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SPACE LAUNCH SYSTEM

Over Target Baseline

Lessons Learned from the NASA SLS Booster Element

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SLS PP&C - MIPPS/SAIC

DAU-South Annual Update
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Presentation Goals

Training on the Earned Value Management discipline: Over Target Baseline (OTB)

Model a case study from the NASA Space Launch System Booster Element's 2015 prime contract OTB.

What went right!

What went wrong!!

Opportunities for improvement.

Why?

True for Earned Value Management

True for an Over Target Baseline (OTB)

Definitions

Reprogramming (or Formal Reprogramming)

- A comprehensive replanning of the remaining PMB that results in an Over-Target Baseline (OTB), an Over-Target Schedule (OTS) or both.
- This type of replan is for **performance measurement purposes only** and **requires prior coordination and approval of the Customer**.

Over Target Baseline (OTB)

- Replanning actions involving establishment of cost and/or schedule objectives that exceed the desired or contractual objectives on the program.
- An OTB is a new baseline for management when the original objectives cannot be met and new goals are needed for management purposes.

Over Target Schedule (OTS)

- An established schedule that extends beyond the contractual milestones or delivery dates.

Source: NASA EVM Implementation Handbook

NASA Federal Acquisition Regulation Supplement (NFS)
Earned Value Management System Policy - 1852.234-2 Earned Value Management System.

(g) If the contractor identifies a need to deviate from the agreed baseline by working against an Over Target Baseline (OTB) or Over Target Schedule (OTS), the contractor shall submit to the Contracting Officer a request for approval to begin implementation of an OTB or OTS. This request shall include a top-level projection of cost and/or schedule growth, whether or not performance variances will be retained, and a schedule of implementation for the reprogramming adjustment. The Government will approve or deny the request within 30 calendar days after receipt of the request. Failure of the Government to respond within this 30-day period constitutes approval of the request. Approval of the deviation request does not constitute a change, or the basis for a change, to the negotiated cost or price of this contract, or the estimated cost of any undefinitized contract actions.

(End of clause)

Source: NASA EVM Implementation Handbook

EAC less than actual costs

Significant technical issue changes plan

Performance data ineffective

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(End of clause)

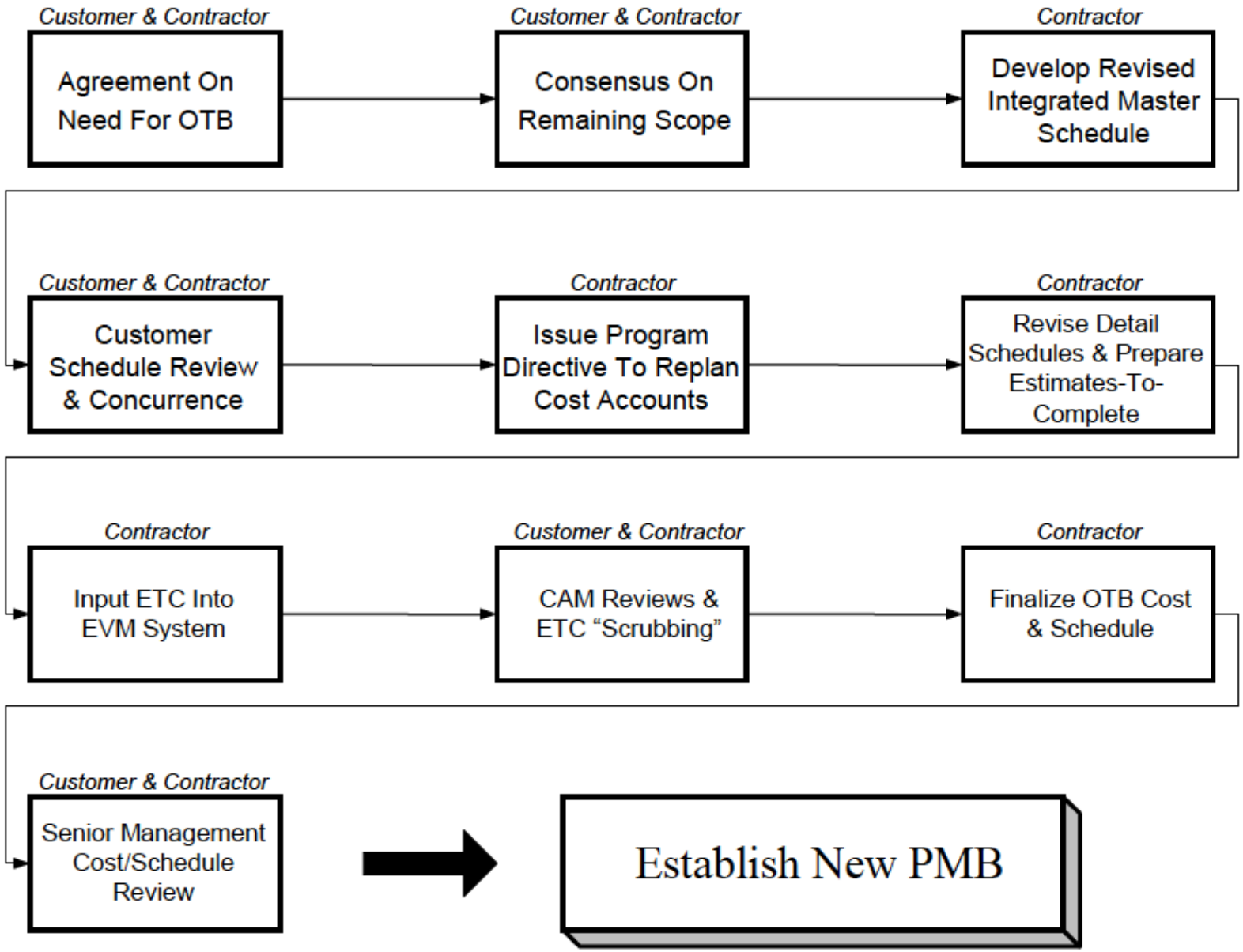
MR burnout

Cost & Schedule variance explanation no longer meaningful

EAC is unrealistic

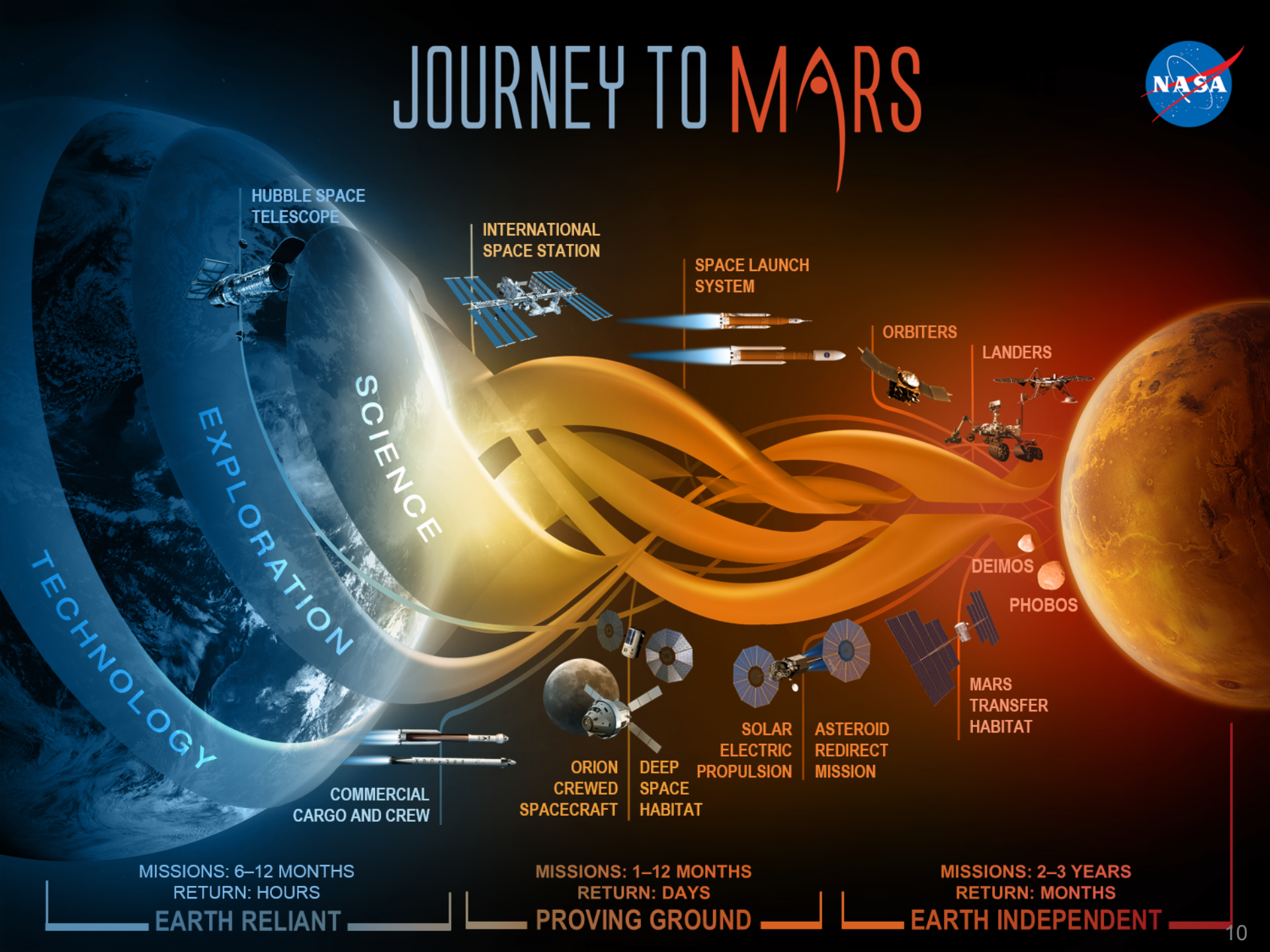
Source: NASA EVM Implementation Handbook

OTB Process Flow

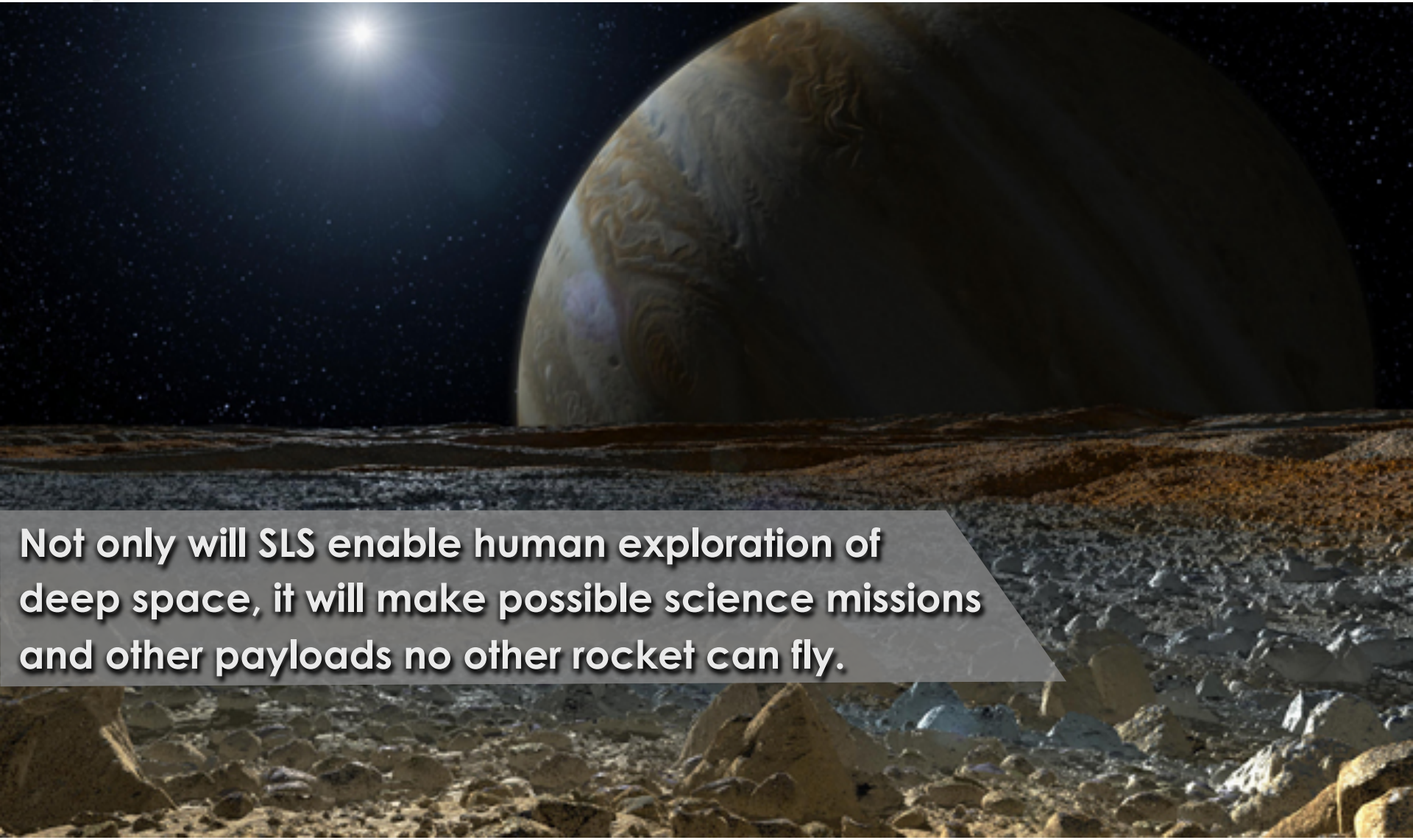


Tiffany, D. *Value Added with EVM and the Over Target Baseline*. 18th IPMC - Nov. 2002.

Case Study

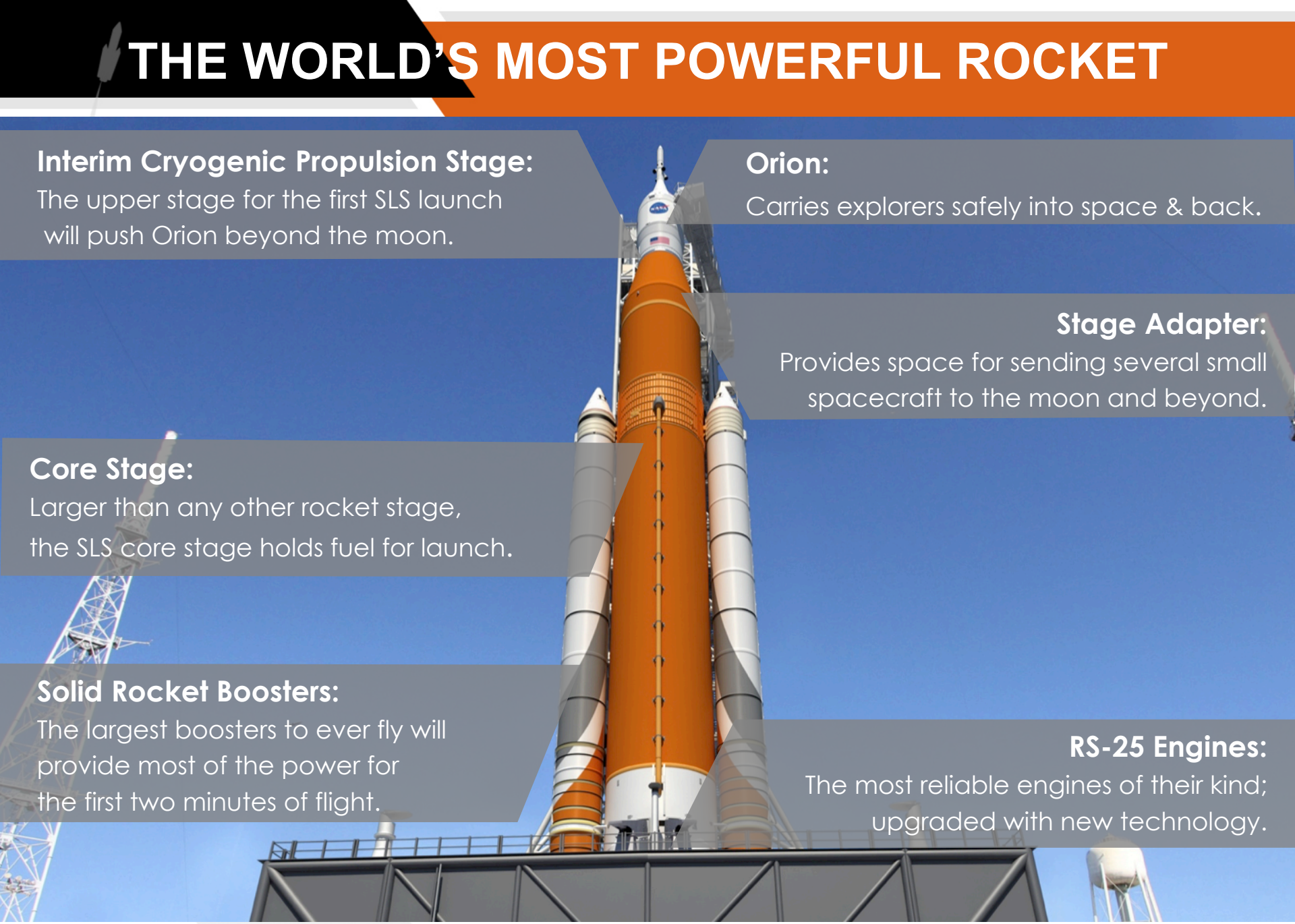

JOURNEY TO MARS
NASA
HUBBLE SPACE TELESCOPE
INTERNATIONAL SPACE STATION
SPACE LAUNCH SYSTEM
ORBITERS
LANDERS
SCIENCE
EXPLORATION
TECHNOLOGY
DEIMOS
PHOBOS
MARS TRANSFER HABITAT
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
ORION CREWED SPACECRAFT
DEEP SPACE HABITAT
COMMERCIAL CARGO AND CREW
MISSIONS: 6–12 MONTHS
RETURN: HOURS
EARTH RELIANT
MISSIONS: 1–12 MONTHS
RETURN: DAYS
PROVING GROUND
MISSIONS: 2–3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT

MAKING THE IMPOSSIBLE POSSIBLE



Not only will SLS enable human exploration of deep space, it will make possible science missions and other payloads no other rocket can fly.

THE WORLD'S MOST POWERFUL ROCKET



Interim Cryogenic Propulsion Stage:
The upper stage for the first SLS launch will push Orion beyond the moon.

Orion:
Carries explorers safely into space & back.

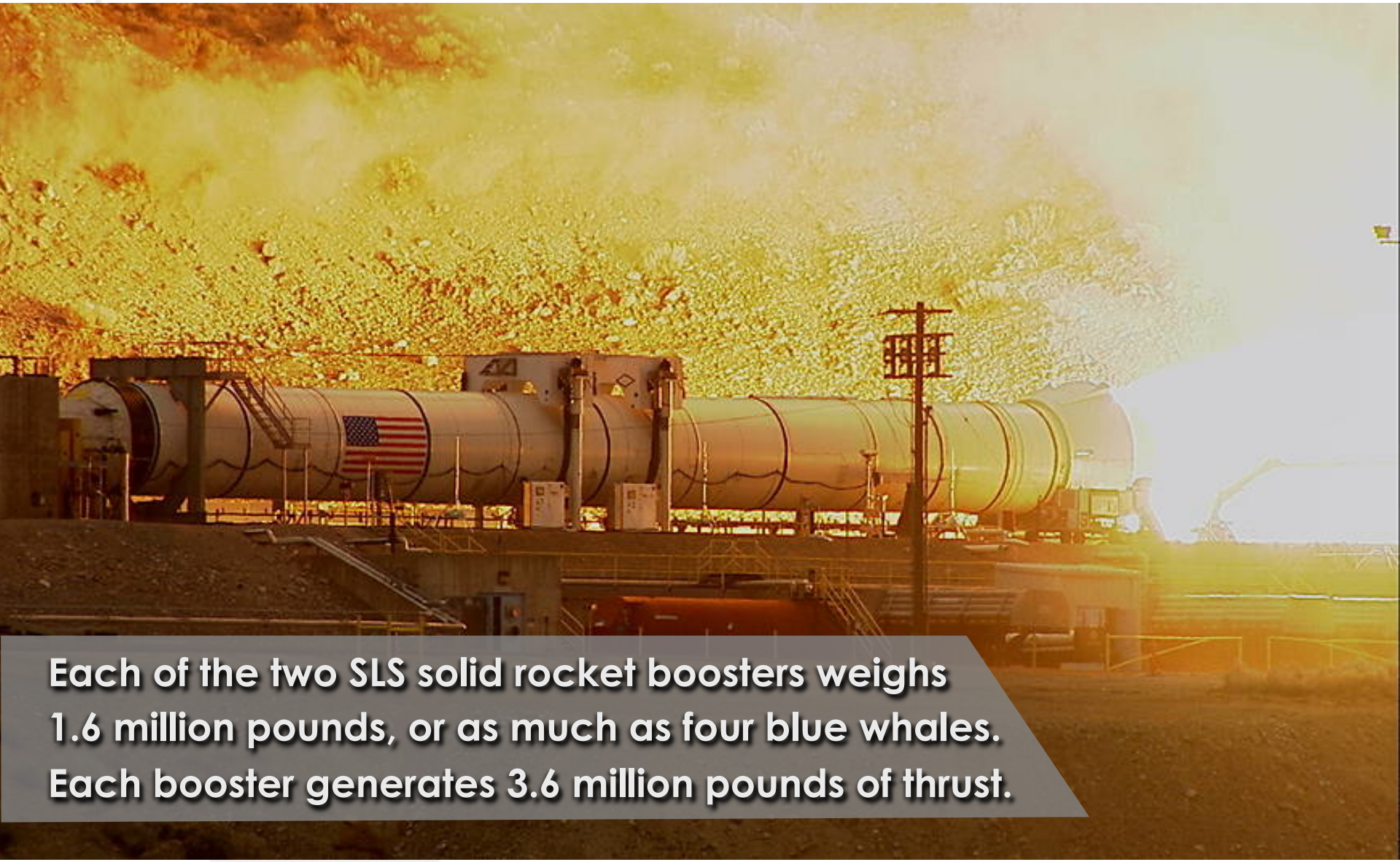
Stage Adapter:
Provides space for sending several small spacecraft to the moon and beyond.

Core Stage:
Larger than any other rocket stage, the SLS core stage holds fuel for launch.

Solid Rocket Boosters:
The largest boosters to ever fly will provide most of the power for the first two minutes of flight.

RS-25 Engines:
The most reliable engines of their kind; upgraded with new technology.

BUILDING A BETTER BOOSTER



Each of the two SLS solid rocket boosters weighs 1.6 million pounds, or as much as four blue whales. Each booster generates 3.6 million pounds of thrust.

SLS BOOSTER PROCESSING

Insulation Layup

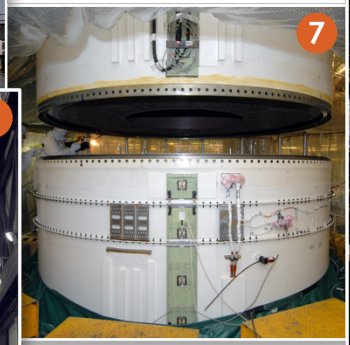
Propellant Casting

Propellant Inspection

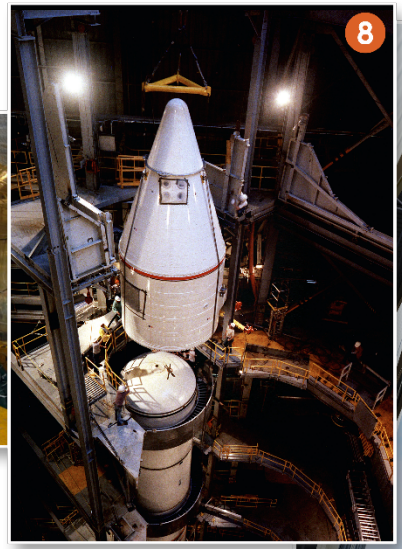
Static Testing

Segments
Travel to KSC

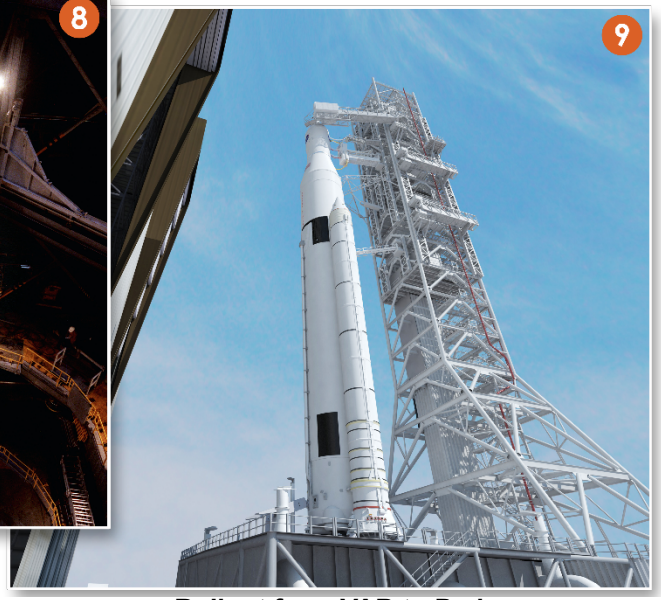
Aft Booster Buildup



Motor Stacking



Booster Stacking



Rollout from VAB to Pad

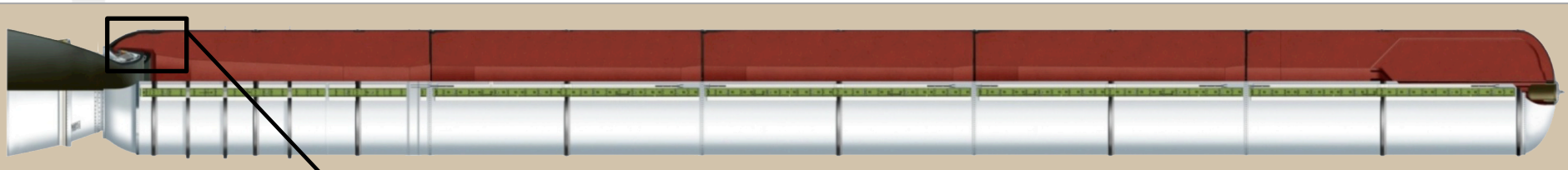
DDT&E Ain’t Easy

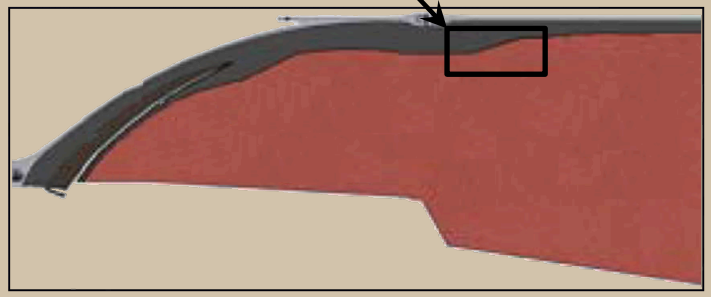
PBI-NBR Insulator Background

- **Shuttle's RSRM baseline design used asbestos and silica-filled nitrile butadiene rubber (ASNBR) as an insulator.**
- **Due to the inherent health issues of ASNBR, new formulations of non-asbestos insulators were developed and tested as candidates to replace the Shuttle ASNBR.**
  - The PBI-NBR formulation was down selected based on its performance in the areas of ease of processing and in-flight performance.
- **From an erosion performance standpoint, PBI-NBR was a significant improvement over ASNBR**
  - Enabled a reduction in total insulation weight and performance data obtained from the development motors was much improved over ASNBR.
- **Processing of PBI-NBR has presented some challenges.**

PLI Un-bond Issue

- Propellant/liner/insulator (PLI) un-bonds were found during x-ray inspection of the QM-1a Aft Segment.
- Most probable cause identified through fault tree approach utilizing multiple full-scale and subscale test articles:





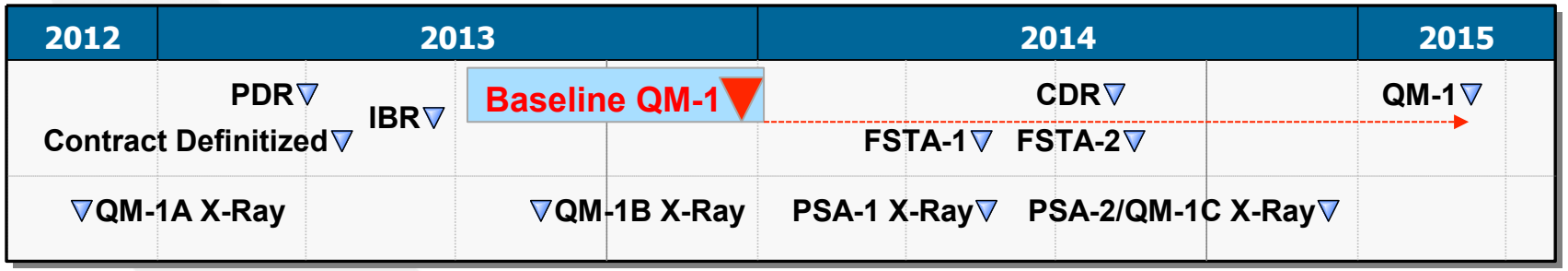
- Two full-size case segments used to demonstrate numerous improvements to design, processing, and inspection.

- Successfully implemented on QM-1

Investigation Lessons Learned

- **Investigation lasted more than two years – Many Lessons**
  - "Heritage" does not mean "Without Challenges"
  - Scale of testing should match final configuration before conclusions are drawn
    - The first rebuild was based on erroneous conclusions from subscale
  - Multiple Demonstration Motors did not fully expose the problem
  - Hundreds of subscale tests and four full scale segments were built

- **This investigation demonstrates what can happen – the unintended consequences of a critical materials change**



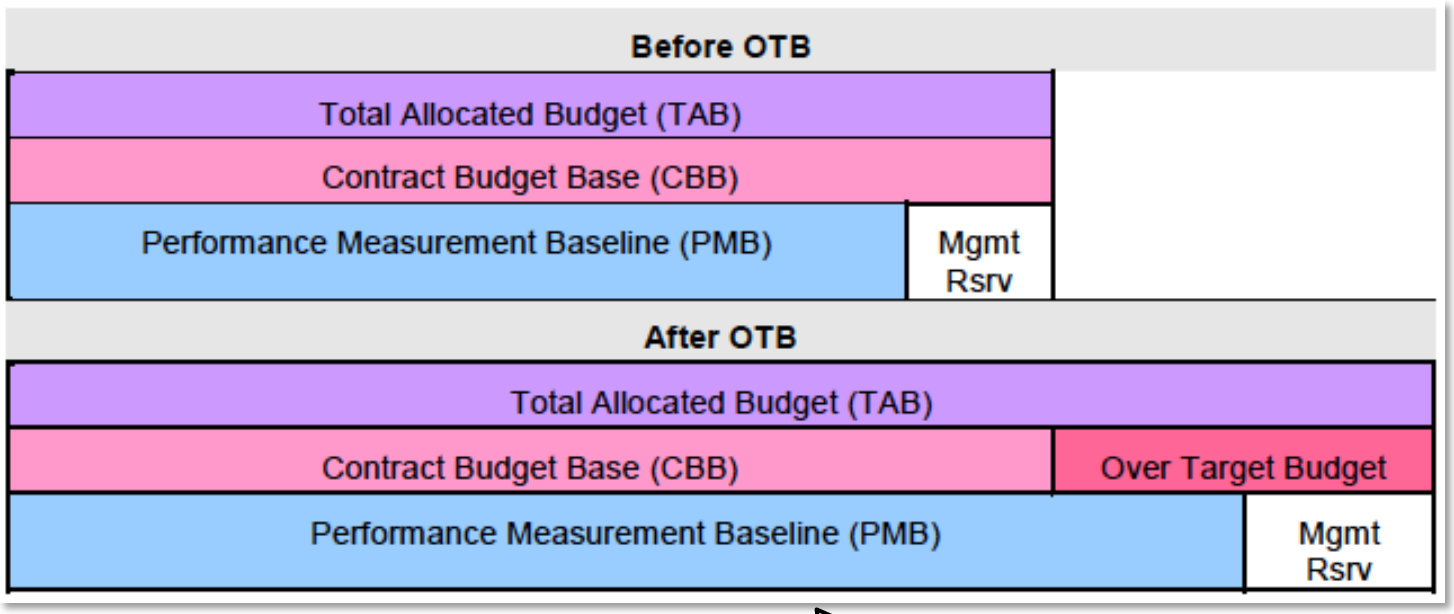
ETC a Mess…Now What?

1. Recognize the Need to Reprogram

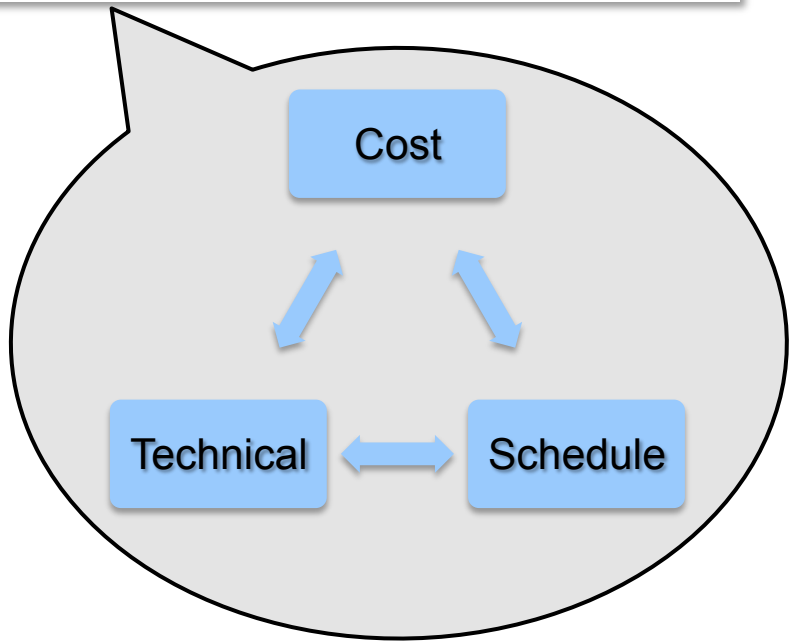
*The contractor should submit an OTB/OTS request when **it** determines that the current baseline does not represent a realistic plan for accomplishing the remaining work and no longer serves as a basis for realistic measurement…The primary reason for implementing an OTB/OTS should be to improve the contractor's ability to manage and control ongoing work. Therefore, the decision to request an OTB/OTS should originate with the contractor.*

– Excerpts from DCMA EVM Implementation Guide

2. Government and Contractor Discuss OTB



- The #1 LESSONS LEARNED from both the Government and Contractor was the importance of COMMUNICATION.
- OTB is a massive effort that impacts a program for ¼ to ½ of a calendar year.
- Discuss, plan, (discuss some more), and ensure understanding and agreements agreements from all stakeholders.
- Keep Lines of Communication Open!



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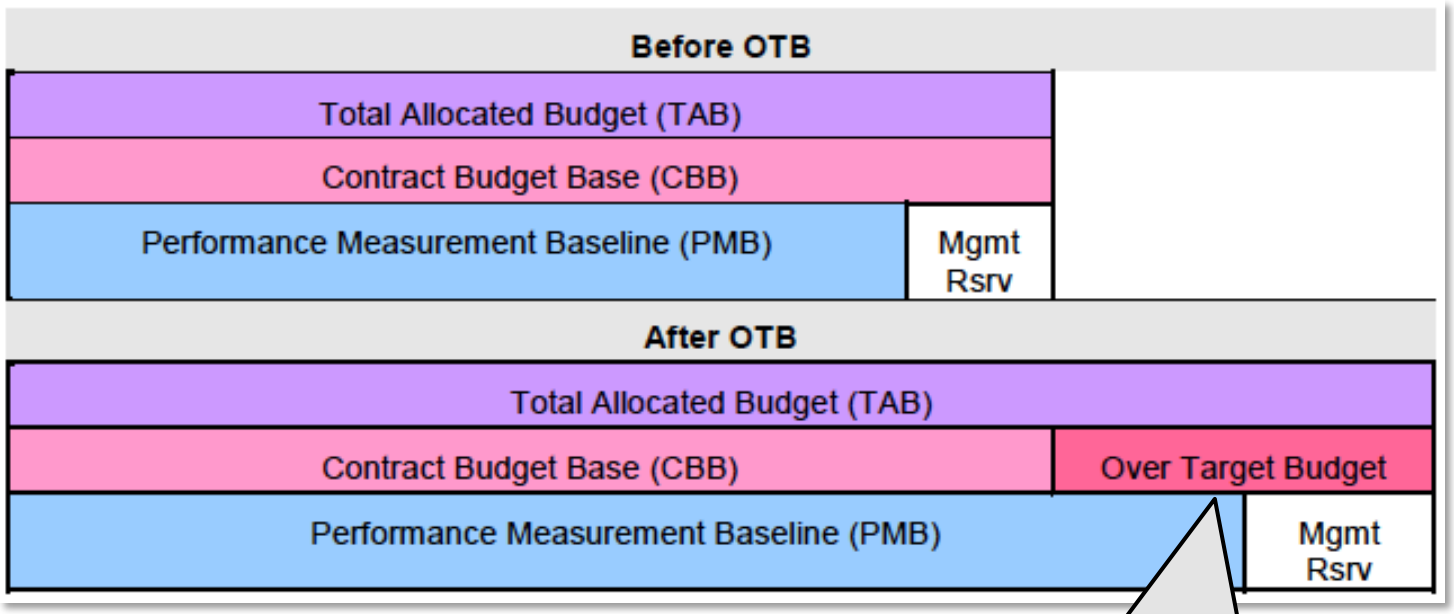

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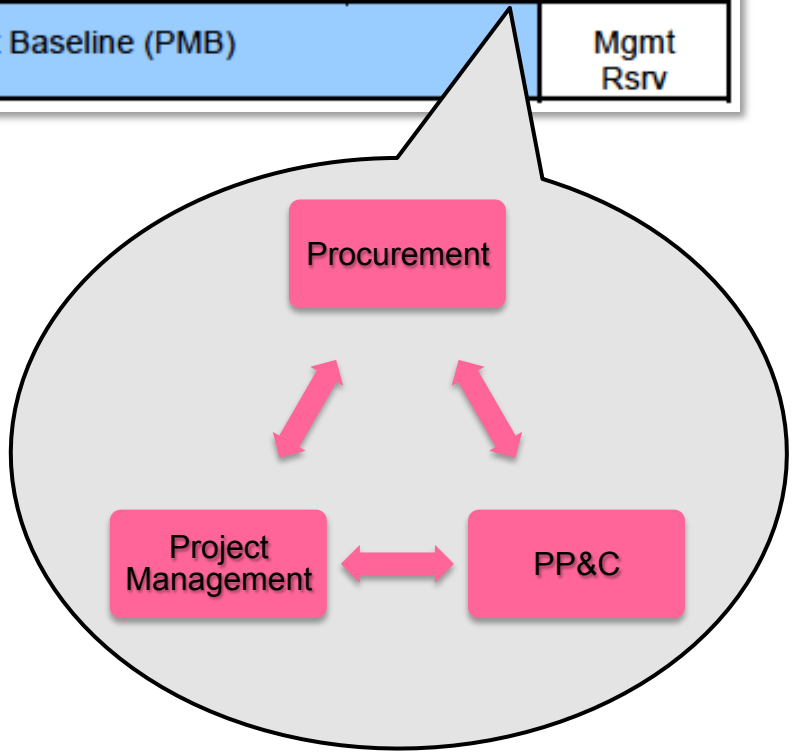


3. Contractor Submits Letter Requesting OTB Approval

APPENDIX A – SAMPLE PROCURING CONTRACTING OFFICER (PCO) LETTER

Office Symbol

Over Target Baseline Review; Contract number

Contractor
Address

1. In accordance with the subject contract, a joint baseline review of the implementation of your Over Target Baseline (OTB) was conducted on (date). The purpose of this review was to determine if the OTB had been implemented in accordance with your earned value system procedures and with the joint team's working agreement on ground rules and assumptions. This OTB is implemented for the purpose of improving the performance management of this contract, and does not constitute direction to change any contractual parameters.

2. Based on the findings of the review, we concur with your implementation of the OTB. The increase in value of [$ ##M] was properly documented and explained and should be reported in the contractually-required, earned value management report, using instructions contained in the applicable data item description.

3. This letter is considered within the current contractual requirements, target cost, terms and conditions. [(For cost reimbursable contracts only) The Government recognizes the potential cost liability to the Government caused by the OTB and underlying revised estimate.] The OTB amount is considered to be outside of the negotiated contract terms and is not subject to fee provisions, including award fee. If you do not concur and consider this letter as direction likely to change these and other contract provisions, notify the Contracting Officer immediately and delay implementing this letter until the matter has been resolved.

4. Please contact [contracting officer, phone #] if you have any questions concerning the results of the OTB Review.

I.M. Warranted
Contracting Officer

CC:
Atch:

Government should respond in writing

Source: Over Target Baseline and Over Target Schedule Guide OUSD AT&L (PARCA). 2012

4. Execute Bottoms-Up Reprogramming

◆ OTB Execution Phase

- Two month (minimum) effort…likely more!
- Focus on replanning the work remaining
  - Bottoms-up estimate of remaining cost and schedule
  - IMS resource loaded and logically linked with reasonable durations
- Determine how OTB will treat existing cost and schedule variances
  - Option 1: Eliminate all Variances
  - Option 2: Eliminate SV only
  - Option 3: Eliminate CV only
  - Option 4: Eliminate selected variances
  - Option 5: Retain all variances
- Future Budgets set to newly revised estimate to complete
- Determine amount of Management Reserve (MR) to include in OTB value
- Input data to EVM system and begin reporting new baseline
- Conduct an Integrated Baseline Review (IBR)

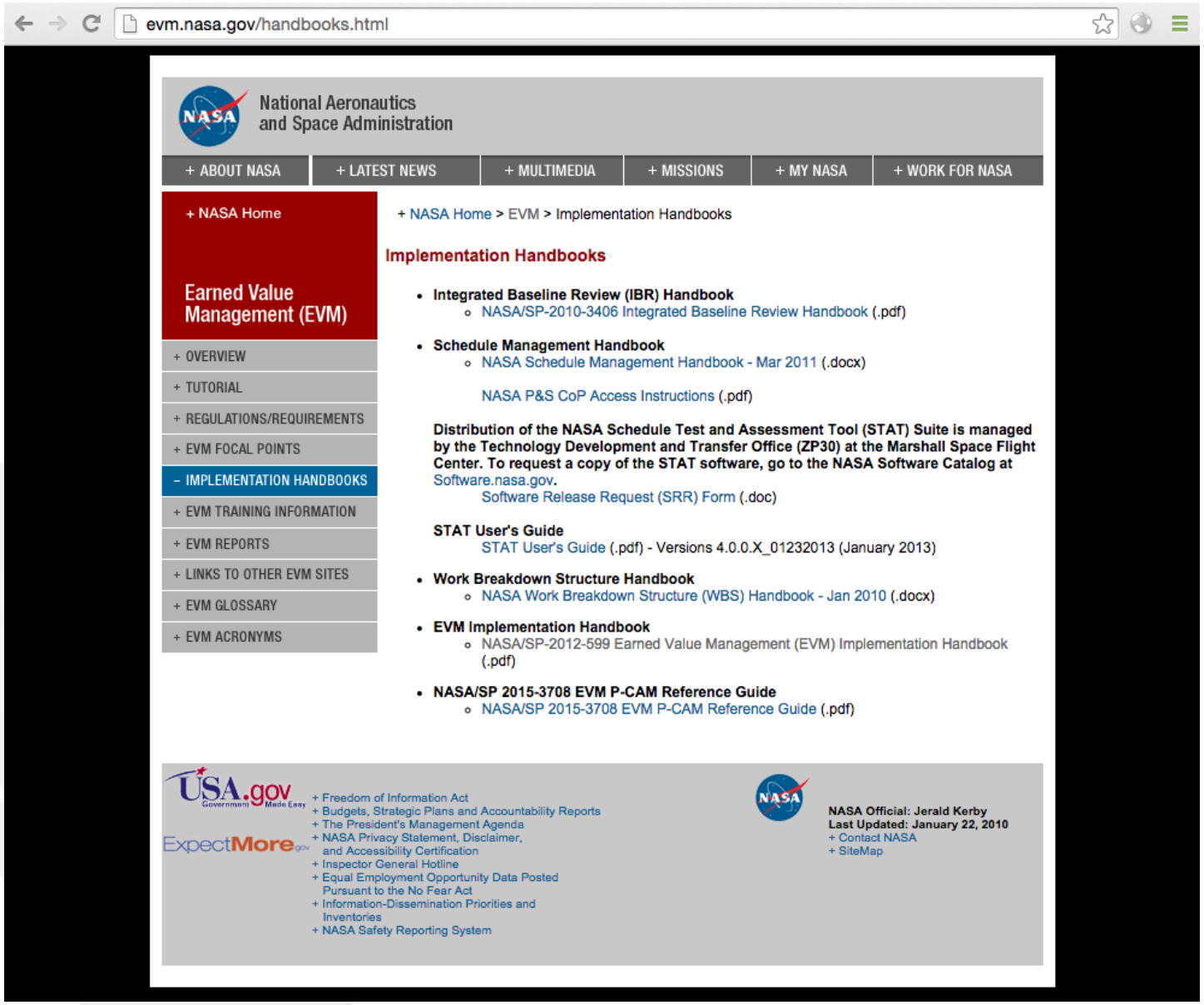
Expectations Following an OTB

- Executable and Achievable Baseline Plan
- Logical Budget for Management Reserve
- Meaningful Performance Indicators
- Restored Confidence

- Warning! A new baseline will not:
  - Prevent future cost growth
  - Contain cost or schedule overruns
  - Ensure future, good planning & scheduling practices
  - Improve management commitment
  - Guarantee the EVMS will operate flawlessly

Source: Over Target Baseline and Over Target Schedule Guide OUSD AT&L (PARCA). 2012

Key Resources



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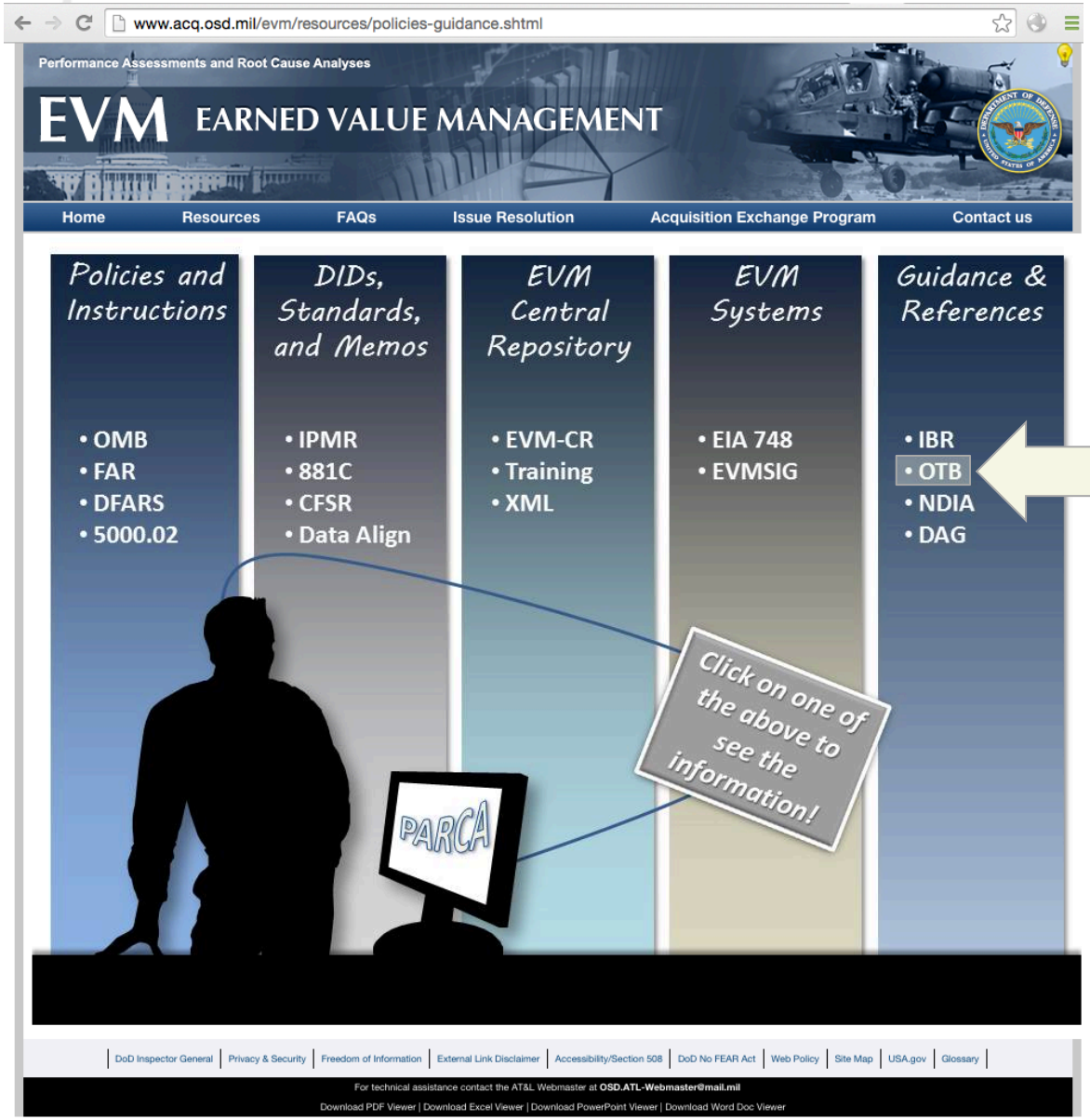

Over Target Baseline
and
Over Target Schedule
Guide

OUSD AT&L (PARCA)
December 5, 2012

Questions

OTB Plan and Execution

1. **Recognize the need to reprogram**
2. **Government and contractor meet and discuss parameters for a bottoms-up EAC**
3. **Contractor submit a letter requesting approval to implement an Over Target Baseline**
4. **Execute Bottoms-Up Reprogramming**
   - Bottoms-up estimate of remaining cost and schedule. IMS resource loaded and logically linked with reasonable durations.
   - Determine how OTB will treat existing cost and schedule variances
     - Option 1: Eliminate all Variances
     - Option 2: Eliminate SV only
     - Option 3: Eliminate CV only
     - Option 4: Eliminate selected variances
     - Option 5: Retain all variances
   - Future Budgets set to newly revised estimate to complete
   - Report using new baseline
   - Conduct an Integrated Baseline Review (IBR)

1. Recognize the need to reprogram

- **Working EVMS will make it hard for contractor to hide a brewing overrun ($TCPI_{eac}$ analysis)**
- **Significant rework on technical scope a good indicator**
- **MR burndown a good indicator**

- *The contractor should submit an OTB/OTS request when **it** determines that the current baseline does not represent a realistic plan for accomplishing the remaining work and no longer serves as a basis for realistic measurement…The primary reason for implementing an OTB/OTS should be to improve the contractor's ability to manage and control ongoing work. Therefore, the decision to request an OTB/OTS should originate with the contractor. – Excerpt from DCMA EVM Implementation Guide*

- **Decision lies with the prime contractor**
  - Recognize the stigma (right or wrong) that comes with an OTB
  - DCMA there to help should the contractor need a push