**Questions/comments about MUSE PM document**

* Overall, this looks like a good start as a framework for filling in the details as project planning progresses. The other comments below are intended to be helpful to the project as they flesh out this initial skeletal framework.
* What/where is the TDR (technical design report?)? – It is referred to as containing the science requirements that flow down to infrastructure requirements. Presumably that is the document that lays out resolutions, efficiencies, rates, number of channels, and so forth are determined.
* Contingency is not a slush fund, but rather an estimate of the uncertainty and risk in the budget for a WBS element. The proposers should have a method for determining or estimating the uncertainty, by WBS element at the lowest practical level of estimation, and translating it to dollars to be added to the total project cost. They say they will use the FNAL system that was used for Minerva, which is probably OK since DOE and NSF project management standards are very similar, I just didn’t see a description of what that is. Auditors will question this, no matter how they do it, so they will need to provide a well substantiated basis of estimate for both the direct budget and for the risk-adjusted Total Project Cost including budget contingency. A good approach is for them to write down somewhere, in a single place and not as a brief note on various WBS spread sheets, what their overall budget estimating plan is and how they have implemented it. For example, catalog items could be assigned a 2% budget uncertainty, vendor quotes (unless they are worried about change orders) could have zero uncertainty, historical data from earlier projects might have 20%, engineering estimates 40%, etc. The formal way to do this is to assign risk factors pertaining to technical, schedule, and other parameters and then translate that to dollars – see the GAO Cost Estimating Guide, Chapter 14, <http://www.gao.gov/new.items/d093sp.pdf> which is a good tutorial reference. Following this reference will put the project in good shape when DCAA shows up to audit the project. Many of the other GAO Guide chapters may also be very helpful to the project (GAO also addresses the particular difficulties associated with estimating software tasks). Another suggestion, since this is a multi-year activity, be sure to estimate costs in current year dollars and then use the OMB cost escalators (typically about 3% per year), or some other escalation factor if justified, to escalate the estimated costs to the year of expenditure. Finally, it looks like some costs are to be expended in Switzerland, so the budget uncertainties and contingency calculations should consider risk due to exchange rate volatility for foreign currency transactions. Another good reason to have a single narrative describing their cost estimating plan is to make sure that they realize that the budget contingency doesn’t belong to the WBS element, but is managed by the Project Manager, who moves it between WBS elements to manage the ensemble risk to the project. That includes pulling residual budget from areas where there are underruns to hold in reserve against future possible risks that may arise elsewhere in the project.
* Technical status reporting, item 15, should include progress reporting relative to an integrated project schedule, since there are dependencies among the various tasks to be done. The attached schedule looks like they are thinking through this and making good progress. They will want to create a resource loaded schedule showing how much each step costs, and also, if resources (like key people or unique equipment) are spread over several areas, to make sure that they aren’t overcommitting somebody during a particular period. The PM needs this information to manage the project. In particular, some means to assess the estimated cost of remaining uncompleted work is essential, as it lets the PM know whether or not the remaining unexpended budget will be sufficient to complete the remaining workscope. Usually there are labor costs that grow (“standing army costs”) if there are delays in accomplishing some part of the project while other parts are idled and people associated with the other tasks have to find something else useful to do.
* Quality control is usually a responsibility of the Project Manager, so the QA (and also the project safety person) report directly to the PM. It should not be delegated to individual WBS elements. This function and the systems engineering function will become more relevant to the project once they build things and perhaps find that some items don’t quite meet performance specifications, but that they can make do by compensating somewhere else in the project. The PM needs to be the traffic cop that coordinates this and the one to allocate contingency budget where necessary. Probably safety is not a major topic since it appears that of all the fabrication work will be done in university shops where university safety policies apply, and presumably PSI safety rules apply to installation. One exception might be the cryo target, where (possibly) an ASME or B&PV code requirement might have to be satisfied. If you bring a target to a US lab like BNL or FNAL, the lab cryo-engineering staff are usually involved in determining it is OK to install and operate apparatus like that supplied by an experimenter.
* Some specific WBS comments:
	+ The MUSE project execution plan says that they will use the PMBOK and FNAL methodology to estimate risk and contingency, so presumably the budget contingency estimates will be updated. Overall, contingency looks too low as a percentage of the total project cost when compared to many larger projects funded by NSF.
	+ WBS 5 – cryo target, contingency seems exceptionally low. Perhaps this is based on recent prior experience with fabricating nearly identical items, but it seems very low, especially when the labor amounts are rounded to numbers like $2K, $5K, $15K, etc.
	+ WBS 6 – there is no labor except at the summary level. Presumably there is software development here. Software development and support costs are very hard to estimate, and usually take much longer and cost a lot more than initial estimates, but an auditor will expect to see something that supports and substantiates where the labor estimate came from. Contingency on labor ($19K on $156K) seems very small for a software task.

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