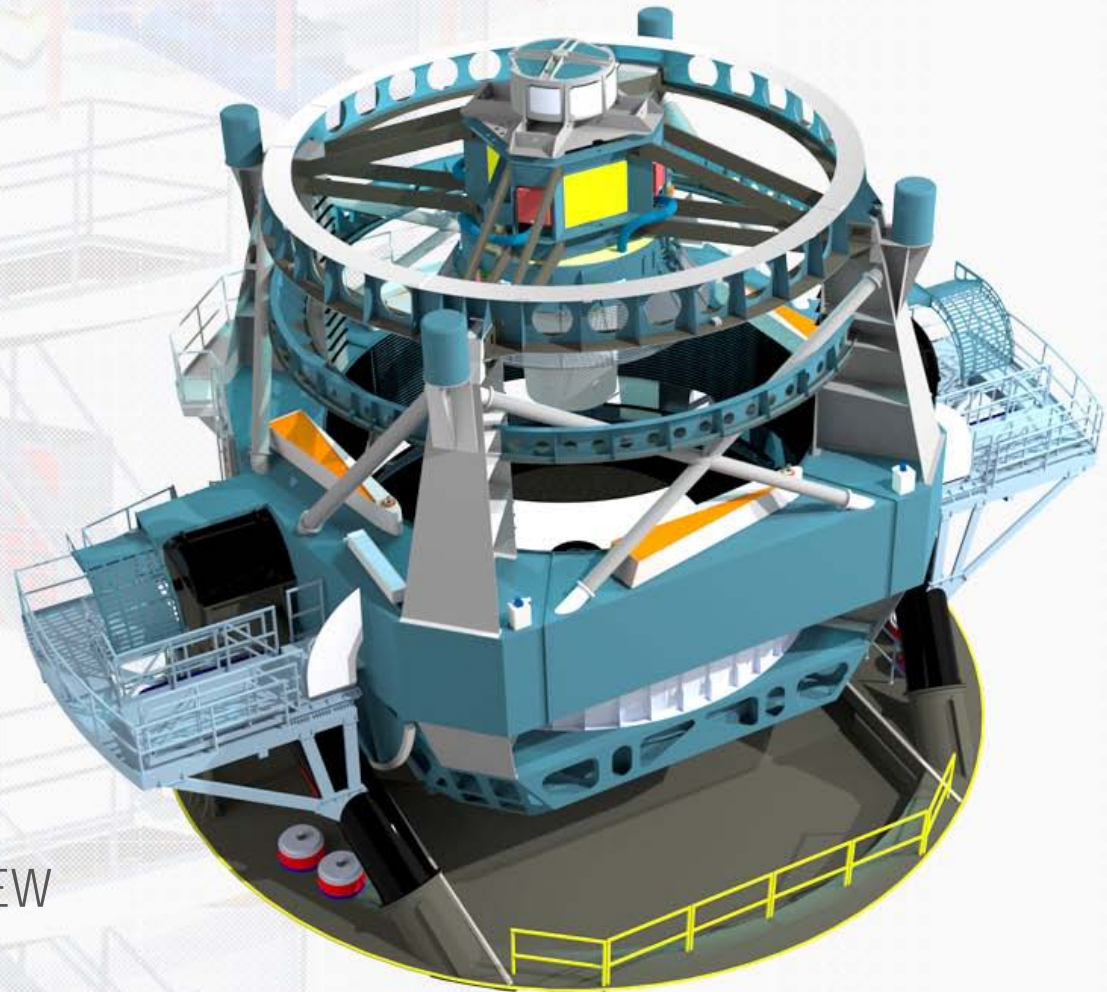


# Education and Public Outreach Summary

Suzanne Jacoby  
EPO Project Manager

October 23, 2013



FINAL DESIGN REVIEW

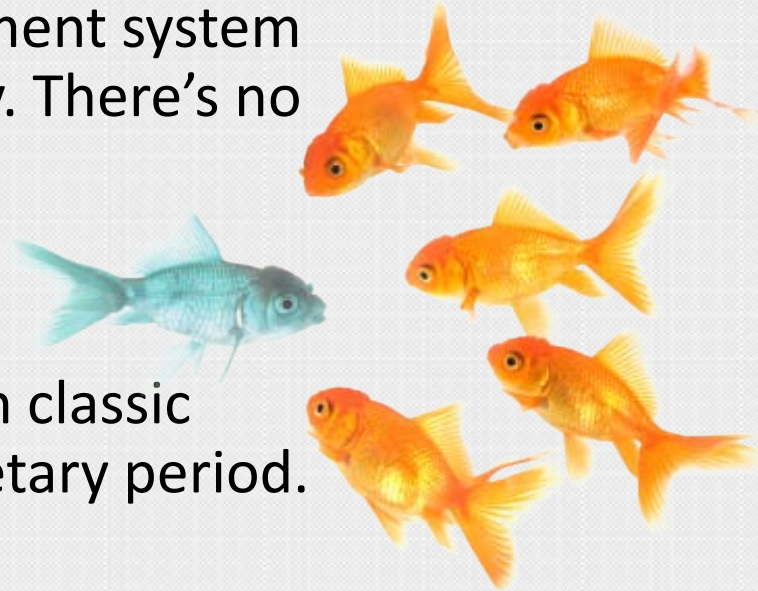
October 21 - 25, 2013



# LSST is a Different Kind of Telescope



- An integrated survey system. The Observatory, Telescope, Camera and Data Management system are all built to support the LSST survey. There's no PI mode, proposals, or time.
- Observe the database, simultaneous investigations, data mining rather than classic observing. Open database, no proprietary period.
- The ultimate deliverable of LSST is not the telescope, or the camera; it's the fully reduced data.



**“LSST” is the database. The “Google Index” of the Optical Sky.**

# Broader Impacts of LSST Include Education and Public Outreach (EPO) Activities



## EPO Goals

- Broadening Participation to Include a Large, Diverse Audience
- Actively engage public in science discovery and research process
- Addressing National Priorities in STEM Education and Science Literacy
- Leveraging Emerging Trends in Free-Choice Learning and Social Networking
- Incorporating Evidence-based Evaluation of Participant Outcomes
- Make LSST a resource for content creators and education researchers





# The LSST EPO Program Engages Many Audiences Including Education Researchers

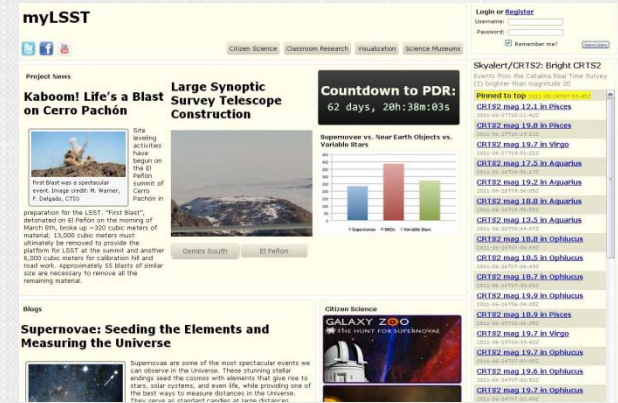


LSST EPO will have a dynamic public **web presence** as well as a **physical presence** in classrooms and science centers promoting engagement in the research process.

## LSST EPO Integrates Education & Research

- Citizen science extends goals of LSST and impacts participants' knowledge
- Education research possible from tracking registered users for 10+ years
- EPO participants gain awareness, engagement, skills, knowledge

Sustainable Partnerships with Institutional Member EPO programs and other organizations are necessary for dissemination, leveraging, and implementation.



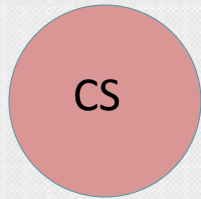
EPO Portal wireframe, circa 2009



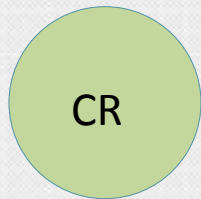
# Learning Experiences for Each User Group



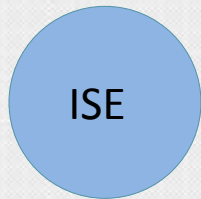
EPO Portal, database, collaborative workspace used by all user groups



One Citizen Science project running at all times; initially Visually Monitoring the Alert Stream. Decision tree agile. Anticipated audience: 250,000 participants.



A few (4) Classroom Research projects available with curated data; workspace allows for independent work. Online tutorials and face to face workshops for professional development. 1000 users per day.



Library of modules for inclusion in kiosks, displays, shows. Online tutorials and face to face workshop for professional development. Community of LSST-saavy content developers. (dozen vendors, 100 content creators)



EPO Portal open to all; exploration and adoption available to all registered users through LSST@HOME. (250,000 users)

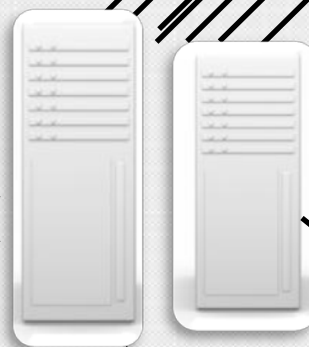
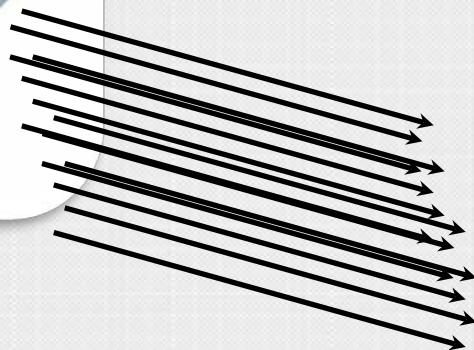


# Citizen Science adds Value to LSST

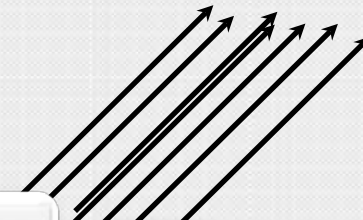
LSST adds Value\* to Citizen Scientist



all data



understood data



need human intervention



machine learning

cool mysteries

understood data

\* Value = understanding, skill, engagement, attitude



Credit: P. Gay/SIUE, S. Jacoby/LSST



# EPO Construction Effort has Defined Scope, Subsystem Requirements, and an Integrated Plan



## SCOPE

Build infrastructure that enables education and public engagement during Operations.

## REQUIREMENTS – Key Documents

LSE-89, the EPO Subsystem Requirements flow from LSR (LSE-29) and OSS (LSE-30)

LSE-131, the EPO/DM Interface Control Document

## PLAN

is described in the Project Management Control System (PMCS) in Work Breakdown Structure (WBS) 5.0 including resources, schedule, and costing details.



*EPO is at an appropriate level of maturity for construction start.*

# There are challenges with EPO in an MREFC project



Must adhere to MREFC “no comingling” of funds policy

- Only for project construction, acquisition, commissioning and upgrades
- Operating an EPO program is disallowed with MREFC funds

Remain agile and flexible building interfaces for 2023-2033

- Public more demanding than scientists
- Technology trends change rapidly

Prioritize and Partnerships

- Institutional Member EPO programs

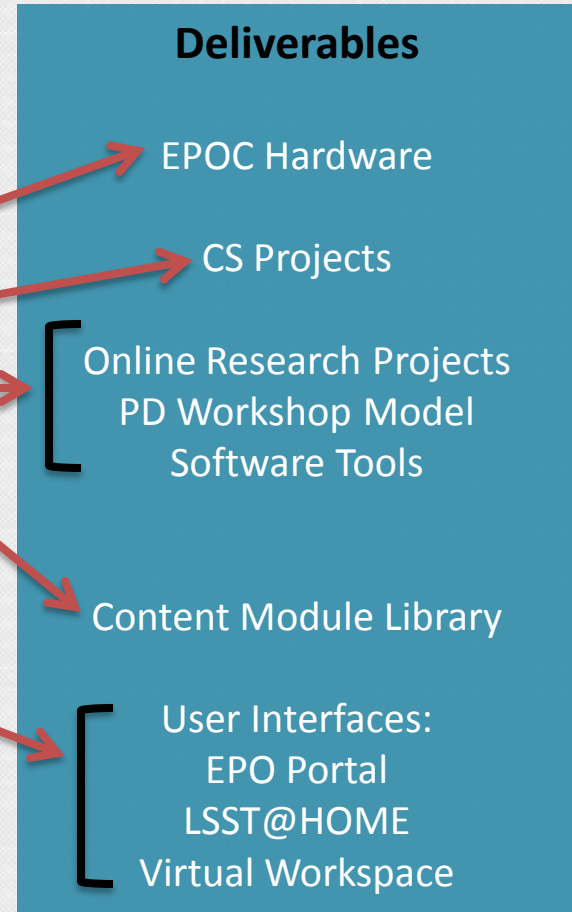




# EPO WBS is Organized around Key Deliverables by Audience



05C	Education and Public Outreach Construction
05C.00	EPO Level 2 Milestones
05C.01	System Management
05C.02	EPO Database and Data Access Services
05C.03	Infrastructure for Citizen Science
05C.04	Classroom / Online Research Toolkit
05C.05	Visualization including Science Museums
05C.06	User Interfaces



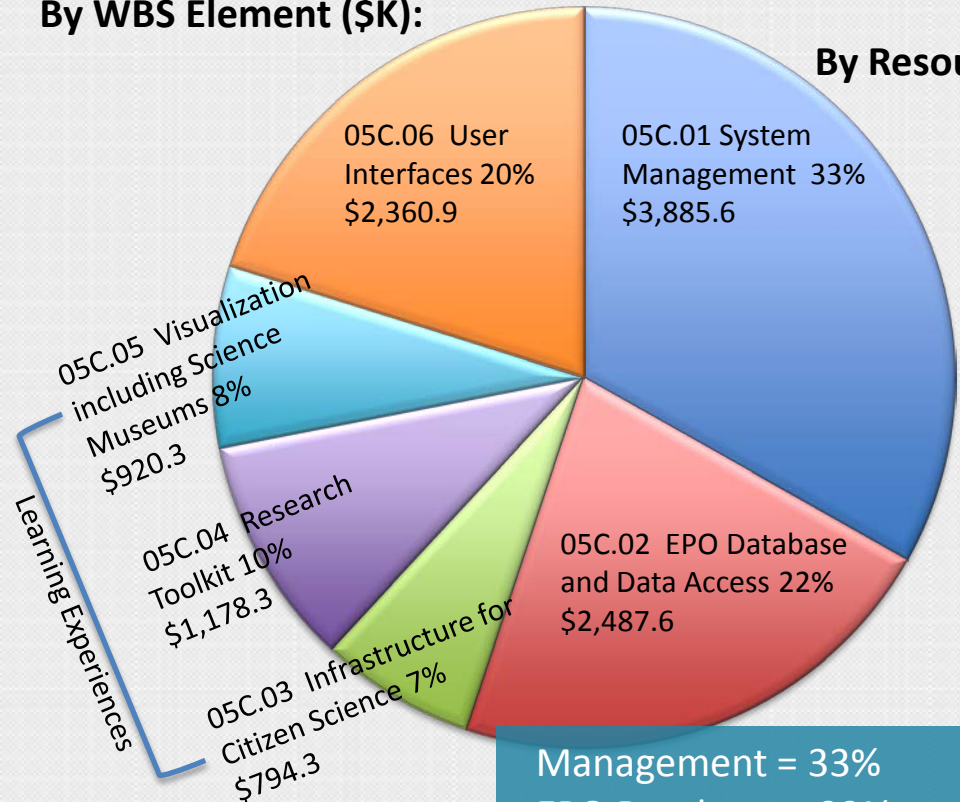
4 Audiences:

- General Public (GP)
- Citizen Science (CS)
- Classroom/Online Research (CR)
- Visualization including Science Museums (ISE)

# EPO Construction Estimate of \$11.6M is 2.4% of NSF Funding

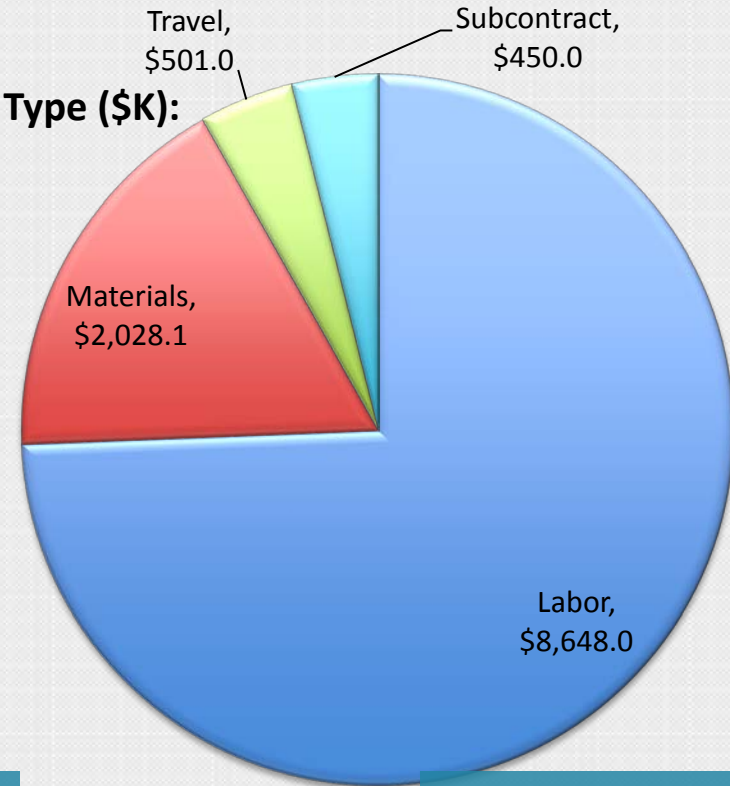


**By WBS Element (\$K):**



Management = 33%  
 EPO Database = 22%  
 User Interfaces = 20%  
 Learning Experiences = 25%

**By Resource Type (\$K):**



Labor = 75%  
 Materials = 17%  
 Travel = 4%  
 Subcontracts = 4%

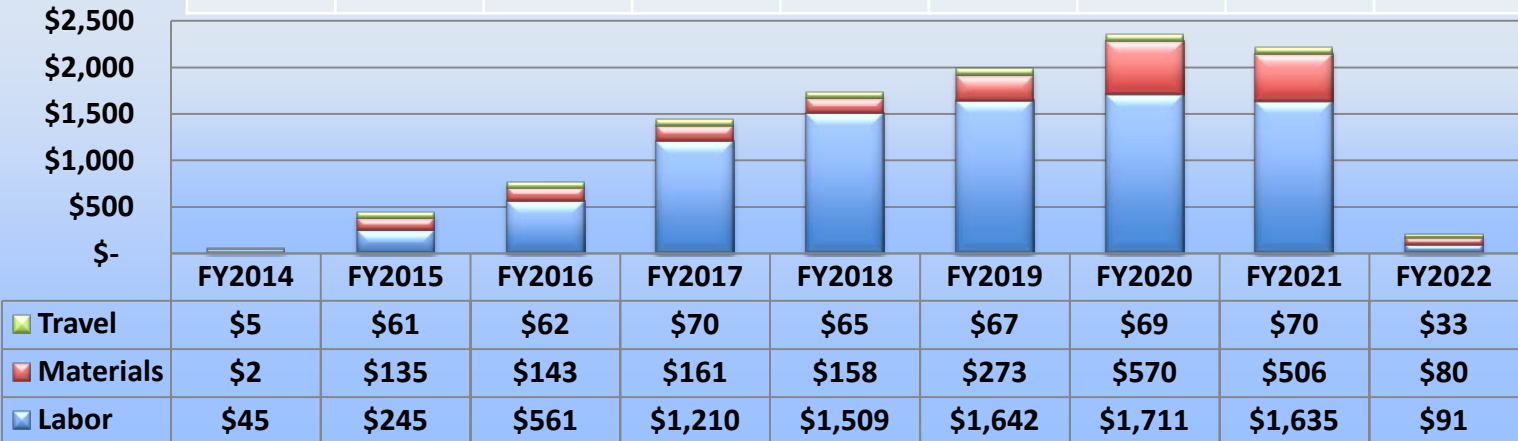
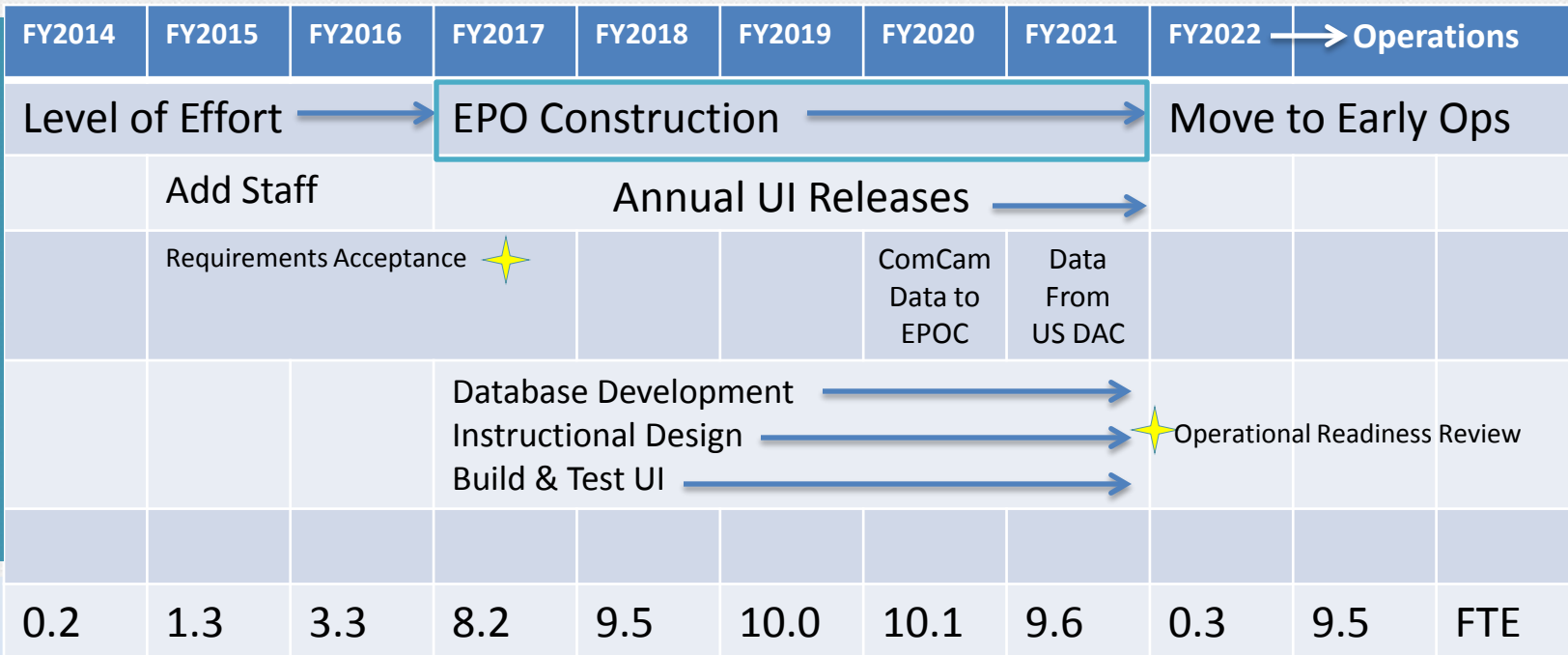


# EPO within Overall Integrated Project Schedule



EPO Begins in FY14 and Transitions into Early Operations in FY22 after 5-year Construction Period

EPO activities start *Late as Possible* with no standing army costs and no impact on Science Ops.  
EPO is not on the critical path.

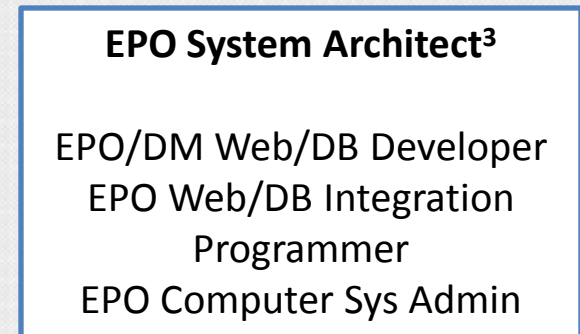
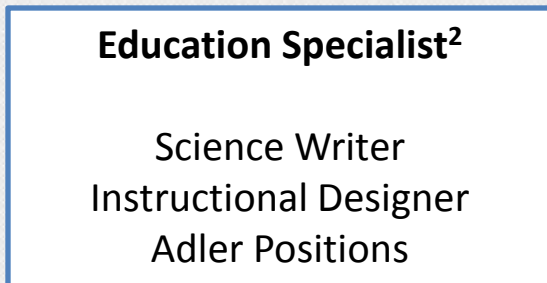
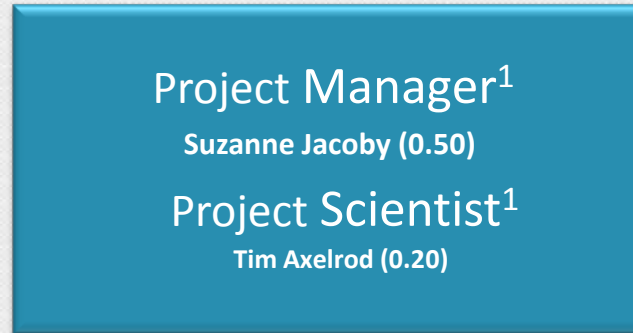


EPO connects with Level 2 milestones in Systems Engineering and Data Management

# EPO Organizational Chart for Construction; Staff in Place by FY2017



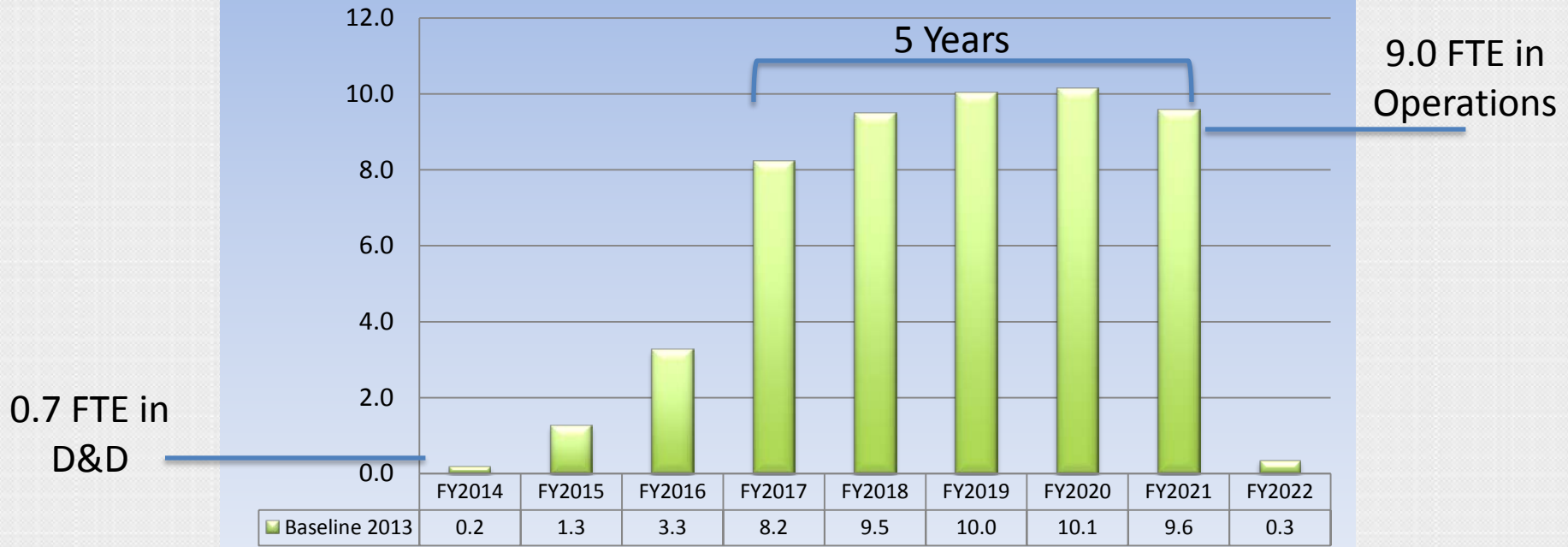
Project Manager and Project Scientist on board now<sup>1</sup>.  
 Education Specialist joins mid-year 2015<sup>2</sup>; lead software developer and system architect start mid-year 2016<sup>3</sup>.







## 05C - Education and Public Outreach Construction FTEs



- 1 new mid-year hire in 2015
- 3 new hires in 2016
- Smooth ramp-up into Construction
- Then transfer smoothly to Operations

# Staffing by Year: EPO FTEs Transition to Operations



	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	Operations
<b>EPO Project Manager</b>	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	1.0
<b>EPO Project Scientist</b>	0.1	0.3	0.3	1.0	1.0	1.0	1.0	1.0		
<b>EPO Education Specialist</b>		0.5	1.0	1.0	1.0	1.0	1.0	1.0		1.5
EPO Instructional Design				0.5	0.5	0.5	0.5	0.5		1.0
EPO Science Writer			0.5	0.5	0.5	0.5	0.5	0.5		1.0
<b>EPO Sr. Web / UI Developer</b>			0.5	1.0	1.0	1.0	1.0	1.0		1.0
EPO Web / Graphic Design				1.0	1.0	1.0	1.0	1.0		1.0
EPO Web/UI Designer				0.2	1.0	1.0	1.0	1.0		1.0
<b>System Architect</b>			0.5	1.0	1.0	1.0	1.0	0.5		
EPO/DM DB Developer				0.5	0.5	0.5	0.5	0.2		1.0
EPO Web/DB Integration Prog				0.0	0.5	1.0	0.6	0.9		
EPO Computer System Admin							0.5	0.5	0.2	0.5
LSST Outreach Specialist (Adler)				0.8	0.8	0.8	0.8	0.8		
LSST Visualization Lead (Adler)				0.1	0.1	0.1	0.1	0.1		
Visualization Designer (Adler)				0.1	0.1	0.1	0.1	0.1		
<b>Total FTE</b>	<b>0.2</b>	<b>1.3</b>	<b>3.3</b>	<b>8.2</b>	<b>9.5</b>	<b>10.0</b>	<b>10.1</b>	<b>9.6</b>	<b>0.3</b>	<b>9.0</b>

**Good match in skills: last year of construction to those needed in operations**

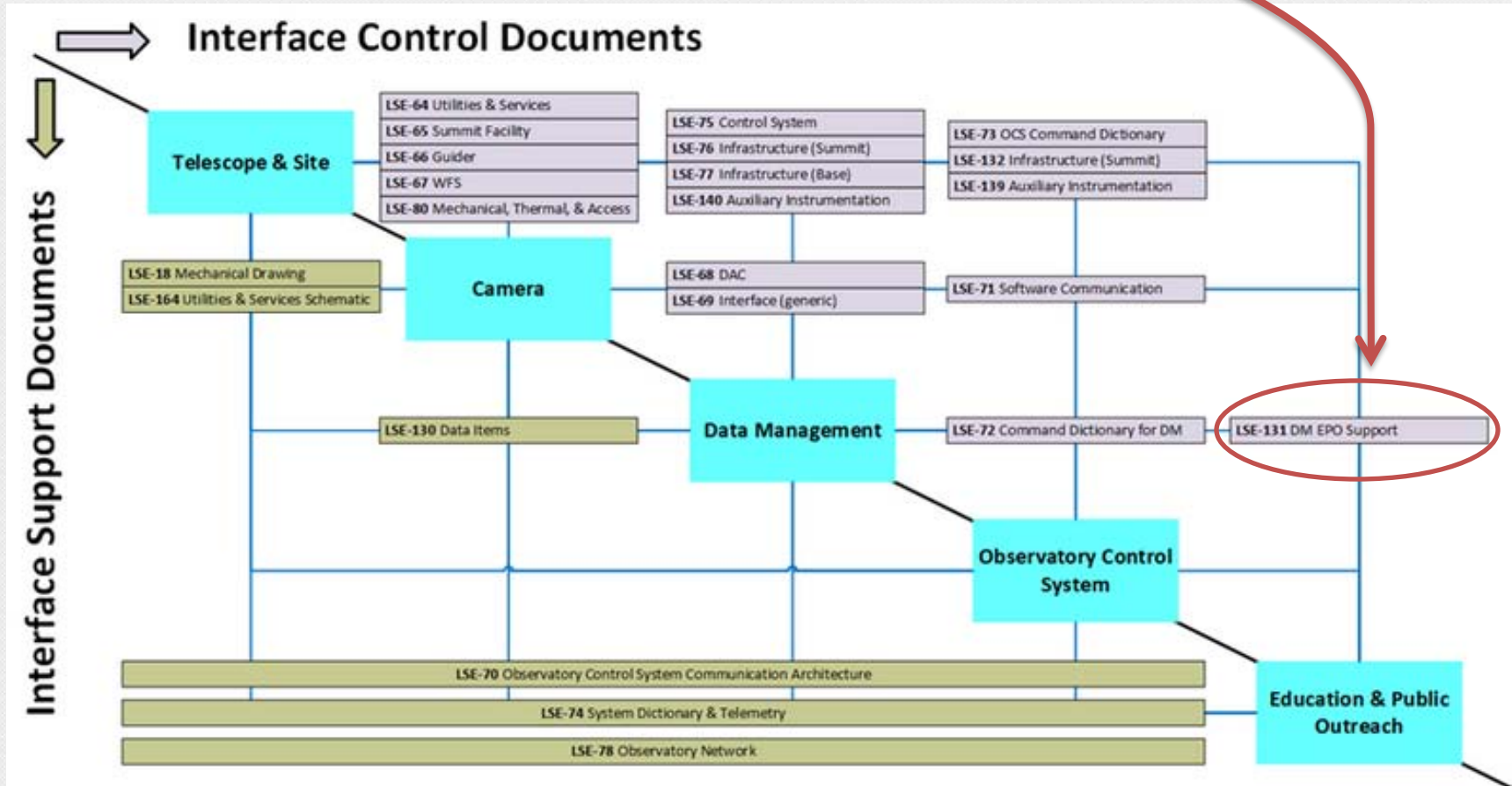


# EPO linked to LSST through single DM/EPO Interface



ICDs are managed and under change control

LSE-131 defines DM/EPO Interface







# EPO Goes to Early Operations in FY22 after passing successful Operations Ready Review.



## ORR Criteria includes:

Verify transfer of data products from DM, using data from science commissioning

Verify ability to filter alerts from DM through an event broker and transfer to EPOC

Test EPO portal at full load using simulated users and commercial web site testing tools

Validate key use cases using small groups of actual users

- Usability testing of User Interfaces
- Citizen Science, using prototype CS project
- Classroom Research
- Science Museums, using Adler as a test user
- LSST@HOME, including full use of inter-user communication and shared workspace
- Feed through of science queries to DM database

Verify functionality of administrative interfaces to EPOC during all testing activities

- Management of user accounts
- Performance monitoring of EPOC and EPO Portal
- Ticketing system
- Test cybersecurity using red team approach



# EPO Risks are not a Significant Threat to Project Success



Tracking 13 EPO Risks; total cost of EPO risk exposure is small (\$1,056K FY13)

EPO is unique in that science operations are not dependent on this subsystem.

We can use the first few years of construction, until FY17, to continue to understand and reduce risk.

secondary sort always by expected exposure cost

Risk ID# (Hover)	Edit Risk (Click)	Title	Review Status (days)	Trigger Date	Probability	Non-labor Cost (2013USD)	Schedule Cost (2013USD)	Expected Exposure Cost (2013 K-USD)	Expected Exposure Cost (then-year)	Estimator	Row # Sort Total Cost
EPO-215	Detail & Edit	EPO software development effort underestimated	17	Distributed	10 - 25%	\$0 K	\$980 K	\$163 K	\$187 K	Jacoby	1
EPO-220	Detail & Edit	Loss of key EPO personnel	17	Random	25 - 50%	\$200 K	\$240 K	\$163 K	\$186 K	Jacoby	2
EPO-208	Detail & Edit	EPO access patterns not as expected	17	2021-03-01	25 - 50%	\$200 K	\$240 K	\$163 K	\$206 K	Jacoby	3
EPO-218	Detail & Edit	EPO and DM Integration Incompatibilities	17	2021-03-01	10 - 25%	\$150 K	\$640 K	\$134 K	\$170 K	Jacoby	4
EPO-214	Detail & Edit	EPO external standards change	17	2021-03-01	10 - 25%	\$200 K	\$480 K	\$116 K	\$146 K	Jacoby	5
EPO-216	Detail & Edit	EPO user interface too complex	17	2019-09-01	10 - 25%	\$0 K	\$480 K	\$82 K	\$97 K	Jacoby	6
EPO-219	Detail & Edit	EPO bandwidth requirements not met	17	2020-10-01	10 - 25%	\$300 K	\$120 K	\$71 K	\$88 K	Jacoby	7
EPO-234	Detail & Edit	EPO Infrastructure Design Becomes Outdated	17	2019-01-01	5-10%	\$200 K	\$480 K	\$51 K	\$61 K	Jacoby	8
EPO-217	Detail & Edit	Required EPO software packages	17	Random	5-10%	\$200 K	\$240 K	\$33 K	\$38 K	Jacoby	9

The total expected exposure cost in FY2013 USD is: \$ 1055.7 K\$ The total expected exposure cost in then-year USD is: \$ 1273.89 K\$

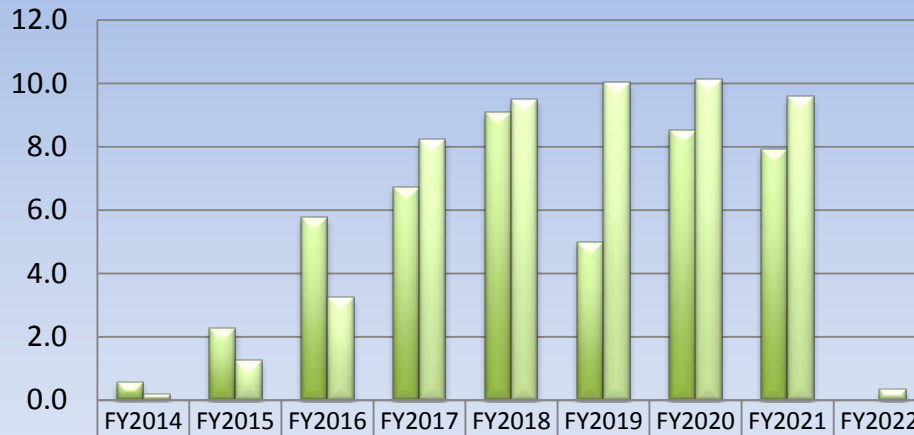


# EPO Plan Changes since 2011 Cost Review



- Costs decreased although schedule lengthened by 9 months
- Contracts replaced with labor
- Refined sizing and costing model for EPOC reduced costs
- Division of effort between EPO and PMO clarified
- Overhead costs now in PMO

## 05C - Education and Public Outreach Construction FTEs



■ Cost Review IMS	0.6	2.3	5.8	6.7	9.1	5.0	8.5	7.9	
■ Baseline 2013	0.2	1.3	3.3	8.2	9.5	10.0	10.1	9.6	0.3

	Cost Review	2013
Total FTE	45.9	52.2
Cost	12.2M	11.6M
Schedule	7Y, 6 mos	8Y, 3mos



- **32. Recommendation:** Staff should create a logic model for each goal set, establish priorities for developing learning experiences, and rework consistent UbD tables, one for each learning experience. During the PDR session, staff discussed well-developed ideas that should be included in the plan, for example the need for longer professional development experiences that could be offered in partnership with LSSTC members.

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PRELIMINARY DESIGN REVIEW

AUGUST 29<sup>TH</sup>, 2011







- **33. Recommendation:** For clarity, separate sections are probably needed for metrics and program assessment, perhaps with the metrics incorporated into the logic models and assessment of learning incorporated into the UbD process. Staff might check with an NSF program officer regarding the preferred format for the evaluation plan.

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PRELIMINARY DESIGN REVIEW

AUGUST 29<sup>TH</sup>, 2011





- **34. Recommendation:** The logic model should include mechanisms to motivate participation in the learning experiences by “inattentive” and underserved populations. For example, LSST could build portal elements for parents, youth organization leaders and others to bring young people to LSST learning experiences. They should also build relationships with appropriate organizations that normally serve these populations.

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# GOAL: Increase minority participation in LSST Project, LSST workforce, and eventual LSST EPO Users



Inputs	Activities	Outputs	Outcomes
<p>38 IM and their existing Diversity efforts</p> <p>LSSTC Board</p> <p>IINSPIRE &amp; PAARE Programs</p> <p>FaST Experience (2008-2010)</p> <p>AURA WDC AURA CAS</p> <p>NSF efforts to increase diversity</p>	<p>Prioritize recruitment of minorities for participation in Design &amp; Development Efforts</p> <p>Proactively engage URM through UI / EPO Portal</p> <p>Attend meetings attended by URM to build Sustainable Partnerships</p> <p>Remove Unconscious Bias from hiring committees</p> <p>Identify and obtain funds to hire diversity coordinator</p> <p>Learn from other projects that have had success in this area</p>	<p># Minorities on OAB</p> <p># Minorities on SC</p> <p># Minorities involved in focus groups and usability testing</p> <p># Meetings where LSST has an active presence</p> <p># Contacts made at meetings</p> <p># Agenda items pertaining to diversity discussed at OAB, AHM, LSSTC and other project sponsored meetings</p>	<p>Increased minority representation in the project now, before operations</p> <p>Formation of group of individuals, from all inputs, that are committed to the cause</p> <p>Diverse workforce of employees working on LSST</p> <p>Put resources into Diversity Goal, demonstrating it is a priority for the project.</p>

## What topics should be discussed next so you can address the charge, including EPO-specific #7?



### **7. Is there a strong plan to promote science education and public outreach during construction and commissioning, continuing credibly into operations?**

- Consider the proposed educational outreach and broader societal impact activities and advise on the merits of the plan.
- Review the preparatory work during construction leading up to those plans.
- Is the planned capital investment in the outreach and education activities from MREFC funds appropriate, well-conceived, adequate to enable the plans, and investment ready?





## Other Presentations are Available

- EPO During Operations
- EPO Center Architecture Design
- LSST EPO Risk Analysis
- Work to be done at Adler
  
- We could also walk through the PMCS or SysML model
- Review the Logic Models