Tailoring and Scaling of EVMS for Science Projects

Xiaofeng Guo and Rebecca Yasky
Large Facilities Office
National Science Foundation

CPM Chapter, Washington D. C.
March 26, 2020

Outline

- Unique challenges of science make tailoring of EVMS necessary
  - Examples
- Characteristics affecting EVMS
- Tailoring EVMS
  - Establishing EVMS and baseline formation
  - EVMS verification and acceptance
  - EVMS surveillance and project progress reviews
- Scaling of EVMS

Science Projects

Exploratory, nonconventional, one of a kind

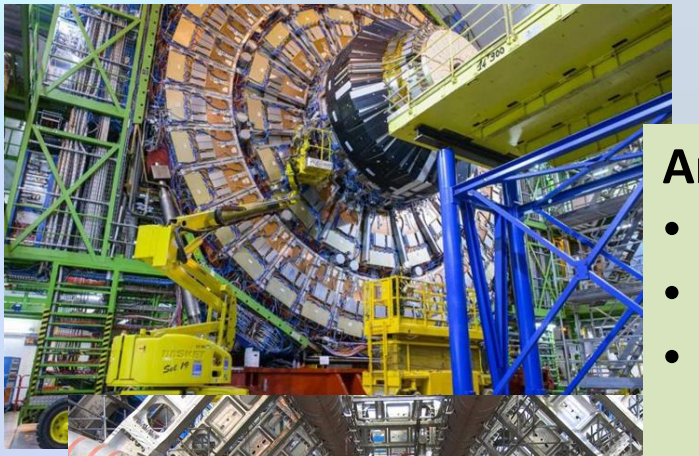
Present unique challenges to the EVMS implementation

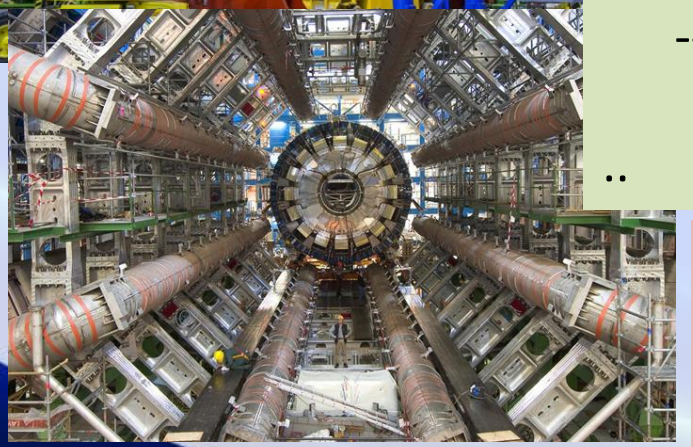
-- No one-size fits all solutions
-- Tailoring is necessary for effective implementation of EVMS

Examples next …

Large Hadron Collider High-Luminosity Upgrades (CMS & ATLAS Detectors at CERN)

Funded by NSF and DOE Office of Science





Collaboration : 3000 scientists, 183 institutions, 38 countries

Amazing facts:

- 100m below ground, similar weight to Eiffel Tower
- Particles traveling at 99.999999% of speed of light
- A billion interactions per second
  -- 20 simultaneous telephone conversations held by every person on the earth

.. …. more

Science Mission:

Explore:

- the most fundamental building blocks of matter
- The fundamental forces govern the interactions
- Early universe

……

Laser Interferometer Gravitational-wave Observatory (LIGO) Livingston and Hanford detectors

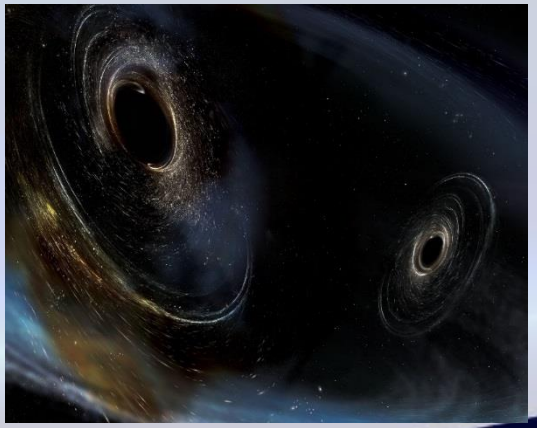
Collaboration: 1000 scientists, over 100 institutions and 18 countries

Amazing facts

- Two detectors situated 3000 kilometers apart and operating in unison
- measuring the distance to the nearest star (~4.2 light years) to an accuracy smaller than the width of a human hair.
- 341-million pounds of air press down on the vacuum tube (3mm thick steel tube)

Science Mission:

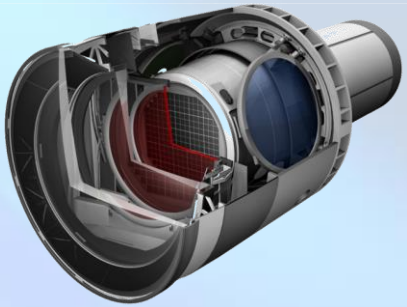
- Explore the gravitational waves and general relativity
- Understanding the history of universe expansion
- What happens if two neutron stars collides
- Black holes …..



Large Synoptic Survey Telescope (LSST) at Chile

Funded by NSF and DOE Office of Science

Consortium of: 34 international institutions/organizations, 8 science collaborations, 23 countries.



Science Mission:

- survey the entire southern sky every few days for a decade
- the widest, fastest and deepest view of the night sky ever observed
- Exploring the universe, dark matter, dark energy
- Formation of the Milk way, solar systems, asteroids

…….

Amazing facts

- largest digital camera ever built on ground
- 3-billion-pixel camera, small car size, 3 tons
- Displaying just one of its full-sky images would require 1,500 high-definition TV screens.
- each of its 30-second observations will be able to detect objects 10 million times fainter than visible with the human eye

Characteristics affecting EVMS

- **Pioneering in technology and forefront scientific research**
  - high risk, high uncertainty
  - extremely specialized
  - limited historical data for references
  - Evaluation of technical risks, cost and schedule estimate requires in-depth technical expertise
- **Heavy R&D effort**
  - prototype cycles, each step relies on prototype and testing results of previous cycle
  - require timely adjustments of the project plan in the following development cycle

Characteristics affecting EVMS

- **Large collaboration**

  (tens/hundreds of collaborating institutions)

  - management of technical and schedule interfaces

  - accounting systems practices vary among participating institutions

  - different funding agencies/sources and different requirements

  - inherent lag-time in financial reports between host institution and collaborating institutions

  Timely and Reliable Project Performance Data

Requires:
- Coordination in cost reports
- Relies on timely input from participating institutions
- Reconciliation with accounting records

Characteristics of Large Science Projects

- **International Collaboration**
  - schedule and tech interfaces with other countries
  - factors affect the project schedule, technical choices maybe outside of the project team's control
  - monitoring and management of such interfaces

-> prompt adjustment of project plan

Defining EVM tailoring

Applying the requirements of the EIA-748 guidelines to fit the project's characteristics while addressing all of the guidelines.

In other words:

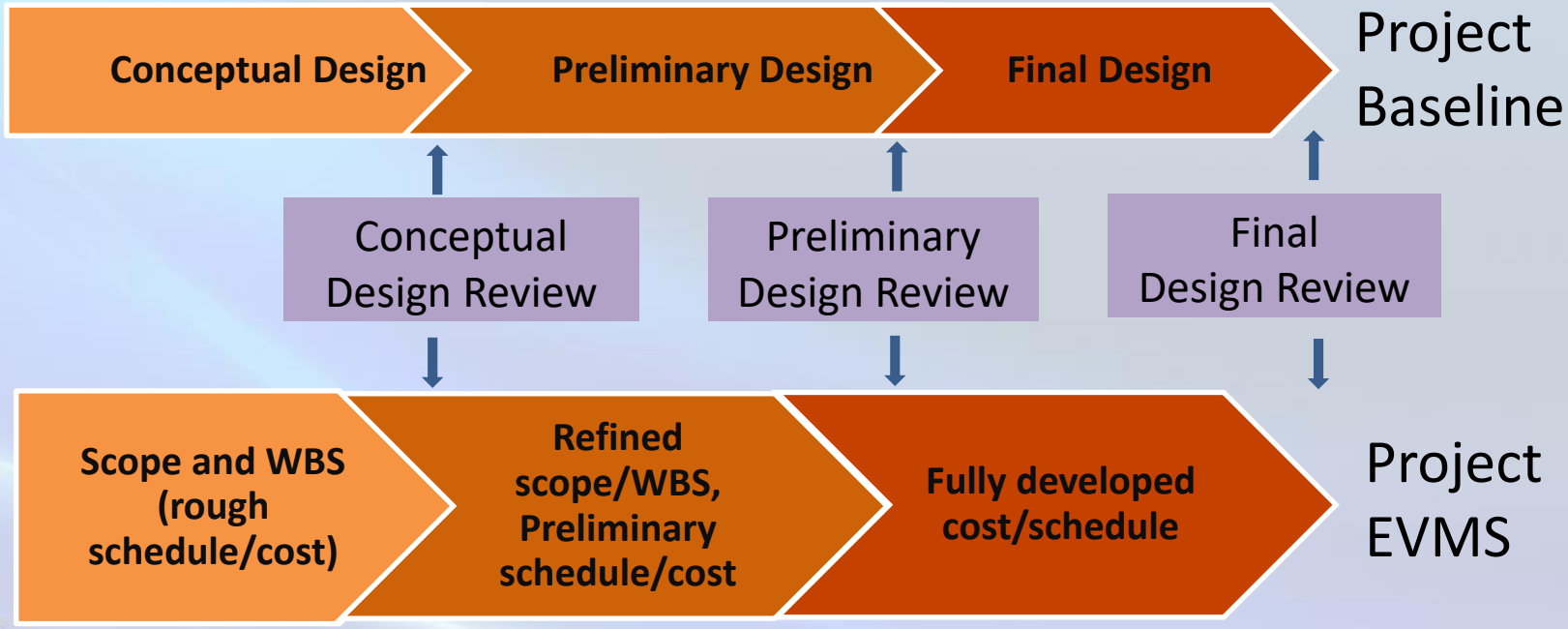
Tailored EVMS implements the EIA-748 32 guidelines in a manner that fits the specific needs of the project for effective project management control and reliable performance reporting to NSF based on the project's characteristics, including the type of work, complexity, execution method.

EVMS Tailoring Strategy (1)

Developing the project EVMS and project baseline formation

--- coherent and iterative process

--- external panel reviews



EVMS Tailoring Strategy (1)
---coherent development of EVMS and baseline

Review panels: Independent and external

Panel members:

--- leading experts for respective subsystems

--- cost/schedule, EVMS professionals

- **Evaluation and advices**
- **Joint evaluation**

Panel Review

- Science and Technical aspects
- Cost/Schedule, EVMS
- Management and Risk assessment

Development process : Iterative and collaborative

Conceptual Design stage

- initial scope, WBS, rough cost/schedule
- system level design, tech choice

- Review Panel recommendations

Preliminary Design Stage

- More detailed design and starting of prototype
- More refined scope, detailed WBS, cost/schedule estimate
- EVMS framework

- Review recommendations
- Initial test and prototype results

Development process : Iterative and collaborative

Final Design stage
- More mature tech decisions and choices
- complete design
- Fully developed scope, cost, and schedule
- Technical risks well-understood

- Review recommendations
- Further test and prototype results

Performance Measurement Baseline
Fully established EVMS

Tailoring of EVMS Strategy (2)

-- EVMS verification and acceptance for the project

- **Focus on the process for generating reliable and timely performance data**

- Tailored to each project

- **Factors considered for tailoring reviews**

- Method of project execution: buy/make, firm-fixed price contracts, collaboration, etc.
- Characteristics unique to the project
- Managing institution's Indirect and overhead cost structures

- **Collaborative and constructive review process**

- Assess and advise:

  providing guidance based on the team's EV maturity level

- Follow-up review for previous review recommendations

  Iterative process: not accepted ➡ conditional acceptance ➡ full acceptance

Tailoring of EVMS Strategy (3)

-- EVMS surveillance concurrent with technical progress review

- **External review panel:**
  -- Technical experts, cost/schedule/EVMS professionals
- **Progress Review**
  -- Assessment of progress toward technical, cost, and schedule objectives
  -- Frequency based on the project performance and risk level
  -- Collaborative: advise on technical and management issues, follow-up previous review recommendations
- **Assessment of EV data reliability reported to NSF**
  -- Technical progress evaluation aligns with the EVMS data
  -- CAM interviews and EV data traces
- **Evaluation of updated baseline and risk assessment**
  - Annually compare "risk-adjusted" ETC to TPC
  - Technical experts input

Tailoring of EVMS Strategy (4)
-- Targeted EVMS surveillance review

- **Tailored surveillance scope**
  - Follow up for review recommendations and Corrective actions
  - Select guidelines based on past reviews and potential concerns
  - Select control accounts
  - Desk or on-site reviews

EVMS scaling

For smaller than the mega-sized projects

- limited resources
- balance of burden and the benefits of EVMS

Define EVMS scaling

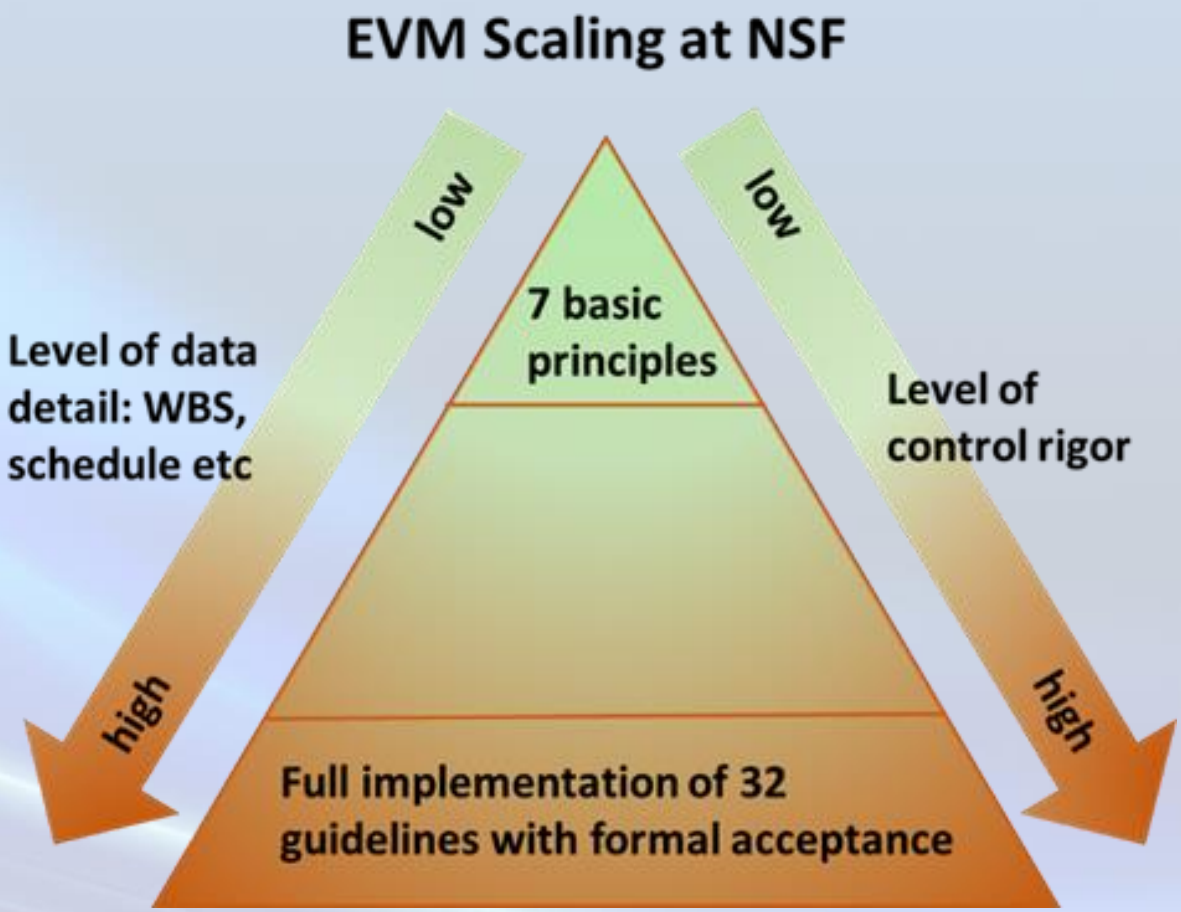
***Focusing on the 7 basic EVMS principals with implementation of EVMS guidelines that are essential for either reliable project management and/or agency oversight*.**

Recognizes smaller or less complex projects do not require the same level of data detail and/or the same level of control rigor

7 Basic principles of an EVMS:

1. Plan all work scope for the program to completion.
2. Break down the program work scope into finite pieces that are assigned to a responsible person or organization for control of technical schedule, and cost objectives.
3. Integrate program work scope, schedule, and cost objectives into a performance measurement baseline plan against which accomplishments are measured. Control changes to the baseline.
4. Use actual costs incurred and recorded in accomplishing the work performed.
5. Objectively assess accomplishments at the work performance level.
6. Analyze significant variances from the plan, forecast impacts, and prepare an estimate at completion based on performance to date and the remaining work to be performed.
7. Use the EVMS information in the organization's management processes.

Define EVMS scaling



NSF Practice Guide for EVM Scaling

- Process 1: Defining and organizing the project (Principles 1, 2)

  Primary guidelines: Guideline 1, 2, 5:
- Process 2: Establishing project cost, schedule, and contingencies (Principles 3)

  Primary Guidelines: Guideline 6,7,8,9,13,14
- Process 3: Progress and performance monitoring (Principles 4, 5, 7)

  Primary guidelines: Guideline 17,18, 22 , 23, 26
- Process 4: Management analysis and control (Principles 6, 7)

  Primary guidelines: Guideline 27, 28, 32

EVMS scaling

Scaled implementation of EVM

- Shortened development cycle and fewer reviews in the establishment of the baseline and EVMS

  -- still a iterative and collaborative process
- WBS -- higher level
- Areas for scaling considerations:

  Resource loaded schedule, weighted milestones

EVMS scaling
-- Tailoring to the project size

Scaled implementation of EVM

- EVMS acceptance and baseline approval

  -- concurrent review

  -- joint review by technical experts and EVMS cost/schedule professionals

  -- focus on the areas that ensures the reliable EVM data

- EVMS surveillance

  -- part of progress reviews and site visits

- More ideas for scaling consideration?

Summary

- Science projects present unique challenges for EVMS implementation
- Tailoring of EVMS is necessary to make it a beneficial management tool
- We established a process for tailoring:
  - iterative and collaborative development process for EVMS and the project baseline
  - external review process, collaborative efforts
  - EVMS surveillance concurrent with technical review
  - focused surveillance
- Scaling of EVMS – Tailor to the size

  exploring good practices in scaled approach

Thank you!