QUESTIONNAIRE FOR DESIGN AND DEVELOPMENT OF HEXA-PEDAL ROBOTIC MULE AS MAKE II PROJECT

1. **Company Details**.

(a) The category of company, whether large/ medium/ small or start up?

(b) Years of existence (Established in _____)?

(c) Annual turnover of the company?

(d) The credit rating of company and net worth?

(e) Annual profit in last three financial years?

(f) The shareholding pattern of the company?

(g) Whether the company is OEM, manufacturing agency or system integrator?

(h) Experience of the company in related fields?

(j) Whether similar equipment has been supplied to any other government agency (Type of equipment, quantity and cost)?

(k) Whether company has patents/ IPR of any critical components/sub-systems?

(l) Whether the company has any tie-ups/ Joint ventures with any foreign firm for producing similar equipment?

2. **Infrastructure**.

(a) Does the company have adequate infrastructure to develop, integrate and manufacture? If not, what would be the procedure and timelines to establish the same?

(b) Does the company have adequate infrastructure for carrying out trials and testing of the equipment?

3. **Cost**.

(a) Cost of the prototype and the product (unit cost and total cost)?

(b) Minimum quantity economically viable for business?

(c) Quantity of prototype recommended for user trials?

4. **Indigenous Content**.

(a) Likely achievable indigenous content at prototype as well as production stage?

(b) Details of important sub systems and enabling technologies of Hexa-Pedal Robotic Mule?

(c) Critical technologies identified for the system and details of critical technologies not likely to be available in India, to be sourced ex-import (in cost percentage terms)?

(d) Sub-systems/equipment manufactured by the company and details of outsourced equipment along with details of the manufacturer?

(e) Details of Intellectual Property Rights (IPR).

5. **Time for Manufacture**. Likely time for development of the prototype (in weeks) and manufacturing capability of the product (per year capability).

6. **Broad Details/Technical Specifications of Existing Products/ Under Development or Capable of Being Manufactured**.

(a) **Technical Parameter**

(i) **Mobility and Terrain Adaptability**

(aa) What is the expected maximum speed of the Hexapedal Robotic Mule on different terrains (flat, rugged, or inclined)?

(ab) What is the maximum obstacle height or ditch width the system can cross?

(ac) Can the system operate in confined spaces and what is the minimum turning radius?

(ad) What mechanisms ensure stability on uneven or challenging terrain?

(ae) How does the system adapt to various terrains like mud, snow or rocky ground?

(ii) **Payload Capacity and Modularity**

(aa) What is the maximum payload capacity and can it carry varied loads like ammunition, medical supplies or tools?

(ab) Are payload mounts modular for quick changes in field conditions?

(ac) How does the system manage load distribution for balance and stability?

(ad) Can the mule accommodate specialized payloads like stretchers, for lying human casuality or surveillance equipment?

(iii) **Power Source and Energy Efficiency**

(aa) What type of power source is proposed (battery, fuel cell or hybrid)?

(ab) How long can the system operate under full load on a single charge or full tank of fuel?

(ac) Does the system include energy regeneration features (e.g., braking or descending)?

(ad) What is the recharge or refuelling time for the system?

(ae) Are power modules swappable and can this be done in field conditions?

(iv) **Navigation and Control Systems**

(aa) What sensors are used for navigation and obstacle detection (e.g., LiDAR, AI, cameras)?

(ab) How does the system function in GPS-denied environments?

(ac) What levels of control are supported (manual, semi-autonomous, fully autonomous)?

(ad) Can the system perform pre-programmed missions or real-time navigation?

(ae) Is there an option for 'following a human operator' and 'swarm operation'?

(v) **Communication and Integration**

(aa) What is the communication range for remote operations?

(ab) Is the system compatible with military-grade encrypted communication?

(ac) Does it support integration with existing command and control platforms?

(ad) Can it relay live feeds or system health data to operators in real-time?

(ae) How does the system maintain communication in signal-obstructed environments?

(vi) **Structural Durability and Environmental Resilience**

(aa) What is the system's operational temperature range?

(ab) How resistant is the system to water, dust and electromagnetic interference?

(ac) What materials are used to ensure durability in rugged conditions?

(ad) Can the system withstand shocks, vibrations and impacts during transport or operation?

(vii) **Maintenance and Life Cycle**

(aa) What is the expected service life of the system?

(ab) What tools and skills are required for routine maintenance and repairs?

(ac) Is predictive maintenance integrated to reduce downtime?

(ad) Are spare parts standardized and easily available?

(b) **Operational Parameters**

(i) **Mobility**

(aa) What is the maximum gradient or incline the system can ascend and descend?

(ab) How does the system recover from tipping or loss of balance?

(ac) Can the system perform lateral movements (crab-walking) for manoeuvring in tight spaces?

(ad) How does the system handle sudden changes in terrain (e.g., transitioning from flat to rocky)

(ii) **Payload Handling**

(aa) How quickly can payloads be attached or detached in the field?

(ab) Can the system operate effectively with asymmetric or unbalanced loads?

(ac) Does the payload system allow simultaneous use of multiple configurations (e.g., carrying supplies and a surveillance module)?

(iii) **Power and Endurance**

(aa) What is the maximum operational endurance (in terms of time or distance) under full load?

(ab) How does the system indicate low power levels or the need for recharging?

(ac) Can the system be deployed for long-duration missions without frequent refuelling or recharging?

(iv) **Navigation and Autonomy**

(aa) What is the system's capability for self-navigation in unfamiliar or dynamic environments?

(ab) Can the system autonomously return to base if communication is lost or power is low?

(ac) How effectively does the system avoid obstacles or adapt to sudden environmental changes?

(v) **Safety and Fail-Safes**

(aa) What safety mechanisms are in place to prevent collisions with personnel or obstacles?

(ab) Does the system include an emergency shutdown feature?

(ac) How does the system ensure operational safety in case of sensor or power failures?

(vi) **Environmental Adaptability**

(aa) Can the system operate reliably in extreme weather conditions like heavy rain, snow or sandstorms?

(ab) What is the water-wading depth and how does the system perform in shallow rivers or swamps?

(vii) **Deployment and Logistics**

(aa) What is the time required to deploy the system in operational settings?

(ab) Is the system compatible with standard military logistics for transportation (trucks, helicopters, etc.)?

(ac) How easily can the system be relocated and redeployed during dynamic operations?

(c) **Product Support**

(i) Ability of the company to sustain product through the life cycle (___ years) (including accessories and upgrades)?

(ii) How will continuous supply of accessories be ensured from?

(iii) Recommended requirement of SMTs/STEs, sigs and fixtures?

(iv) Warranty period of the product?

(v) Ease to carrying out the schedule servicing & maintenance tasks. Any recommendation for further easing the tasks?

(vi) Any difficulty expected/ encountered while carrying out service tasks?

(vii) What are the details of frequency and periodic servicing required to be carried out on the eqpt? Define Periodicity.

(viii) Is there sufficient accessibility for use of tools for servicing, removing and refitting assemblies and components which requires frequent maintenance?

(ix) Are the various SMTs/ STE listed by manufacturer adequate as per repair and maintenance point of view?

(x) Is there any special or unusual technique required for removal, repair, refitting and testing of any of the assys/ components? If any, give details.

(xi) Are interchangeable components performing identical functions?

(xii) Are all bolts, studs, screw, grease nipple and terminals generally of standard metric size?

(xiii) Is there any requirement of calibration of Assy/Sub Assy? If Yes, then the periodicity to be defined.

(xiv) List them out along with their equivalents, if known, otherwise specification from the manufacturers will be obtained and mentioned in MET report.

(xv) Any special Oils and lub required for extreme cold condition at high altitude area (HAA)?

(xvi) Is there any software involved in the eqpt? If Yes, then the requirement for update & periodicity to be defined.

(d) **Other Aspects**

(i) Any other relevant details about the system, if not included in the Questionnaire may be provided.

7. **Response Time**. The questionnaire is requested to be responded by prospective vendors to the contact person mentioned at para 8 below within **21 days** of uploading on the Dept of Defence Production website.

8. **Contact Details**

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