INDIAN INSTITUTE OF TECHNOLOGY MADRAS
Chennai 600 036

Telephone: [044] 2257 9798/9723
E-mail: tender@imail.iitm.ac.in

The Senior Manager (Project Purchase)

Ref: MEE/BVSS/050/2019
Date: 12.11.2019

Open Tender No: MEE/BVSS/050/2019

Due Date: 5th December 2019, 4 PM

Pre-Bid meeting: - Dated 7.11.2019

Technical Bid opening meeting on 9th December 2019, 9:00 AM at Department of Mechanical Engineering, IIT-Madras.

Dear Sir/Madam,

On behalf of the Indian Institute of Technology Madras, offers are invited for the **"Turbomachinery prototype manufacturing and supply"** conforming to the specifications given in Annexure IA, Annexure 1B, Annexure II and Annexure III.

Annexure 1A and 1B will be shared with suppliers along with the open tender document. Annexure III will be uploaded before 15th November 2019.

Instructions to the Bidder

I. **Preparation of Bids:** - The tenders should be submitted under two-bid system (i.e.) Technical bid and Financial bid.

II. **Delivery of the tender:** - The tender shall be sent to the address mentioned below, either by post or by courier so as to reach our office before the due date and time specified in our schedule.
The offer/bid can also be dropped in the tender box on or before the due date and time specified in the schedule.
The tender box is kept in the office of the:

The Senior Manager,
Project Purchase,
IC & SR Building, 2nd floor,
I.I.T. Madras,
Chennai – 600 036.

III. **Opening of the tender:** - The offer/bids will be opened by a committee duly constituted for this purpose. The technical bids will be opened first and will be examined by a technical committee which will decide the suitability of the bids as per our specifications and requirements. All bidders will be invited for opening of the technical bids. For opening the financial bid, only technically qualified bidders will be called.

IV. **Prices:** - The price should be quoted in net per unit (after breakup) and must include all packing and delivery charges to the **Department of Mechanical Engineering**. The offer/bid should be exclusive of taxes and duties. The percentage of tax & duties should be clearly indicated separately. Kindly note that IIT Madras is eligible for concessional GST and relevant certificate will be issued.

In case of import supply, the price should be quoted without custom duty. IIT Madras is exempted from levy of IGST on Imports and eligible for concessional custom duty (not exceeding 5%) and the price should be quoted on EX WORKS and CIP basis (stating the Cost, Insurance, Freight separately) and indicating the mode of shipment.

V. **Agency Commission:** - Agency commission, if any, will be paid to the Indian agents in rupees after receipt of the equipment and its satisfactory installation. Agency Commission will not be paid in foreign currency under any circumstances. The details should be explicitly shown in the tender document even in the case of 'Nil' commission. The tenderer should indicate the percentage of agency commission to be paid to the Indian agent. The Foreign Principal should indicate the percentage of payment and it should be included in the basic price quoted originally (if any)..

VI. **Terms of Delivery:** - The item should be supplied to the **Department of Mechanical Engineering, IIT Madras** as per the Purchase Order. In case of import supply, the item should be delivered at the cost of the supplier to our Institution. The Installation/Commissioning should be completed as specified in our important conditions.

VII. **Technical Bid Opening:** The technical bid will be opened on 9th December, 2019, 9:00 AM at the **Department of Mechanical Engineering, IIT-Madras.** The financial bids of those tenderers who are technically qualified will be opened at a later date under intimation to them.

VIII. **IIT Madras** reserves the full right to accept / reject any tender at any stage without assigning any reason.

Yours sincerely,

12/11/19

The Senior Manager (Project Purchase)
IC&SR Building, I.I.T. Madras,
Chennai – 600 036.

SCHEDULE

Important Conditions of the tender

1. The due date for the submission of the tender is **05.12.2019, 4.00 PM.**

   The offers / bids should be submitted under two bid system (i.e.) Technical bid and financial bid. The Technical bid should consist of all technical details / specifications only. The Financial bid should indicate item-wise price for each item and it should contain all Commercial Terms and Conditions including Taxes, transportation, packing & forwarding, installation, guarantee, payment terms, pricing terms etc. The Technical bid and financial bid should be put in separate covers and sealed. Both the sealed covers should be put in a bigger cover. The Open Tender for **"Turbomachinery prototype manufacturing and supply"** should be written on the left side of the Outer bigger cover and sealed.

2. **EMD: -** The **EMD (Should be in INR) in the form of Account Payee Demand Draft/Fixed Deposit Receipt/ Banker's Cheque or Bank Guarantee for 2% of the quoted value of the item; drawn in favor of The Registrar-IIT Madras, payable at Chennai should be enclosed in the cover containing financial bid.** Any offer not accompanied with the EMD shall be rejected summarily as non-responsive.

   The EMD of the unsuccessful bidders shall be returned within 30 days of the end of the bid validity period. The same shall be forfeited, if the tenderers withdraw their offer after the opening during the bid validity period. The Institute shall not be liable for payment of any interest on EMD. EMD is exempted for Micro and Small Enterprises (MSE) as defined in MSE Procurement Policy issued by Department of Micro, Small and Medium Enterprises (MSME).

   When a foreign vendor does not have a local agent in India, he can submit a demand draft equal to 2% or wire transfer the amount to our account as detailed in the attachment (Annexure II) and enclose the proof with the financial bid.

3. **Performance Security: -** The successful bidder should submit Performance Security for an amount of 5% of the value of the contract/supply. The Performance Security may be furnished in the form of an Account Payee DD, FD Receipt from the commercial bank, Bank Guarantee from any nationalized bank in India. **The performance security should be furnished within 21 days from the delivery of the purchase order.**

   Performance Security in the form of Bank Guarantee:- Incase the successful bidder wishes to submit Performance Security in the form of Bank Guarantee, the Bank Guarantee should be routed through the Beneficiary Bank to the end user bank. Otherwise, the Indian Agent of the foreign vendor has to submit a Bank Guarantee from a Nationalized Bank of India.
   The Bank Guarantee should remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the supplier including the warranty obligations.

4. **Indian agent:** If an Indian agent is involved, the following documents must be enclosed:
   Foreign principal's proforma invoice indicating the commission payable to the Indian Agent and nature of after-sales service to be rendered by the Indian Agent.
   - ✓ Copy of the agency agreement with the foreign principal and the precise relationship between them and their mutual interest in the business.

5. The offer/bids should be sent only for a machine that is available in the market and supplied to a number of customers. A list of customers in India and abroad with details must accompany the quotations. Quotations for a prototype machine will not be accepted.

6. Original catalogue (not any photocopy) of the quoted model duly signed by the principals must accompany the quotation in the Technical bid.

7. Compliance or Confirmation report with reference to the specifications and other terms & conditions should also be obtained from the principal.

8. **Validity:** The validity of Quotation should not be less than 90 days from the due date of tender.

9. **Delivery Schedule:** - The tenderer should indicate clearly the time required for delivery of the item (subjected to the executive committee-IITMadras approval). In case there is any deviation in the delivery schedule, liquidated damages clause will be enforced or penalty for the delayed supply period will be levied.
   If there is delay, the penalty will be @1% per week of delay subject to a max of 10% of the value of purchase order and if the delay is more than accepted time frame by IITM, the PO would be cancelled and liquidated damages will be enforced.

10. **Risk Purchase Clause:**- In the event of failure of supply of the item/equipment within the stipulated delivery schedule, the purchaser has all the right to purchase the item/equipment from other sources on the total risk of the supplier under risk purchase clause.

11. **Payment:**-
    (i) No Advance payment will be made for Indigenous purchase. However 90% Payment against Delivery and 10% after installation are agreed to wherever the installation is involved. In case of import supplies the payment will be made only through 100% Letter of Credit i.e. (90% payment will be released against shipping documents and 10% after successful installation wherever the installation is being done).
    (ii) **Advance Payment:** No advance payment is generally admissible. In case of specific percentage of advance payment is required, the Foreign Vendor has to submit a Bank Guarantee equal to the amount of advance payment and it should be routed through the Beneficiary Bank to the end user Bank. Otherwise, the Indian Agent of the foreign vendor has to submit a Bank Guarantee through a Nationalized Bank of India.

12. **On-site Installation:** - The equipment or machinery has to be installed or commissioned by the successful bidder within number of days (as prescribed by PI) from the date of receipt of the item at site of IIT Madras

13. **Warranty/Guarantee:** - The offer should clearly specify the warranty or guarantee period for the machinery/equipment. Any extended warranty offered for the same has to be mentioned separately (For more details please refer our Technical Specifications).

14. **Late offer:** - The offers received after the due date and time will not be considered. The Institute shall not be responsible for the late receipt of Tender on account of Postal, Courier or any other delay.

15. **Acceptance and Rejection:** - I.I.T. Madras has the right to accept the whole or any part of the Tender or portion of the quantity offered or reject it in full without assigning any reason.

16. **Do not quote the optional items or additional items unless otherwise mentioned in the Tender documents / Specifications.**

17. **Disputes and Jurisdiction:**

Settlement of Disputes: Any dispute, controversy or claim arising out of or in connection with this PO including any question regarding its existence, validity, breach or termination, shall in the first instance be attempted to be resolved amicably by both the Parties. If attempts for such amicable resolution fails or no decision is reached within 30 days whichever is earlier, then such disputes shall be settled by arbitration in accordance with the Arbitration and Conciliation Act, 1996. Unless the Parties agree on a sole arbitrator, within 30 days from the receipt of a written request by one Party from the other Party to so agree, the arbitral panel shall comprise of three arbitrators. In that event, the supplier will nominate one arbitrator and the Project Coordinator of IITM shall nominate on arbitrator. The Dean IC&SR will nominate the Presiding Arbitrator of the arbitral tribunal. The arbitration proceeding shall be carried out in English language. The cost of arbitration and fees of the arbitrator(s) shall be shared equally by the Parties. The seat of arbitration shall be at IC&SR IIT Madras, Chennai.

a. **The Applicable Law:** This Purchase Order shall be construed, interpreted and governed by the Laws of India. Court at Chennai shall have exclusive jurisdiction subject to the arbitration clause.
b. Any legal disputes arising out of any breach of contact pertaining to this tender shall be settled in the court of competent jurisdiction located within the city of Chennai in Tamil Nadu.

18. All Amendments, time extension, clarifications etc., will be uploaded on the website only and will not be published in newspapers. Bidders should regularly visit the above website to keep themselves updated. No extension in the bid due date/ time shall be considered on account of delay in receipt of any document by mail.

19. Unsuccessful bidders are required to destroy all specifications, designs, geometry models, drawings and all other technical information of any nature whatsoever (in tangible or electronic form) pertaining to this project and certify to the project team in writing that such action has taken place in accordance with the terms of this open tender.

Acknowledgement: - It is hereby acknowledged that the tenderer has gone through all the conditions mentioned above and agrees to abide by them.

SIGNATURE OF TENDERER
ALONG WITH SEAL OF THE
COMPANY WITH DATE

ANNEXURE II

CENTRE FOR INDUSTRIAL CONSULTANCY & SPONSORED RESEARCH (IC&SR)
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI 600 036

ELECTRONIC CLEARING SERVICE (Credit Clearing) / REAL TIME GROSS SETTLEMENT (RTGS) FACILITY FOR RECEIVING PAYMENTS

A. Details of Account Holder

Name of the Institution	Indian Institute of Technology - Madras
Complete Contact Address	Industrial Consultancy and Sponsored Research Indian Institute of Technology-Madras, IIT- Madras Campus Post Office, Sardar Patel Road, Guindy, CHENNAI - 600 036
Telephone No./ Fax No.	Tel - 044-22578355 / Fax - 044-22570545
E- mail ID of the FO/AO/REG/DIR	dricsr@iitm.ac.in

B. Bank Account Details:

Institution Account Name (As per Bank Record)	The Registrar, Indian Institute of Technology - Madras
Account No.	2722101001741
Account Print Name	IIT F A/C , The Registrar IIT Madras
IFSC CODE	CNRB0002722
Bank Name (in full)	Canara Bank
Branch Name	IIT-Madras Branch
Complete Branch Address	Canara Bank, IIT-Madras Branch, IIT- Madras Campus Post Office, Sardar Patel Road, Guindy, CHENNAI - 600 036
MICR No.	600015085
Account Type	Savings Account

Certified that the Institute's account is in an RTGS enabled branch.
I hereby declare that the particulars given above are correct and complete.

Date:

Signature of the Competent Authority of the Institution with seal.

DEPUTY REGISTRAR (IC&SR) (I/c)
IC & SR, I.I.T. MADRAS
CHENNAI - 600 036

Certified that the particulars furnished above are correct as per our records.

Date: - 8 JUL 2019

CANARA BANK
SENIOR MANAGER
CHENNAI 600 036

Signature of the Authorized Bank Official with Bank Seal.

B. SEKAR
Senior Manager
SP No. 39312

Phone : +91 (0) 44 2257 8062 / 8061 / 8060 Fax : +91 (0) 44 2257 0545 / 2257 8360 email : dricsr@iitm.ac.in website : http://www.iitm.ac.in

CENTRE FOR INDUSTRIAL CONSULTANCY & SPONSORED RESEARCH (IC&SR)
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI 600 036

K VIJAYALAKSHMI
DEPUTY REGISTRAR (IC&SR) i/c

Project Accounts
July 5, 2019

TO WHOMSOEVER IT MAY CONCERN

In connection with project, US currency may be transferred to CANARA BANK, IIT – MADRAS Branch In connection with the following details.

FOR TRANSFER OF CURRENCY US DOLLAR

Please Credit in USD (THROUGH)

JP MORGAN CHASE, NEW YORK
SWIFT CODE: CHASUS33

For credit to

USD ACCOUNT No: 001 – 1395969, of CANARA BANK INTERNATIONAL DIVISION MUMBAI

For Further Credit to

ACCOUNT NO: 27221010001741 of IIT Chennai – Swift Code: CNRBINBBIIT OF THE REGISTRAR, IIT, MADRAS

DEPUTY REGISTRAR(IC & SR) i/c

This is to certify that particulars furnished are correct.

for CANARA BANK
Senior Manager
Canara Bank – IIT Madras branch

B. SEKAR
Senior Manager
SP No. 39312

- 8 JUL 2019

DEPUTY REGISTRAR (IC&SR) (i/c)
IC & SR, I.I.T. MADRAS
CHENNAI - 600 036

Phone : +91 (0) 44 2257 8062 / 8061 / 8060 Fax : +91 (0) 44 2257 0545 / 2257 8565 email : deanicsr@iitm.ac.in website : http://www.iitm.ac.in

ANNEXURE IA

Objective: To obtain quotations for manufacturing and assembly of turbomachinery being designed through IIT Madras and GE collaboration project.
The turbomachinery converts pressure energy of air into rotational energy. It consists of 1 stage turbine, epicyclic gearbox and drive section. Overall assembly is ~14in long and 10in in diameter.

Work scope:

Quotations are requested for **1 prototype in assembled condition** and **1 set of spares** per following requirement.
Inputs provided by IIT Madras and GE Project team:

1. Geometric solid models
2. Preliminary drawings
3. Bill of Materials
4. Standard hardware selection guide
5. Assembly process and instructions

Above items will be provided to you through access controlled box folder.
Following items will be provide by GE and IIT Madras project team.

1. Bearings
2. Clutch
3. Turbine seal

Supplier Scope will be as follows:

1. Manufacture hardware as per BoM using drawings and geometric solid models provided by GE and IIT Madras project team.
2. Supplier can propose alternate manufacturing processes and design changes for producibility improvement.
3. Material test coupons (test specimen) manufacturing, test certificates for strength and chemical composition for rotating parts (Turbine Disk, Carrier Arm, Drive Shaft) and additively made parts are required.
4. Heat treatment and other special processes as mentioned on the drawing notes with quality check reports.
5. Part inspection reports to be submitted.
6. Procure standard hardware:
    a. O-rings
    b. Wave springs
    c. Bolts
    d. Threaded inserts
    e. Nuts (including bearing lock-nuts)
    f. Design requirements of standard hardware will be provided in terms of standard hardware selection guide. Alternate hardware meeting the requirement will be considered.
7. Assembly operations to take place in clean environment using parts manufactured by supplier, standard hardware procured, and other hardware provided by GE and IIT madras team.
8. Component and sub-assembly level balancing of the rotating components to a level of 0.03gm-in for turbine rotor and .09gm-in for carrier arm and clutch assembly.

9. Assembly process to create required interference fits and bolt preloads. Supplier to plan for tooling and fixtures required for assembly if any. Typical radial interference values are in the range of 0.001 to 0.002in.
10. Given the raw material lead times, CNC program validations or check runs may be planned as needed before machining of components.
11. It is desirable to perform mechanical checkout runs by spinning the rotor of the prototype assembly up to 3000 RPM with the help of shop air and under no load conditions.
12. Supplier is required to provide machining, assembly, alignment and balancing support through the performance testing phase of the prototype till rated power. The support activities will include dis-assembly of the prototype, performing necessary corrections and reassembling the prototype.

Quotations Requested per following guidelines:

Kindly provide the quotations separately for below 3 packages:

1. Package 1: Additive and Cast parts
    a. This package includes components that the supplier plans to make through 3D printing or casting process.
    b. Following parts could be considered
        i. P.No. 2: Nozzle Ring
        ii. P.No. 8: Housing, Turbine Exhaust
        iii. P.No. 79. Housing, Drive
2. Package 2: Turbine rotor and Gears
    a. This package includes manufacturing of following Turbine rotor and gear components.
        i. P.No. 4: Disc, Turbine
        ii. P.No. 5: Shaft, Turbine
        iii. P.No. 33: Ring Gear
        iv. P.no. 35: Planet gear
        v. P.No. 42: Carrier arm
3. Package 3: Conventional Machined parts & integration
    a. This package includes manufacturing of all the components not included in Package 1 and Package 2 above.
    b. Procurement of Standard hardware
    c. Assembly of components from package 1 and 2, standard hardware and GE – IIT Madras provided components into sub-assemblies into sub-assemblies followed by final prototype assembly.
    d. Perform mechanical checkout runs by spinning the assembly upto 3000 RPM with shop air under no load conditions.

If manufacturing supplier is willing to quote for part of the workscope (e.g. only 1 or 2 of the 3 packages), they may indicate their preference to do so.

Other guidelines:

1. Manufacturing suppliers may engage other suppliers for components manufacturing and or special processes following NDA process meeting GE & IIT Madras Collaboration project requirements. Other suppliers need to be ready to enter into NDA with the project team.

2. If the supplier has capability to perform sub-system and/or prototype level performance testing, they may indicate their capabilities for further discussion on testing requirements with the IIT Madras and GE project team.
3. Supplier shall extend maximum assistance, cooperation and provide full transparency to the GE and IIT Madras project team during the prototype development. Project team may depute personnel at the supplier site during the manufacturing process to witness the quality of workmanship and understand the processes followed.
4. All technical communication to take place through box folder. Use of emails, what's app or other social media tools for sharing, exchanging project technical information like drawings, specifications, photos etc. with GE or internal to the supplier organization is not acceptable. Mode of communication with supplier's sub-contractors for exchange of technical data should be approved by GE-IIT Madras project team.
5. Supplier shall share with GE-IITM project team, weekly update reports to substantiate prototype development progress in the form of photographs, manufacturing documents, testing reports.
    a. There will be joint project review at a monthly frequency between the GE-IIT Madras project team and Supplier.
    b. Monthly project review meeting shall be at Supplier premises or at supplier's sub-contractor premises as needed.
6. Unsuccessful bidders are required to destroy all specifications, designs, geometry models, drawings, and all other technical information of any nature whatsoever (in tangible or electronic form) pertaining to this project and certify to the project team in writing that such action has taken place in accordance with the terms of this open tender.

Attachments:

Following inputs are provided for quotation purposes only through access controlled box folders. Kindly note the following while referring to the geometry files and drawings:

1. Geometry Solid models are preliminary and intended for RFQ purposes only.
2. Fillets, chamfers and break-edges are not modelled at all locations and will be added before final machining release.
3. Use the drawings provided for datums, notes, special process requirements, and tolerances. Additional dimensions and drawing views may be added before the machining drawings are issued.
4. Final drawings and geometry models will be provided at the time of PO placement.

Machined Parts (Material – Refer drawings)

Following drawings and geometry solid models are provided through box folder.

Part No.	Part Name	QTY	Geometry Solid models in stl format (file Name)	Dwg File in pdf format (file name)
1	Housing, Turbine Inlet outer	1	1_HOUSING, TURBINE INLET OUTER_V0	1_HOUSING, TURBINE INLET OUTER_V2
2	Nozzle Ring	1	2_NOZZLE RING_V0	2_NOZZLE RING_V2
3	Liner, Flow path	1	3_Liner, Flow path_V0	3_Liner, Flow path_V0
4	Disc, turbine	1	4_Disc, turbine_V0	4_Disc, turbine_V0
4_forge	Disc, Turbine_forge	1	NA	4_Disc, turbine_Forged Part_V0_Dwg
5	Shaft, Turbine	1	5_Shaft, Turbine_V0	5_Shaft, Turbine_V0
6	Nut – counterbore, Turbine	1	6_Nut–Counterbore, Turbine	
7	Ring, Containment	1	7_Ring, Containment_V0	7_Ring, Containment_V0
8	Housing, Turbine Exhaust	1	8_Housing, Turbine Exhaust_V0	8_Housing, Turbine Exhaust_V2
9	Axial Cutter	1	9_Axial Cutter_V0	9_Axial Cutter_V0
12	Sleeve, Turbine Bearing	1	12_Sleeve, Turbine Bearing_V0	12_Sleeve, Turbine Bearing_V0
20	Sleeve/Spacer, Turbine Bearing Rotating	1	20_Sleeve,Turbine Bearing Rotating_V0	20_Sleeve,Turbine Bearing Rotating_V0
31	Housing, Gearbox	1	31_Housing, Gearbox_V0	31_Housing, Gearbox_V2
32	Sleeve, Gearbox Housing	1	32_Sleeve, Gearbox Housing_V0	32_Sleeve, Gearbox Housing_V0
33	Gear, ring	1	33_Gear, ring_V0	33_Gear, ring_V0
35	Gear, Planet	3	35_Gear, Planet_V0	35_Gear, Planet_V0
36	Bearing Sleeve	1	36_Bearing Sleeve_V0	36_Bearing Sleeve_V0
38	Thrust washer, planet gear	6	38_Thrust washer, planet gear_V0	38_Thrust washer, planet gear_V0
42	Carrier arm	1	42_Carrier arm_V0	42_Carrier arm_V0
62	Inner ring, Clutch	1	62_Inner ring, Clutch_V0	62_Inner ring, Clutch_V0
63	Outer ring, Clutch	1	63_Outer ring, Clutch_V0	63_Outer ring, Clutch_V0
66	Lock Nut, Clutch inner Ring	1	66_Lock Nut, Clutch inner Ring_V0	
67	Retention Ring, Inner Clutch bearing	1	67_Retention Ring, Inner Clutch bearing_V0	67_Retention Ring, Inner Clutch bearing_V0
68	Retention Ring, Outer Clutch bearing	1	68_Retention Ring, Outer Clutch bearing_V0	68_Retention Ring, Outer Clutch bearing_V0
71	Drive Shaft	1	71_Drive Shaft_V0	71_Drive Shaft_V0
75	Output Shaft	1	75_Output Shaft_V0	75_Output Shaft_V0
76	Drive Spline	1	76_Drive Spline_V0	76_Drive Spline_V0
77	Holder Threaded Shaft	1	77_Holder Threaded Shaft_V0	77_Holder Threaded Shaft_V0
79	Housing, Drive	1	79_Housing, Drive_V0	79_Housing, Drive_V2
85	QAD	1	85_QAD_V0	85_QAD_V0

Standard Hardware list:

Part No.	Part Name	Size & Spec	Material	Quantity
6	Nut – counterbore, Turbine; 6_ Nut– Counterbore, Turbine	5/16 – 24 UNJF 3A	A286	1
14	Lock Nut, Turbine bearing 14_ Lock Nut, Turbine bearing_V0	Compatible w/ bearing	Low Carbon Steel	1
15	Bolt, Exhaust Housing	#8-32 Thread 0.164" Dia	18-8 Stainless Steel	4
16	Bolt, Inlet Outer Housing	#10-32 Thread 0.190" Dia	18-8 Stainless Steel	8
17	Nut, Inlet Outer Housing	#10-32 Thread 0.190" Dia	18-8 Stainless Steel	8
18	Pin Dowel, Flow path Liner	Dia .1 X .12	18-8 Stainless Steel	2
19	Nut insert, Inlet outer housing	¼-28 UNJF 3B – 3/8-16 UNJF3A	A286	8
21	Wave Spring, Containment Ring	8.00 IN Bore -7.19 IN Shaft -120 Lbs Preload	17-7 Stainless Steel	2
22	Nut insert, exhaust housing	¼-28 UNJF 3B – 3/8-16 UNJF2A	A286	4
23	Wave spring, Turbine bearing pre-load	3.0 IN Bore – 2.76 IN Shaft - 250Lbs Preload	17-7 Stainless Steel	3
34	pin, ring gear anti-rotation	Dia .1875 X1.25	18-8 Stainless Steel	2
37	Retention Ring, planet gear	Spiral External Ring .812 Shaft Dia, Thk .031	302-Stainless Steel	3
41	Lock Nut, Bearing Carrier Arm; 41_ Lock Nut, Bearing Carrier Arm_V0	Compatible w/ bearing	Low Carbon Steel	1
44	Wave Spring, Preload Shaft Bearing	1.00 IN Bore -.855 IN Shaft – 100Lbs Preload	17-7 Stainless Steel	1
45	Lock Nut, Bearing Shaft Turbine; 45_ Lock Nut, Bearing Shaft Turbine	Compatible w/ bearing	Low Carbon Steel	1
66	Lock Nut, Clutch inner Ring; 66_Lock Nut, Clutch inner Ring_V0	Compatible w/ bearing	Low Carbon Steel	1

Part No.	Part Name	Size & Spec	Material	Quantity
69	Insert, Outer retention ring	10-32 UNJF 3B – 5/16-18 UNJF2A	A286	8
70	Bolt, drive shaft	1/4"-28 UNJF 3A	Stainless Steel 12-Point Screw	8
73	Lock Nut, Drive shaft bearing; 73_Lock Nut, Drive shaft bearing_V0	Compatible w/ bearing	Low Carbon Steel	1
74	Wave spring, Preload drive shaft bearing	4.2 IN Bore – 3.5 IN Shaft - 100Lbs Preload	17-7 Stainless Steel	1
78	Lock Nut, drive spline; 78_Lock Nut, drive spline_V0	Compatible w/ bearing	Low Carbon Steel	1
80	Bolt, machine – double hexagon extended washer head	.2500-28 UNJF-3A	Corrosion and heat resistant nickel alloy per AMS5662	8
81	Dowel Pin	Dia .312 x 1.00	18-8 Stainless Steel	2
82	O-Ring	ID Dia 8.237 IN	Rubber Fluorocarbon	2
83	O-Ring	ID Dia 6.737 IN	Rubber Fluorocarbon	1
84	O-Ring	ID Dia 1.489 IN	Rubber Fluorocarbon	1

For guidance on standard hardware selection see attachment "MAYBACH_ATS_Standard hardwares.pdf". Alternate standard hardware meeting the requirements can also be considered.

IIT Madras & GE Supplied Hardware:

Part No.	Part Name	Quantity
10	Seal Stator, Turbine	1
11	Seal Rotor, Turbine	1
13	Bearing, Turbine	2
39	Bearing Set, Roller Planet Gear	3
40	Bearing, Carrier arm	1
43	Bearing, Shaft Turbine	1
61	Sprag Clutch	1
64	Bearing, Ball Clutch	3
65	Bearing, Roller Clutch	1
72	Bearing, Drive shaft	1

Annexure 1B

Supplier needs to complete attached checklist and attach it along with the technical bid. Kindly include relevant experience to make your responses more complete.

Package 1 (Parts manufactured through additive or casting approach.)

Sl. No.	Question	Response from the Supplier
1	Which parts are you planning to manufacture by 3D printing process?	
2	Where do you plan to perform 3D printing of the parts?	
3	What 3D printing process do you plan to use? On what machine model?	
4	Where do you plan to perform the post processing (support removal, heat treatment etc.) of 3D printed parts?	
5	Where do you plan to finish machine the interface features of the 3D printed parts?	
6	What manufacturing process do you plan to use for part No. 2, nozzle ring?	
7	How do you plan to perform and report nozzle airfoil inspection summary?	
8	What surface finish would you be able to achieve on the airfoil surfaces of part No. 2, Nozzle Ring and flow path regions of part No. 8, Housing Turbine Exhaust?	
9	What inspection process do you plan to use for inspection of flow path regions of part No. 8, Housing Turbine Exhaust?	

Package 2

Components: Disc, Turbine (P. No. 4); Shaft, Turbine (P. No. 5); Gear, Ring (P.No. 33); Planet, Gear (P. No. 35); Carrier Arm (P.No. 42)

Sl. No.	Question	Response from the Supplier
1	What raw material form do you plan to use for turbine disc component (P. No. 4)? refer drawing 4_Disc, turbine_Forged Part_V0_Dwg.pdf	
2	Where do you plan finish machine to machine turbine disc component 4?	
3	How do you plan to perform, and report turbine AF (Part 4) inspection summary as specified in drawing?	
4	What manufacturing process do you plan to use for machining turbine disc internal spline features for part 4?	
5	What manufacturing process do you plan to use for planet gear part 35 and sun gear tooth part 5?	
6	What manufacturing process do you plan to use for ring gear part 33 internal tooth machining?	
7	What manufacturing process do you plan to use for sun shaft Part 5 external spline features?	
8	How do you plan to verify the carburizing hardness and case depth?	
10	What inspection process do you plan to use for verification of gear tooth and spline features?	

Package 3

Machining of components not covered in package 1 and 2, Standard hardware procurement, assembly of the entire product.

Sl. No.	Question	Response from the Supplier
1	What manufacturing process do you plan to use for machining external spline tooth features on output shaft part 75 and Drive Spline part 76?	
2	What manufacturing process do you plan to use for machining internal spline tooth features drive shaft part 71?	
3	How do you plan to inspect spline tooth profile?	
4	What processes do you plan to followed for interference fits (Thermal, press fits) creation? Describe the facilities/capabilities you have in your assembly shop? You may include information on oven, chiller size, capability, press capacity etc.	
5	What Assembly process are planned bearing assembly and dis-assembly?	
6	What tools do you plan to use for applying required amount of pre-load?	
7	Do you have dynamic rotor balancing capability in your facility? Do you have experience in rotor balancing per Grade 2.5 Quality of ISO 1940?	

General Questions

Sl. No.	Question	Response from the Supplier
1	Which components do you plan to outsource?	
2	Which special processes do you plan to outsource?	
3	What is your confidence level about completing the project in 4 months from PO. Indicate your tolerance band in terms of +/- number of weeks from 4 months.	
4	Have you reviewed all non-GE	

	standards and specification mentioned in the drawings?	
5	What Inspection capabilities do you have in your facility? Are they approved by NABL?	
6	What inspection processes do you plan to conduct outside your facility? Are the facilities already identified?	
7	How do you plan to inspect thread features on different parts?	