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|  | Mu2e Project Office **BASIS of ESTIMATE FORM (BoE)** | **Document Number:** Mu2e-doc-1639-v14 (Applications) |
| **Date of Estimate:**  |
| 10/17/2011 |
| **Prepared by:**Brian Drendel |
| **WBS Section: 475.02.11.02****Activity ID:**  | **Task Name:** Operations Preparations – Application Codes |
| **Cost Type:** **\_ x \_ M&S** **\_ x \_Labor** | **Costing Method:**\_x\_Engineering Estimate\_\_\_Prior purchase or experience. Source: \_\_\_Catalog Price. Source:\_\_\_Vendor Quote (attached)**\_\_\_** Other- Description: |
| **Attach Relevant Documents (including but not limited to):**RFP, Responses to RFP, Technical Evaluation of RFP, Vendor Quotes, Technical Specifications, drawing numbers |
| **Task Duration** (calendar days)Minimum: 730Most Likely: 730Maximum: 1100 |
| **Task M&S Cost** (FY11$)**:** Minimum: $0KMost Likely: $0K Maximum: $0K **Task M&S Contingency (%) for most likely cost:** 25%. *The minimum cost is derived from the base cost minus some cost savings opportunity and does not include contingency. The most likely cost lists two numbers. The number inside of parenthesis is the base cost without contingency. The number not in parenthesis is the most likely cost, which is the base cost plus contingency. The maximum cost also has two numbers. The number inside of parenthesis is the base cost plus risks without contingency. The number outside of the parenthesis is the maximum cost, which is the base cost plus risks with contingency added.* | **Task Labor** (Functional Role & work hours, 85% efficiency assumed)**:** **Task Labor Contingency for most likely duration** (25%)**:** *The minimum hours are derived from the base hours minus some cost savings opportunity and does not include contingency. The most likely hours lists two numbers. The number inside of parenthesis is the base hours without contingency. The number not in parenthesis is the most likely hours, which is the base hours plus contingency. The maximum numbers column also has two numbers. The number inside of parenthesis is the base hours plus risks without contingency. The number outside of the parenthesis is the maximum hours, which is base hours plus risks with contingency added.* |
| **Functional Role** **(from docdb # XXXX)** | **Minimum Hours** | **Most Likely Hours** | **Maximum Hours** |
| Engineering Physicist (FN.AD.TE.OT.EP) | 20 | 62.5 (50) | 100 (80) |
| Controls Engineer, Computer Professional and Front End Programmer (FN.AD.EN.EE.CS) | 17300 | 43125 (34500) | 73750 (59000) |

Details of Estimate:

This Basis of Estimate covers the Post-CD0 design, post-CD1 preliminary and finals designs, and post CD-3 implementation & close-out tasks associated with upgrading and rewriting Pbar software applications for Mu2e operations. Below is a breakdown of the most likely manpower needed to complete the project. The first tasks listed are those involving the engineering planning and oversight.

**Engineering Oversight (Management):**

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| Engineering Physicist (hours) |
|  | Minimum/Likely/Maximum |
| 475.02.11.04.01.012010 Post CD-0 Conceptual Design | 5 | 10 | 20 |
| 475.02.11.04.02.013010 Post CD-1 Preliminary Design | 5 | 10 | 20 |
| 475.02.11.04.02.013020 Post CD-1 Final Design | 5 | 10 | 20 |
| 475.02.22.04.03.014010 Post CD-3 Implementation & Close-out | 5  | 10 | 20 |
| Total | 20 | 50 | 80 |

Significant controls software development will need to be undertaken prior to Mu2e operations. A detailed survey of existing ACNET applications will need to be completed in order to determine the required levels of application programming effort. Applications for Antiproton Source systems that are not needed for Mu2e operations, such as stochastic cooling programs, can be retired. Many applications, such as vacuum, diagnostics and power supply programs, can be reused or upgraded. There are also a number of applications that will need to be developed from scratch, such as those controlling the new RF systems and Debuncher resonant extraction. ACNET index pages will need to be reorganized to better reflect Mu2e operations. Controls experts estimate one month of full-time effort of an application programmer for each application that needs to be upgraded, on four months of full-time effort of an applications programmer for each application that needs to be written new.

Additional controls effort will include updating and creating database entries for parameters. Existing parameter pages will need to be restructured to reflect Mu2e operations. Parameter subpage names will need to be renamed in some cases. New parameter pages may need to be added. Software tasks requiring automation via OAC clients or ACL scripts will need to be determined and developed. Appropriate analog, digital and acknowledgeable alarms will need to be setup for Mu2e devices.

In addition, front end work will need to be done that controls experts estimate will take 2 or 3 FTE programmers at least two years to complete.

Labor and M&S numbers are taken from our costing documentation1. Cost estimates are divided into minimum, most likely and maximum scenarios.

* Minimum:
	+ Applications: 5 new applications, 30 updates. 2 FTEs for 2 years.
	+ Front End: 2 FTEs for 2 years
* Most Likely:
	+ Applications: 20 new applications, 45 updates. 5 FTEs for 2 years.
	+ Front End: 3 FTEs for 2 years
* Maximum:
	+ Applications: 46 new applications, 42 updates. 6 FTEs for 3 years.
	+ Front End: 3 FTEs for 3 years

A summary of the labor costing is provided below1: We assume 1 FTE month for each updated application and 4 FTE months for each new application.

**Labor (EDIA and Implementation):**

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| Labor475.02.11.04.01.012010 Post CD-0 Conceptual Design475.02.11.04.02.013010 Post CD-1 Preliminary Design475.02.11.04.02.013020 Post CD-1 Final Design475.02.22.04.03.014010 Post CD-3 Implementation & Close-out |
|  | Minimum/Likely/Maximum(hours) |
| Controls Applications Programmer | 9000 | 22000 | 40000 |
| Controls Front End Programmer | 8320 | 12480 | 18720 |

No known M&S items are needed at this time.

References:

1. B. Drendel, et el, “Acnet Application Upgrades for Mu2e Operations,” Mu2e Documents Database #1640, July 2011.