

National Aeronautics and Space Administration



# Project Management ABCs— A is for Acquisition

*APPEL PM Challenge Conference  
February 2008*

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June Zakrajsek

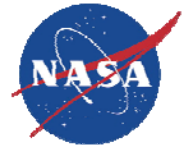
NASA Glenn Research Center  
(and the rest of the VTC Acquisition Team)

[www.nasa.gov](http://www.nasa.gov)



# Purpose

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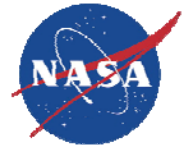
**This presentation shares a number of experiences and lessons learned from the recently completed Vibro-Acoustic Test Capability design/build acquisition at Glenn Research Center for Constellation's Orion qualification testing program.**

*If you have knowledge, let others light their candle with it.*

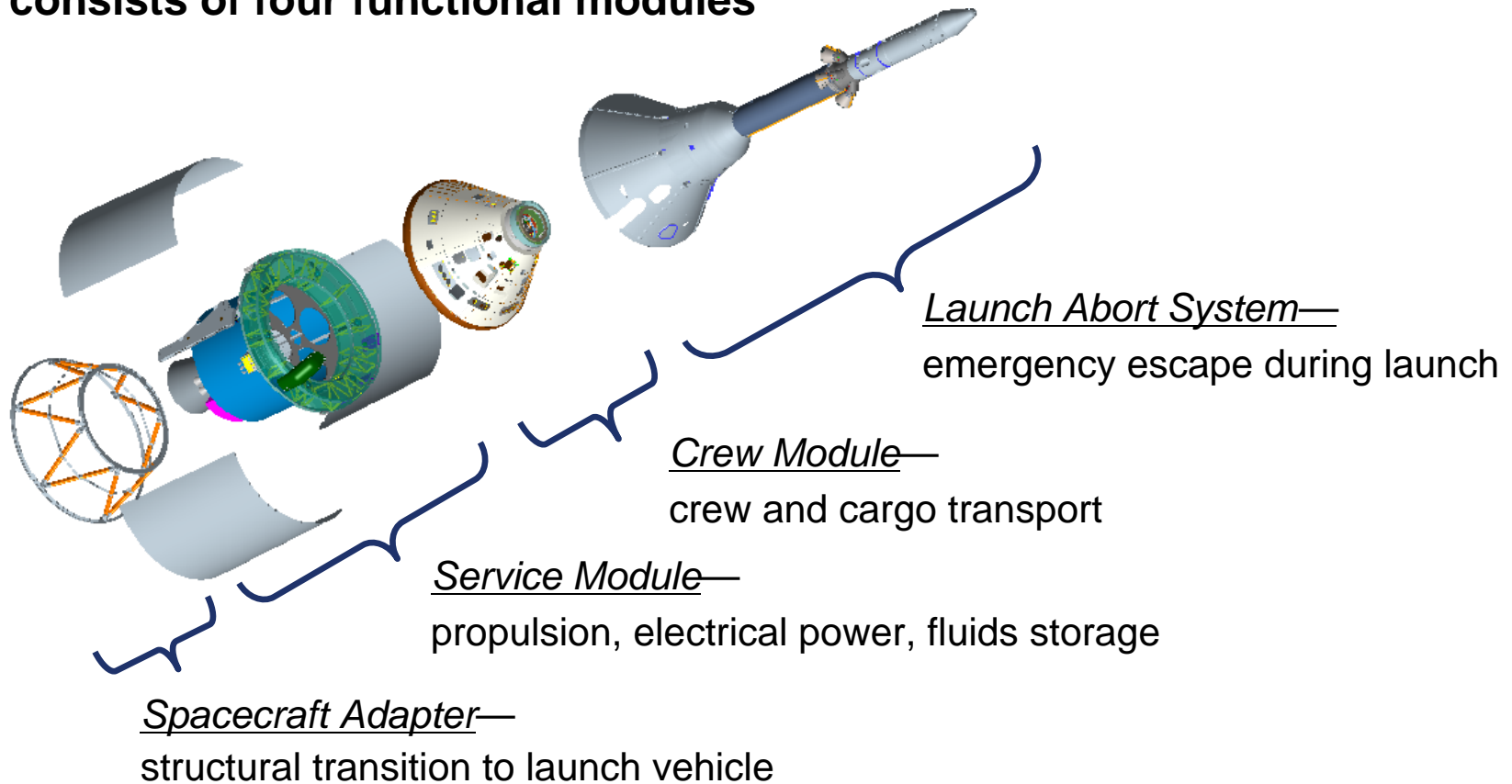
*—Winston Churchill*



# Orion System Elements

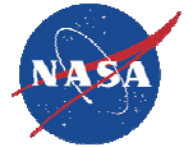


The Orion Crew Exploration Vehicle consists of four functional modules





## Project Objectives/Overview

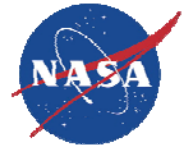


- **Provide Orion Structural Development Unit (SDU) testing and Orion Integrated Environmental Qualification Testing in a “test as you fly” configuration**
  
- **Perform modifications to GRC/Plum Brook Station’s Space Power Facility**
  - Acoustic Vibration
  - Mechanical Vibration
  - Thermal/Vacuum
  - EMI/EMC testing
  
- **Provide test support for Orion Test and Verification SDU and Qualification testing**
  
- **Critical Path is preparing for SDU/Ground Test Article testing**
  - Requires Mechanical Vibration and Reverberant Acoustic Vibration Facilities
  - Government estimated design/build time at 18 to 24 months

**“Ready to Test”  
need date: 12/2008**



# Four Test Facilities Within Space Power Facility



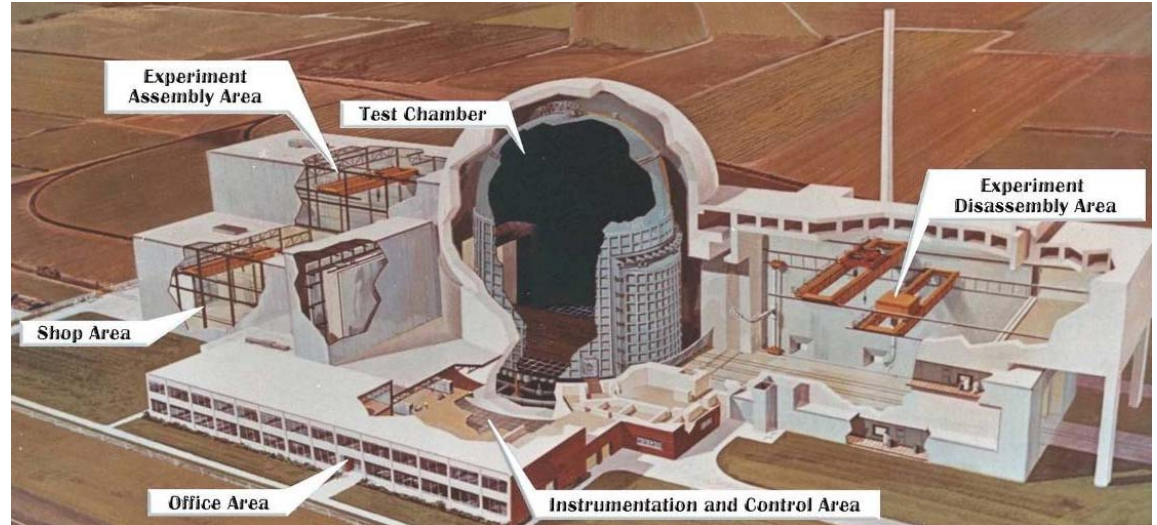
## SPF Test Facilities

- Test Chamber
  - Thermal Vacuum
  - Electro-Magnetic Compatibility
- Disassembly Area
  - Mechanical Vibration
  - Reverberant Acoustic



Large high bay areas adjacent to two sides of the test chamber allow for handling of large hardware for pre- and post-test processing

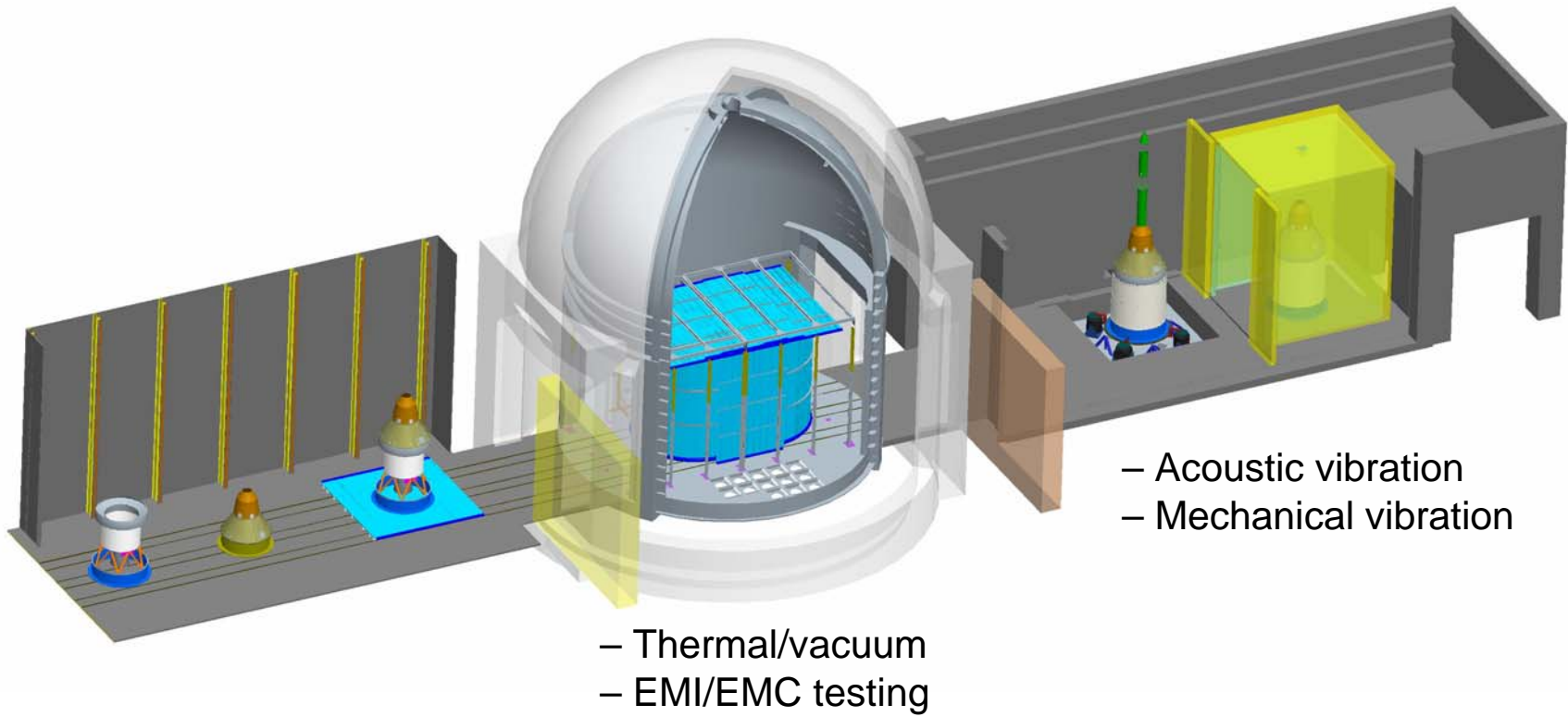
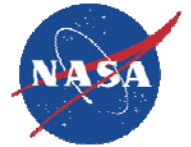
Rails provide the ability to transport large items from high-bays into test chamber



**Space Environmental Testing Under One Roof**

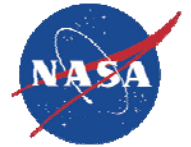


# Conceptual Facility Architecture for Orion Testing





# Environmental Testing of Orion at SPF

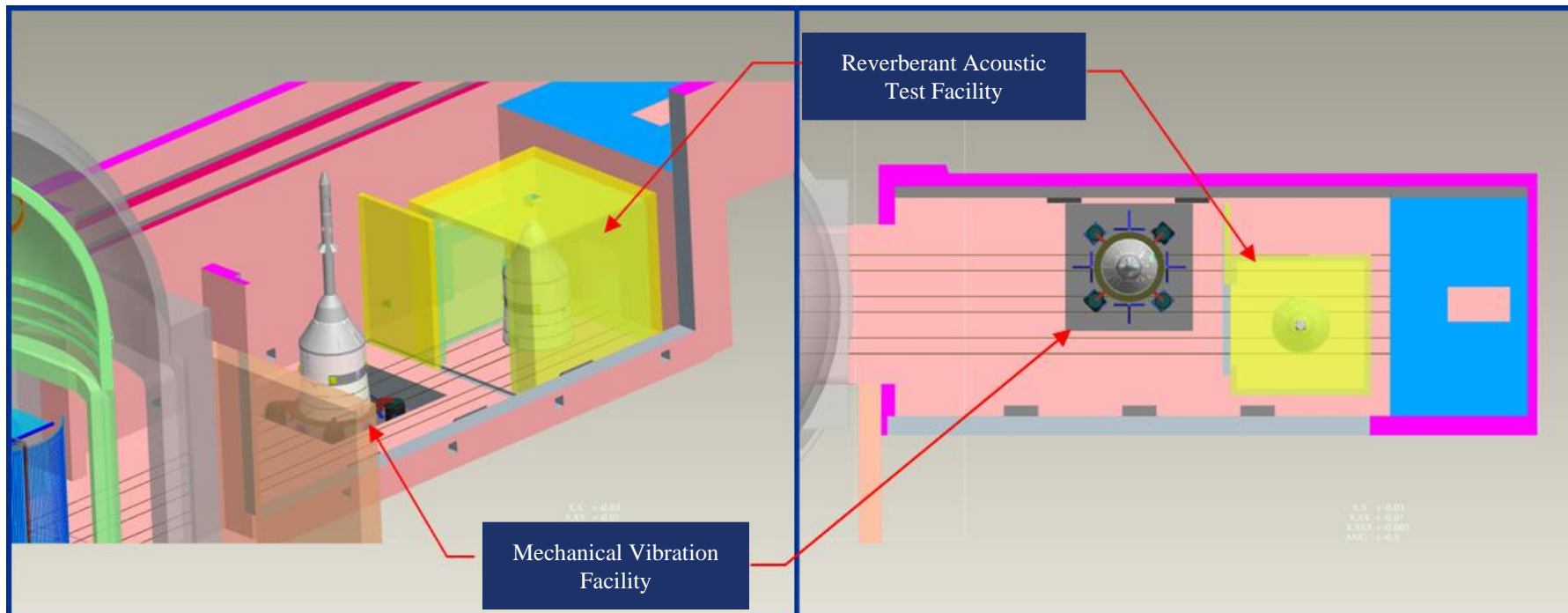


2:25 min





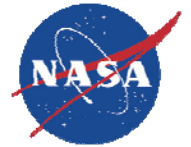
# The Major Upgrade— A Vibro-Acoustic Test Capability







# Vibro-Acoustic Test Capability Project Overview



- **October 2006—Program needs generated (Orion)**
- **November 2006—Solicitation of test sites**
- **January 2007—Program decision - GRC is a backup**
- **February 11, 2007—Plan the Plan**
  - Prepare; conduct Engineering Studies, not implementation
- **March 15, 2007—GRC announced as prime test site**
  - Implement test capabilities

**Authorized to Acquire a Vibro-Acoustic Test Capability  
March 15, 2007; Target ready date December, 2008!**

**A normal procurement of this magnitude would  
encompass ~145 days, once budgeted and approved.**

**“Normal”**

Solicitation (60)

Proposal Build (30)

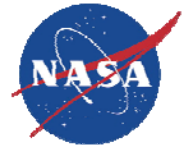
Evaluation (45)

Selection (10)



# We've Got the Job, Now What?

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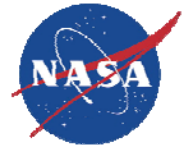


## Acquisition of Vibro-Acoustic Test Capability steps into high gear...



# Vibro-Acoustic Test Capability Acquisition

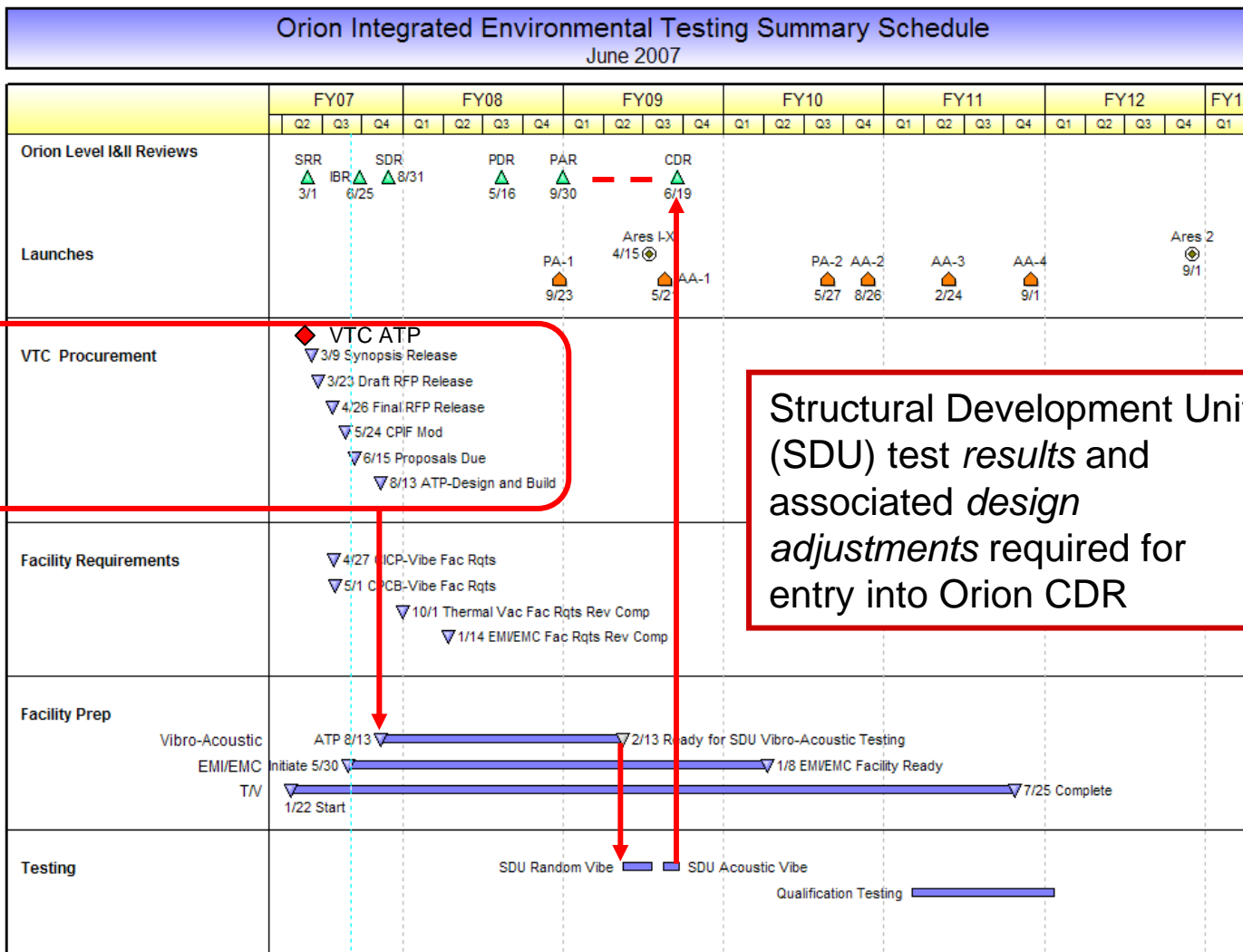
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- **Conduct a competitive procurement for the Vibro-Acoustic Test Capability aspect of the Integrated Environmental Test project**
  - Reverberant Acoustic Test Facility (RATF)
  - Mechanical Vibration Facility (MVF)
  - High Speed Data Acquisition System (HSDAS)
  
- **In parallel**
  - Realign Construction of Facilities (CofF) budget line item to enable a GRC implementation
  - Continue definition of Orion design and testing requirements



# Schedule (revised)

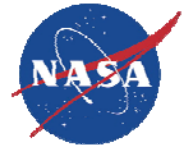


VTC ATP  
 ▼ 3/9 Synopsis Release  
 ▼ 3/23 Draft RFP Release  
 ▼ 4/26 Final RFP Release  
 ▼ 5/24 C/PF Mod  
 ▼ 6/15 Proposals Due  
 ▼ 8/13 ATP-Design and Build

Structural Development Unit (SDU) test results and associated design adjustments required for entry into Orion CDR



# Acquisition “VTC Project” Overview



- February 11, 2007—Plan the Plan
- March 15, 2007—Implement with target contract selection of May 21, 2007  
... Yes, **67 days** ...
- How, you might ask, could we do that? And why?
- Start with an unrealistic plan
- Adjust it to stay out of jail!

“Normal”	Solicitation (60)	Proposal Build (30)	Evaluation (45)	Selection (10)	145
Plan 1	10	14	7	4	↓ 67
Plan 2	13	30	16 <sup>3</sup>	5	
Actual	<i>(later...)</i>				



# Adopt a Jail-Free, Unrealistic Plan



## Acquisition Plan Adopted (#2): (on 4/2/07)

- Sources sought issued — 1/12/07
- Synopsis issued — 3/9/07
- Release RFP — 4/2/07
  - Conduct a Firm Fixed Price competition (simplified pricing)
- Request Volume II Past Performance and Experience 1 week before proposals due (start evaluation early)
- Proposal due — 5/2/07 (page limits imposed, simplify evaluation)
  - Complete evaluations - 16 days
- Anticipated Source Selection — NLT 5/21/07
- Design/Build and Commission Period of Performance of 18 months (6/1/07-12/1/08)

## SEC Features:

- SEC multicenter, program/project team (GRC, JSC, GSFC, LaRC, HQ) containing stakeholder representatives, technical experts

**But we are getting ahead of ourselves...**



# The Acquisition Strategy

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## ➤ **First Principles**

- **Good Requirements** — What does the customer want? What does (s)he need?
- **Good planning** — What is the standard approach?
- **Risk management** — Where can time be saved?  
Where will issues arise?



# Deriving VTC Project Requirements



## Integrated Environmental Test

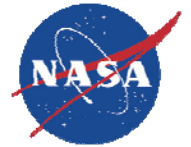
- **Conduct Qualification test program on Crew Exploration Vehicle**
  - Thermal Vacuum—significant existing asset, minor modifications
  - Electro-Magnetic Interference/Compatibility—test-specific configuration modifications
  - Mechanical Vibration—New Capability; rivals state-of-the-art
  - Reverberant Acoustic—New Capability; beyond state-of-the-art

**Remember, Schedule is a Driver**





## VTC Project Objective/Overview



### **Recall:**

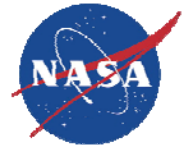
- **Provide facility for Orion Structural Development Unit (SDU) testing and Orion Integrated Environmental Qualification Testing in a “test as you fly” configuration**
  
- **Perform modifications to GRC/Plum Brook Station’s Space Power Facility**
  - Acoustic Vibration [major]
  - Mechanical Vibration [major]
  - Thermal/Vacuum [minor]
  - EMI/EMC testing [minor]
  
- **Provide test support for Orion Test and Verification SDU and Qualification testing**
  
- **Critical Path is being ready for SDU/Ground Test Article testing**
  - Requires Mechanical Vibration and Reverberant Acoustic Vibration Facilities
  - Government estimated design/build time at 18 to 24 months... *Do it in 18.*

**“Ready to Test”  
need date: (still) 12/2008**



# Stakeholder Expectations

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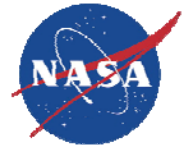
## A Resource for Good Requirements . . . Maybe

- **Stakeholder overview (who/why)**
  - Can you find them and collect their needs?
  - Do they know they need to be a stakeholder?
  - Are their objectives consistent?
- **Scope overview (test articles)**
  - Is there only one customer, or at least a limited number?
  - Are the requirements consistent or in conflict?
  - Are the requirements stable?



# Requirements Management

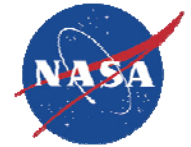
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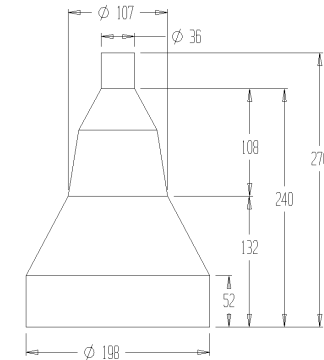
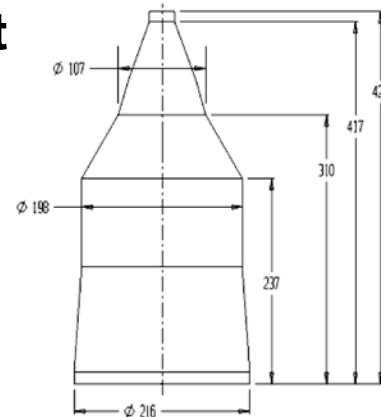
- **Sometimes Requirements must be self-generated**
- **Identify the “driving requirements” and formally baseline them, iterating back to the stakeholders**
- **Expect requirements to change (or that there is a desire to change) over time**
  - October 2006: Facility proposals
  - November 2006: Round 2 proposals
  - April 2007: RFP (vehicle requirements reflected)
  - May 2007: Stakeholder/Customer requirements baselined
    - Note: the RFP had already been released
  - September 2007: Establish baseline at Contract start
  - Ongoing: (change orders) during contract administration



# Driving Requirements



- Requirements were established yet continued to undergo change
- Requirement Evolution caused by
  - Test article size growth
  - Incorporating future Constellation architectural element requirements
  - Tests and testing parameter development



Technical Requirements

CEV Integrated Test and Verification

- Critical technical requirements were baselined through CPCB on 1/19/07. Major requirements baselined included:
  - Minimum of 163 dB OASPL acoustic level in a reverberant chamber
  - Maximum test article height of 44 ft for acoustic testing
  - Maximum test article diameter of 18.64 ft
  - Test durations as specified in CEQATR
  - Tests planned (3-4 months duration)
    - 1 configuration for random vibration or modal test
    - 2 test configurations for acoustic test
- Technical requirements were baselined at T&V CP on 3/9/07. Major requirements growth included:
  - Maximum test article height of 46.6 ft for acoustic testing
  - Maximum test article diameter of 23 ft
  - Continuous test runs for CEV re-use life (20 minutes)
  - Tests Planned
    - 3 test configurations for acoustic test
- Technical requirements growth as discussed at SDU Kick Off TIM on April 10 to April 11 (still in flux)
  - Minimum of 166 dB acoustic levels in a reverberant chamber
  - Maximum test article height of 53 ft for acoustic testing
  - Tests planned (6-7 months duration)
    - TBD Configurations/Requirements for subsystem random vibration tests
    - 3 test configurations for Acoustic
    - Impact test (requires retaining of personnel)
    - 4 Modal test configurations

Evolution during Acquisition

1/15/07

+

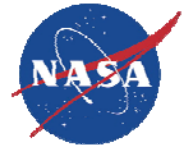
3/9/07

+

4/10/07



# Good Planning



## Acquisition Planning per 7120.5D and the FAR

**1.2.a. Formulation**—the identification of how the program or project supports the Agency’s strategic needs, goals, and objectives; the assessment of feasibility, technology and concepts; risk assessment, team building, development of operations concepts and **acquisition strategies**; establishment of **high-level requirements** and success criteria; the preparation of plans, budgets, and schedules essential to the success of a program or project; and the establishment of control systems to ensure performance to those plans and alignment with current Agency strategies.



## 7120.5D Definition

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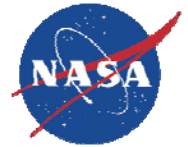


**Acquisition**—The acquiring by **contract** with **appropriated funds** of supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. **Acquisition begins** at the point **when Agency needs are established** and includes the description of requirements to satisfy Agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling Agency needs by contract.

(Note: A broader view of the term acquisition is taken at the ASP meeting and ASM.)



# 7120.5D Best Practices



## Sometimes the normal approach doesn't fit

- Timing discrepancy with annual budget submission
- Alignment with Congressional operating plan changes
- Baseline project requirements flow down (SRR)

Review	Description
Acquisition Strategy Planning (ASP) Meeting*	The ASP meeting is integral to the <b>annual budget submission process</b> . The ASP meeting is structured to allow Agency senior management to review major acquisitions that evolve from Needs, Goals, and Objectives, as well as requirements introduced to the Agency from external sources (e.g., The President's Vision for Space Exploration) and internal sources (e.g., major acquisitions initiated by MDs/MSOs). The purpose of the ASP meeting is to identify and define roles and responsibilities of Mission Directorate(s), Centers, major partnerships, and associated infrastructure (workforce and facilities) with the focus on maintaining ten healthy Centers.
Acquisition Strategy Meeting (ASM)*	The ASM applies to both programs and projects. The ASM should be convened as early as practicable and prior to partnership commitments. The purpose of an <b>ASM is to obtain senior management approval of acquisition strategy</b> (e.g., make-or-buy, Center assignments, and targeted partners) for programs and projects. The ASM meeting also delineates if a Procurement Strategy Meeting (PSM) is required for each acquisition under consideration. The Program ASM may be held in conjunction with the Program/System Requirements Review (P/SRR) but must be held prior to KDP I. The <b>Project ASM may be held in conjunction with the project SRR</b> , but must be held prior to KDP B. The supporting materials for the ASM include appropriate program/project documentation that covers budget, schedule, requirements, and risk.



# Planning the Acquisition



## Federal Acquisition Regulations

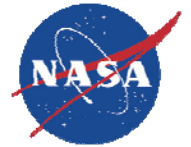
- **Developing the RFP and SOW**
- **Creating objective evaluation elements**
- **Instituting a Source Evaluation Board/Committee (SEB/SEC) of appropriate representation**
  - **Did you know?**
    - 7 voting members is the maximum allowed
      - Chair and CO are required
    - Non-Voting membership is limited to 20
    - Ex-Officio membership can be invaluable as support to the SEB
- **Seeking Approval to issue RFP**





# Plan to *Actively* Manage the Acquisition

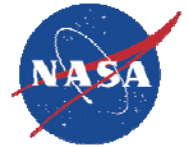
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- **RFP/SOW**
  - Questions and Answers
    - Remember the answers become part of the RFP (and might result in changes to the established requirements)
- **Expect the unexpected**
  - Requests for additional site visits, more information
  - Requests for extensions
  - Number and skills of offerors
  - Design approaches offered (a “feature” of Design/Build)
  - Documentation, preparing for the “dreaded protest”
- **Remember to communicate with your stakeholders!**



# Tools in Managing the Acquisition



## ➤ Use of electronic tools

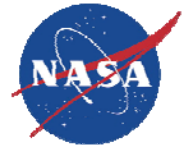
- Moderate (security) eRoom for SEC collaborative usage
- Procurement Tools
  - The Virtual Procurement Office (VPO)
  - NASA Acquisition Internet Service (NAIS)
  - The Electronic Posting System (EPS)
    - Note: There is not a standard contract template for Design/Build
  - Website created to upload information for industry access
- Electronic versus paper submission of proposals
  - Usage/preference of team
  - Order of precedence for discrepancies

Proposal submissions from one offeror  
Vol. I, II, III  
Discussions clarification data  
Revised Vol. I, III





# Risk Management



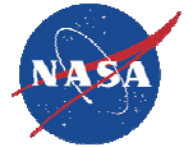
## Vibration Test Capability Schedule

- **Acquire the MVF and RATF capabilities as well as a common HSDAS in a turn-key contract**
  - Design/build
  - Commissioning
  - End-item performance acceptance
- **Design/build/commissioning duration government estimate: 18 to 24 months**
- **Be ready for Orion Structural Developmental Unit testing in December, 2008**  
*[only 18 months from targeted award—IF all goes well]*

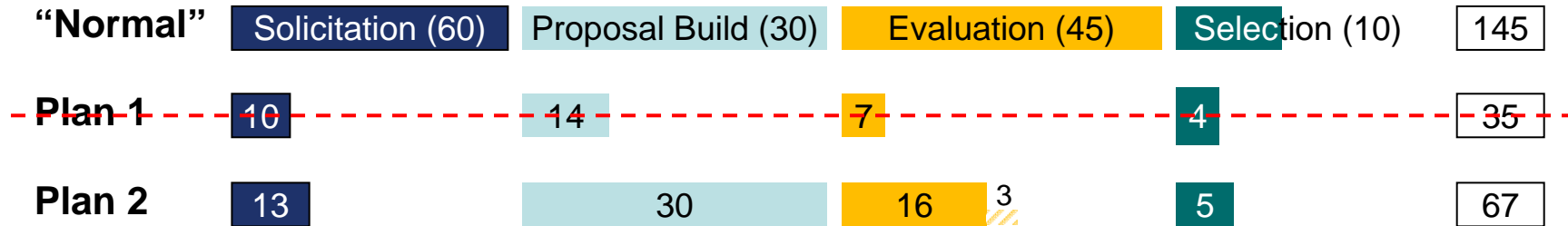
**Can the Acquisition be successfully accelerated?**



# Schedule Compression



## Crashing the schedule...a HUGE risk

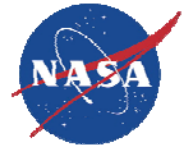


### ➤ Trim from the normal schedule, but “stay out of jail”

- Limited sources (JOFOC)
- Parallel draft RFP with Industry Day
- Parallel Engineering Study
- Transfer risk to contractor (use a FFP approach)
- Government required to provide 30 days to build proposals
- Set SEB review objectives appropriate for scope
- Assemble expert team and support committee
  - Cover all pertinent end items
- Use Ex-Officio’s to clear the path externally
- Keep the SSA informed along the way

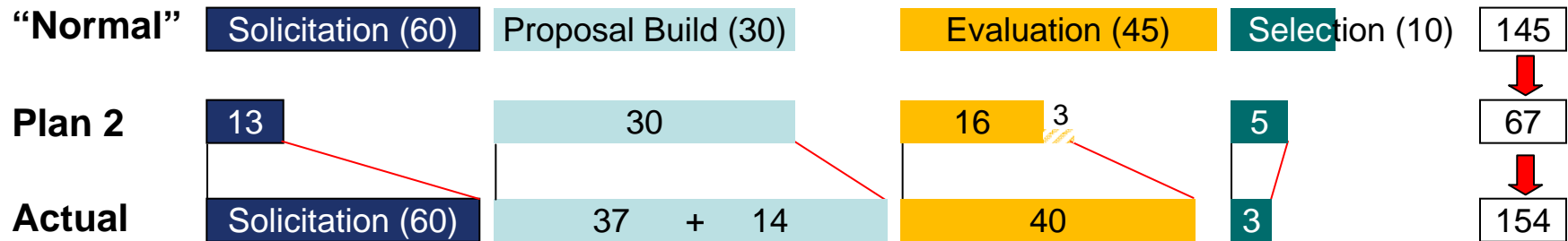


# VTC Project—Reality



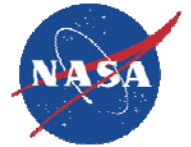
- February 11, 2007—Plan the Plan
- March 15, 2007—Implement by May 21, 2007  
... **Nope, 154 days later** ...
- August 16, 2007—Source Selection Briefing

*What happened to “fast”?  
How did we get here!?*





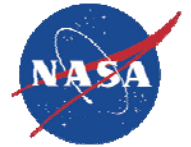
# Responding to a *Few Unusual Conditions*



- **“Fast” acquisition template** 67
  - **Competition versus sole/limited sources sought** +10
  - **Unstable requirements and resource estimates** +20
  - **Multiple-source funding** +10
    - Congressional Operating Plan CofF change
    - State of Ohio “contribution” nuance
  - **Taking on an acceptable risk posture (FFP to CPIF)** +21
  - **Receipt of a sole offer** +21
  - **Offeror response(s) are significantly different than government concept/approach and therefore cost estimate** +14
- ● ●
- 
- 154



# Lessons Learned



- **Stakeholder Communication**
  - Start early; rely on it often
  - Remember, even requirements may be negotiable
- **Don't assume the government solution will be the offerors' solutions**
  - It may not even be the optimal solution!
- **Plan for changes**
- **Should we have accelerated the acquisition?**

**YES**

**NO**



## Where Are We Now?

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- The **Baseline** has been established; contract award was August 31, 2007, with a period of performance of 18 months (not a 12/1/08 date) for the design/build and commissioning phases.
- We are in the midst of the **C** in the ABCs of project management—

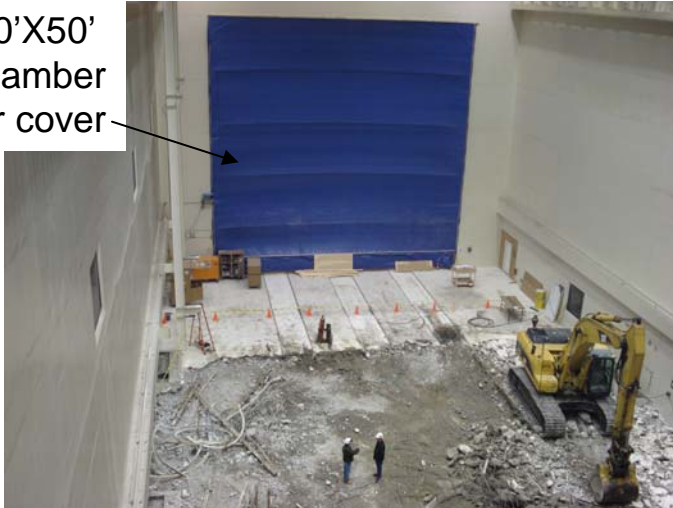
### **Contract Administration**

- And the “Ready to Test” need date is now 7/2009 (+8 months)



# Construction Status (12/13/07)

50'X50'  
chamber  
door cover



Hot cell  
6' thick  
wall cut



**See you in 2010 with results from our success story!**



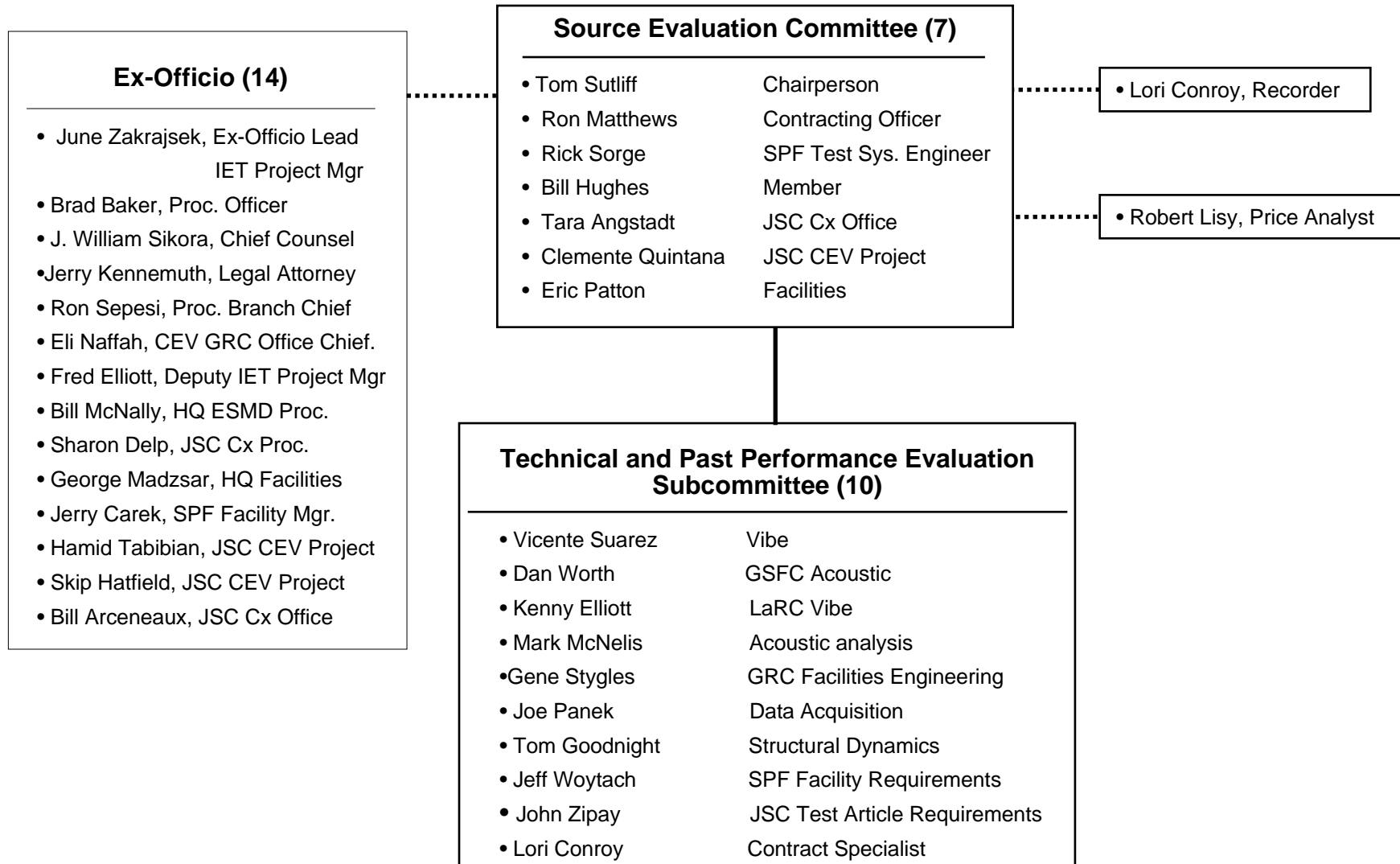
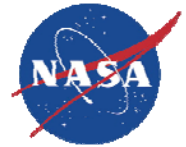
# Backup Information

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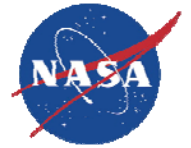


# SEC Evaluation Organization

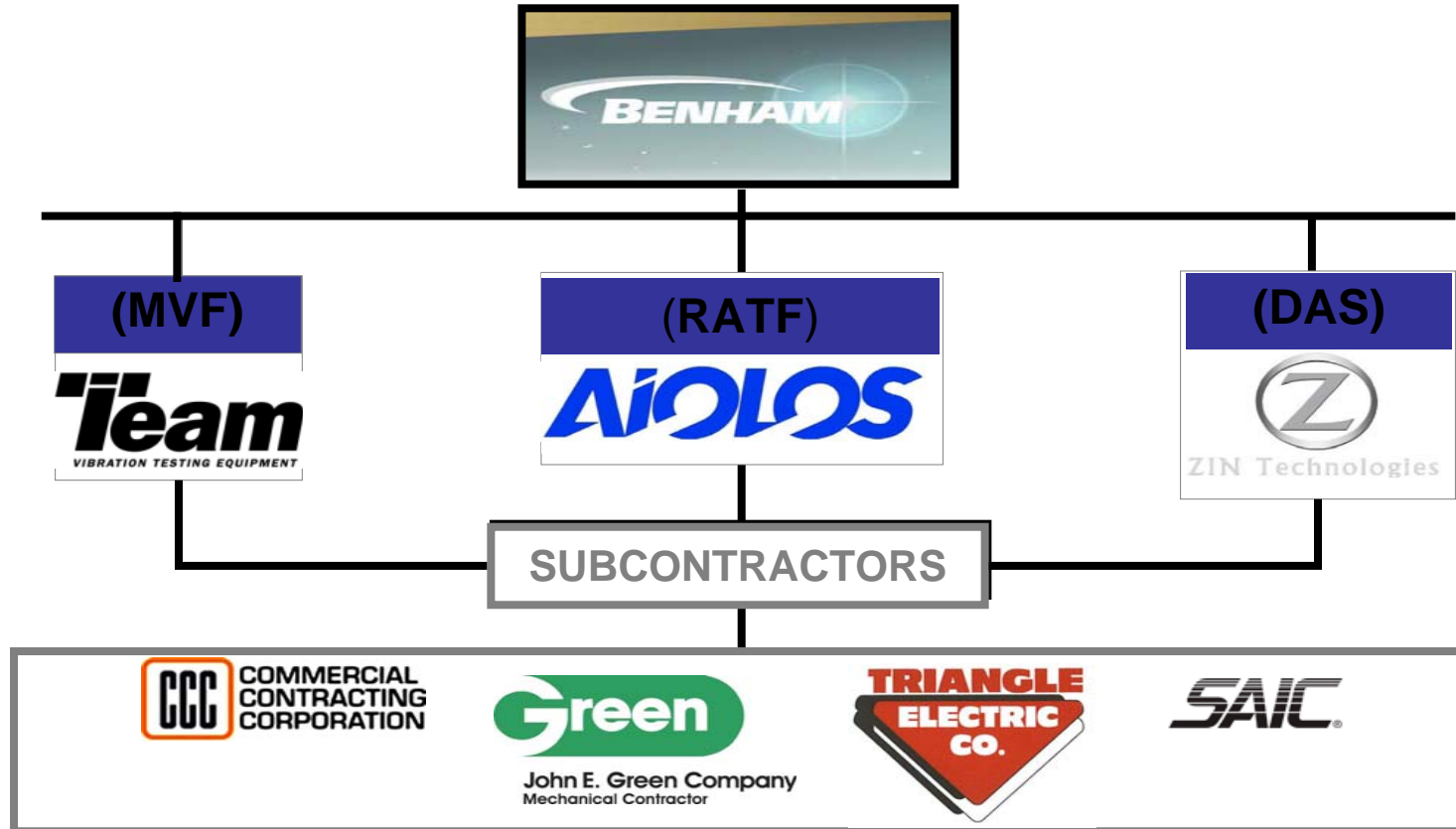




# Contractor Team



## Mix of Construction and Test Development Skills

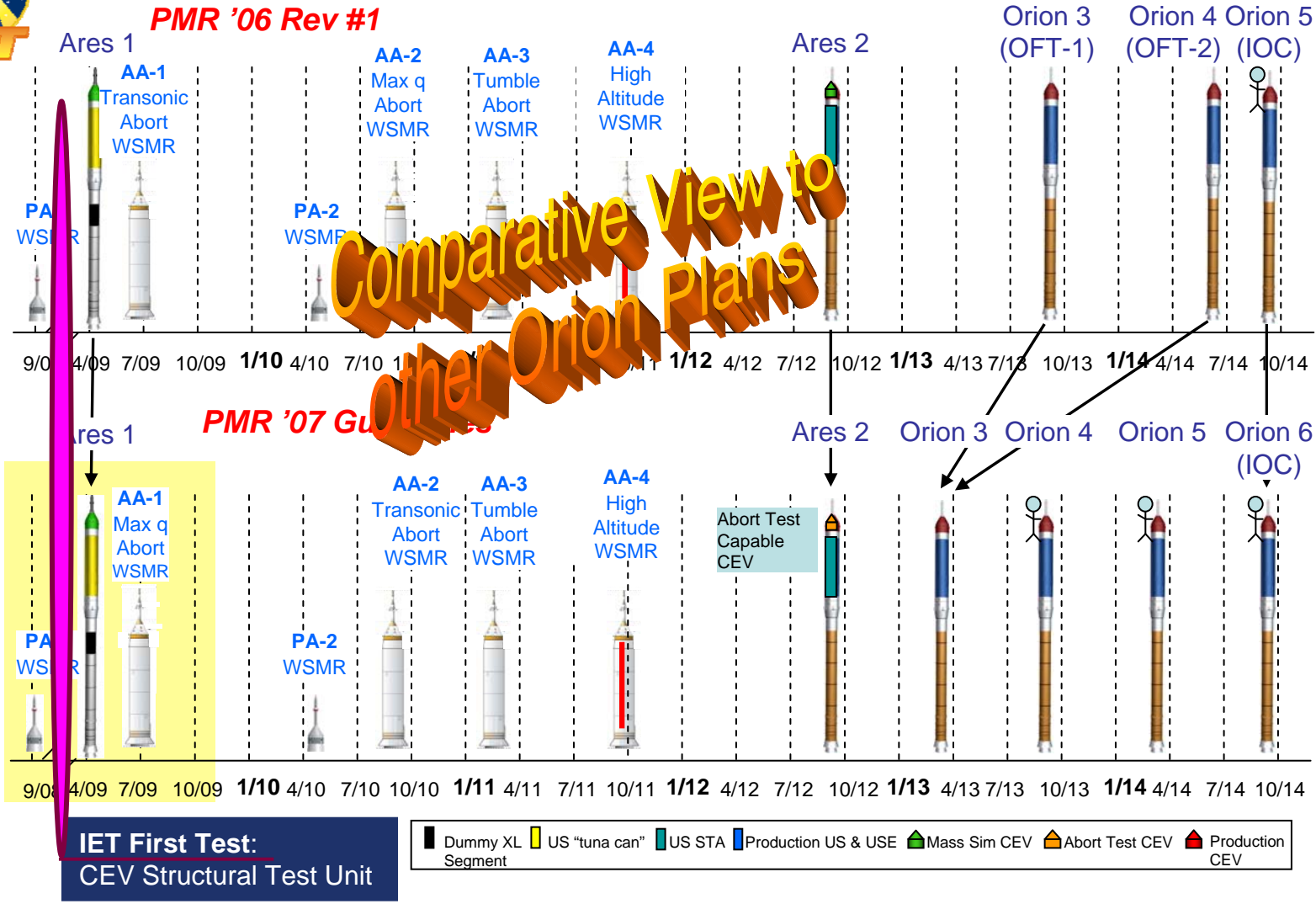




# Integrated Flight Test Strategy

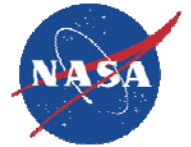


## PMR '06 Rev #1 vs. PMR '07 Guidelines





# Past SPF Test Programs



Atlas/Centaur



EELV Delta IV



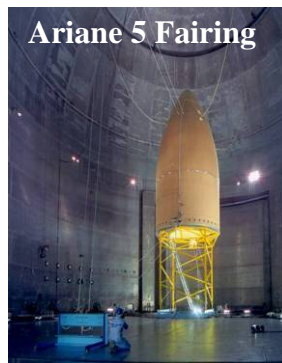
EELV Atlas V



Sky Lab Fairing

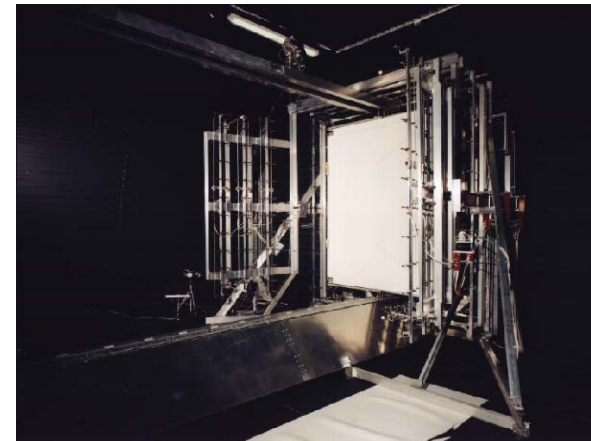


Titan Fairing



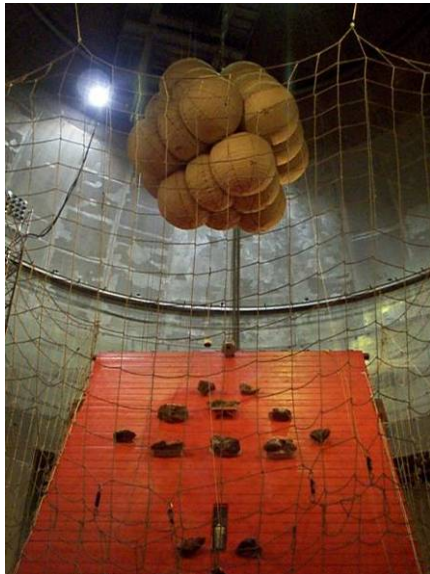
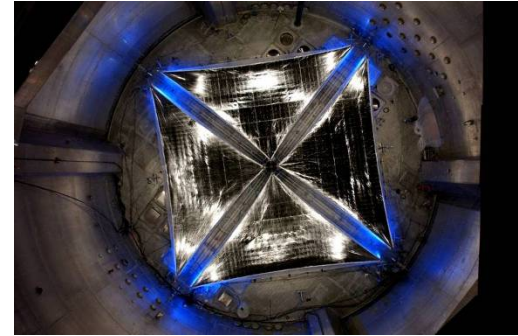
Ariane 5 Fairing

## Launch Vehicle Payload Fairing Deployment Testing



## International Space Station Radiator Deployment and Performance Testing

# Past SPF Test Programs



**Mars Exploration  
Rover  
*Spirit and Opportunity*  
Airbag Landing  
System Tests**



**Solar Sail  
Deployment  
Testing**



# SPF Presently Testing



**Ariane V Payload Fairing Test**  
**1<sup>st</sup> Test Series 9/07 to 12/07**  
**2<sup>nd</sup> Test Series 7/08 to 10/08**

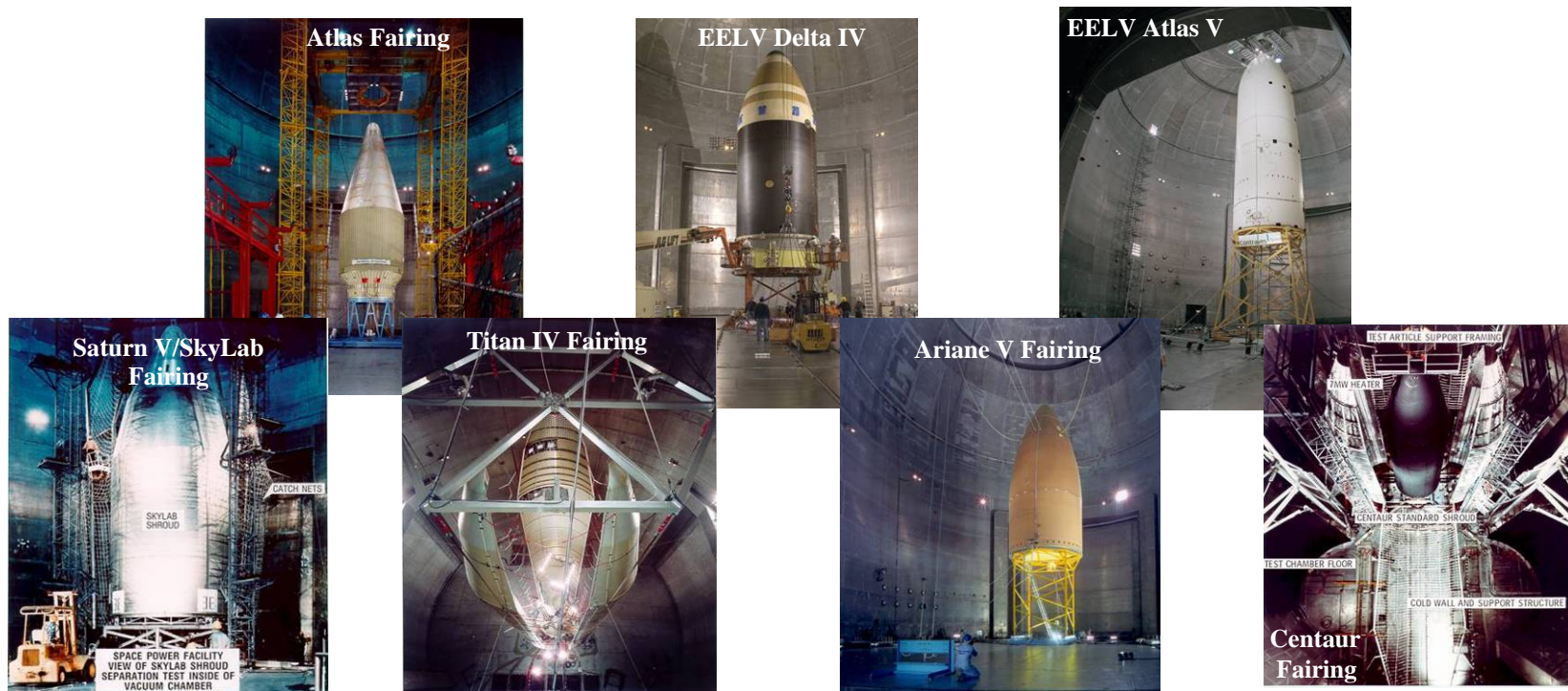




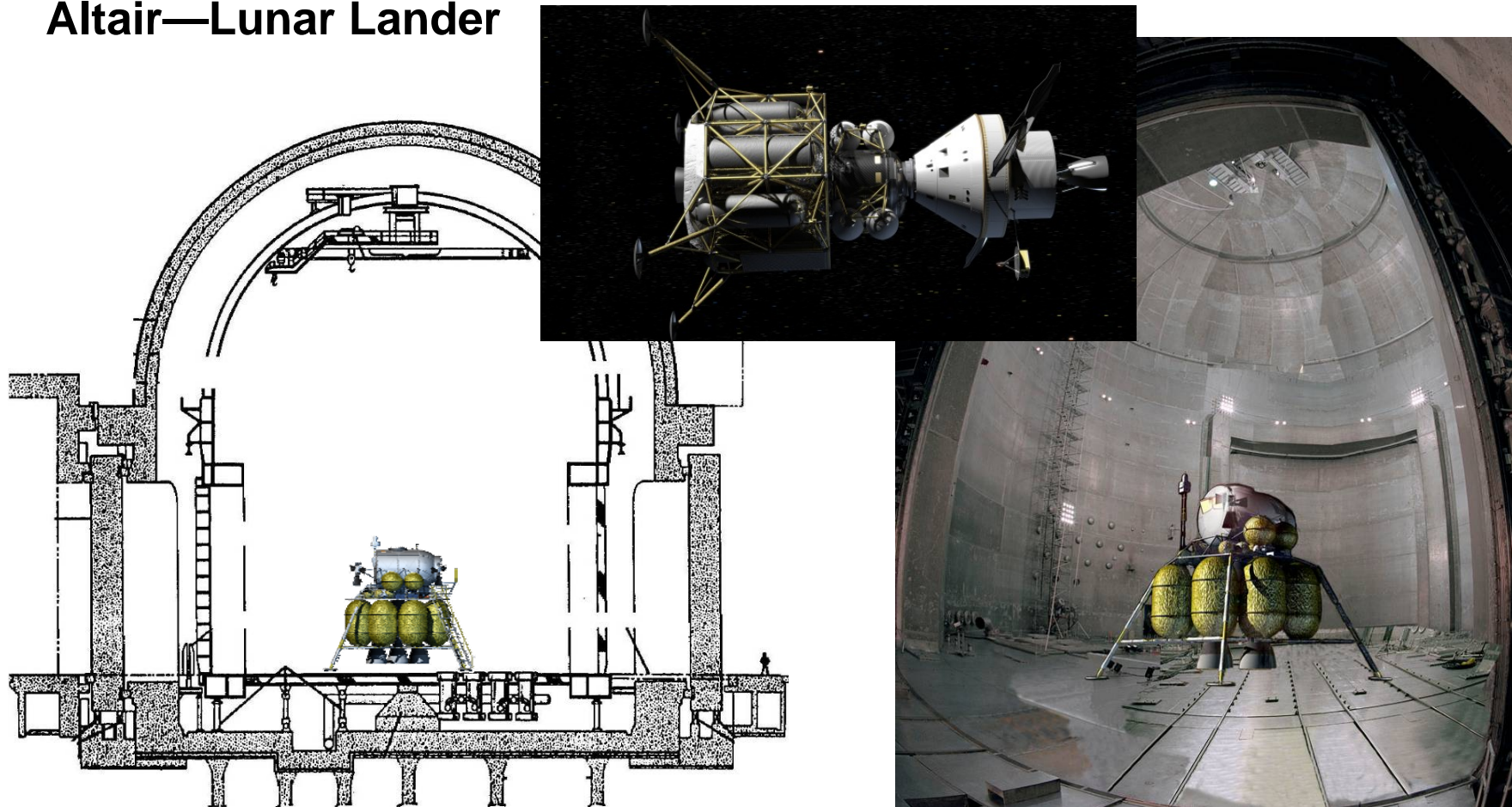
# SPF *FUTURE* Testing



- SPF can perform deployment testing of the Ares V fairing, simulating altitude temperature and pressure conditions at fairing jettison. The fairing provides an aerodynamic shroud for the Lunar Lander during Ares V ascent.
- SPF has performed large fairing deployment tests for every large launch vehicle in the United States and Europe.
- SPF is the only facility in the United States large enough to accommodate the Ares V fairing.



## Altair—Lunar Lander



An Artist's Concept of a Lunar Lander in Thermal-Vacuum Testing in the SPF Chamber

***Its never too soon to start planning!***