PERSPECTIVE ON PROCUREMENTS OF MAJOR COMPONENTS FOR THE LANSCE ACCELERATOR MODERNIZATION PROJECT (LAMP)

D. A. Dimitrov*, R. Lujan, H. Xu, D. Gorelov, T. Grumstrup, R. Roquemore, T. Hartzell, L. Rybarcyk, S. Kurennoy, D. Dominguez, J. Montross, J. Medina, J. Lyles, M. Barrueta, M. Gulley, M. Pieck, M. Holloway, M. Johnson, M. Bowman, R. Thornton, S. Herrera, W. Hall, S. Swickley, J. Lewellen, G. Dale
Los Alamos National Laboratory, Los Alamos, New Mexico, USA

Abstract

The Los Alamos Neutron Science Center (LANSCE) accelerator delivers different beams to multiple experimental stations simultaneously. These beams have different intensity and time structure. The LANSCE Accelerator Modernization Project (LAMP) seeks to upgrade the technology in the front-end while preserving the unique capabilities of LANSCE. LAMP seeks to replace the two 750-keV Cockroft-Waltons with a single Radio Frequency Quadrupole (RFQ), and a new 100-MeV Drift Tank Linac (DTL). Procurements represent a significant portion of the project's funding and drive schedule decisions. We discuss the process to procure major accelerator components for LAMP with our initial focus on the acquisition of the RFQ and the first tank of the DTL.

INTRODUCTION

The accelerator complex now known as the Los Alamos Neutron Science Center (LANSCE) began operation in 1972 as LAMPF, the Los Alamos Meson Production Facility. In the intervening 53 years, the complex has been expanded in capability several times, both in terms of its accelerator performance and the user facilities it supports.

Today, the LANSCE accelerator is unique in the world both for its ability to concurrently accelerate two beam species, H^+ and H^-, and to support simultaneous user operations at five separate facilities [1]: the Isotope Production Facility, the Lujan Neutron Scattering Center, the Weapons Neutron Research facility, Proton Radiography, and the Ultracold Neutron source. LANSCE also supports specific run modes enabling direct access to the 800 MeV proton beam for diagnostic development, space-radiation testing, and other applications. The LANSCE complex supports a wide variety research critical to the US national security, the broader neutron-based research community, and the national medical isotope program.

Although various aspects of the LANSCE accelerator complex have been upgraded and enhanced over the preceding five decades, the linear accelerator structures themselves are essentially unchanged from their initial installations. In recent years, it has become apparent that the 750 keV Cockcroft-Walton (C-W) based injectors and 100 MeV drift-tube linac (DTL), in particular, have reached the end of their service lives.

The LANSCE Accelerator Modernization Project (LAMP) will replace the "front end" of the LANSCE accelerator, from the ion sources [2] through the end of the DTL, to ensure operation of the facility through at least 2050.

The LAMP conceptual design [3] is based on the use of modern accelerator design approaches and structures, many of which have evolved considerably since the inception of LAMPF. The LAMP DTL, for instance, will incorporate permanent-magnet quadrupole focusing and in-tank diagnostics such as beam current and position monitors. A radio frequency quadrupole (RFQ) accelerator will be used to accelerate the beams from the ion sources for injection into the DTL.

The project has a strategy for efficient execution reflected in its schedule shown in Fig. 1. We have developed an approach for phased early procurements timed to coincide with design maturity, prototyping, removal and installation to meet the schedule. The critical path, shown with red line segments in Fig. 1, indicates the essential role of procurements, in particular large and long-lead ones, to meet the schedule.

Technology development represents one of the two main thrusts of the project. The project has performed an initial internal assessment of Critical Technology Elements (CTEs) and is planning appropriate technology maturation efforts. Technology maturation areas include high-performance beam chopper development, the RFQ Test Stand (RFQTS), and the LAMP in the ADEF (Accelerator Development and Engineering Facility) Tunnel (LAT) demonstration accelerator.

For LAT, we will construct through the first DTL tank in the ADEF tunnel for CTE demonstration and pre-commissioning activities. The LAT test stand effectively represents the new LANSCE front end up to the first DTL tank. A three-dimensional (3D) solid model of the LAMP beam line conceptual design up to (a portion) of the first DTL tank is shown in Fig. 2.

Here, we discuss our approach to procure major accelerator components for LAT and focus on the RFQ and the DTL first tank procurements.

WE USE A TEAM APPROACH TO PROCUREMENTS

At the Los Alamos National Laboratory (LANL), LAMP is an institutional priority and is supported as such by

* dandd@lanl.gov

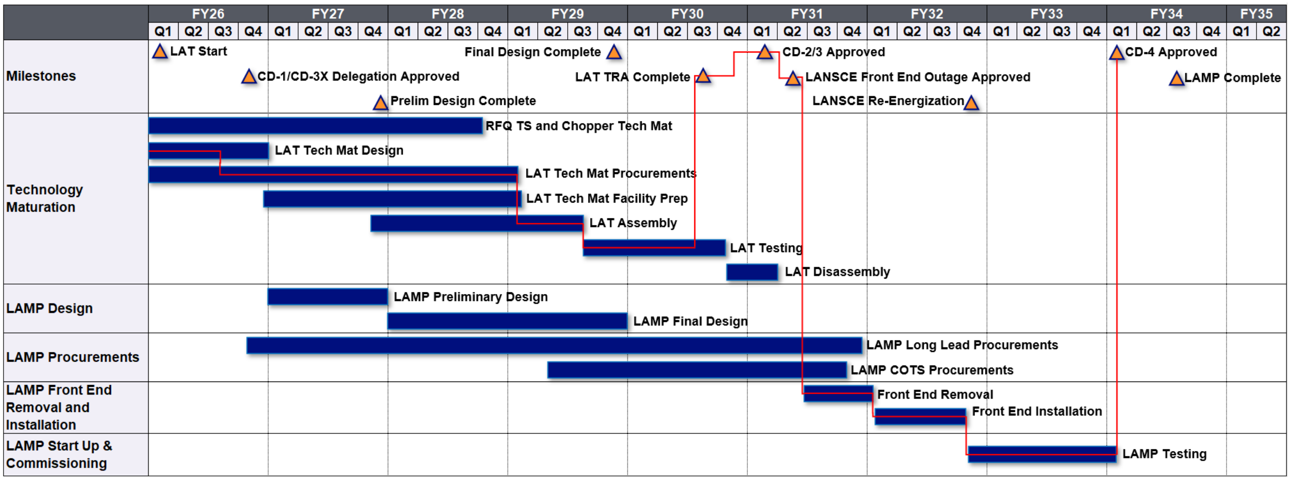

Figure 1: The project schedule is designed for efficient management and delivery of the new front end. The red line indicates the critical path. It highlights the critical importance of delivering procurements to maintain the schedule.

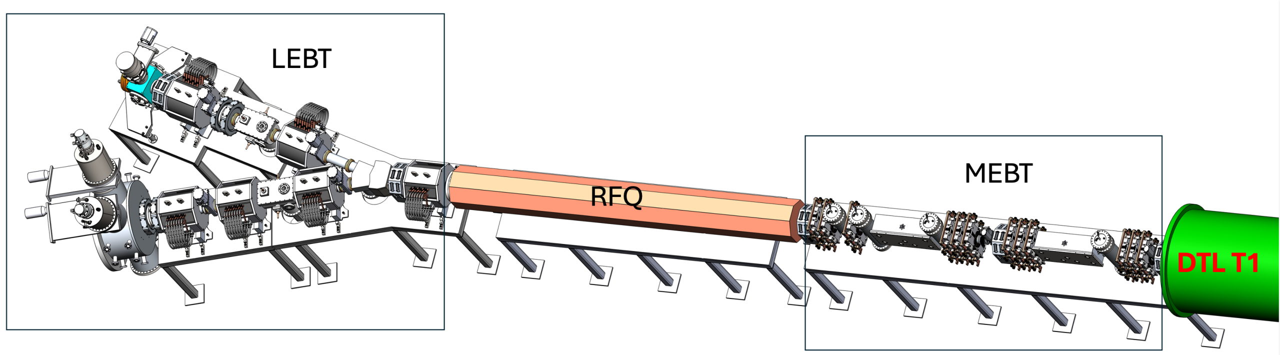

Figure 2: The low-energy beam transport (LEBT), the radiofrequency quadrupole (RFQ), the medium-energy beam transport (MEBT), and the drift tube linac (DTL) with only a portion of DTL tank 1 (T1) are shown in the three-dimensional solid model we have developed for the LAMP conceptual design.

LANL's Acquisition Services Management (ASM). The LAMP project has been utilizing the existing LANL procurement process and system. The ASM division is delegated the authority to execute procurements for LANL projects, programs, and operations. LANL uses the SAP Ariba system as the software for procurements.

LANL specifies different purchasing thresholds. A commercial, low-hazard, low-risk, firm fixed price procurement with a cost of less than $250K uses the simplified acquisition process. For the purpose of the LAMP project, we consider any procurement with an independent cost estimate exceeding $250K to represent a major procurement. The RFQ and each of the DTL tanks are examples of such procurements.

In general, the approach is to allow vendors to fairly compete for these procurements. The goal is to obtain best value at the lowest price technically acceptable. However, for specific procurements, technical capability and schedule are critical and are prioritized to obtain best value. Since schedule and technical capability are critical for the RFQ and the DTL tank 1 procurements for LAT, we are following the best value approach for them.

As the first step for these procurements, the LAMP project has issued requests for information (RFIs) to communities of vendors through the LANL procurement process. The RFIs and Ariba discovery postings allow us to gain interest from industry vendors that we could work with on these procurements. The next step is to develop and issue requests for proposals (RFPs). A major component of the RFP package is the statement of work (SOW). The SOW defined the technical requirements and describes the desired final work product to be delivered.

We designed the LAMP RFQ at LANL using a suite of RFQ design codes [4] developed at LANL and widely used at major laboratories around the world. The RFQ suite of codes includes the CURLI, RFQUICK, PARI, PARMTEQM, and VANES programs. RFQ 3D solid modeling, quasistatic (electrostatic) simulations, and particle-in-cell simulations were performed using the CST Studio Suite [5].

The CST simulation results were in excellent agreement with the RFQCodes predictions. The RFQ tank will consist of multiple longitudinal segments, or "modules," assembled together, nominally three or four. The RFQ longitudinal electric field distribution on the beam axis is provided in Fig. 3. The typical sections of an RFQ, i.e., the shaper section, gentle buncher section, and the accelerator section, are labeled. The internal length of the RFQ tank is 3.55 m. Our deign of the RFQ and its required performance parameters are described in the technical requirements of the SOW.

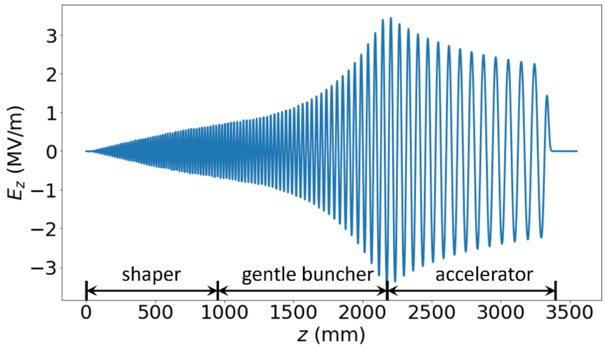

Figure 3: Longitudinal electric field distribution along the RFQ beam axis. Result from the CST Electrostatic Solver simulation is shown.

Similarly to the RFQ, we designed the first tank of the DLT and described it in a SOW that vendors can use as a starting point to develop a complete design and fabricate it. It is for a 201.25 MHz DTL tank with input energy of 2.1 MeV and output of approximately 8.6 MeV. A 3D representation of the DTL tank 1 form our CST model is shown in Fig. 4. The length of the DTL tank 1 is approximately 4.31 m. The DTL first tank is needed for LAT to demonstrate technical maturation and resolve CTEs the project has identified.

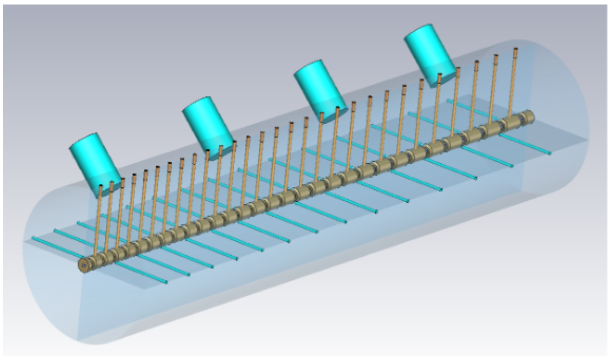

Figure 4: Three-dimensional representation generated using our CST model of our DTL tank 1 conceptual design with slug tuners and post-couplers.

In addition to the SOW, the RFPs for major procurement include several other exhibits that are developed by different organizations at LANL working as a team. These exhibits define environmental and safety requirements, institutional quality requirements, physical and cyber security requirements, legal support with detailed terms and conditions. The work is lead by a procurement specialist supported by a subcontract technical representative to incorporate all exhibits in a subcontract. The procurement specialist and the subcontract technical representative, together with the support organization, work to negotiate a contract and then manage it until the major procurement is delivered according to the requirements in the contract and both factory and site acceptance tests are passed. Our implemented approach and team that is in place allows us to effectively manage the major project procurements to insure their successfuly delivery, meet the project schedule, and best support the project's objectives.

SUMMARY

The cost of the RFQ and the DTL represent a significant portion of the LAMP project funding and drive schedule decisions. These highly specialized accelerator components represents long-lead, critical-path risks to construction of the LAMP's LAT test stand, with procurement and fabrication durations expected to exceed 18 months. Here, we discussed LANL's approach to procurements of major accelerator components such as the RFQ and the DTL first tank. While our goal is to obtain best value at the lowest price technically acceptable, for specific procurements, technical capability and schedule are critical and could be prioritized to obtain best value. Since schedule and technical capability are critical for the RFQ and the DTL tank 1 procurements for LAT, we are following the best value approach for them in order to retire schedule and technical risk to the LAMP baseline. This approach is expected to enable timely acquisition of mission-critical major accelerator components required to maintain the LAMP project schedule.

ACKNOWLEDGMENTS

Work was performed under the auspices of the US Department of Energy by Triad National Security under contract 89233218CNA000001.

REFERENCES

[1] S. Mosby *et al.*, "The LANSCE experimental program: accelerator requirements", LANL, NM, USA, Rep. LA-UR-23-22164, Mar. 2023.

[2] J. W. Lewellen *et al.*, "Summary of the LANL mini-workshop on source region options for LAMP", in *Proc.IPAC'24*, Nashville, TN, USA, May 2024, pp. 2702-4. doi:10.18429/JACoW-IPAC2024-WEPS05

[3] J. W. Lewellen *et al.*, "LANSCE accelerator modernization project conceptual design report", LANL, NM, USA, Rep. LA-UR-25-31513, Nov. 2025.

[4] K. R. Crandall *et al.*, "RFQ Design Codes", LANL, NM, USA, Rep. LA-UR-96-1836, May 1996.

[5] Dassault Systèmes, "CST Studio Suite", Dassault Systmes Simulia Corp., 2025.