



Closeout Presentations

Director's

CD-2/3a Preliminary Review

of

DECam

October 30-31, 2007

This page intentionally left blank

Table of Contents

Executive Summary 5

1.0 Introduction..... 7

2.0 Focal Plane Detectors (WBS 1.2)..... 8

3.0 CCD Readout Electronics and SISPI (WBS 1.3, 1.6)..... 10

 3.1 CCD Readout Electronics (WBS 1.3)..... 10

 3.2 SISPI (WBS 1.6)..... 11

4.0 OPTO-Mechanical (WBS 1.5)..... 13

5.0 Project Management (WBS 1.1)..... 16

 5.1 Cost 16

 5.2 Schedule..... 19

 5.3 Management..... 22

6.0 Charge Questions 25

This page intentionally left blank

Executive Summary

Technical

A draft Technical Design Report (TDR) has been prepared for the Dark Energy Camera (DECam) portion of the Dark Energy Survey (DES) project. The TDR documents the preliminary design, R&D progress to date and plans for additional R&D, final design, and construction of DECam. Good technical progress has been made since the May DOE / NSF Review of DES with the completion of the draft TDR, ordering of the large optics blanks, and promising CCD tests and development of more advanced R&D test plans. Several design reviews (both internal and external) have been performed and many more are planned.

The DECam status and presentations generally support the CD-2 Performance Baseline stage well. DECam is also requesting CD-3a, limited construction, approval for the early critical path items including the CCD processing and packaging and hexapod support and alignment system. The CCD request seems appropriate, but additional work is needed to support the hexapod request.

Schedule

A more than 1300 line Resource Loaded Schedule for DECam has been prepared using the Microsoft Project (MSP) scheduling software. Well over 300 tiered Level 0 – 4 milestones have been identified. The CD-4 date including schedule contingency is December 2011 with an initial hardware complete and delivered to the telescope in Chile target date of October 2010.

Generally the durations in the schedule are thought to be reasonable with one exception being the release of the design and construct contract for the hexapod.

The current critical path is the optics followed by the barrel support (hexapod). The CCDs are near critical path items. The blanks for the large lens have been ordered and a CD-3a approval for the hexapod and CCD processing and packaging is requested.

Cost

A total project cost (TPC) of \$26.4M was shown. There is some confusion about labor efficiencies that have been assumed which will need to be cleared up before the DES Directors' Review to be held in December.

Many bases of estimate (BOE) have been prepared and documented in the MSP notes field (and in many cases amplified in BOE documents residing in docDB). This BOE strategy is judged reasonable and should be completed for all tasks in accordance with the DECam guidance of creating BOE for all tasks costing \$5K or more. Additional quality checks on consistency of BOE with the actual numbers in the rolled up estimate are needed.

Management

The complete complement of DECam project office staff and L2 managers have been named. This is a good team for executing DECam. In an early project staffing exercise,

named engineering and Design & Drafting staff are over-allocated. This problem will be addressed as the resource leveling activity is performed following receipt of funding guidance. The Fermilab Associate Director for Research plans to provide such funding guidance in the next week or so based on budget discussions with the program office.

Most of the associated project management documents for a project at the CD-2/3a stage exist in a draft form. These will need to be finalized prior to the Directors' and DOE Reviews of DES in December and January. The DECam project management also is aware of the need and plans to address the 16 Lines of Inquiry (LOI) at these next reviews as well.

1.0 Introduction

A Director's Preliminary CD-2/3a Review of the DECam Project was held on October 30-31, 2007. The charge included a list of topics to be addressed as part of the review. The assessment of the Review Committee is documented in the body of this closeout presentation.

Each section in this closeout presentation is generally organized by Findings, Comments and Recommendations. Findings are statements of fact that summarize noteworthy information presented during the review. The Comments are judgment statements about the facts presented during the review and are based on reviewers' experience and expertise. The comments are to be evaluated by the project team and actions taken as deemed appropriate. Recommendations are statements of actions that should be addressed by the project team. Progress on the recommendations is to be reported on during future DES Working Group Meetings (WGMs). A response to recommendation(s) is expected and actions taken will be reported on during future reviews.

2.0 Focal Plane Detectors (WBS 1.2)

Primary Writer: Hogan Ngugen

Contributors: Marcel Demarteau, Mike Lingren

Findings

- The project has 8 tasks within 4 weeks of the critical path, and 32 tasks within 12 weeks of the critical path.
- The project plans to perform multi-CCD tests, but not necessarily using all science-quality devices. The plan is to have a fully populated focal plane.
- The project is baselined assuming 20% yield of CCD production and packaging. CCD cost is \$1.43M with 15% contingency. Additional contingency covers 14.3% yield. The schedule impact of lower yield CCD's can be accommodated by CCD installation at the telescope.
- The yield for CCD production was derived from experience with wafer-level processing and measurements (cold probe tests), and experience with packaging both 2k x 2k and 2k x 4k devices. The project believes that the yield derived from both types of devices would be applicable to 2k x 4k devices.
- There are two vendors for thinning of wafers, Umicore and SiliconQuest. Umicore has so far been a very reliable vendor, but recently they are seeing increased breakage of the wafers and longer lead times. To investigate, the project visited Umicore. It turned out that there was some turn-over in the staff at Umicore and the project did not carry a high priority. The project is now qualifying a second vendor, SiliconQuest. So far they are happy with the quality of the work at the second vendor, but it is based on small statistics.
- The project has packaged 2k x 4k devices with good yield, using the "V1" packaging style. They are working on an improved version ("V2.1"), which could be used in the final device. They left room in the schedule for another design cycle ("V3").

Comments

- There is currently no reliable basis for assuming that the project can do without a Lot 3 run for CCD production.
- We commend the project for changing the packaging design. The changes implemented for V2.1 devices are all for the better and improve the yield.
- The R&D on packaging 2k x 2k devices (for the 12 guide-and-focus CCD's) is not as advanced as for 2k x 4k devices (albeit similar in style). Installation and testing of 2k x 2k modules are within 4 weeks of the critical path.

- Installation and testing of 2k x 4k devices are 0.8 weeks from the critical path. This is driven by the scheduled delivery of the “focus plane support plates” from WBS 1.5.
- The project’s request for CD3a approval for CCD processing, packaging, and testing, is reasonable, provided that parts from WBS 1.3 (AIN cards and connectors) are well-developed and made available.

Recommendations

1. The recent wafer thinning results demonstrate a clear exposure to the performance of a single vendor. The project should investigate its exposure to single vendors and try to mitigate the risk by qualifying a second vendor in any area of possible exposure.
2. Since it is likely that Lot 3 wafers will be needed, the project should use the actual cost of Lot 3 wafers as part of the base cost. If the wafer yield from Lot 2 is such that Lot 3 wafers would not be needed, then use the approved change-request procedure. The savings could be added to the project contingency.
3. The multi-CCD testing task should be split into 3 separate tasks, each being 10 weeks in duration. System tests could be done initially with a partially populated focal plane, with the tests becoming more extensive as the focal plane becomes more fully populated. The project should develop a plan of what they want to accomplish during these tests.
4. Look for ways to advance the delivery of production-version “focal plane support plates” from WBS 1.5.
5. Advance the R&D of the packaging of 2k x 2k (“guide-and-focus”) CCD’s.
6. Explore ways to shorten the procurement time of M&S from LBNL, using for example inter-laboratory agreements or memorandum purchase orders.
7. Scrub the cost & schedule for consistency with the supporting BOE documents, especially for the labor estimate of module assembly.
8. Take advantage of cost savings from reusing parts from failed CCD packages.

3.0 CCD Readout Electronics and SISPI (WBS 1.3, 1.6)

3.1 CCD Readout Electronics (WBS 1.3)

Primary Writer: Pat Lukens

Contributors: Bob Dematt, Ted Liu

Finding

- The documentation supporting the number of AIN boards to be fabricated, and the number of associated connectors to be procured, did not clearly indicate how the quantities were calculated.

Comment

- These quantities will need to be established prior to the CD-2/3a review.

Recommendation

9. Re-check these calculations and update the justification in the BOE.

Finding

- The Front End Electronics subproject currently has 27 tasks within 4 weeks of the critical path.

Comment

- The critical path for the entire project is in flux due to the varying budget profile scenarios that are being considered. The members of the Front End Electronics subproject seemed surprised to learn that their tasks were now appearing near the critical path.

Recommendation

10. Establish the budget profile as soon as possible in order to take subsequent steps in the subprojects to reallocate resources and reduce the number of items near the critical path.

Finding

- Recommendation 16 from the July, 2006 Director's CD1 Review called for the subproject members to "Create a clear set of acceptance testing criteria for each stage of board development, which includes all components to be included. Design reviews between steps should include comparisons of results with these criteria and provide branch points such as eliminating design iterations or implementing fallback solutions."

Comment

- This recommendation has not yet been implemented though the subproject members are considering how the criteria should be developed.

Recommendation

11. The subproject should follow through on implementing this recommendation.

Finding

- The schedule called for a Multi-CCD Readout Review that was held on September 17, 2007. The next review that appears in the schedule for Front End Electronics is for a Production Electronics Review to be held on January 14, 2009.

Comment

- Design reviews help ensure that components being developed will meet their requirements.

Recommendation

12. Design reviews should be added for the printed circuit boards and for other major components being developed for the subproject.

Finding

- Multiple circuit board designs are being implemented in the same form-factor, with the same style of backplane connectors, for main modules and transition boards.

Comment

- Circuit boards of the same form-factor, with the same connectors, can easily be inserted into a backplane slot that may not have a compatible companion module (main module or transition board) located in the same slot on the other side of the backplane.

Recommendation

13. The members of the subproject should determine whether damage can occur to circuit boards if a circuit board is inserted on the front of the backplane while a board that is not meant to be its companion is located on the back side of the backplane. If damage could result, steps should be taken to preclude this from happening. The production circuit boards may need to have a keying system implemented to prevent this from occurring at the telescope.

3.2 SISPI (WBS 1.6))

Primary Writer: Pat Lukens

Contributors: Bob Dematt, Ted Liu

Finding

- Several Basis of Estimate entries were not consistent with the information in the notes sections of the schedule.

Comment

- The BOE back-up documentation should be consistent with what appears in the schedules.

Recommendation

14. Scrub the Basis of Estimate and the schedule in order to make them consistent with one another.

Finding

- The schedule risk is primarily related to whether the collaborating institutions will be able to provide the manpower necessary for the software development work.

Comment

- The members of the subproject were unsure of how to handle the hypothetical situation where additional labor needs to be brought to bear beyond what the collaborating institutions have committed to.

Recommendation

15. Establish a fallback plan for the possibility of a labor shortfall.

4.0 OPTO-Mechanical (WBS 1.5)

Primary Writer: Joe Howell

Contributors: Tom Peterson, Elaine McCluskey

Findings

- Preliminary designs exist for the majority of the scope of WBS 1.5, and are documented in the DocDB. 3-D models exist for every major component, and drawings were shown for selected systems.
- A Resource Loaded Schedule was presented for the R&D and MIE tasks for this WBS that included 210 activities.
- The schedule included 46 milestones distributed among the WBS levels as follows: 2 at L1, 8 at L2, 14 at L3 and 22 at L4
- The L2 manager indicated that design reviews are included formally in the schedule for some design tasks but not for all.
- This WBS includes significant testing of prototypes and components, such as testing of a prototype cooling system in Lab A at Fermilab
- This WBS contains over half of the tasks for the project that are within 4 weeks of the critical path.
- This WBS had Basis of Estimate (BOE) documentation available both in the DocDB and in the notes field of the schedule. However, the information was incomplete in several of the drilldowns performed.
- Basis of estimate documentation for major procurements (> \$50k) was vague for several tasks, and even noted to be WAGs. (like to find a word to convey the same meaning)
- The WBS number and MS project UID for some BOE documentation did not match the numbers in the Resource Loaded Schedule
- Prepared manpower resource charts were not available for the MIE portion of this WBS but in the breakout session charts were created that showed approximately 4 FTE of engineering in the first two years tapering off in the final year.
- The L2 manager showed Requirements and Specifications Documents (RSD) that demonstrated that scientific requirements are being translated into engineering specifications and signed off appropriately as the design develops.
- The TDR chapter for this WBS area was quite detailed, but some sections were noted as to be added later and several document numbers contained placeholders.

- The decision to use a vendor designed and produced 6 degree-of-freedom hexapod or a project designed 3 degree-of-freedom system for alignment and focus adjustment of the corrector-imager has not been finalized, according to the project manager and the TDR. Responses from 4 vendors to a Request for Information (RFI) for a hexapod design and fabrication resulted in a wide range of cost estimates. The RFI responses required additional discussions with the vendors and the need for review and clarification of specifications with the scientists. An image quality review/workshop is scheduled for November at which time these issues will be addressed. The hexapod fabrication procurement has been requested for CD-3a. It is not on the critical path now, but would be if it was delayed until CD-3b.

Comments

- The number of milestones distributed approximately at 1 per month seems appropriate.
- For those tasks that included testing of prototypes and components, it was not clear whether the schedule included time for reacting to other than positive test results.
- Some of the tasks near the critical path seem to be for designs that are well developed (focal plane) or less complex (dry gas purge system and cage temperature monitoring system). Adjusting the schedule to reduce the number of items near the critical path may help the L2 manager focus on the remaining items that are near the crucial path because of their complex nature or long lead times.
- The engineering manpower needs shown in the breakout session seemed appropriate to the tasks. An engineering new hire has been approved and when this person is added this WBS will be up to the required engineering manpower.
- The RSD documentation is very good, but it would be helpful to reviewers to have these gathered together on the review webpage for easy reference.
- Uncertainties over the corrector-imager alignment and focus system need to be resolved in order to prepare a strong case that the project is ready for the CD3-a approval for the procurement of this system. If the vendor produced hexapod system is the option chosen a significant amount of work is required to review and update the specifications, quotation evaluation criteria and receive quotations from the vendors. The project should also consider cost/benefit of additional risk management strategies such as performing the design/prototype work with two vendors in parallel. If the project is seriously considering a project designed system a risk/benefit/cost analysis of the project designed system should be done to understand if it is a reasonable option if the specifications can be relaxed to the point that it is viable technical option.

Recommendations

16. Check that all major procurements have a design review task associated with them before purchasing begins.
17. Verify that the schedule includes time for reacting to other than positive test results, as needed based on an assessment of the risk of test failures.
18. The Basis of Estimates should be improved so that 1) there is information about the basis in at least the notes field, 2) the BOE documents make sense when looking at them in correlation with the notes field, 3) where proprietary information should not be divulged, but is used for estimate basis, this should be explained in the notes field.
19. Obtaining quotes for larger procurements where none currently exist.
20. Finalize the incomplete portions of the TDR chapter.
21. The project should decide as soon as possible whether specifications for the corrector-imager alignment and focus system can be relaxed and decide which position adjustment system will be used. If the vendor designed and produced hexapod system seems likely then a procurement plan that includes risk management should be prepared as soon as possible.

5.0 Project Management (WBS 1.1)

5.1 Cost

Primary Writer: Marc Kaducak

Contributors: Dean Hoffer

Findings

- The DOE TPC of DECam is currently estimated at \$25.4M including contingency and burdens. An additional ~\$8M is funded by in-kind contributions.
- In some cases the project added 15% to its labor estimates in an effort to address vacation/opto and an efficiency factor. Then 15% was later deducted uniformly across the board from the labor costs produced in COBRA, since COBRA also accounts for vacation/opto.
- Some BOE documents were either incomplete or were not directly referenced from the MS Project Notes field, making them difficult to locate. Examples include but are not limited to:

ID 674 Preliminary design of primary cage and F/8 handling 100k (BOE: none)

ID 874 Procure alignment system 759k (BOE: "Estimate")

ID 629 Procure filters and blanks 400k (BOE: "N/A")

ID 873 Contract Engineering studies for Hexapod (BOE: "Estimate")

ID 883 Procure Telescope Simulator parts 204k (BOE: "Engineering Estimate")

- The required obligation profile presented was:

	Estimated Total Base w/Ind. & Esc.					
	FY07	FY08	FY09	FY10	FY11	Total
R&D	0.53	3.72	1.10	0.00	0.00	5.35
MIE	0.00	3.60	6.91	4.38	0.37	15.26
MIE-Cont	0.00	0.00	1.06	2.30	2.40	5.76
Total	0.53	7.33	9.07	6.68	2.77	26.37

- The project has been given the following DOE funding guidance, although it is currently under discussion and likely to be revised by the Fermilab Directorate:

Kathy Aug. 30 07	FY07	FY08	FY09	FY10	FY11	Total
R&D	1.40	2.58	1.20			5.18
MIE		3.60	7.50	6.70	2.00	19.80
Total	1.40	6.18	8.70	6.70	2.00	24.98

- The project is planning to request CD-3a approval for the following activities:

	Request for CD3a	Start	Labor (k\$)	M&S (k\$)
WBS 1.2	CCD processing at LBNL	4/1/2008	0	639
WBS 1.2+1.3	CCD Packaging	4/21/08	553	526
WBS 1.5	Procure Hexapod	8/11/08	22	866
	Total Request (inc. OH)		575	2,032

Comments

- The WBS seems to be comprehensive and the committee did not identify any omitted activities.
- In June 07 DECam was awarded \$900k out of a total of \$3M for 27 proposals submitted for a Dark Energy R&D solicitation. The project is to be commended for this award.
- The value and method of managing in-kind contributions could have been presented more clearly and identified in the cost overview. Showing the progress and commitments of other contributors can have a positive effect in a DOE review.
- BOEs should be better organized so drill down exercises are more straightforward.
- A cost table showing obligation profile by L2 tasks will almost certainly be required at a CD-2 review but was not presented. This table was provided later upon request.
- The method of including vacation/opto/efficiency in the labor estimates was unconventional and reduced the utility of the project cost and contingency spreadsheet to only the final corrected line. All other numbers in the table are inflated. This issue could also be providing misleading EVMS reports, which currently show positive cost variances in all tasks. The committee felt that the project should use working hours as a basis for labor cost estimates while entering appropriate durations in the schedule and allowing COBRA to burden them as is usually done.
- CCD production Lot #3, WBS 1.2.2.2 “Contingency CCD Wafers Based on Demonstrated Yield”, is currently handled by assigning zero base cost and including its cost and schedule in project contingency. The committee felt that there was a high enough probability that this lot would be needed that it should be included in the base cost.

- Estimates for the items included in the CD-3a request seem to be defensible and conservative, since vendor quotes are available for the alignment system, despite the fact that its design is not complete. The cost of CCD production and packaging is well understood from prior experience and more will be understood about the low side uncertainty in a few weeks.
- The DOE funding profile totals to \$24.98M and the obligation profile totals to \$26.37M, while the project cost and contingency spreadsheet lists the TPC at \$25.4M. These numbers obviously need to match.
- Funding guidance from Fermilab Directorate is needed.

Recommendations

22. Perform a bottom-up scrubbing of Basis of Estimate documentation such that it is more transparent and complete.
23. Rectify the double counting of vacation/opto/fringe by allowing COBRA to do the calculation.
24. Prepare a cost table showing the obligation profile by L2 task. Ensure that all cost and obligation profiles are within the TPC and match the funding profile. Also ensure that TPC is consistent between documents and within presentations. Fermilab Directorate needs to provide funding guidance to complete this recommendation.
25. Consider including cost of CCD production Lot#3 in the base cost estimate.

5.2 Schedule

Primary Writer: Dean Hoffer

Contributors: Marc Kaducak

Findings

- The DECam presented a Resource Loaded Schedule (RLS) in the scheduling software tool Microsoft Project (MSP).
 - The schedule presented has 1361 lines, with 790 lowest level activities and 380 milestones.
 - The schedule has a total of 161 activities and milestones that have constraint dates assigned. (150 activities and 11 milestones)
 - The schedule has a total of 212 activities that have a duration \geq 60 work days.
- CD-4 Milestone baseline completion date in the schedule is December 7, 2011 with a schedule forecast completion date of April 19, 2011, which has a float of approximately 6 months.
- DECam has a tiered milestone system which includes Level 0, 1, 2, 3 and 4 milestones. The schedule presented has 8 – L1, 57-L2, 85-L3 and 230-L4, which is slightly different than that which was presented during the plenary project overview.
- Milestone Definitions are documented in the schedule notes field for many of the 380 milestones.
- Bases of Estimates (BOEs) exist for many of the activities in the schedule. Guidance for generation of BOE's was for activities that are >\$5K. BOEs are documented in the notes field in the schedule and supplemental BOE documentation in DECam's docdb.
- Work Breakdown Dictionary exists for many of the schedule activities and exists in the schedule notes field. The DECam's schedule does include some design review activities.
- Schedule contingency is included in the schedule by building it into specific milestones and then monitoring the float (L1~30W, L2~12W, L3~4W and L4-0W). Additional schedule contingency of 60 weeks exists with WBS 1.2.2.2 "Contingency CCD Wafers Based on Demonstrated Yield" since the cost is in contingency and not in the base cost.
- Some Resource Leveling has been performed on the DECam's schedule.
- A single page master schedule with the critical path was presented.

- Both functional resources and named resources have been assigned in the schedule.

Comments

- The TPC and schedule duration is in question because of inconsistency on how durations were developed and resource hours assigned, since some estimates included inefficiencies and vacation time and some did not, the durations and resource hours assigned need to be validated. The activity duration should reflect how long in calendar time it will take to complete the job, which includes inefficiencies and resource availability. The resource hours should be determined based on the time a resource will need to work to complete the scope of the activity.
- Since the project has not received clear funding guidance, the project did not present a schedule that could be baselined. When the schedule is revised to reflect the funding guidance, the project completion date may be extended.
- A critical path exists, but it can not be determined if it is a true critical path until the resources hours have been validated, schedule adjusted to conform to the funding guidance, and resource leveled. Activities on the critical path should be distinguished from activities that are near critical path.
- The schedule has 150 activities with constraint dates. The use of constraints should be minimized because it can cause the critical path to be skewed. If there are multiple activities with the same constraint (e.g. CD-3a approval, CD-3b approval and fiscal year funding) a milestone can be used and link to those activities instead of using individual constraints. This also makes it easier to perform what-if scenarios.
- Many WBS and Milestone Definitions have been documented in the schedule notes field, but several still need to be generated and the existing ones should be validated.
- BOE's have not been generated for the entire scope of the project nor do they meet the internal project guidance which requires a BOE for all activities >\$5k. Some of the existing BOEs are lacking in sufficient detail or are not aligned with what is in the schedule.
- There are many review activities in the schedule, but some additional ones are needed.
- Using both functional resources and some named resources is not considered a normal schedule practice. Using the availability of the named resources assigned to an activity to determine the appropriate duration of an activity and the sequencing of activities so as not to over allocate that resource is a good planning tool. Keeping the named resources in the schedule when it is being baselined is not considered a good practice.

- Including WBS 1.2.2.2 “Contingency CCD Wafers Based on Demonstrated Yield” in the schedule is appropriate since there is a good chance it will be needed. Since the cost for this activity is included in the contingency and not in the base cost, this activity is an inline schedule contingency, which is not a good practice. The cost for this activity should be moved out of contingency and put in the base cost.

Recommendations

26. The existing schedule needs to be validated and scrubbed. This should be accomplished by the December EVMS review. Some of the specific areas that need to be scrubbed are as follows:
 - Validate and revise the activity durations and resource hours assigned.
 - Minimize the number of constraints used.
 - Evaluate the long duration activities to determine if they can be broken up into small duration tasks with specific deliverables or that there are adequate existing milestones to measure the progress of long activities. This is important to improve accuracy of status and measuring progress and critical in Earned Value reporting.
 - Evaluate the review activities in the schedule and determine if additional ones need to be assigned and resource load those activities.
 - After completing the scrubbing of the schedule for the items listed above assess the resource need vs. the availability of resources and perform resource leveling where needed. This helps in increasing the likelihood that the activities can be completed in the timeframe scheduled and minimize variances in Earned Value reporting.
 - Complete WBS Definitions, Milestone Definitions and BOEs. Also validate the existing ones.
27. Fermi Management should give the project funding guidance so DECam can update the schedule that can be presented as a baseline schedule for the next review.

5.3 Management

Primary Writer: Debbie Harris

Contributors: Ed Temple

Findings

- Project team has put together a technical specifications document that outlines the performance baseline, as well as an advanced draft of the Technical Design Report that is close to satisfying the prerequisite documents needed for CD-2.
- The performance baseline is also reflected in a resource-loaded schedule that contains almost 1400 tasks including milestones. The basis of estimate documentation for most of the tasks can be found in the notes field of each of these tasks. Supplemental BOE documentation in the form of vendor quotes or more detailed descriptions exists for tasks equaling roughly half of the costs in the project (spread equally between labor and M&S).
- The Hazard Analysis Report has been updated since the CD-1 review, and the PSAD has been drafted and comments from the Fermilab ES&H Section have been incorporated.
- A Risk Management plan has been submitted for review and risk accounting forms and procedures have been established, with Level 2 Managers filling out approximately 13 risk analysis forms for the review.
- Seven CD-4 requirements for project completion were presented in the management breakout session and are contained in the PPEP presented for review. Two of the seven requirements (DECam Optics and DECam SISPI Software and Hardware) are associated with tasks that are accomplished with in-kind contributions.
- In addition to the 25M\$ included in the Total Project Cost, an additional 8M\$ worth of in kind contributions are needed to satisfy the DECam technical specifications. These in kind contributions are listed in the project file as 1.4M\$ in In-Kind Labor (technicians and engineers at Universities or abroad) and 4.3M\$ in In-Kind M&S (including 2.7M\$ in optics, 800k\$ in common funds to be used for cost overruns, and \$660k for Front End electronics).
- A project critical path was shown, and there were tasks spanning all level 2 WBS elements on that critical path.
- The resource loaded schedule includes 24 generic costed resources and 17 specific resources associated with a particular name.
- Project documents such as the project schedule, the PEP, PMP, PSAD, etc. were available on the web page or from the DECam docdb.

Comments

- Some of the notes fields have incomplete or missing information, in particular for the milestone definitions. For some tasks, detailed quotes may exist but because of the proprietary nature of the quotations these are not provided in the document database.
- Although many of the project management documents were ready for this review (in some cases because they have been only slightly modified since the CD-1 review or in the case of the PEP or PMP they were only missing funding profile information) they were not easily accessible in the review website. Two documents which were not easy to find but may have been ready in advance were the PMP and the Updated Hazard Analysis.
- The risk management machinery has been set in motion but a comprehensive view of the risks and the relative threat levels across the entire project has not been prepared.
- The substantial level of in kind contributions may be hard to manage given that the DOE project management does not have authority to augment or decrease funding levels or secure additional resources. The common fund, which is meant to cover cost overruns in in-kind contributions above base+contingency is not owned by the DECam project manager, and as such may be spent on tasks unassociated with DECam.
- Similarly, two of the CD-4 requirements may not be appropriate as part of the DOE-funded part of the project. In addition, several of the CD-4 requirements may be difficult to achieve or prove given that they do not all contain specific quantities of elements, or because they are too aggressive in their definition.
- The definition of milestone levels shown in one of the technical breakout talks did not match what's in the Configuration Management Plan for those items.
- Funding profiles broken down by level 2 WBS elements were not shown although that would help reviewers assess if contingency levels are appropriate for the outyears, and how well the funding profile matches the funding guidance.
- The number of tasks on the critical path seems large, the statement was made that once the funding profile was established then more work could be done to try to add in more schedule contingency to some of the tasks.
- Of the 17 specific resources called out in the schedule, only 4 of them are not over-allocated. Some of this may be due to incomplete funding guidance information for R&D Labor for FY08.
- Several of the reviewers had trouble seeing the Microsoft project-generated information that was in the powerpoint presentations in the memory sticks.

Recommendations

28. The resource loaded schedule should be scrubbed so that every milestone is defined and that all of the tasks above a cost threshold of \$5,000 contain BOE information. For tasks above a certain labor cost (or duration) the inefficiency due to vacations should be spelled out so that the project is sure to not double count costs for vacation.
29. The top risks in the project overall should be clearly identified in the risk analysis, and each of the level 2 managers should be able to discuss the highest risks associated with their WBS elements.
30. When the project shows the costs or the funding profile it may be helpful to also show the In Kind contributions as separate lines. Responsibilities for completing the in kind work might be better defined in the PMP.
31. The Level 2 Managers should be able to address the cost and schedule and critical path items (and CD-3a items) as part of their review presentations in the future. It would also be helpful if they were prepared to discuss configuration management and quality assurance procedures in the breakout sessions.
32. Similarly, the funding profile for each of the level 2 WBS elements should be available and defensible by the Level 2 managers.
33. Level 2 presentations need to be given in a consistent format, and the cost information and milestone dates need to be consistent across all presentations and within individual presentations.
34. The Directorate should provide budget authority guidance in a timely way so that the project can prepare the Directors' Review documents well enough in advance so that these materials are available to reviewers 2 weeks before the review.
35. Given that guidance the project must strive to level the resources or work with PPD to secure additional labor resources.
36. Review materials should be available in either paper or pdf formats. The organization of the information should be improved so that the reviewers can easily access all relevant information.

6.0 Charge Questions

Technical

6.1 Is the project scope well defined and supported by the preliminary design documentation, technical specifications and objectives?

The project scope appears to be well defined, although some technical choices have not yet been made. The goals of the project are described in the Technical Design Report. A Specifications and Technical Requirements document describes the specifications that are to be met by the project, to meet the scientific goals.

Neither the Technical Design Report (TDR) nor the Dark Energy Camera Specifications and Technical Requirements documents are complete. The TDR is currently missing information in most sections. The Technical Requirements document is also incomplete. It is in “draft” form, and needs considerable editing.

6.2 Is the defined project scope reflected in the projects cost and schedule?

The cost and schedule was found to be reasonable for all the areas examined. It should be noted that the technical solutions are not completely defined. The hexapod stands out as a particular example. However, the general impression of the reviewers is that the cost and schedule is appropriate for the scope, since conservative estimates have been taken when appropriate.

In several instances, the detailed definition of the scope was difficult for reviewers to obtain. The basic assumptions behind some parts counts need to be described in the Basis of Estimate documents.

Cost

6.3 Is the Work Breakdown Structure (WBS) appropriate for the project scope?

Yes, the WBS seemed comprehensive and no omitted tasks were identified.

6.4 Do the cost estimates for each WBS (or cost) element have a sound documented basis and are they reasonable?

The project has a guideline of preparing a BOE for any item over \$5k. This was executed in most cases, but there were some instances where the committee found it difficult to trace the costs so further organization of BOEs was recommended.

6.5 Does an obligation profile exist? How does it compare with the funding guidance?

The project has worked on the basis of matching its obligation profile to the funding guidance given by DOE in August 2007. However, Fermilab management will provide a revised version in the near future. An obligation profile by L2 task was requested by the committee since it was not presented at the review. The numbers for the DOE funding profile, the project’s obligation profile, and the TPC currently do not match.

Schedule

6.6 Is the schedule well developed and appropriately structured by specifying relationships, predecessors, successors, critical path, resource loaded, etc?

The schedule is generally well developed, but the schedule does need some scrubbing on use of constraint dates, validation of assigned activity durations and assigned resource hours.

6.7 Are the durations for the activities and overall schedule reasonable and achievable with the assumed resources?

This could not be determined at this time since the duration and resource hours assigned to the activities was not consistently done across the whole project and resource leveling has not been completed.

6.8 Does the schedule contain appropriate levels of milestones, sufficient quantity of milestones for tracking progress, and do they appear to be achievable?

There are a sufficient number of milestones in the schedule. There should be further discussion on the Level 1 milestones before they are finalized.

6.9 Does the schedule include activities for design reviews, which include assessment of the designs readiness for procuring prototypes, preproduction and production materials?

Yes, the schedule does include activities for design reviews, but some additional ones are needed.

6.10 Is there narrative which precisely defines the deliverable(s) required to satisfy the CD-4 Milestone?

The narrative is appropriate.

Management

6.11 Is there an appropriate management organizational structure in place to accomplish the design and construction?

The project office that has been assembled is technically knowledgeable and able to complete the construction of the DECam project.

6.12 Is the organization structure well documented responsibilities defined and appropriate for the scope of work?

The organizational structure was well-documented in the management breakout session, although that structure should have been more thoroughly discussed in the plenary talks. Although the addition of the project scientist was the result of a previous review recommendation, his responsibilities were not described during the presentations.

6.13 Are there adequate staffing resources available or planned for this effort?

Currently there are not adequate staffing resources available, although there is a plan. The named drafters and engineers are oversubscribed, and a job posting has been listed for an additional mechanical engineer that has yet to be filled. The project is awaiting

budget guidance from the Directorate to understand best how to find the additional labor needed.

6.14 Is there a funding plan available or proposed to meet the resource requirements to realize the project?

The committee was not given a clear funding profile.

6.15 Has a Risk Plan been developed, risks identified, risks analyzed, risk responses planned/implemented, risk monitoring/control process established and do they seem appropriate?

The risk plan has been developed, several risks have been identified and mitigation strategies proposed. However, the risks in the different WBS elements have not been evaluated across the entire project to determine what constitutes the top risks in the project. A plan for regularly updating the risk register was suggested at the review and should be incorporated by the project office.

Procurement

6.16 Have the critical procurements been identified and are they included in the schedule with adequate lead time built in?

The critical procurements have been identified, leading off with the procurements identified in the request for CD-3a. The project has included procurement durations in the schedule for the critical procurements that are reasonable.

6.17 Have critical make vs. buy decisions been evaluated in conjunction with the scope and is that reflected in the baseline cost estimate, schedule and technical risk plan?

There was no discussion of make vs. buy decisions presented, but the project manager confirmed that a number of substantial purchases planned had been under consideration for “make”, and after review it was determined that “buy” was a better option. Documentation for these should be straightforward to assemble in time for a baseline review.

6.18 The Project designs and procurement packages prepared to the degree appropriate to order materials and initiate construction as scheduled?

The project has several procurements well in hand, and could order many of the critical components now, if they had the needed approvals. The committee could not decide if the hexapod procurement, for which cd-3a approval has been requested, would be ready to be ordered on the timescale in the current schedule.