

**Request for Network Insight**  
*in support of*  
**Strategic Radiation Test Equipment - Electron Linear Accelerator**

This S²MARTS announcement is intended to pulse NSTXL's Innovation Network to discover potential solutions that will evolve radiation testing. This request is for planning purposes only and does not constitute a Request for Solution or an invitation to submit formal proposals. The Government & NSTXL are not liable for reimbursing any costs associated with response preparation.

Naval Surface Warfare Center, Crane Division (NSWC Crane), Radiation Sciences Branch (GXMR), is interested in possibly pursuing the design and fabrication of a prompt dose rate Linear Accelerator (LINAC) prototype for radiation testing on electronic devices and Integrated Circuits (ICs).

Responses are requested no later than 12:00PM ET on Friday, 7/31/2020 and may be submitted via email to [S2MARTS@nstxl.org](mailto:S2MARTS@nstxl.org). No classified information may be included, and information contained within the response must be marked appropriately.

There are no formatting restrictions, however responses should be less than 10 pages (MS Word and/or Adobe PDF files preferred).

To best inform the acquisition strategy, NSWC Crane is requesting the following information which will be used for planning the associated budget, schedule, and requirements with our Strategic Program sponsors.

1. Approximate cost for the **design** of a LINAC with the proposed technical requirements (Table 1). Technical requirements may be influenced based on the collective feedback received, and any recommended adjustments/additions to the listed requirements (below) are welcomed as final requirements are formulated;
2. Approximate costs for the **fabrication** of a LINAC prototype with the formulated final technical requirements (Table 1); and,
3. A notional **schedule for the design and fabrication** of a LINAC prototype with the final technical requirements and yearly rolled up cost estimates.

NSWC Crane currently operates an electron LINAC to perform high dose-rate testing; however, there is a need to design and develop a new capability using modern components, such as solid-state electronics, capable of performing radiation effects testing long into the future.

Responses to this RFI may establish the Key Performance Requirements for the design and fabrication of a LINAC prototype. This prototype system will likely be installed at NSWC Crane, located in Crane, Indiana, in a government provided building.

It is intended that the LINAC will have an eventual technology readiness level of TRL 7 or 8 and will perform in the role of the primary irradiator for high-throughput operations for NSW Crane.

**LINAC PROTOTYPE TECHNICAL OBJECTIVES**

The device shall be a pulsed, traveling wave electron LINAC. The LINAC must include transient mode, and it must have variable endpoint electron energy, pulse width, and exposure dose rate. The Key Performance Parameters (KPP) are displayed in *Table 1*.

Focusing and steering elements shall give proper definition and direction to the electron beam for transport through the system to the target. The system shall have dual injectors and be capable of injecting a “long” and a “short” pulse within a specified time interval that is undefined.

It is important to note that the Government is seeking to learn more about innovative approaches, recent developments in technology, and alternative solutions that could potentially exceed the KPP thresholds listed below.

It is the Government’s intent to ensure the prototype is designed & developed to meet the criteria of NAVSEA RAD-010 for safety requirements.

Parameter (LINAC)	Unit	Threshold
Peak End Point Energy	MeV	≥ 40.
Operating Mode	N/A	E-Beam
Short Pulse Width (FWHM)	ns	10 - 40
Long Pulse Width (FWHM)	µs	1 - 10
Pulse Rise Time	ns	≤ 2
Pulse Fall Time	ns	≤ 2
Dose Rate (short pulse)	Rad (Si)/s	≥ 3x10 <sup>12</sup>
Dose Rate (long pulse)	Rad (Si)/s	≥ 3x10 <sup>10</sup>
Exposure Area Diameter	cm	≥ 2
Beam Current (during pulse)	A	≥ 20
Exposure Rate	per sec	≥ 1

*Table 1: KPPs for the LINAC*

**The following are definitions and clarifications for the KPPs:**

- 1) The Peak Endpoint Energy shall be the greatest electron energy produced by the simulator during a shot.
- 2) Operating mode shall be E-beam, but the simulator shall be supplied with hardware to produce x-ray exposure areas with lower peak dose rate. There are no performance requirements associated with the x-ray mode of operation.

- 3) Dose Rate - Pulse Width shall be measured between 50% of the peak dose rate on the rise and 50% on the fall. The Dose Rate – Pulse Width shall vary from shot to shot within the range indicated [i.e.  $\pm 20\%$  (threshold)].
- 4) Rise/Fall Times shall be measured prior to the peak between 10% and 90% of the peak.
- 5) Dose Rate shall be measured in air exterior to the LINAC's output window.
- 6) The Exposure Area shall be the area in a plane perpendicular to the output window's centerline over which the area-weighted average dose ranges from its peak to 50% of peak (i.e. the area with 2:1 uniformity).
- 7) Control computers with installed control software shall be included. The software shall be able to monitor LINAC diagnostics and provide the Human/Machine interface to the control system.

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