



CENTRE FOR TECHNOLOGY DEVELOPMENT AND TRANSFER
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Lr. No: 2021IN1133/CTDT

Dated: 07.09.2020

Dear Professor,

Sub: CTDT – Research / Consultancy services by CVRDE - Regarding.

Combat Vehicles Research and Development Establishment (CVRDE) would like to avail research / consultancy services from interested academic institutions during various phases of their project. Based on interest, cost information shall be provided to CVRDE at the earliest to enable them to complete the pre-project planning activities by 15th September 2020. A Brief introduction and indicative list of work packages of CVRDE is enclosed in the annexure.

All the interested regular faculty members are encouraged to submit the consultancy project to CVRDE through CTDT.

DIRECTOR, CTDT

To

1. All the Deans of Main Campus / Constituent Colleges / Regional Campus
2. All Heads of the Department / Directors of Centre & Institute
3. Director, RCC (with a request to communicate to all staff members through University mail)
4. PS to Vice-Chancellor
5. PA to Registrar
6. Stock file

Research/Consultancy Services from Academic Institutions for Proposed DRDO/CVRDE Project
Development of Technologies for Active Protection System
Ver: 0.1 Date: 03 Sep 2020

Armoured Fighting Vehicles are currently protected by passive and reactive armour solutions. New innovative solutions are required to provide survivability against ever-increasing lethality of anti-armour threats as the weight of the current generation tanks has already reached the limit. Active protection systems (APS) can provide this capability without significantly affecting mobility. They neutralise/ defeat the incoming threats before they hit the tank (unlike passive and reactive solutions) by automatically acquiring, tracking and responding with countermeasures (kinetic or explosive means for hard-kill APS systems) to neutralize anti-armour threats.

CVRDE would like to avail research/consultancy services from interested academic institutions during various phases of the project. Based on interest, cost information shall be provided to CVRDE at the earliest to enable us to complete the pre-project planning activities by 15 Sep 2020.

Work packages related to the design, development, test & evaluation of specific sub-systems related to active protection systems shall be considered. Along with functional requirements, requirements related to reliability, quality and safety shall also be considered. The work packages may also include System engineering studies, algorithm development, modelling & simulation, etc. Some of the work packages are indicated below.

Work Package - 1: Trajectory generation:

Modelling and simulation of anti-armour threat trajectories are required to study the sensor detection and tracking, fire control algorithms and interceptor miss distance analysis. Anti-armour threats include anti-tank rockets, anti-tank guided missiles (both 2nd and 3rd generation), tank fired chemical energy & kinetic energy projectiles.

Work Package – 2: Target state estimation and/or data fusion

Based on the sensor (radar and IR) data, APS central computer need to estimate the incoming threat information using estimation algorithms (e.g. Kalman filter). Target states to be estimated include instantaneous range, azimuth and elevation angles, instantaneous velocity and flight path angles. Data fusion algorithms may also be required to fuse multiple sensor data. The estimation algorithm needs to run in hard real-time (1 ms update rate).

Work Package – 3: Counter fire control algorithm

Using the estimated threat information, the counter-fire algorithm (implemented in central computer) needs to perform the following functions at the update rate of 1 ms.

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- a) Compute predicted impact point (PIP) of the inbound threat
- b) Discriminate whether threat will overfly, hit or miss the vehicle based on PIP.
- c) Compute time remaining to impact the protected vehicle
- d) Compute time to launch counter-measure considering the velocity of the threat and the counter-measure so as to intercept at chosen intercept distance
- e) Chose appropriate launcher and countermeasure
- f) Compute angle of launch and command launcher to slew in both azimuth and elevation angles
- g) Enable counter-fire command at time to launch.

Work Package – 4: Launcher control system

1. Technical areas shall be assessed for the development of tactical launcher including, but not limited to, the following
 - a. Rotary electro-mechanical system configuration – mechanical and electrical
 - b. Servo control structure, strategies, and design of servo-controller
 - c. Feedback sensors
 - d. Launcher power supply unit including
 - i. DC-DC converter (28V to ~600V)
 - ii. Fast charge and discharge mechanisms capable of delivering high peak current required for servo drives and counter-ammunition launch
 - e. Effect of external disturbances (including recoil forces, vehicle motion, etc.) on positional accuracy
 - f. Effects on protected platform during firing of counter-ammunition
 - g. Testing mechanisms
2. RSP shall conceptualize, study, and analyze requirements for the tactical launcher suitable for integration in AFV.
3. RSP shall carry out design of modules suitable to meet the derived requirements and generate realistic simulation models to prove the design.
4. RSP shall select suitable commercially available components to meet the design and integration requirements.
5. RSP shall participate in all design reviews, interaction with development partner and product testing.

Work Package – 5: Modelling & simulation of IR Sensor

IR sensor need to be modelled to detect and track anti-armour threat signatures (aerodynamic heating of projectiles, missile plume, gun/muzzle flash).

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Work Package – 6: Modelling & simulation of Radar sensor

Modelling & simulation includes both FMCW radar and pulsed Doppler radar for staring transmitter configuration and adaptive virtual beamforming receiver concepts.

Work Package – 7: Real time Ethernet network

Modelling, simulation and analysis of real time Ethernet network (with Audio Video Bridging protocol, Time triggered Ethernet, etc.)

Work Package – 8: APS end-to-end simulation

Integration of various modelling and simulation packages (threat trajectory, sensor model, threat estimation, counter-fire algorithm, launcher control system, end game including counter measure and threat interaction)

Work Package – 9: Design for X

Design and testing for quality, reliability, safety, availability, maintainability, etc during the design and development phase of the project.

Work Package – 10: EMI/EMC

Consultancy for EMI/EMC design, qualification and testing

Work Package – 11: Durability for operating environment

Consultancy for durability design, qualification and testing

Work Package – 12: Technology/project management

Consultancy for technology and project management.