

EXPRESSION OF INTEREST (EOI)

For

**Identification of Indian Industry Partner in
Establishment of IR Detector Development &
Fabrication Facility in India through Technology
Transfer from an Identified Established Foreign
Foundry (EFF)**



Instruments Research & Development Establishment (IRDE)

Dehradun

Defence Research & Development Organization (DRDO)

Government of India, Ministry of Defence

June 2024

Expression of Interest (EOI)

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Brief introduction of Lab/Estt:

Instruments Research & Development Establishment (IRDE) is a Lab of Defence Research & Development Organization (DRDO), under Ministry of Defence and is situated at Raipur Road, Dehradun, Uttarakhand, India – 248008. IRDE is involved in research & development in the field of Electro-Optical Instrumentation.

1. Objective of EOI:

The broad objectives of this EOI are as follows:

- This EOI is being published to get the proposal from an Indian Industry for involvement in Establishment of IR Detector Fabrication Facility in India through Transfer of Technology (ToT) from an Established Foreign Foundry (EFF) identified by DRDO.
- The lab is in the process of identification of EFF through a separate EOI.
- The Lab is in the process of pre-qualification of the Indian industries based on their responses for this EOI and its evaluation by a Technical Assessment Committee (TAC).
- Subsequently, an RFP will be floated to obtain techno-commercial proposal from prospective Indian industries. The industry offering highest bid (H1) (subject to the fulfillment of all the techno-commercial conditions of RFP) will be chosen for the ToT process in collaboration with DRDO. The RFP will subsequently lead to contract for Establishment of IR Detector Fabrication Facility in India.
- Being a state-of-the-art IR detector fabrication facility, execution of the intended ToT requires multi-disciplinary expertise from the bidders in the areas of fabrication of IR detectors of required specifications as mentioned in sub-sequent sections of the document. The Indian industry should have domain knowledge about these detectors. It should also possess human resources, which are highly skilled and capable of understanding and executing of the said ToT.
- The EOI is being issued with no financial commitment; and the Ministry of Defence reserves the right to withdraw the EOI and change or vary any part thereof at any stage. The Government of India and the agency nominated by GoI (DRDO) also reserves the right to disqualify any prospective industry should it be so necessary at any stage on grounds of National Security.

2. Scope of Work:

2.1a The main scope of work of this EOI, is to identify an Indian industry to be a stake-holder in manufacturing IR detector (3-5 μm , 640 x 512; pitch 10 μm and 1280×1024 format; pitch 10 μm) and maintenance of all existing detectors through ToT provided by EFF identified by DRDO. The total ToT provided by EFF identified by DRDO would include the transfer of production technology and documentation, including FPA, use of sorted Si wafer for ROIC and assembly/supply of cooler, associated direct production machinery, on the Job Training (OJT) by EFF expert personnel (including required materials) at EFF's FAB facility and training by its expert personnel in India at IRFAB facility as well, IT and Logistic support.

2.1b The Indian industry has to participate in establishment, operation and maintenance of a fabrication line for InSb based MWIR Detector through Transfer of Technology (ToT) from an Established Foreign Foundry (EFF). The full ToT will be provided by identified EFF.

The development work would include:

- Establishment of a foundry for fabrication of InSb based MWIR Detector.
- Establishment of state-of-the-art fabrication infrastructure and equipment for the development of IR FPAs. Equipment will be supplied by identified EFF.
- Operation & maintenance of fabrication facility

2.1c The complete work would involve:

- Acquisition/purchase of land (about 5000 Sq mt) at an identified place mutually agreed between DRDO, prospective Indian industry partner and identified EFF.
- Building of infrastructure involving
 - ☐ IRFAB building with Clean Rooms
 - ☐ Clean room utilities
 - ☐ This would involve FAB design, air Conditioning and Humidity control, DI/ RO Water, acid exhaust, solvent exhaust, process gases, dragger, electrical cabinets and ups, PCW, waste treatment, liquid and gas nitrogen, cleaned dry air, house vac, building control etc.
 - ☐ Standard production room & room for operation management
 - ☐ Environmental & Supplies Building (For power, water supply etc)
 - ☐ Logistic support building (For IT, Technical / Engg. etc.)
- Installation and commissioning of all the fabrication equipment along with accessories
- Acquisition of ToT from identified EFF
- Production of detectors as per details given in the subsequent sections
- Operation & maintenance of fabrication facility
- Hiring of manpower and training of the manpower

- 2.1d** The work mentioned in item 2.1c would be shared between DRDO, prospective Indian industry partner and identified EFF on mutual agreement as per contract that will be signed between three parties.
- 2.1e** Similarly, the investment involved for the establishment and operation of IRFAB would also be shared between three parties. The percentage of investment of industry partner would be discussed at a later stage with DRDO. This process will be executed after prospective industry partners are shortlisted by TAC through this EOI. A separate RFP will be floated for the same and Indian industry offering highest bid (H1) will be designated as Industry partner for IRFAB facility.
- 2.1f** IRFAB will manufacture, sell and maintain IR detector for the Indian govt./ armed forces/Indian industries. Export control from the IRFAB will be according to the agreement between GOI and the foreign Govt. of EFF.
- 2.1g Equipment Identification:** EFF will identify all the equipment required for various processing, assembly and characterization of IDDCA components at various phases. The EFF will supply all the identified equipment required for IRFAB facility. Tooling, fixtures, recommended spares etc should be identified and supplied for each phase of the ToT. EFF shall be responsible for equipment purchased and supplied to IRFAB as part of the ToT at Indian industry premises. The list of equipment being provided by EFF are attached herewith as Annexure I.
- 2.1h Raw Material:** Raw material qualification facility should also be established in IRFAB facility by EFF.
- 2.1i Manpower Training:** Suitable manpower will be selected for training at various stages and for different activities. Skill requirement for the manpower during different phases of the development will be defined by the DRDO, EFF and Industry partner jointly. Training should be provided by EFF at EFFs facility, and also at the designated IRFAB facility once established.
- 2.1j Instrumentation for Test & evaluation:** EFF will identify & supply the instrumentation for test & evaluation at various stages and at final product level. Necessary training will be incorporated by the EFF to the Industry partner.

2.1k Delivery Schedule: Timeline or different activities are defined below in Table 1:

Table 1. Delivery Timelines

S. No.	Activity	Timeline (in Months)
1.	Kickoff (Start of the ToT)	T0
2.	Initial FAB Layout design	7
3.	Handing-over of Technical and Infrastructure document by EFF	9
4.	Final FAB design	10
5.	FAB construction	22
6.	Infrastructure and FAB equipment	32
7.	Final FAB design review	18
8.	Training of DRDO/Industry personnel at EFF	18
9.	Procurement of all Fab Equipment	32
10.	Identification and Procurement of Raw Materials	36
11.	Installation & Training of all Fab equipment	40
12.	Testing of FAB Equipment & Raw Materials	43
13.	Finalize FAB facility, infrastructure and equipment	48
14.	FAB SETUP for IR detector production	54
15.	First detector manufacturing by IR Fab	60
16.	Training of DRDO/Industry team at IR Fab Facility	68
17.	Production of IR detectors at IR Fab	72
18.	Manufacturing of IR detectors by DRDO/Industry team	72
19.	Indigenous IR Fab	84

2.1l Intellectual Property Right: IPR for detector manufacturing in India will remain jointly with DRDO, Indian industry partner and EFF.

2.1m Export of the product: Export to other countries will be decided by the Management Board (MB) of IRFAB, subject always to receipt of the EFF's and its governments prior consent, including any export or other licenses as may be required for such export.

- 2.1n Management Board:** Execution of IRFAB will be done by Management Board (MB) from DRDO, Industry and EFF. The Chairperson of the MB will be from DRDO. The MB will consist of total 12 members. 6 Members will be from DRDO side, 4 members from Industry partner side and 2 members from EFF.
- 2.1o Product Pricing:** Product pricing will be controlled by the MB of IRFAB.
- 2.1p** Technical proposal received from Indian Industry will be evaluated by a Technical Assessment Committee (TAC), which will examine the technical proposal against the projected requirements of manufacturing of the IR detector in India in the EOI & short list the prospective Indian industry to absorb the ToT for establishment of IRFAB in India through identified EFF. In case if desired, reps from Indian Industries may be asked to be present in the TAC meeting for presentation on their capability to take-up the activity. In that case, Indian industries & its authorized representative will be intimated at least 7 days before TAC meeting. TAC may also visit Indian Industry facility to assess their capability and infrastructure to execute this ToT.
- 2.1q** After completion of Technical Assessment by TAC, the names of qualified Indian industry will be declared by a competent authority followed by request for techno-commercial proposals.
- 2.1r** After firming up the EFF and Indian industry, a tri-partite agreement will be executed between EFF, Indian industry and DRDO for further execution of work.

3. Technical Specifications:

Through this ToT following three types of detectors are proposed to be fabricated in IRFAB:

- I. MWIR VGA 640 Detector with Integrated Cooler (Quantity 500 Nos/Year)
- II. MWIR VGA 640 FPA with JT Cooler (Quantity 1000 Nos/Year)
- III. MWIR 1280 HD IDDCA (Quantity 500 Nos/Year)
- IV. Maintenance of existing IR detectors

3.1 Requirements of Thermal Imaging instruments at present are as follows:

- Clear Image (High Operability, low dead pixels, high resolution)
- Good SNR (Low NETD: temporal & Spatial)
- Good Range with high detectivity
- High frame rate (Dependent on ROIC)
- Low input power consumption and long MTTF

- Low cool down time
- Zoom: Electronic + optical
- Low size, weight & power consumption
- Low system cost

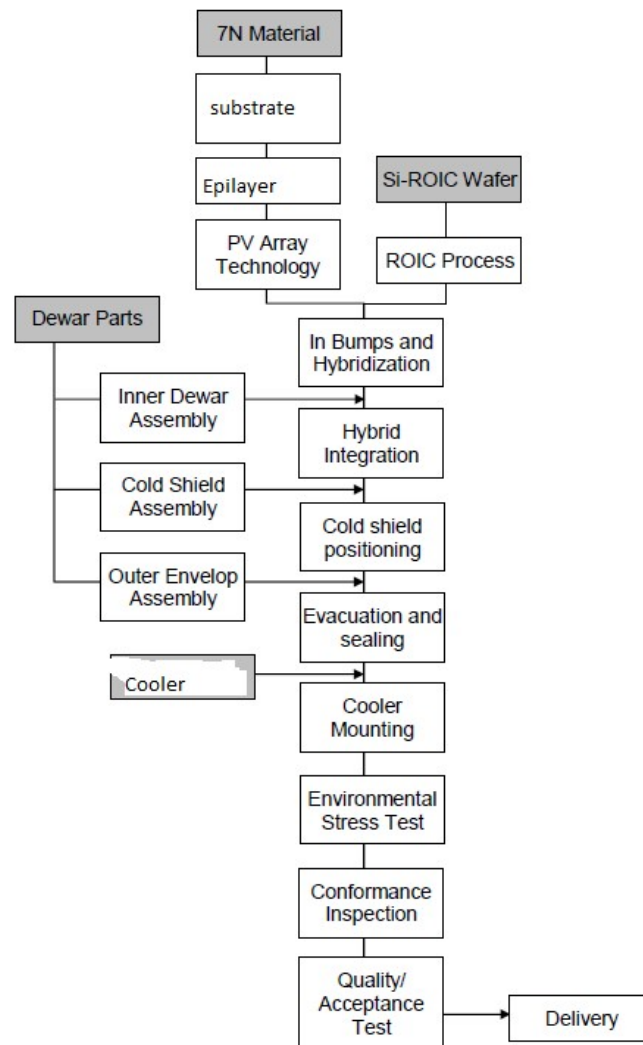
3.2 Towards meeting the above requirements Cooled Digital IDDCAs InSb (3 to 5 μm) is proposed to be fabricated with following components:

The following components are essentially required for complete digital IDDCa detector fabrication in India –

- (a) FPA
- (b) Cold Shield and cold finger
- (c) Infrared Window
- (d) Dewar
- (e) Getter
- (f) Cryo – Cooler and its interface with FPA
- (g) ROIC & Proximity board with Flex harness
- (h) Ceramic Feed through unit

3.3 Processes Involved & technology Requirements are:

The manufacture of IDDCa calls for typical process technologies and manufacturing in respect of the following -



3.4 Technical Characteristics and Features of MWIR IDDCA:

The technical characteristics and features that are to be met by this ToT process should cover all the aspects in detail including the following:

- a) Setting up of facilities, infrastructure and machinery.
- b) Sourcing of raw material for detector & characterization.
- c) PV arrays manufacturing.
- d) ROIC design & manufacturing
- e) Hybridization of PV array & ROIC.
- f) Dewar manufacturing & assembly.
- g) FPA & dewar Integration and qualification.
- h) Integrated cooler manufacturing and cooler controller & qualification.
- i) Cooler dewar integration.
- j) Proximity electronics & qualification.

K) EO testing of IDDCA.

l) Samples qualification for environmental specifications & EMI/EMC.

3.5 The broad specifications of finished digital MWIR IDDCA with proximity electronics are as under:

Table 2. Specification of MWIR VGA 640 Detector with Integrated Cooler

IDDCA Parameters	Value
Detector Type	InSb Photovoltaic Array
Spectral response	3.6 to 4.9 μm
F/#	4
Array Format	640 x 512
Pitch	10 μm
Cooler	Micro Cooler, Split Linear; ≤ 5 min at 25 °C

Table 3. Specification of MWIR VGA 640 FPA with JT Cooler

IDDCA Parameters	Value
Detector Type	InSb Photovoltaic Array
Spectral response	3.6 to 4.9 μm
F/#	3
Array Format	640 x 512
Pitch	10 μm
Cooler	Joule-Thomson (JT)

Table 4. Specification of the MWIR 1280 HD IDDCA

IDDCA Parameters	Value
Detector Type	InSb Photovoltaic Array
Spectral response	3.6 to 4.9 μm
F/#	3.6 or 4
HD Array Format	1280 x 1024
Pitch	10 μm
Cooler	0.5 Watt High reliability Integral sterling micro cooler; ≤ 8 minutes for ambient of 23°C

3.8 It should be noted by the prospective Indian industry that the facility being established is scalable to higher format detectors at a later stage.

3.10 Delivery Schedule: Details of expected delivery schedules for deliverables and services are as given above from the effective date of contract as per Table 1 of this EOI.

4. Procedure for Response:

4.1 The technical Proposal should be submitted to the undersigned at the following address:

**Director
Instruments Research Development Establishment
Ministry of Defence
Raipur Road, Dehradun-248008
Uttarakhand, India
POC: Dr. Sudhir Khare, Sc 'G' (E-mail: sudhirkhare.irde@gov.in;
Ph: +91-135-2782444)**

4.2 Any queries / clarifications sought are to be sent to this office within one week of issue of this EOI.

4.3 The Indian Industry may be invited for technical presentation and clarification. A notice of at least one week will be given for this purpose. Necessary details of the personnel to make presentation / interactions, may immediately be sent to Director, Instruments Research Development Establishment, Raipur Road, Dehradun-248008, Uttarakhand, India, to facilitate obtaining of security clearance.

4.4 Director, IRDE will not be responsible for postal delays or server down time. Hence, it is suggested to prepare your response well in advance in order to avoid rejection due to late submission.

5. Instructions/Notes:

5.1 General

- a) All copies of documents submitted along with EOI should be clear, legible and self-certified by the authorized representative of the applicant.
- b) Lab/Estt reserves the right to physically check the original documents / certificates, the copies of which are submitted along with the EOI
- c) Lab/Estt reserves the right to cancel this process of EOI at any time without any financial or otherwise liability and without assigning any reasons thereof.
- d) The applicant may kindly note that shortlisted firm will be required to sign a Non-Disclosure Agreement (NDA) at a later date as required by Lab/Estt.
- e) The applicants may note that mere meeting of the minimum criteria does not entitle any company/firm/organization the right for appointment.

- f) Lab/Estt will not be responsible/ liable to any party in any way for costs associated in preparation & submission of EOI.
- g) Lab/Estt is also not obliged to share clarification related questions with other respondents than the one who seeks clarification.
- h) Lab/Estt reserves the right to accept or reject any EOI proposal without signing any reasons whatsoever.
- i) This Labs/Estt reserves the right to withdraw the EOI and change or vary any part thereof or foreclose the EOI at any stage.

5.2 Submission of Information/Documents: Information should be submitted in the formats specified in this document. The pre-qualification documents shall be submitted as follows:

- a) Two (hard) copies with all supporting documents.
- b) One digital copy of the entire documentation.
- c) With a covering letter duly signed by the Authorized Representative of the company with the company's seal. Document in support of authorization granted to the authorized representative to be submitted.

5.3 Failure by the applicant to provide essential information/documents for evaluating the applicant's qualifications, or to provide timely clarification or substantiation of the supplied information, may result in the disqualification of the applicant.

6. Evaluation Criteria

The broad guidelines for evaluation of Proposals will be as follows:

In respect of this proposed proposal, the technical Proposal forwarded by the proposer will be evaluated with reference to the technical characteristics of the ToT execution as mentioned in the EOI. The compliance of Technical Proposals would be determined on the basis of the parameters specified in the EOI.

6.1 Compliance by firm, to be provided in their proposal:

The firm has to provide a complete compliance as per Table 5 of this document. It is requested that line entry wise compliance and the details regarding the manner and extend to which compliance is provided is to be brought out clearly in the proposal by the Indian industry, for the following:

It is to be understood that the identified EFF will provide the following details during the progress of ToT:

- a. Providing of electrical, water and space requirements.
- b. Providing of building plan for supporting infrastructure (water treatment, power treatment, captive power plant, air-conditioning plants, clean room maintenance, chemicals & gases storage and routing, safety mechanisms etc)
- c. Provision of specifications, preferred sources, and implementation details for water treatment, power treatment, captive power plant, air-conditioning plants, clean room maintenance, chemicals & gases storage and routing, safety mechanisms etc.
- d. Providing of building plan for IDDCA fabrication, integration, testing maintenance and storage infrastructure.
- e. Providing of Fabrication line machinery, preferred sources, installation details, operational requirements, software with source / pseudo codes, complete process documentation etc.
- f. Providing of test line machinery, preferred sources, installation details, operational requirements, software with source / pseudo codes, complete test procedure documentation etc.
- g. Providing of Operator requirements, operator training with respect to various phases, their certification for all operations including support operations.
- h. Providing of quality control documents, overseeing and ensuring of quality product

output (IDDCA).

- i. Provision for smooth, free information exchange and for exchange of technical personnel as required.
- j. Provision of line entry wise compliance to the technical specifications of EOI.
- k. Provision of full commitment to ensure the realization of Fabrication facility in time with quality output.

The Indian Industry should clearly express their willingness in response to this EOI for all of the above-mentioned details and should be ready to take-up and execute the complete ToT.

6.2. Evaluation and Acceptance Process.

Technical Assessment Committee (TAC): The technical proposals forwarded by the firm will be evaluated by a TAC. TAC will examine the compliance of the offers from prospective Indian industry. TAC, if so desires, may also visit Indian industry to assess their capability to get involved in the ToT process. The recommendations of the TAC will be final and binding.

6.3 Other Specific Requirements from Indian Industry

6.3.1 Specific Experience

The Indian industry has to provide the details of Manpower, infrastructure and experience of working with the above-mentioned detectors and electro-optical instruments employing these kinds of detectors. These technical requirements are must keeping in view sophisticated nature of the ToT proposed to be undertaken.

6.3.2 Willingness/Undertaking Format

(To be enclosed as part of the Expression of Interest proposal on the letterhead of the company)

Date:

To:

The Director

Instruments R&D Establishment (IRDE)

Raipur Road

Dehradun, Uttarakhand

India – 248008

Reference: Expression of Interest No. ----- dated -----
2024

Dear Sir,

We hereby confirm that we have confirmed the Lab/Estt EOI Document dated -----

- i. That we agree to all terms and conditions of the EOI document.
- ii. ---
- iii. ---

Yours faithfully,

[Applicant Head Signature]

6.3.3 Summary Sheet: Organization Structure / Legal Status / Current Contract Commitments / Works in Progress

The Applicant firm shall submit with EOI the following organization Structure, Legal status of the applicant, Place of registration, Principal place of business, Brief on business activities undertaken by the applicant, Ownership details, Shareholder pattern, Details of manpower, including discipline and geographical location wise permanent manpower strength for providing support in execution of proposed project, Names and addresses of the present Directors and Senior management and such other relevant details as the Applicant may like to share in the following format.

- a. Corporate -----
- b. Corporate Structure -----
- c. Applicant's Technical Capacity (State total number of professional staff indicating each individual's experience/qualification):

- d. Applicant's facilities and experience

Name & Signature of authorized representative of the Applicant:

Name and Stamp of Company:

Date:

6.3.4 Contract/ToT Details

Applicant should provide information on their work performed recently in last five years and also the current commitments on all contracts/ToT that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued in the following format.

Year	Project Name/Client	Contract No. & Date	Value of Contract	Stipulated Period of Completion	Actual Date of Completion

6.3.5 Financial Capability

The applicants shall furnish complete audited annual financial year statements for the last 3 years, including balance sheets, profit & loss account statements, audit reports, and all other schedules of the immediate preceding financial year, self-certification of not being under liquidation, court receivership, or similar proceedings, for any of the past 3 financial years. The company should be a positive net worth firm for the last three years. In support of this claim, the prospective industry needs to submit copies of the balance sheet, profit & loss account duly audited, pertaining to the previous 3 years.

Applicant should provide financial information to demonstrate the firm's capability for assessment of the financial status by Lab/Estt. If necessary, use separate sheets to provide complete banker information.

Applicant should have a positive net worth.

Banker	Name of the Banker (s)
	Address of the Banker(s)

	Telephone	Contact name and title of Senior Bank official
	Fax	E-Mail

6.3.6 Litigation/Arbitration History

Applicant should provide information on the history of court litigation or arbitration proceedings resulting from contracts executed in the last 5 years or currently under execution. The information should also be provided for any significant subcontractors.

Year	Decree/Award for or against Applicant	Name of Client, Cause of Litigation, and Matter in Dispute	Disputed Amount (Current Value)

7. Compliance Table

The firm has to provide the Compliance to all EOI Clauses as per following table:

Table 5: Compliance Table

Sr. No.	Activity	Remark	Reasons/ Justification for non-compliance/ Suggestions (if any)
1.	The Indian industry should be willing to take-up Full ToT along with DRDO.	Yes/No	
2.	<p>The Indian industry has to participate in establishment, operation and maintenance of a fabrication line for InSb based MWIR Detector through Transfer of Technology (ToT) from an Established Foreign Foundry (EFF). The full ToT will be provided by identified EFF.</p> <p>The development work would include:</p> <ul style="list-style-type: none"> ➤ Establishment of a foundry for fabrication of 	Yes/No	

	<p>InSb based MWIR Detector.</p> <p>➤ Establishment of state-of-the-art fabrication infrastructure and equipment for the development of IR FPAs. Equipment will be supplied by identified EFF.</p>		
3.	<p>The complete work would involve:</p> <p>➤ Acquisition/purchase of land (about 5000 Sq mt) at an identified place mutually agreed between DRDO, prospective Indian industry partner and identified EFF.</p> <p>➤ Building of infrastructure involving</p> <ul style="list-style-type: none"> <input type="checkbox"/> IRFAB building with Clean Rooms <input type="checkbox"/> Clean room utilities <input type="checkbox"/> This would involve FAB design, air Conditioning and Humidity control, DI/ RO Water, acid exhaust, solvent exhaust, process gases, dragger, electrical cabinets and ups, PCW, waste treatment, liquid and gas nitrogen, cleaned dry air, house vac, building control etc. <input type="checkbox"/> Standard production room & room for operation management <input type="checkbox"/> Environmental & Supplies Building (For power, water supply etc) <input type="checkbox"/> Logistic support building (For IT, Technical / Engg. etc.) <p>➤ Installation and commissioning of all the fabrication equipment along with accessories</p> <p>➤ Acquisition of ToT from identified EFF</p> <p>➤ Production of detectors</p>	Yes/No	
4.	The prospective Indian industry has to comply for the willingness for investment in establishment of IRFAB facility.	Yes/No	
5.	Availability of experienced and qualified manpower with the Indian industry.	Yes/No	
6.	Experience of having worked with IR detectors and	Yes/No	

	electro-optical instruments based on IR detectors.		
7.	The firm should have positive networth for the last three years.	Yes/No	
8.	IR detector components: <ul style="list-style-type: none"> a) FPA b) ROIC c) Cold finger & Dewar design as per required f# d) Proximity Electronics e) Sterling/JT cooler with integration f) Customization in pixel pitch & array format g) Facility can be extended for T2SL & XBn/ HFM detectors 	Yes/No	
9.	Processes <ul style="list-style-type: none"> a) PV array fabrication Technology b) Device mounting on dewar and assembly c) Dewar envelope design, manufacturing and assembly d) Hybridization and packaging of FPA & ROIC (flip chip bonding) e) Cryo Cooler assembly & Integration f) Infrared Window Design, fabrication and Assembly g) Cold shield Design, Assembly & Ceramic feed through assembly & testing h) Cold finger & getter design, assembly, testing and integration i) FPA & Dewar Integration j) Silicon readout technology k) Performance evaluation and Environmental Testing l) Quality Control 	Yes/No	

	m) Manpower Training		
10.	Compliance to the Detector Specifications as mentioned under section 3.5 Table 2, Table 3 & Table 4.	Yes/No	
11.	The Indian industry should note that the facility established by the IRFAB is scalable to higher format detectors at a later stage.	Yes/No	
12.	Compliance for items listed in section 6.1 of this document	Yes/No	

S. No.	Internal cleanroom machinery infrastructure
1.	H2 Oven
2.	N2,H2 balloons
3.	Solvents wethood
4.	Acid wethood
5.	Ni Coationg Wethood
6.	Medium Ultrasonic Bath
7.	Belt Oven
8.	Point welding device (for Getters)
9.	Wethood for manual soldering
10.	Device for fingers assembly
11.	Wethood for finger washing
12.	Device for washing cold shields
13.	Large UltraSonic device
14.	Leak detector(for fingers)
15.	100Deg C Oven
16.	Device for filters evaporator
17.	Evaporator for Filters
18.	Soldering iron devices
19.	Micriscope
20.	N2 Disicator
21.	Drying 80DegC Oven
22.	Small Mechanical lathe
23.	adittional auxiliary equipment
24.	Glass cutting machine
25.	Metal cutting machine
26.	Residue removal device (Trumel)
27.	Oxidation Oven
28.	casting Oven (including special chamber)
29.	Annealing Oven
30.	Brasing Oven
31.	Outgassing system
32.	mini enviroment class 100
33.	60 Deg Oven (for glue curing)
34.	Device for cold shields gluing
35.	Alumina Spray nachine

S. No.	Equipment of FPA Manufacturing
1.	Coater/Developer 3"-4"
2.	Coater/Developer 6"-8" CDM-05
3.	STEPPER 5X- 8"
4.	STEPPER 5X -4"
5.	Implanter
6.	Trion-Oxygen Plasma for wafers
7.	SSEC - Wafer8"cleaning /Lift
8.	SSEC - Wafer4"cleaning /Lift
9.	SSEC - Dies cleaning
10.	SSEC - Lactic acid etch, BHF Etch & Scrubber cleaning
11.	PECVD-051
12.	ORF-06
13.	Mic Stereo Zoom
14.	Anodization
15.	Amonia Oven
16.	CM-04
17.	E-Gun
18.	DENTON-03
19.	Hot Plate
20.	Defects review N-Spec
21.	Humidity Chamber
22.	Prober-01 for electrical test
23.	WH-099 Barrier preparation
24.	Wet Hood - back side photo resist
25.	Indium Evaporator
26.	Wet hood- bumps lift off
27.	Wafer Inspection WI-02
28.	CD'S MICROSCOPE OLIMPOS
29.	SEM CD's 8"
30.	SEM CD's 4"
31.	MUTEC - CD measuring
32.	Ammonia - reversal photolithography
33.	MICROSCOPE INSPECTION OLIMPOS
34.	EVG SPRAY COAT - die sawing preperation
35.	MICROSCOPE INSPECTION OLIMPOS
36.	HAMATEK - MASK CLEANING
37.	Blue M - furnace
38.	Bumps - Humidity cell
39.	Microscope Olympus
40.	Microscope Zoom
41.	open prob - IV & CV Measurment
42.	Electrical test for wafers and dIe - prober pa200

43.	Electrical test FOR FPA ATE tester live test
44.	Cryogenic prober Lab Dewar - kadel
45.	Electrical test for Detector ATE tester live test
46.	ATE radiometric tester
47.	Accessories
48.	KLA 8720
49.	Stre-ozom
50.	In. thermal evaporation
51.	Metal thermal evaporation
52.	SIO thermal evaporation
53.	PECVD SiO2
54.	RTP
55.	Annealing plate
56.	Dektak
57.	Nanometer
58.	Elipsometer
59.	Metal E_Gun evaporation
60.	Sputter for Ti/Pt
61.	RIE
62.	Microscope for inspection
63.	XRF
64.	DISCO321 - dicing+UV cure
65.	MATDA - pick up dicing
66.	FC 300 - bonding
67.	Underfill gluing dispenser
68.	die GRINDER
69.	Chemical menchanical polish

S. No.	Equipment for Detector Development
1.	Wedge Bonder 0.7 mil Pt/Ir Wire
2.	Ball Bonder 1 mil Au Wire
3.	DDA Electrical Tester1
4.	PUMP DETECTOR
5.	Pinch Off 1
6.	Automatic Test Equipment 03
7.	Maknur-15
8.	LDSVIB-2
9.	Cooling Rate 5 - 2
10.	Automatic Test Equipment 03