ATTACHMENT 1: DET Domain and Topic Area Technology Development Prototype Requirements

The purpose of this attachment is to describe the Domains, Domain A: High Energy Laser (HEL) and Domain B: High Power Microwave (HPM) and associated topic areas as well as provide associated response requirements. The topics outlined in each domain are primarily associated with >6 TRL capability developments. Figure 1, Overview of DET Topic Areas shows how these may fall.

The Government requests vendors to self-assess their TRL within their responses. The response should clearly discuss why the vendor is self-assessing at the TRL declared and provide a technical approach for achieving a greater TRL for potential production and fielding of the capability and prototype.

The Government understands that higher TRL technologies may begin with some S&T feasibility risk reduction but are intended to progress and produce fielded capability(ies).

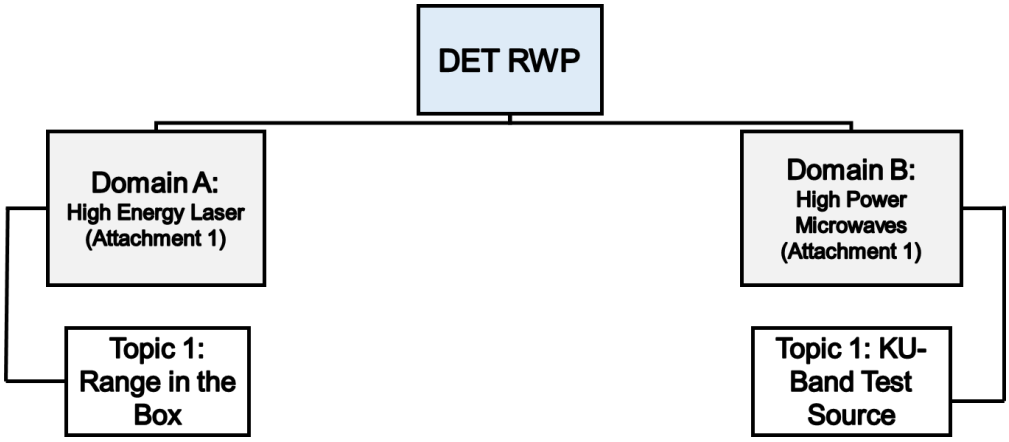

Fig 1. Overview of DET Topic Areas

Domain A: High Energy Laser (HEL)

1. Range in the Box (RiB)

The Government is seeking solutions for the development of a Range in a Box (RiB) to provide the capability to diagnose High Energy Laser (HEL) system performance at range. This capability will provide significant risk reduction to HEL programs by providing testing capabilities before and after platform integration. The RiB is to emulate far field target returns during HEL system ground propagation tests to assess performance through different atmospheric conditions. The required RiB capability is to verify and measure the tracking, wave front compensation, residual beam centroid jitter & drift, aim-point offset, aim-point control, and irradiance profile of the HEL system at a simulated far field target using a sample of the HEL or Surrogate HEL (SHEL) beam; and to capture and measure HEL beams. The RiB shall provide surrogate return signals to simulate point source and illuminated extended source targets including mid-wavelength infrared (MWIR), track illuminated, and beacon illuminated targets in the far-field. The RiB shall be used for ground testing of full HEL systems prior to and after installation on an air, ground or shipboard platform including alignment of the line-of-sight of the HEL system and identify techniques to make the system adaptable to the various weapon platforms. The RiB system inputs include surrogate, pulsed, or continuous wave (CW), Track Illuminator Lasers (TILL) and Beacon Illuminator Lasers (BILL) to replicate far field target returns to ensure all

pointing, tracking, wave front, and jitter control elements are exercised and functioning nominally. The RiB shall provide capabilities for atmospheric distortion of the optical path to far field targets to verify the system atmospheric compensation capability. In addition, the RiB should have a high-power beam diagnostics capability that shall be able to measure the HEL, TILL, and BILL beam power, and near field beam profile. The RiB shall be isolated from both ambient mechanical and acoustic disturbances, and/or account for the disturbances in the diagnostic measurements while testing the HEL System in a quiescent or vibration environment. The expected deliverable quantity is one prototype system. The RiB prototype system shall meet the following high-level requirements:

Key Performance Parameters (KPP)	Threshold	Objective
Minimum RiB Input Clear Aperture	60 cm (40 cm HEL [either filled or obscured] with separate aperture MWIR/CT 15 cm plus separate aperture TIL)	90 cm (60 cm HEL [either filled or obscured] with separate aperture MWIR/CT 25 cm plus separate aperture TIL)

Key System Attributes (KSA)	Threshold	Objective
Max HEL Power into Beam Dump	150 kW	500 kW
Max HEL Sample/Surrogate at RiB Entrance	100 Watts	300 Watts
HEL Sample/Surrogate Wavelength Range	1.045 μm – 1.085 μm	Same
Hit Spot & HEL Dwell Time Measurement Duration	10 sec	20 sec
Simulated Far-Field Target Ranges	5 km and 10 km	5 km, 10 km, and 18 km
Sample/Surrogate HEL Hit Spot Centroid Size Accuracy	+/- 5% of the $1/e^2$ beam diameter averaged over 1 second	Same
Hit Spot Centroid Size Sample Rate	30 Hz	100 Hz
Hit Spot Centroid Position Sample Rate	10 Hz	30 Hz
Hit Spot Centroid Angular Position Error Resolution	500 nrad (output space)	Same
Beam Spot Jitter Power Spectral Density Frequency Range	10 Hz – 100 Hz	30 Hz - 300 Hz
Jitter Angular Resolution	250 nrad (output space)	Same
Drift Angular Resolution	500 nrad (output space)	Same
Drift Determination Integration Rate	10 Hz	Same

Key System Attributes (KSA)	Threshold	Objective
Bucket Diameters for Far-Field Power in the Bucket (PIB)	5 cm and 10 cm (output space)	Same
PIB Sample Rate	10 Hz	30 Hz
Sample Measurement Accuracy of PIB	+/- 2%	+/- 1%
MWIR Target/Sensor Wavelength	3-5 μm	Same
Input/Simulated TIL Target Wavelength	1.4-1.6 μm	Same
Input/Simulated TIL return pulse format	CW	100 Hz $\leq$ PRF $\leq$ CW
Input TIL Average Power	<50 W	< 100 W
Input/Simulated BIL Reference Wavelength	0.8-0.98 μm or 1.2-1.3 μm	0.8-0.98 μm and 1.2-1.3 μm (Selectable)
Input/Simulated BIL return pulse format	100 Hz $\leq$ PRF $\leq$ 10 kHz	Same
Input BIL Average Power	<50 W	< 100 W
Input/Simulated LRF Wavelength	1.4-1.6 μm	Same
Input LRF Average Power	<50 W	< 100 W
LRF Pulse Length	5 to 10 nsec	1 to 10 nsec
Surrogate MWIR, TIL and BIL Return Irradiance	100 nW/cm^2 to 100 μW/cm^2	Same

Domain B: High Power Microwave (HPM)

1. Ku-Band Test Source

The U.S. Army White Sands Missile Range Survivability, Vulnerability and Assessment Directorate (SVAD) has a Test and Evaluation (T&E) need to develop a DE HPM Ku-Band test and evaluation (KU-T&E) source meeting the KPP's and KSA's as shown below to assess lethality, survivability, and vulnerability effects of systems to an HPM environment IAW Military Standard 464C (MIL-STD 464). The source will be required to be transportable in order to meet the secondary use case as noted below. This source shall be equipped with an HVAC system for self-contained environmental control. A single point power connection shall be supplied with the source to accept either building power or generator power. Generator Power for source transportation and remote operation shall be part of the source solution. Building power will be supplied by the Government.

The secondary use case for this DE HPM KU-T&E source will be to assess and evaluate combined /collateral effects of a DoD HPM weapon on DoD systems that are fielded in theatre in accordance with MIL-STD 464. This use case is to deploy the

transportable Ku-Band source to generate a combined environment using an external trigger to fire the Ku-Band source with precision.

The DE HPM KU-T&E source will supply the DoD with an enhanced capability to evaluate the lethality, survivability/vulnerability of mission critical DoD military systems to DE HPM attack or unintentional exposure from DoD HPM weapon sources. MIL-STD 464 prescribes system test guidance required for electromagnetic environmental effects, though specific requirements for HPM survivability are mission dependent and left to the procuring activity to specify additional requirements. Therefore, the DoD requires agile, frequency tunable sources which are scalable for T&E capabilities to meet the requirements of MIL-STD 464.

Key Performance Parameters (KPP)	**Threshold**	**Objective**
Tuning from 14 to 18GHz	Continuous, covering 50% of band	Continuous, covering full band
Key System Attributes (KSA)	**Threshold**	**Objective**
Bandwidth	~<1% Single-frequency	~<1% Single-frequency
3 dB Spot Size at Target	> 1 m^2 at ≤75 m	> 1 m^2 at ≥50 m
Pulse Width Adjustability	10 ns to 20 ns	10 ns to 20 ns
Pulse Repetition Rate	200 Hz	500 Hz
Pulse Burst Capability	100 pulses	500 pulses
Field Intensity Variability	10 dB	20 dB