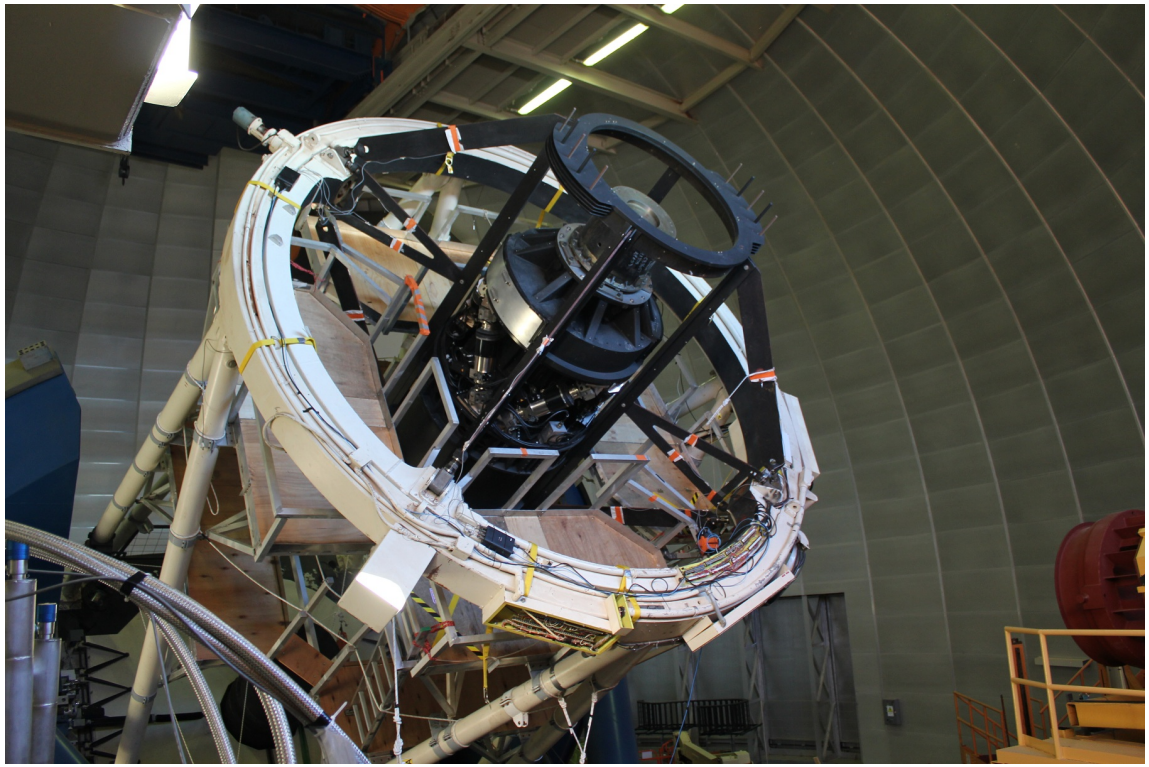
DARK ENERGY SURVEY

DES Review Response



Josh Frieman

Briefing for DOE and NSF

August 14, 2012

Highlights of Progress since the May 2-3 Review

DARK ENERGY SURVEY

- Installation:
  - Primary mirror and Cassegrain cage reinstalled, telescope rebalanced
  - Telescope dressed with imager cooling hoses and cables
- Imager:
  - C5 lens installed, vacuum checked, cool down test of system done
- DES Data Management:
  - Workflow refactoring plan matured; work on wrappers & architecture begun; readying pipeline for DC7 & SV; expanded help from collaboration; new org structure and Project Scientist
- Community Pipeline:
  - CP1.5 delivered and tested by NOAO, CP2.0 this week, CP2.1 (sufficient for operations start) by Sept.
- Science Verification:
  - Team and Plan put in place to carry out DES Science Verification tests

May 2-3 DOE Review Recommendations

- Response to “Technical” Recommendations
  - **Response**: Table listing all recommendations, leaders responsible for addressing/responding to each recommendation, text describing steps taken or that will be taken to address the recommendation.
  - **Doc-Db: 6587**

May 2-3 DOE Review Recommendations

DARK ENERGY SURVEY

- Management-level Recommendations
  - Develop a comprehensive, coherent, integrated plan for installation, integration, commissioning, science verification, and operations
  - Flow down tools & deliverables for each step of the plan & assign to people
  - Roll up the resources required to implement the plan and address any funding shortfalls
  - Define and assess descopes and determine their impact
  - Reevaluate science requirements and assess risk of not meeting them
  - Reevaluate Community Pipeline requirements, assess when and how they will be verified
  - MOU partners need to support the plan and present it coherently to the funding agencies
  - Org chart(s) should be reworked to show functional as opposed to funding lines

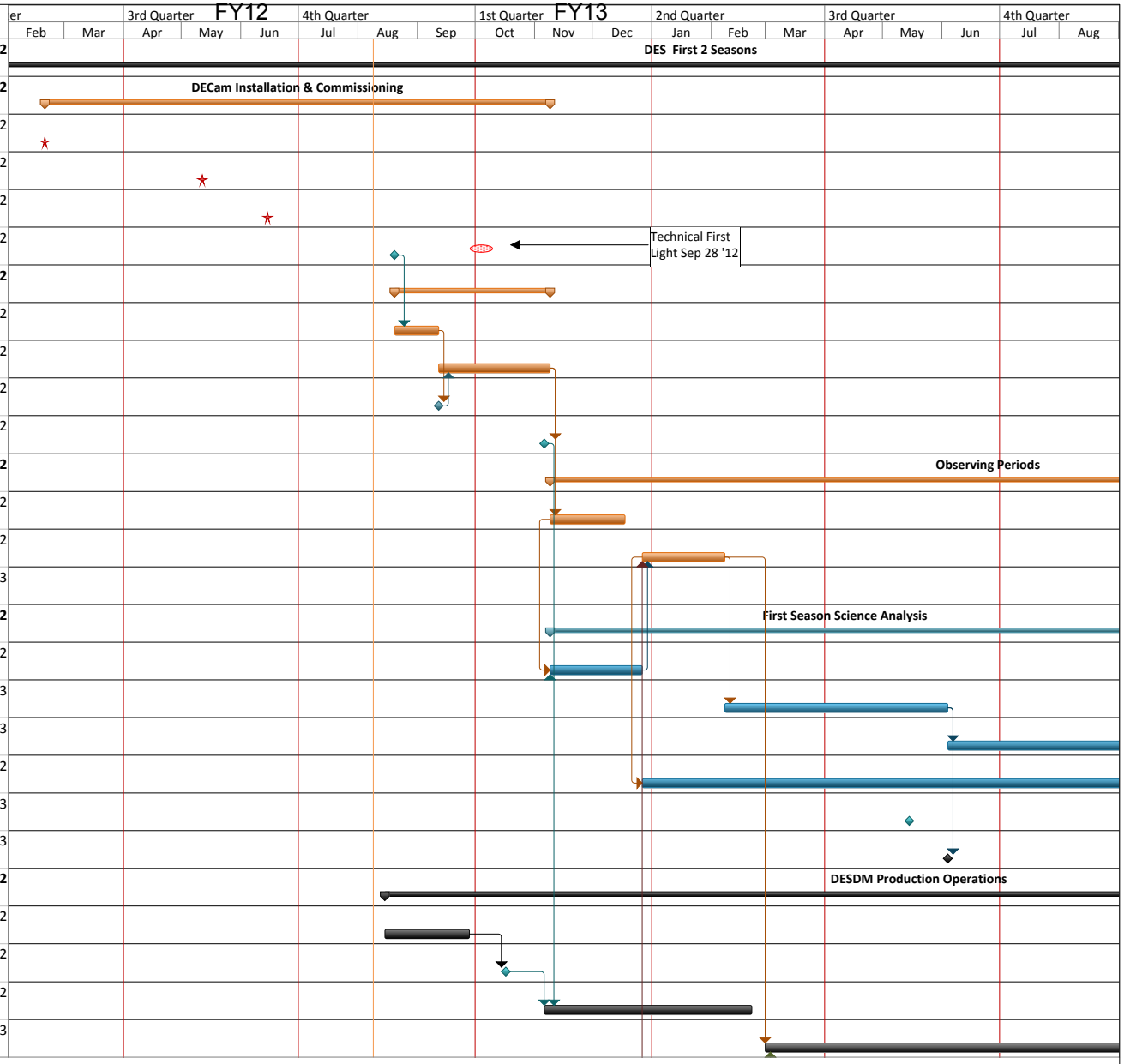
Management Response

DARK ENERGY SURVEY

- Plan for DES Integration, Commissioning, Science Verification, and Early Operations
  - High-level document written by the Director & DES Executive Committee, laying out the plan; *the central document for this briefing*
  - Includes Executive Summary describing changes/steps we are implementing, and summarizing the funding/budget/resource situation and plan/proposal
  - Summarizes and refers to package of 18 documents that describe detailed plans, information, schedules and budgets for the major operational subsystems of DES.
  - **Doc-Db: 6597**
- DES Integrated Schedule
  - Tasks and milestones remaining for installation, commissioning, Science Verification, DESDM, Community Pipeline, and first science analyses
  - **Doc-Db: 6623**

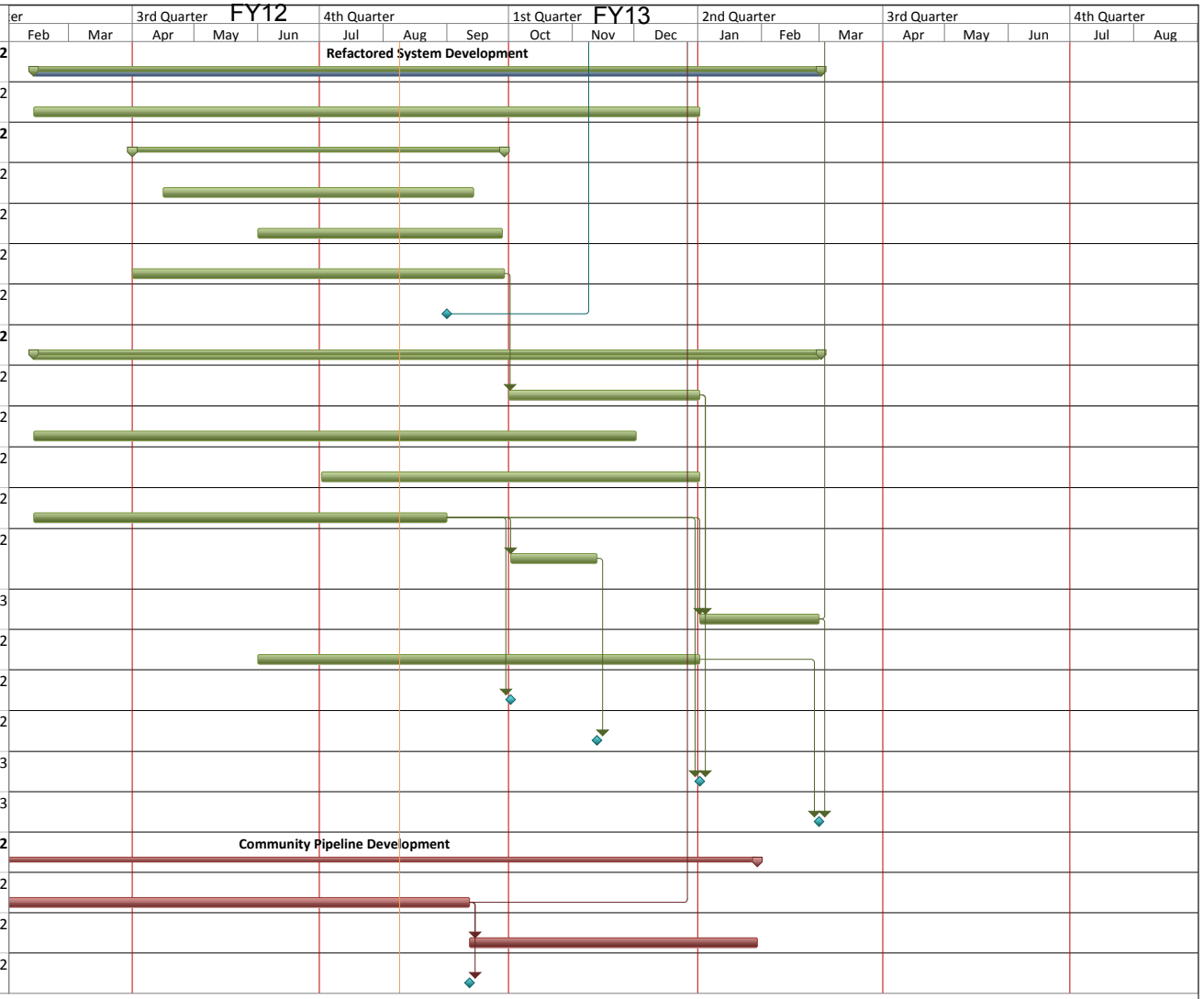
DES Integrated Schedule

ID	Task Name	Start
1	**DES First 2 Seasons**	**Sun 1/1/12**
2	**DECam Installation & Commissioning**	**Mon 2/20/12**
3	Camera Accepted - Installation Shutdown Begins	Mon 2/20/12
4	Cage Installed & Aligned	Sat 5/12/12
5	Blanco Moves with New Cage	Fri 6/15/12
6	Telescope Modifications Complete	Mon 8/20/12
7	**DECam Commissioning**	**Mon 8/20/12**
8	Commiss Phase I	Mon 8/20/12
9	Commiss Phase II (Imager testing)	Wed 9/12/12
10	Imager Ready for Readout (Schedule Driven)	Tue 9/11/12
11	DESDM Operations Start Required for completion of commissioning	Tue 11/6/12
12	**Observing Periods**	**Fri 11/9/12**
13	Science Verification Observing	Fri 11/9/12
14	Survey I	Thu 12/27/12
15	Survey II	Fri 9/20/13
16	**First Season Science Analysis**	**Fri 11/9/12**
17	Provide SV Feedback on Requirements	Fri 11/9/12
18	Develop Calibration for First Season	Fri 2/8/13
19	Initial DE Analyses w/ 1st Calib	Tue 6/4/13
20	Science Analyses Season I	Thu 12/27/12
21	Present Preliminary Analyses to Collab	Wed 5/15/13
22	Calibrated Catalog for Science Analyses	Mon 6/3/13
23	**DESDM Production Operations**	**Wed 8/15/12**
24	Data Challenge 7	Wed 8/15/12
25	Completion of DC7 plus its punchlist - current DESDM ready for production running	Wed 10/17/12
26	DESDM Operations Current System	Tue 11/6/12
27	DESDM Operations Refactored Syst	Fri 3/1/13



DES Integrated Schedule

ID	Task Name	Start
28	**Refactored System Development**	**Mon 2/13/12**
29	Refactored System Design	Mon 2/13/12
30	Work to enable Unit Running	**Sun 4/1/12**
31	Submit wicl w/ query interface, DB access fake	Mon 4/16/12
32	Provide external pkgs via eups	Fri 6/1/12
33	Wrapper Coding Phase I (1st 20)	Sun 4/1/12
34	Ready for Unit Running of Precal & First Cut (10 wrappers)	Sat 9/1/12
35	Work to enable efficient production system	**Mon 2/13/12**
36	Wrapper Coding Phase II (Update 1-20, code 21-60)	Mon 10/1/12
37	Complete submit wicl, query code accessing DB, code for DB insert	Mon 2/13/12
38	Provide job distribution function on deployment systems	Mon 7/2/12
39	New schema changes (provenance, metadata, file catalog)	Mon 2/13/12
40	Deploy representative wrappers running in pseudo-production mode (talking to test DB)	Tue 10/2/12
41	System Integration Testing	Wed 1/2/13
42	Build System Development	Fri 6/1/12
43	Deploy new provenance/metadata schema to test DB	Tue 10/2/12
44	Test representative pipelines with development schema at NCSA	Tue 11/13/12
45	Refactored System Integration Begins	Wed 1/2/13
46	Refactored System Production Begins	Fri 3/1/13
47	**Community Pipeline Development**	**Sun 1/1/12**
48	Devel through V2.1 (required for survey start)	Sun 1/1/12
49	Devel to complete CP	Wed 9/12/12
50	CP V2.1 Delivered	Wed 9/12/12



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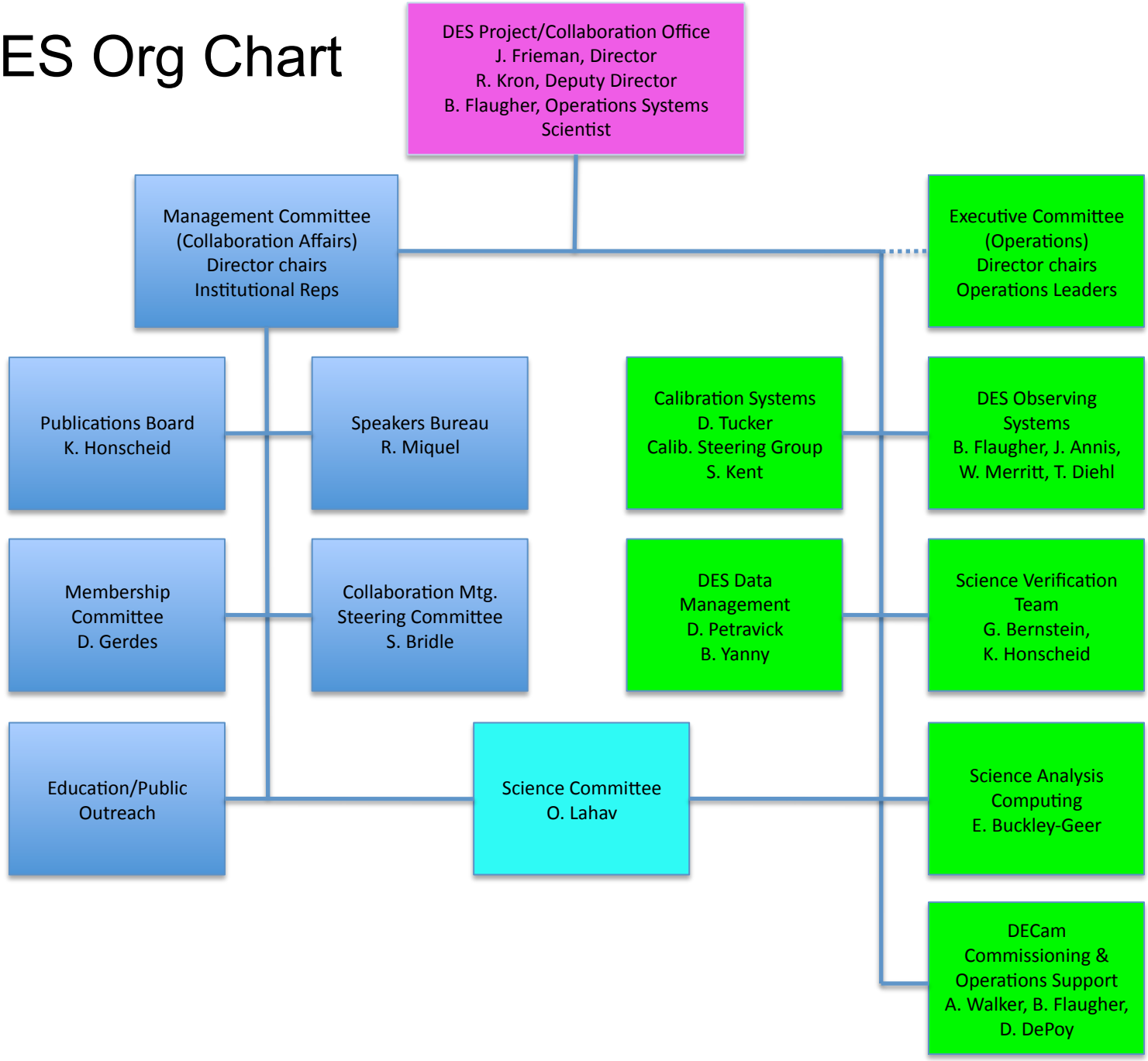
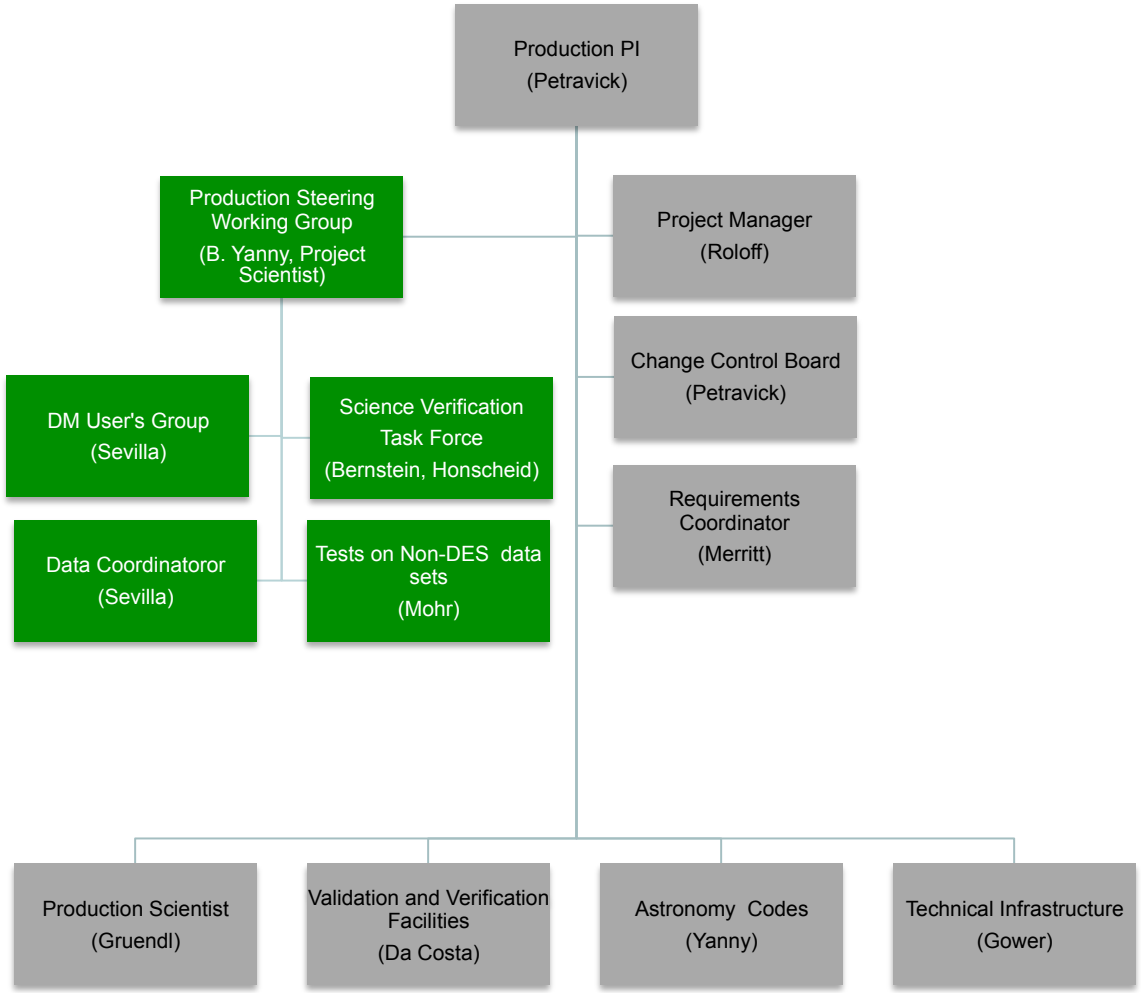
Org Charts

- DES Org Chart (**Doc Db-6588**) (slide 9)
  - Separate Operations (under new Executive Committee) from Collaboration Affairs (under institutional Management Committee)
  - Executive Committee comprises operational systems leaders, meets weekly to get updates and discuss cross-cutting issues
  - Leading to better communication across the project and therefore a more coherent project
- DESDM Org Chart (**Doc Db-6594**) (slide 10)
  - Overhauled to more clearly define roles for completion of development and for operations
- DECam Operations Org Chart (**Doc Db-6596**) (slide 11)
  - Revamped to clarify how CTIO is organized to operate & maintain DECam, how DES/Fermilab fits into DECam operations/maintenance, and how DES/NCSA fits into Community Pipeline operations/ maintenance

DES Org Chart

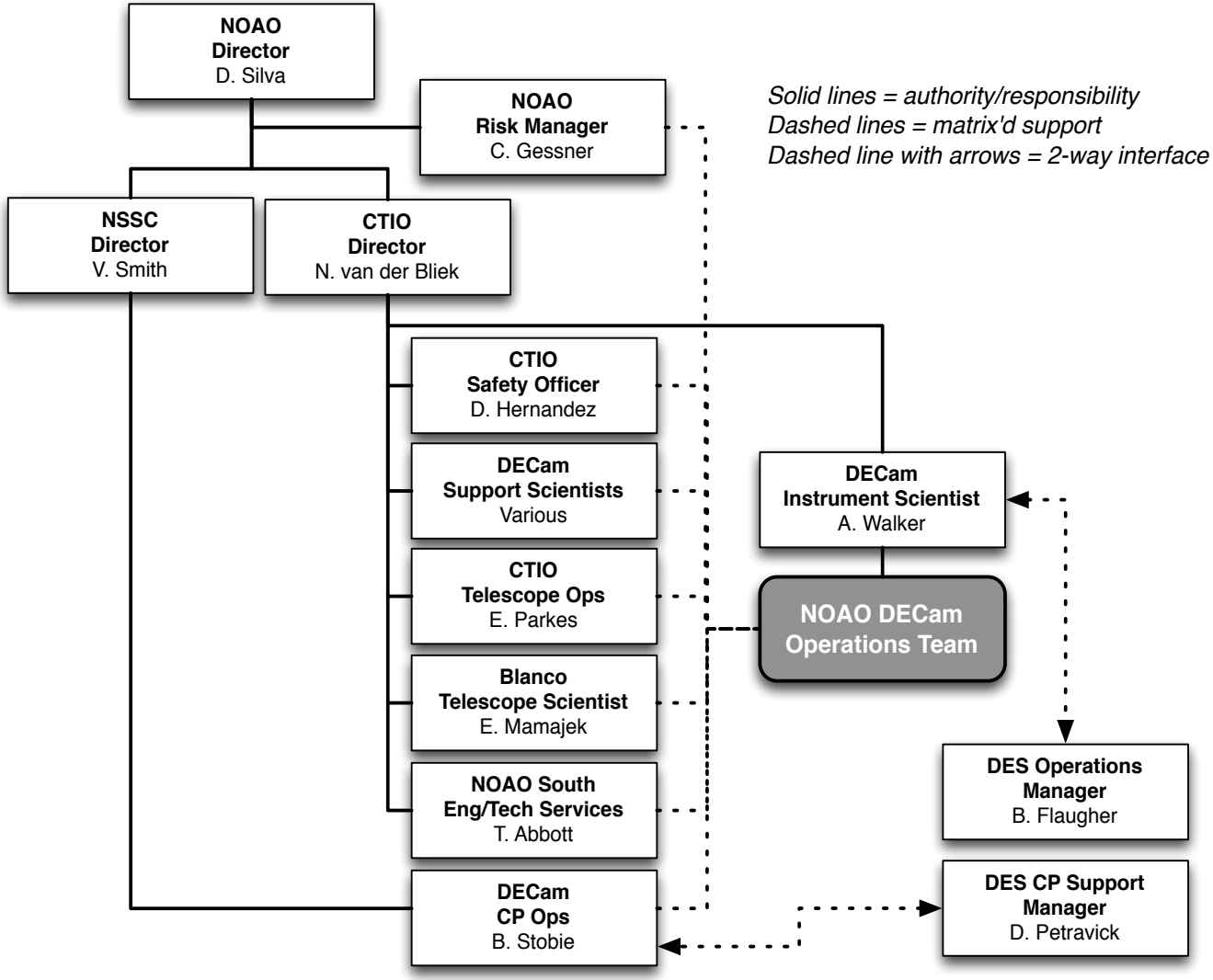


DESDM Org Chart



DECam Operations Org Chart

DARK ENERGY SURVEY



Other Key Developments

DARK ENERGY SURVEY

- DECam Installation and Commissioning Schedule revised **Doc-Db 6589**
  - Contingency added (as recommended)
  - Sept. 28 technical first light; Commissioning to mid-Nov.; Science Verification to mid-Dec.; followed by DES & community operations
- DECam System Commissioning Plan fleshed out **Doc-Db 3734**
  - More detail on specific tasks, including calibrations, personnel
- DES Data Management Replan undertaken
  - Rewrite of DESDM Requirements document in progress **Doc-Db 6533**
  - Additional resources brought in from NCSA, ETH-Zurich, Fermilab, and the collaboration helping to close but not eliminate gaps. **Doc-Db 6616**
  - Plans and schedules developed for final Data Challenge (operational readiness), Science Verification, and workflow refactoring
- Science Analysis Computing Plan overhauled, better justified

Doc-Db 6595

Operations Resources

DARK ENERGY SURVEY

- DES Operations Budget Plan
  - Working with NSF/NCSA budget and with guidance from DOE: $1.5M per year from FY13 plus DECam contingency roll-over
  - DECam operations at CTIO supported by NSF budget to NOAO
  - Have rolled up resources into proposed Operations Budget Statement (**Doc Db 6615**) (next slide)
  - Expected DOE resources (as above) should be sufficient to cover DES observing, maintenance support, proposed FNAL contribution to DESDM refactoring and QA (Brian will discuss), and first 2 years of proposed Science Analysis Computing plan. Hardware contingency is spent down in FY14.
  - ~$900K annual adjustment above the $1.5M annual DOE operations cost will be needed starting FY15 to continue operations and Analysis Computing program
  - Critical shortfall in DESDM effort at NCSA remains: estimated at $830K total over the next 3 years (FY13-15). Request to NSF.

DOE Budget Summary

DARK ENERGY SURVEY

DOE Burdened* Operations Costs in $ for Dark Energy Survey

	Actual costs	Actual to date + Estimated	Estimated	Estimated
Cost Category	FY11	FY12	FY13	FY14
Technical Labor at CTIO	$22,268	$409,702	$157,818	$100,870
Technical Labor at FNAL	$6,673	$489,064	$251,080	$120,409
Travel	$59,648	$588,398	$518,198	$338,261
CD Effort (DES Support)	$91,409	$243,545	$667,613	$680,966
M&S (PPD NOT INCL Travel)	$62,972	$273,775	$230,293	$135,994
M&S (CD) DES Support	$8,743	$241,650	$327,258	$223,772
Total	**$251,713**	**$2,246,133**	**$2,152,260**	**$1,600,271**
DESDM Fermilab contribution		$0	$548,927	$113,494
SWG Analysis Computing			$573,000	$685,000
	$251,713	**$2,246,133**	**$3,274,186**	**$2,398,766**

* Burdened Costs include overhead and escalation

DES DOE Operations Funding (in $K)

	FY11+FY12	FY13	FY14	
Requested Funding	$5,193	$1,500	$1,500	FWP requests for FY11+12; KT guidance for FY1
Funding Received to Date	$5,473			FWP received + DECam contingency for FY11+1
DECam Estimated needs (revised	$2,498	$2,152	$1,600	
DESDM + Analysis Comp	$0	$1,122	$798	DESDM refactoring + SWG Analysis computing
Total need	$2,498	$3,274	$2,399	
Integral need	$2,498	$5,772	$8,171	
Integral funding	$5,473	$6,973	$8,473	Received FY11-12 + Budget requests FY13-14
Difference (funding minus need)	**$2,975**	**$1,201**	**$302**	

(Integral funding includes DECam project contingency of $1.1M)

Justification of DESDM Request to DOE

DARK ENERGY SURVEY

Three areas in which the DESDM project has asked Fermilab for help:

+ Assume **science leadership**, drawing in more of the collaboration to help.

+ Help implement a **refactoring project** which solves, at a root cause level, problems identified in the DESDM system that require science input to resolve.

    example problem: several person-weeks required to put a change into production.

+ Help **provide quality controls** and a software framework for running this fall.

DESDM Science Leadership

DARK ENERGY SURVEY

Brian Yanny has become DESDM Project Scientist and also leads the astronomy codes effort

Issue: DESDM does not support scientists at home institutions running small-scale pipelines. The central system cannot support the needs of all the interested collaborators. Small-scale running is needed to obtain contributions from collaborators and to support rapid look at early DECAM data.

Proposed: work to support small-scale running, collaborates with and leverages the refactoring work, provides testing on the Open Science Grid and small user machines/clusters.

Resources: Marko Slyz

FY12: 0.15 Computing Professional (CP) FTE-yr

FY13:0.57 CP FTE-yr

DESDM Refactoring

DARK ENERGY SURVEY

Issue: The operational assessment of DC6 found a number of flaws in the system. Workshops at FNAL and NCSA attended by senior DES and Computing Division staff identified a refactoring project as the lowest cost solution. The work is to wrap science codes to a central framework, collaborating with framework factoring at NCSA.

Proposed: FNAL scientists will oversee the work and harmonize this work with the needs for small=scale running. Request is for computing professional support. People: Marc Mengel, Michael Wang, Marko Slyz

FY12: 0.30 CP FTE-yr

FY13: 1.40 CP FTE-yr

FY14: 0.50 CP FTE-yr

DESDM Quality Controls

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The experienced astronomers at NCSA are working to deliver an acceptable Community Pipeline to NOAO. Delivery of Community Pipeline to NOAO is a prerequisite for telescope time for DES and has taken more time than originally planned

Help is needed at NCSA to provide Quality Controls that would have been provided by the NCSA astronomers. The request to DOE is to support Eric Neilsen to help with these controls. The collaboration is supplying additional help from Penn (Armstrong, Fisher) in this area.

Request FY13: 0.5 FTE-yr

Rollup for Proposed Fermilab DESDM Support (FTE years)

	CP small test env	CP refactorig	CP Quality Controls	CP total	Scientirst Support
FY 12	0.15	0.3	0	**0.45**	0.20
FY 13	0.57	1.4	0.5	**2.47**	0.67
FY 14	0	0.5	0	**0.5**	0.08
Total	**0.72**	**2.20**	**0.5**	**3.42**	**1.0**

Note: CP=Computing Professional

As noted above, this effort can be completely supported through FY14 with the assumed DOE operations budget profile, plus rollover of remaining DECam contingency.

DESDM Shortfall at NCSA

DARK ENERGY SURVEY

DESDM Budget Comparison to Original $14M Grant Proposal

	K$
Confirmed contributions from all sources	
Current Operations grant NSF	8000
ETH Software Engr -- 1.5 FTE, NCSA equiv $$	709
Bertin + Jarvis partial support ® DES Project Office	135
Miscellaneous contributions from NCSA since 12/15/11	100
PSP Cluster Use at NCSA - funded by DES Proj Off	100
QA from U Penn	160
FY12 Refactoring & Deployment Effort for SV (FNAL)	98
Subtotal	**9302**
Value recovered by descoping	
Elimination of Portals/Footprint	213
Elimination of tape at NCSA	400
Central Store reduction at NCSA	400
Subtotal	**1013**
Value recovered by value engineering of plans	
Address many problems in one refactoring instead of piecemeal	551
Oracle configuration value engineering	150
Reduce sysadmin by 0.35 FTE	241
DBA 100% ® 80%	153
Subtotal	**1095**
Planned Appeals	
Additional request to NSF	**830**
Refactoring, QA and deployment effort (FNAL)	**778**
QA from collaboration	**640**
Subtotal	**2248**
Total Value	**13658**

Unretired Risk - Delay of Embedded QA	**236**

Summary of confirmed and requested contributions by source	
NSF	8830
DES collab	1744
DOE	876
NCSA	100
Total Contributions	**11550**
Total Descope + ValEngr	2108
Total Value	**13658**

Request for Additional DESDM Resources at NCSA

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- Build Manager
  - 1 FTE for 3 years ASAP
  - Incorporate & validate unit-tested software (from developers) on test data before releasing into the Production System, thereby supporting change control & speeding development timescale
- Software Engineers
  - ¼ FTE senior programmer for 2.5 years to mature C codes (e.g., detrending) and support astronomy codes
  - 1.25 FTE-years data management programmer to replace staff moving off-project
- Project Manager
  - ¼ FTE for 2 years to track budget profiles, schedules, & progress; support change management within new DESDM requirements; document agreements with external contributors

NSF Request for NCSA

DARK ENERGY SURVEY

NCSA Burdened* Operations Costs for Dark Energy Survey - Additional Request

By Fiscal Year in $

NCSA Costs

	Gap Estimate FY13	Gap Estimate FY14	Gap Estimate FY15	Total
Build Manager	$69,538	$85,949	$88,527	$244,015
Data Management Programmer	$69,538	$53,588	$13,832	$136,958
Senior Scientific Programmer	$23,748	$24,461	$0	$48,209
Senior Project Manager	$44,703	$34,533	$0	$79,236
Labor at NCSA	$207,528	$198,531	$102,360	$508,418
Travel	$5,000	$5,000	$5,000	$15,000
Overhead	$124,329	$119,066	$62,806	$306,200
Total	**$336,856**	**$322,596**	**$170,165**	**$829,618**

DESDM Plan and Budget Request Justification **Doc-Db 6616**

Science Analysis Computing Plan

DARK ENERGY SURVEY

- DES Scientific Analysis Computing Plan has been rewritten
  - Bottoms-up assessment of computing needs that is now uniform across the 4 Dark Energy Working Groups
  - Includes DES-specific simulations that are necessary for carrying out DES scientific analyses to achieve Dark Energy measurements
  - Off-loads to supercomputing centers (NERSC, XSEDE, Europe) those simulations and analysis efforts that make sense to do so
  - Lays out coherent case for compute cluster resources at national lab(s) to satisfy Dark Energy needs across the collaboration
  - Better-justified case and budget justification for the plan
  - Small-scale computing at US Universities will still be needed
  - Strategic approach should deliver better science at lower cost
  - **Doc Db: 6595**

Five Year Analysis Computing Requirements for DES Science

DARK ENERGY SURVEY

	Probe	Millions of CPU Hours	Number of Cores	Memory/Core	Disk Space (TB)	Tape Space (TB)
Simulations	SN	0.02	Negligible	32 GB total	2	
	CL+WL+LSS	30 75	2000 5000	4 GB 2 GB	300	5500
Value-Added Catalogs	SN	0.8	40	0.1	42	-
	Clusters	3	70	4 GB	5	-
	WL	24	1000	32 GB/Node	360	-
	LSS	DESDM				
Analysis	SN	-	-	-	-	-
	CL+WL+LSS	25 20	1000 400	-	-	-

Numbers in red represent runs on existing facilities, such as XSEDE, NERSC and the Barcelona Supercomputing Center. Numbers in black are for DES computing cluster(s). Black and red are additive.

Analysis Computing Hardware and Personnel Resources

DARK ENERGY SURVEY

Hardware:

	FY13	FY14	FY15	FY16	FY17
Million CPU Hours	4.8	10.4	17	20.6	27.2
Clock Hours	17000	16300	18700	18000	22000
Cores Added	940	1200	900	800	1140
Disk (TB)	240	40	40	40	0
Tape (PB)	0.5	1.5	1.5	1	1
Personnel (FTE-years)	0.6	0.7	0.8	0.83	0.9

Costs (fully burdened and escalated)

	FY13	FY14	FY15	FY16	FY17	Total
Nodes (K$)	238	303	241	223	346	
Disk (K$)	124	21	22	23	0	
Tape (K$)	49	151	154	106	108	
Infrastructure (K$)	15	30	38	46	45	
Personnel	144	173	202	215	239	
Total (K$)	573	685	665	617	743	3283

As noted above, FY13 and FY14 costs can be covered by DOE ops budget guidance plus DECam rollover. FY15-17 would require augmentation. Have not yet resourced beyond FY17.

DARK ENERGY SURVEY

The Out-Years

- Nominal DES observations (on-mountain operations) will extend into FY18 (early CY18). An extended survey would go beyond that.
- Final DESDM data processing leading to final data release expected to extend through FY20 (current estimate)
- Science analyses (including analysis computing needs) will therefore run through (at least) FY20, with gradual tapering off beyond that
- We plan to submit NSF proposal for final years of DESDM operations (FY17-FY20/21)
- Significant agency support for science analyses needed through at least FY20