Digital Intercommunication System:

The communication system with a radio link of voice and data in separate channels is to be supplied. Subsequently, during induction phase, the in service communication system will have to be integrated by the vendor. The communication system should be handling data transmission from BCP and intra-gun communication and have following capabilities:

i) Command post to each gun more than 1 km.
ii) Digital Inter Com System should be handling Det intra communication – Gun crew should be able to communicate with each other.

Voice Communication between BCP and Gun by Digital Intercom System – less than 1 km

Typical ATP for DIS is enclosed for ready reference please, Vendor may formulate its own ATP for testing the communication system based on similar guidlines

6.1. FUNCTIONAL CHECK LIST FOR DIGITAL INTERCOM SYSTEM (DIS) :

S.NO.	FUNCTION	C/NC/P	OBSERVATIONS
AT GUN SYSTEM :			
1.	Ensure all the Initial interconnection of cable and initial setup. Connect the Field Telephone cable – BCP to the BCP connector in Connection Box draw bar. The Other end of the telephone cable is to be connected to the BCP line cable and BCP unit should be turned on. (Four Cable of 250 mts introduced instead of single i.e. of 1 km) Switch ON the Gun Battery on the Control Panel & Switch ON "S1" on the Capacitor box. Switch ON 'S1' in DC-DC Module. When system is powered On it will goes to NEUTRAL INTERCOM MODE (No audio message will be heard). In this Mode No.1,2& 3 users of Gun will be in two ways comm by default (BCP, Troop Leader and VPS users are in silence).		
2.	**INTERCOM MODE:** **All Audio messages are removed (for any mode).** Press INT Switch in the MH1 Cable to initiate Intercom mode by crew members. **'Intercom mode'** can be initiated by No.1,2 & 3. However, Crew member 4, 5, 6, 7, 8 with VPS MK III can only listen, they cannot transmit. Intercom communication is enabled as long as the "INT" switch is pressed. **Troop Leader can listen to the user who is initiating the INT.** **Note:** During the Intercom mode of operation, ensure that the VPS MK III radio sets with the crew members No: 5 to 9 are tuned to the same frequency of the radio set mounted on the gun.		

S.NO.	FUNCTION	C/NC/P	OBSERVATION
3	**CONFERENCE MODE :** **'Gun Conference mode'** can be initiated by No.1, 2 & 3 by pressing CON PTT switch, BCP can listen to the user who initiated CON PTT (Simplex). NEUTRAL INTERCOM MODE will not be disturbed (Duplex). Troop Leader also listens to the CON initiated user (Simplex). If BPC is activating PTT, BCP CONFRENCE MODE is initiated and all the Gun crews can listen to BCP (Simplex). All VPS user are in silence. **Note** : In order to established duplex. Communication between Gun and BCP , both the BPC and Gun Crew should initiate respective PTT.		
4	**TROOP INTERCOM MODE:** By pressing the INT and CON switches in the MH1 cable the Troop leader can activate the **Troop Intercom** and **Troop Conference** modes respectively. The communication in **Troop intercom mode is** bidirectional. Commander, loader layer of all the 3 guns will be in communication during Troop intercom mode and BCP, VPS MK III are not included in communication. **TROOP CONFERENCE MODE** : Initiated by Troop Leader by pressing CON PTT Switch. **(a)** In this No.1 of all Guns, Troop Leader 1 and Troop Leader 2 will be in two way communication (Duplex). **(b)** Gun Crew No.2 and No.3 can listen to the Troop Conference (Simplex) **(c)** NEUTRAL INTERCOM MODE will not be disturbed (Duplex). **(d)** All VPS user are in silence.		

AT BCP SYSTEM : S.NO.	FUNCTION	C/NC/P	OBSERVATIONS
5.	Ensure all the Initial interconnection of cable and initial setup. Connect the Field Telephone cable – One end should be connected to the GUN1 to GUN6 connector in the BCP RACK ASSY, depending on the Gun number. The other end of the telephone cable is to be connected to the connector 'BCP' in the Connection box draw bar and the DIS on GUN should be turned on. Connect the Head Set to the H/AL port in the BCP CMU via BCP Chest Cable Assy (BCP-Handset) 2.5 M. Switch on the BCP Rack Assy. After powering ON self echo will be heard in the BCP Hand Set after pressing the PTT switch in the Hand Set. If BCP is activating PTT, BCP CONFERENCE MODE is initiated and all the Gun crews can listed to BCP (Simplex) **Standby Mode** initiated by BCP by keeping the PTT switch in chest cable to stand by position. Used for Gun to Gun Communication Once the BCP initiated the standby Mode, Voice of Gun Crew who is pressing CON-PTT will be heard by all the crew of six guns & BCP can listen. All VPS users are in silence. **Note**: Subjected to the availability of the gun.		

COMPLETE SYSTEM LEVEL COMMUNICATION CHECK

6 **(a) Intercom Mode :**

From	To	Communication	C/NC/P	Observation
Commander	Layer	Duplex		
	Loader	Duplex		
	Troop Leader	Simplex		
Layer	Commander	Duplex		
	Loader	Duplex		
	Troop Leader	Simplex		
Loader	Commander	Duplex		
	Layer	Duplex		
	Troop Leader	Simplex		
Troop Leader	Commander	Duplex		
	Layer	Duplex		
	Loader	Duplex		
Commander/ Layer/Loader	Crew No.4 to 8 VPS Mk-III	Simplex		

Repeat the test for Gun 2 to Gun 6.

(b) Conference Mode :

From	To	Communication	C/NC/P	Observation

	Battery Command Post (BCP)	Commander	Simplex		
		Troop Leader			
		Layer			
		Loader			
		Crew No.4 to 8 VPS Mk-III	No Communication		
	Repeat the test for Gun 2 to Gun 6.				
	(c) Troop Intercom Mode :				
	From	**To**	**Communication**	**C/NC/P**	**Observation**
	Troop Leader **1**	Gun **1**, Commander/ Layer/Loader	Duplex		
		Gun **2**, Commander/ Layer/Loader			
		Gun **3**, Commander/ Layer/Loader			
	Gun **1**, Commander/ Layer/Loader	Gun **2**, Commander/ Layer/Loader			
	Gun **2**, Commander/ Layer/Loader	Gun **3**, Commander/ Layer/Loader			
	Gun **3**, Commander/ Layer/Loader	Gun **1**, Commander/ Layer/Loader			
	Crew No.4 to 8 VPS Mk-III		No Communication		
	Repeat the same for second troop of Guns i.e. Gun 4, Gun5 and Gun 6.				
	1. In Troop Conference; Troop Leader 1 & 2and no. 1 of all six guns will be in two way communications (Duplex). 2. BCP can listen.				

6.

7. Electronic Upgrade Kit : An electronic upgrade kit comprising of loader display unit, Joy stick , Electro Hyd. Valve block including servo valve cabling and Mil grade connectors , Mountings will also be supplied by the vendor and integrated / Commissioned on the Gun system to achieve the desired operational performance

A loader display is also connected to FCC that assists the loader in loading the gun with appropriate shell, fuze and charge. The display must have minimum 10 characters and visible in day & night. It should clearly display the Fuze /Shell nomenclature in 02 rows. Fonts of Loader Display should be visible from at least distance of 2.5 mtr.

7. Deliverables

The following items are the deliverables. The cost of each of the deliverables is to be indicated only in the commercial offer: -

Sr No	Description of Items	Quantity Required /Gun	Total Qty Rqd.
1	Optronic Sight / Unified Direct Aiming sight (TI, Day Camera and LRF) (a) Cables and Connectors (b) Mounting Items (c) Bore Sight		
2	Inertial Navigation System (AGAPS) (a) Mission Computer (CDU) (b) GPS receiver with antenna (c) Inertial Navigation Unit (d) VMS/ Odometer (e) Cables and Connectors (f) Mounting Items		
3	Muzzle Velocity radar (a) Cables and Connectors (b) Mounting Items		
4	Electronic upgrade Kit (For Auto Laying) (a) Servo solenoids (b) Electro Hyd Valve block (c) Loader display Unit (d) Joystick (e) Cables and Connectors (f) Mounting Items (g) Drive Electronic unit (h) If any additional hardware/Software required for integration		
5	Fire Control/ Ballistic Computer (a) All softwares for desired operations (b) Cables and Connectors (c) Mounting Items		
6	Digital Intercommunication System		
7	Cabling and Mil grade connectors mountings , fasteners etc		
8	Integration and commissioning	-	
9	Training for installation and maintenance		
10.	Technical support during integration at GCF and firing trials at LPR Jabalpur, PXE, Balasore and		

	PFFR Pokharan.		
11	Integration, repairing and trouble-shooting of all items should be available in India.	Yes/No	

NOTE : a] Price of each item should be quoted separately .
b] Depending upon total cost and requirement of user, some of the items may not be required.
c] If vendor considers any additional essential requirement for completeness of system for integration the same should also be quoted separately.

7. (A) List of Essential Documents To Be Supplied

1) List of P.C. Boards / Control Panel for electrical/electronic System.
2) Detailed description of working of all PC Boards.
3) Components list/components specifications.
4) Electrical wiring diagrams.
5) Circuit diagrams of all equipments.
6) Test certificates/ OEM certificate for purchased items.

NOTE: The above mentioned essential documents are to be supplied by the vendor at the time of delivery of sub-system.

(B) List of Technical Literature to be Supplied

1. Part catalogues, User Handbook/operators Manual,
2. Design Specification- Electronic & software ICD, software for laying controls and its instrumentations.
3. Technical Manual
   (a) Part I: Technical description, specifications, functioning of various systems
   (b) Part II: Inspection/Maintenance tasks Repair procedures, materials used, fault diagnosis and use of Special Maintenance Tools (SMTs)/Special Test Equipment (STEs).
   (c) Part III: Procedure assembly/disassembly, repair up to assembly/ subassembly (LRU/SRU) level, safety precautions.
   (d) Part IV: Part list with drawing reference and list of SMT/STEs with Test Bench.
4. Manufacturer's Recommended List of Spares (MRLS)
5. Illustrated Spare Part List (ISPL)
6. Technical Manual on STE with drawing reference
7. List of BO Items
8. CCES
9. Permissible Repair Schedule
10. ATP/Acceptance Criteria
11. Drawing and drawing schedules
12. Maintenance Schedule with procedure

Note: The above mentioned technical literature will be in English Language both in hard and soft copy.

8. Commissioning / Integration:

The commissioning and integration will be done by the vendor at place designated by ~~OFB~~/GCF.

The Vendor shall guarantee, besides other things, the following: -

5.1 Satisfaction of technical and other parameters mentioned in the specifications and contract.

5.2 Quality and strength of materials used in the manufacture of the equipment considering the applicable codes of practice and regulations.

6.3 Adequate factors of safety for all parts of the equipment to withstand the electrical stresses developed therein under specified operating conditions.

6.4 Performance data furnished/specified for the equipment shall be actually obtainable when the equipment is installed and tested.

9. Operating conditions and general requirements of system :

i]	Operating temperature Storage temperature	- -	[-] 35 ° C to [+] 55 ° C [-] 40 ° C to [+] 70 ° C
ii]	Humidity	-	Latest MIL standard 100% minimum
iii]	MIL qualifications	-	MIL Std. JSS-55555- 810 G MIL Std - 461 E 461 F (Essential)/ (desirable)
iv]	Interface	-	RS 232/ RS 422
v]	Rain protection	-	For varying Indian conditions
vi]	Dust protection	-	For varying Indian conditions
vii]	Drop & Shock	-	As per matrix of gun
viii]	Solar radiation		
ix]	High altitude	-	up to 5500 mtrs.
x]	Salt fog		

xi] **Ergonomics:** All the items supplied must be ergonomically designed, manufactured and fitted for easy handling and comfort of crew/operators. The laying & fitting of equipments/cables etc. shall be considering the ease of maintenance and ergonomics.

xii] Suitable Bracket for mounting of sub-systems should be provided.

10. MTBF and MTTR: The firm must provide the MTBF and MTTR for all the modules. The system must be reliable.

APPENDIX – B

DRAFT WARRANTY CLAUSE

1. The Seller warrants that the goods supplied under this contract conform to technical specifications prescribed and shall perform according to the said Technical Specifications.

2. The Seller warrants for a period of **24** months from the date of installation and commissioning of equipment in the consignee unit , that the goods / stores supplied under this contract and each component used in the manufacture of these shall be free from all types of defects / failures .

3. If within the period of warranty, the goods are reported by the Buyer to have failed to perform as per the specifications, the Seller shall either replace or rectify the same free of charge, maximum within **45** days of notification of such defect received by the Seller, provided that goods are used and maintained by the Buyer as per instructions contained in the Operating Manual. Warranty of the equipment would be extended by such duration. Record of the down time would be maintained by user in Log Book. Spares required for warranty repairs shall be provided free of cost by Seller. The Seller also undertakes to diagnose, test, adjust, calibrate and repair / replace the goods / equipment arising due to accidents by neglect or misuse by the operator or damage due to transportation of the goods during the warranty period, at the cost mutually agreed to between the Buyer and the Seller .

4. Seller hereby warrants that necessary service and repair back up during the warranty period of the equipment shall be provided by the Seller and he will ensure that the down time does not exceed **5%** at one time, within an overall down time of **15%** of the warranty period.

Appendix- C

COMMERCIAL OFFER

SL. NO.	DESCRIPTION OF ITEM	QTY. REQD. PER GUN	TOTAL QTY. REQD.	UNIT COST	TOTAL COST
1	Optronic Sight / Unified Direct Aiming sight (TI, Day Camera and LRF) (a) Cables and Connectors (b) Mounting Items (c) Bore Sight	1	2		
2	Inertial Navigation System (AGAPS) (a)Mission Computer (CDU) (b) GPS receiver with antenna (c) Inertial Navigation Unit (d) VMS/ Odometer (e) Cables and Connectors (f) Mounting Items	1	2		
3	Muzzle Velocity radar (a) Cables and Connectors (b) Mounting Items	1	2		
5	Electronic upgrade Kit (For Auto Laying) (a) Servo solenoids (b) Electro Hyd Valve block (c) Loader display Unit (d) Joystick (e) Cables and Connectors (f) Mounting Items (g) Drive Electronic unit (h) If any additional hardware/Software required for integration	1	2		
7	Fire Control/ Ballistic Computer (a) All softwares for	1	2		

	desired operations (b) Cables and Connectors (c)Mounting Items				
8	Digital Intercommunication System	1	2		
9	Cabling and Mil grade connectors mountings , fasteners etc	1	2		
10	Integration and commissioning	1	2		
11	Training for installation and maintenance	1	2		
12	Technical support during integration at GCF and firing trials at LPR Jabalpur, PXE, Balasore and PFFR Pokharan.	1	2		
13	Integration, repairing and trouble-shooting of all items should be available in India.	Yes (Mandatory requirement)			
	TOTAL COST				

Appendix – D

PAYMENT TERMS

Terms of Delivery and Payment

1. The delivery of good will be based on FOR basis and consigned to GCF, Jabalpur
2. **Payment**
   - Payment will be done in 02 stages
   - 40% payment will be released after successful completion of stage 1 and stage 2 as mentioned in Part IV 44 (d) in TE and remaining 60 % will be done after success of stage 3.

Performance Bond / Warranty bond

3. A Performance Bond of 5% of value of the contract and a separate Warranty Bond would be furnished by supplier in the form of a Bank Guarantee from a first class bank of international repute. Details of the bank are to be furnished in the commercial offer.
4. Warranty Bond of 5 % of the value of the contract in the form of a Bank Guarantee from a first class bank and duly confirmed by State Bank of India or Bank of Baroda or Canara Bank will be furnished. The said Warranty Bond shall be valid for 03 months beyond the warranty period agreed by the vendor.

Liquidated damages

5. In the event of supplier's failure to have the stores delivered by the date/dates specified in the contract, the buyer may, at his discretion withhold any payment until the whole of the stores have been supplied, and the Buyer may also deduct from the Supplier as agreed, liquidated damages and not by way of penalty the sum of 0.5 % of the contract price of the undelivered stores for each and every week or part of a week for the which the stores have been delayed subject to a maximum of 5% of the value of delayed stores, in case the delay in delivery is acceptable to buyer.

Appendix – E

COMPLIANCE STATEMENT

I. INSTRUCTION TO TENDERERS

Para of instruction to tenderers	Details	Compliance Yes or No	In case of noncompliance , deviation to be indicated

II. TECHNICAL SPECIFICATION

Para of technical specification	Details	Compliance Yes Or No	In case of noncompliance , deviation to be indicated

III. GENERAL REQUIREMENTS OF CONTRACT

Para of General condition of contract	Details	Compliance Yes Or No	In case of noncompliance , deviation to be indicated

Appendix – F

CHECK LIST [COMPLIANCE REPORT]

SL. NO.	DESCRIPTION	FIRM'S REMARKS YES / NO	IN CASE OF NON-COMPLIANCE DEVIATION TO BE INDICATED

Confirmation for submission of Performance Security Deposit.

Validity 180 days from the date of opening of tender documents.

Delivery period .

Warranty period .

Submission of un-priced copy of Price Bid along with Technical Bid .

Para wise compliance statement .

Confirmation regarding scope of supply and prices available against each item in price bid as per scope of supply mentioned the technical specification .

Payment terms .

Submission of catalogues / drawing of the proposed machines / equipment .

Submission of Customer's List / reference list to whom the similar / proposed equipment supplied by the tenderer .

Submission of test chart of the proposed equipment .

Confirmation to L.D cases .

Confirmation to General Conditions of contract clause no..