

**Indian Institute of Technology Delhi**  
**Electrical Engineering Department**

25-02-2015.

**Sub: NIQ for Twin Rotor Multiple Input Multiple Output System.**

On behalf of duly constituted purchase committee, sealed quotations are invited from the OEMs & Authorized dealers for **Twin Rotor Multiple Input Multiple Output System** as per specifications given below.

The **Twin Rotor Multiple Input Multiple Output System** should be composed of the following components:

**1. Helicopter Plant:**

- The 2 DOF (Degrees of Freedom) Helicopter should provide access to control the pitch and yaw of a simplified Helicopter model.
- It should be actuated by 2 DC motors, mounted at 90 degrees to each other, it should have the ability for pitch and yaw actuation.
- The Helicopter frame should free to rotate on a vertical base equipped with an electrical contact slip ring. Electrical signals to and from the Helicopter should be channeled through the slip ring to eliminate tangled wires, reduce friction and allow for unlimited and unhindered yaw.
- The coupling between the pitch and yaw motor torques should result in a coupled 2 input - 2 output system.
- The experiment should provide a Hardware-in-the-Loop testbed to understand and develop control laws for a vehicle that has dynamics representative of a tethered rigid body helicopter, spacecraft or underwater vehicle.

Technical Specification of Helicopter Plant

Specification	Value	Units
Body Height	0.4-0.5	m
Body Weight 3.5 kg	Less than or equal to 3.5	kg
Base Dimensions - Length	16-18	cm
Base Dimensions - Width	16-18	cm
Body Moment of Inertia	0.30- 0.31	kg m <sup>2</sup>
Total Length	40-42	cm
Distance from pivot to pitch motor	20-21	cm
Distance from pivot to yaw motor	20-21	cm
Pitch propeller diameter	280	mm
Pitch range of motion	At least 90° (± 45°)	degrees
Yaw propeller diameter	203	mm
Yaw range of motion	Full 360°	degrees



Pitch Encoder Resolution	4096	counts/rev
Yaw Encoder Resolution	8192	counts/rev

A data acquisition card, compatible with the helicopter unit should also be provided, with the following specifications.

2. Data Acquisition Card –
  - USB 2.0 Hi-Speed Interface,
  - Multiple OS compatibility and Interrupt support USB for the encoder index pulses.
  - No I/O shall be • 2 ADCs , • 2 DACs ,
  - Interrupt support is provided in Q2-USB for the encoder index pulses, external interrupt and external convert lines
  
3. Additional Required Features
  - The unit should be fully compatible with MATLAB/Simulink & LabVIEW
  - It should have Open architecture design.
  - The unit should be equipped with safety grills surrounding both propeller blades to eliminate injury
  - Full documentation of the system models & parameters, should be provided along with the unit.
  
4. **Rapid control and Prototyping software-** A Windows single-user license for Real-Time Control, should be provided with the unit The support software should have the following capabilities:
  - a. The system should be able to control through the software which should have capabilities and features which shall optimize the RCP process.
  - b. Flexible and extensible communications blocks configurable for real-time TCP/IP, UDP, serial, shared memory and other protocols
  - c. RTW Code Optimization support
  - d. Modularity and incremental builds via model referencing
  - e. Asynchronous execution (e.g., ideal for efficient communication)
  - f. Self-booting models for embedded targets
  - g. External Hardware-In-the-Loop card and communication interfacing provided in C/C++, MATLAB®, LabVIEW™, and .NET languages Simulink® 3D Animation (formerly known as Virtual Reality) Toolbox support
  - h. Ability to interface with MATLAB® GUIs, LabVIEW™ panels, and Altia
  - i. Student workbook, teacher workbook and lab setup guide should be provided in electronic format On CD.
  - j. A selection of pre-built controllers and complete dynamic model should also be provided.

### Terms and Conditions:-

1. Please submit the TECHNICAL and FINANCIAL bids in separate sealed envelopes. Mark the two envelopes clearly as **“Technical Bid”** and **“Financial Bid”**. Both the sealed envelopes should be sent in a single sealed envelope, with clearly marked as Quotation for as **“Twin Rotor Multiple Input Multiple Output System”**. The quote should reach the following address on or before **12/03/2015 up to 5.00PM**.

**Name : Dr. S. Janardhanan**

**Address : Control Lab,  
Room No. II-214,  
Department of Electrical Engineering,  
IIT Delhi, New-Delhi – 110016 ( India )**

2. Please quote the price at FOB / CIF New- Delhi, inclusive of installation charges.
3. Quote should be in Indian Rupees as well as US Dollars or GBP and to be valid for at least three months.
4. Attached all technical literature and list of similar installation done in India.
5. Warranty as per OEM.
6. Mention if you can provide any technical support like training of IIT Delhi personnel at IIT Delhi or in your factory and providing a technical person for operation of the equipment for the initial period of 2 years. Kindly mention about this in technical bid.
7. If the quote is being submitted by the representative of the principals/manufactures themselves, a valid Agency ship/ Dealership certificate authorizing the agent to quote to IIT Delhi on behalf of the Principals should be enclosed.
8. The institute reserves the rights to accept/reject any/all quotations without assigning any reasons thereof.
9. Complete set of manuals for the operation of the equipment should be given. All circuit diagrams, other mechanical and electrical schematics must be provided to main unit, sub systems and accessories.
10. Delivery within 20 weeks on receipt of PO.
11. Clearly specify the installation requirements – Such as space, power, frequency, environment ( Temperature and Humidity) .
12. If the item quoted are proprietary in nature, please enclose proprietary certificate from the principals stating “certificate that ----- is proprietary item of M/s ----- and no other manufacture make these items”.
13. If the bidder is Indian agent, the agency certificate should be enclosed.
14. Please produce compliance certificate for the specification.
15. Please ensure that the Indian agent has been enlisted with the Department of Expenditure, evidence may please be attached.
16. All bank charges payable in India are to buyer’s account and the bank charges in seller’s country to seller’s account.



**(Dr. S. Janardhanan)**

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