

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0409

Topic # N16A-T010

Additive Manufacturing for Microwave Vacuum Electron Device Cost Reduction  
RadiaBeam Technologies, LLC

## WHO

**SYSCOM:** NAVSEA

**Sponsoring Program:** PEO IWS 2.0

**Transition Target:** Legacy Radars

**TPOC:**

(812)854-5264

**Other transition opportunities:**  
Future EW and countermeasures systems

**Notes:** Electron Beam Melting (EBM) additive manufacturing (AM) technology will produce vacuum electronic devices to meet on-demand, flexible, and affordable manufacturing requirements. This process reduces production costs by 70%.



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## WHAT

**Operational Need and Improvement:** Vacuum electronic device (VED) components, critical for RF systems with extremely high output power densities, require an additive manufacturing (AM) process to meet on-demand, flexible, and affordable manufacturing requirements. By using this method, VED's could be developed for use at higher frequencies and thus would bring new capabilities to millimeter wave systems as well as replace VED's in legacy systems at reduced cost.

**Specifications Required:** Dimensional tolerances are important. Notionally, the finalized part would meet the requirements, including surface finishing and tolerances.

**Technology Developed:** Electron Beam additive manufacturing will open opportunities for improved thermal management designs for RF circuit cavities as well as for more advanced RF circuit cavity designs. Directed Energy RF system such as HPM would also benefit. Higher frequency operations would require smaller devices. With X-Band in the 8-12 gigahertz range, smaller VEDs could be provided. S-bands, which are more numerous, would also benefit.

**Warfighter Value:** The technology being developed here offers a dramatic reduction in the manufacturing cost of MVEDs. Current coupled cavity TWTs would be produced on-demand and affordably. By using this method VED could be developed for use at higher frequency so be used in millimeter wave systems, leading to a new capability and as it could also replace VED's in legacy systems

## WHEN

**Contract Number:** N68335-18-C-0103 **Ending on:** February 14, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Additive Manufacturing (AM) system for production of copper parts w/ optimized material properties	Low	Meets material density, O2 content, UHV compatibility requirements	6	May 2019
AM system for production of copper parts with optimized geometric properties	Med	Meets surface finish, dimension, tolerances requirements	6	November 2020
RF cold testing of AM VED component	Med	Meets RF/electrical requirements	6	February 2021
AM system for direct production of microwave VED with 70% cost reduction	High	Industrial validation of VED component	8	May 2022

## HOW

**Projected Business Model:** RadiaBeam seeks to license the developed AM technology/designs.

**Company Objectives:** RadiaBeam is seeking interested parties in the developed AM technology/designs.

**Potential Commercial Applications:** This development will also open opportunities for improved thermal management designs for RF circuit cavities as well as for more advanced RF circuit cavity designs and any system using VED's (such as TWTs). Department of Energy has interest in this process.

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