MOST IMMEDIATE

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No. 5651/Uni/Tech Coord/ARDIC/HIT

07 February 2024

To: All Concerned

Subject: **Invitation to Participate in Vehicle Modeling and Analysis Competition**

Dear Sir,

I trust this letter finds you in good health. I am writing to inform you about an exciting opportunity for the talented researchers / students of your university to participate in "*3D modeling and analysis of armoured vehicles*" competition. The event, organized by the *"Advanced Research, Development and Information Centre (ARDIC) – Heavy Industries Taxila"*, presents a unique opportunity for your esteemed institution to showcase its true potential in the realm of Engineering Design.

Competition Details. The competition challenges researchers / students to carryout 3D modeling and analysis in the following categories:

- **Project I**: Wheeled Armoured Security Vehicle - Details as per Annex 'A'
- **Project II**: 4x4 Mine-Resistant Ambush Protected (MRAP) Vehicle - Annex 'B'

This initiative aims to foster innovation, creativity, and technical proficiency among researchers / students pursuing degrees in relevant fields. We firmly believe that researchers / students of your university possess the necessary skills and expertise to contribute significantly to this competition. Researchers / students are welcome to participate individually or form groups, supervised by senior faculty members, and may choose to compete for one or both Projects. Key highlights of competition are: -

- **Task**. 3D modeling and analysis of Category I, Category II or both.
- **Submission Deadline**. April 30, 2024
- **Evaluation Criteria**. As per criteria defined in attached details. A jury, consisting of four members headed by Chairman HIT, will evaluate the design products. Shortlisted researchers / students will be invited for a presentation at HIT. HIT reserves the right for rejection of submissions in case of non-compliance to technical requirements.
- **Prizes**.

	Project – I	Project – II
1st Place:	Rs. 800,000/-	Rs. 1,200,000/-
2nd Place:	Rs. 300,000/-	Rs. 300,000/-

We encourage participation from researchers / students across various departments, as this competition provides a unique platform to integrate theoretical knowledge with practical application. To express interest or request further information, please contact our organizing committee representative AWM Bilal Ibrahim at *dadt-ar@hit.gov.pk* or *0321-6876650*. Upon confirmation of participation, detailed guidelines, specifications, design bounds, and additional resources will be provided.

We are confident that your university has a wealth of talented researchers / students who would greatly benefit from this competition. We eagerly anticipate witnessing the creative contributions from your institution.

Sincerely,

sdxxx
Managing Director (ARDIC)

Annex 'A'

Project – I

Wheeled Armoured Security Vehicle

1. HIT intends to design and manufacture of body Structure of armoured wheeled vehicle using commercially available Land Cruiser 79 Series chassis. An open competition is announced among different universities to select most aesthetic and aggressive shaped outer profile of armoured vehicle to undergo design and manufacturing process in HIT.

2. Final submission for competition should include following:

   a. **Vehicle CAD model:** Competitors are invited to build 3D CAD model of complete outer profile of wheeled vehicle using chassis frame and layout drawing attached as Appendix-I of this document. Outer profile be built using 6.5mm steel and 45 mm thick glass wherever applicable in model. Steel density be taken as 8.0 g/cm^3 and Glass density be taken equivalent to Aluminum to depict bullet proof glass. Maximum bend angle allowed for 6.5 mm steel sheet is 30^o. Outer bounds in terms of crew and engine compartment should not deviate from layout given in Appendix-I. Competitors are encouraged to study available bullet proof vehicle designs used world over and to come up with a novel, aesthetic, aggressive and manufacturing friendly design. Conceptual design should not be copied to infringe intellectual property rights. Competitors may develop 3D model in any CAD packages however Creo software is preferred being industry standard used in HIT.

   b. **Vehicle Analysis Model:** Alongside 3D CAD model, competitors need to submit an engineering analysis model of designed vehicle platform with following calculations / analysis:

      (1) Gross vehicle weight (GVW) to be calculated using available chassis weight, crew weight (Seating cap incl crew is 10) and material weight allocated in vehicle outer profile.

      (2) Calculation of center of gravity of design vehicle.

      (3) Mathematical modeling of vehicle dynamics to ascertain vehicle's longitudinal and lateral / steering performance. Model should be capable to calculate following:

         (a) Uphill vehicle performance

         (b) Steering wheel angle and vehicle roll angle

         (c) Yaw rate and vertical forces of sprung masses.

(4) Comparative analysis of base Land Cruiser 79 Series and newly designed vehicle be also carried out supporting why new design is chosen.

(5) Power curves of any compatible 200hp engine with five speed manual gear shift be used in vehicle analysis model.

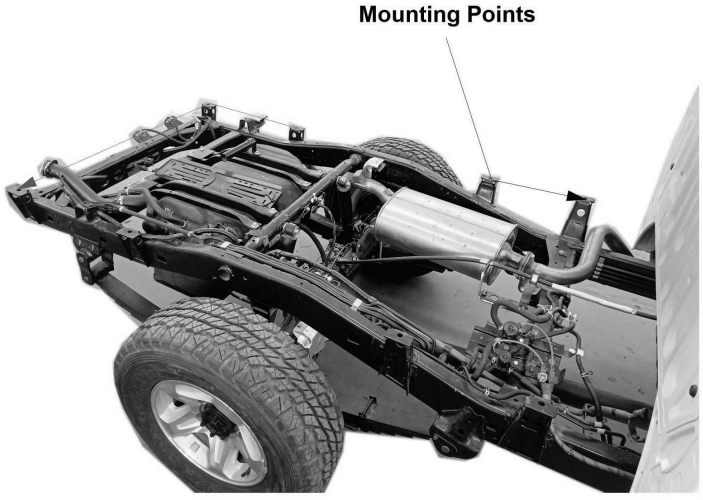
(6) Any other analysis not covered above can be carried out by the competitors.

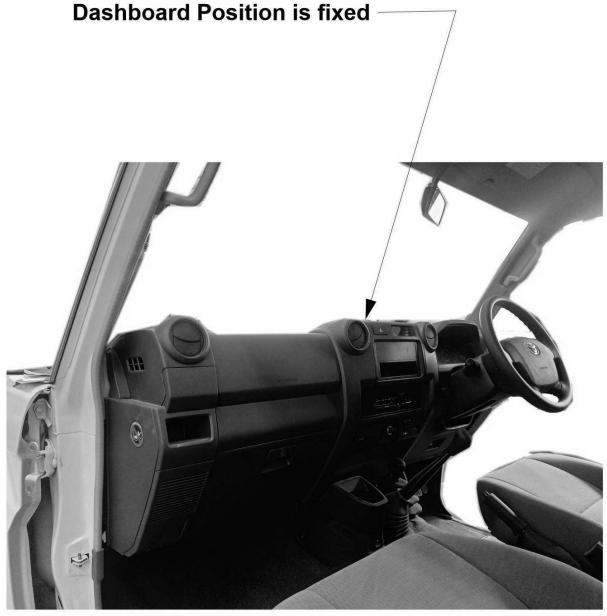
SPECIFICATIONS

Ground Clearance	-	180mm(From Rear Leaf Spring)
Steering	-	Power Steering
Tyre	-	LT 285/75R16
Turret	-	360° Rotation with Provision of MG1A3 Gun Mount
Seating Capacity	-	08 (2+2+4)
Gradeability	-	60%
Slide Slope	-	30%
Curb Wt	-	2100kg
GVW	-	5.8 T

NOTE:

Competitors will be allowed to take the dimensions of Mounting Points.





Annex 'B'

Project – II

1. HIT intends to develop monocoque 4x4 MRAP with maximum GVW of 12-14 Tons. An open competition is announced among different universities to select most aesthetic and aggressive shaped outer profile of armoured vehicle to undergo design and manufacturing process in HIT. MRAP monocoque structure / outer profile should be built using 6.5mm steel and 45 mm thick glass wherever applicable in model. Steel density be taken as 8.0 g/cm^3 and Glass density be taken equivalent to Aluminum to depict bullet proof glass. Maximum bend angle allowed for 6.5 mm steel sheet is 30^o. However, welding is allowed to get any shape in side profile of MRAP. Competitors are encouraged to study available 4x4 MRAP designs used world over and to come up with a novel, aesthetic, aggressive and manufacturing friendly design. Conceptual design should not be copied to infringe intellectual property rights. Competitors may develop 3d model in any CAD packages however Creo software is preferred being industry standard used in HIT.

2. Final submission for competition should include following:

   a. **Vehicle CAD model:** Competitors are invited to build 3D CAD model of complete outer profile of MRAP conforming following specifications.

Parameters	Specs
Power to wt Ratio (HP/Ton)	25
Seating Cap incl crew	10
Engine HP	350
Tx	Auto
Protection	Lvl 2; Upgradable to lvl 3
Suspension	Independent
Tyres	Runflat
GVW(Ton)	15
Payload (Ton)	2.0
Length (m)	6-7
Width(m)	2.5-3.0
Height(m)	2.5-3.0
Hull Config	Monocoque
RCWS	12.7mm (Optional)

Table 1 4x4 MRAP

b. **Design Characteristics:** Vehicle should be capable to be deployed on-road and off road (cross country) and should be a 4x4 Right Hand drive vehicle providing required ballistic and blast protection while option of converting the vehicle from Right Hand Drive to Left Hand Drive should also be there. It should be able to integrate Remotely Controlled Weapon station (14.5 mm / 12.7 Gun). The vehicle must have a good power to weight ratio to maneuver all types of terrain such as boggy, sandy, undulated, hilly and scare growth.

c. **Hull Configuration:**

(1) The V-shape monocoque hull.

(2) 5 x door configuration (1 x left, 1 x right, 1 x left 2nd seater, 1 x right 2nd seater, 1 x rear door/ ramp).

(3) 1 x emergency cargo/ firing hatch (top side).

d. **Seating Capacity:**

(1) 10 Personnel including driver.

e. **Weights:**

(1)	GVW	12 -14 Ton

f. **Performance (Minimum):**

(1)	Gradient	70 %
(2)	Side slops	35 %
(3)	Angle of approach	45 °
(4)	Angle of departure	45 °
(5)	Ground Clearance	350 mm
(6)	Turning radius	7 - 9 m
(7)	Fording	1000 mm (without preparation)
(8)	Ditch Crossing	600 mm
(9)	Vertical Obstacle	400 mm

3. **Vehicle Analysis Model:** Alongside 3D CAD model, competitors need to submit an engineering analysis model of designed vehicle platform with following calculations / analysis:

a. Gross vehicle weight (GVW) to be calculated using available chassis weight, crew weight (Seating cap incl crew is 10) and material weight allocated in vehicle outer profile.

b. Calculation of center of gravity of design vehicle.

c. Mathematical modeling of vehicle dynamics to ascertain vehicle's longitudinal and lateral / steering performance. Model should be capable to calculate following:
   (1) Uphill vehicle performance
   (2) Steering wheel angle and vehicle roll angle
   (3) Yaw rate and vertical forces of sprung masses.
d. Power curves of any compatible engine with auto gear shift be used in vehicle analysis model. Make and Model of engine must be mentioned in the report.
e. Any other analysis not covered above can be carried out by the competitors.