EELV Program Assessment

Presentation for the Honorable Christine Fox

Curt Khol

John Tomick

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OSD CA Study

EELV

	Complete	On-Going
1. Provide Historical Perspective	✓	
2. Estimate Future Resource Requirements (Compare to AF SPO Estimate) NOTE: Current projections reflect uncertainty of NASA path ahead which impacts engine prices	✓	
3. Compare projected with realized cost savings of ULA (Groundwork for Future Congressional Action)		✓
4. Assess production and launch capacity (Combined Satellite & Production Model)		✓
5. Evaluate alternative acquisition strategies (Support OSD Study & Other requests)		✓

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Background

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- **Launch Sites**
  West Coast (Vandenberg) & East Coast (Cape Canaveral)

- **Program History**

Launch systems developed from prior systems supporting manned space, ICBM, and satellite programs

1994 : Moorman Study recommended AF be responsible for Expendable Systems and NASA Re-usable Systems. Also recommended evolving a single "common core system" for the expendable system

1997: Decision to retain two providers due to forecast of robust commercial market

1998 : Boeing (Delta IV) and Lockheed Martin (Atlas V) awarded Development and Procurement (Buy 1) contracts

2000: Program Restructured due to contractor losses. LM relieved of west coast Atlas pad

2003: Boeing Procurement Integrity Act (PIA) violations results in launch suspension and reassignment of missions to LM; Atlas west coast pad restored

2004: Nunn-McCurdy Cost Breach; program certified in April 2004

2006: United Launch Alliance (merged Boeing & LM launch services) formed 1 December 2006

2007: Program placed in sustainment phase & final SAR

2009: ULA merger formally approved by U.S. Government

- **RMD tasking** - "D,CAPE, USD(AT&L), ASD(NII), and Air Force, identify and assess alternatives for reducing US Government launch costs, including options for down-selecting to a single EELV family and leveraging commercial and foreign launch capabilities".

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1. Historical Perspective

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NSS Historical Launch Investment and Yield

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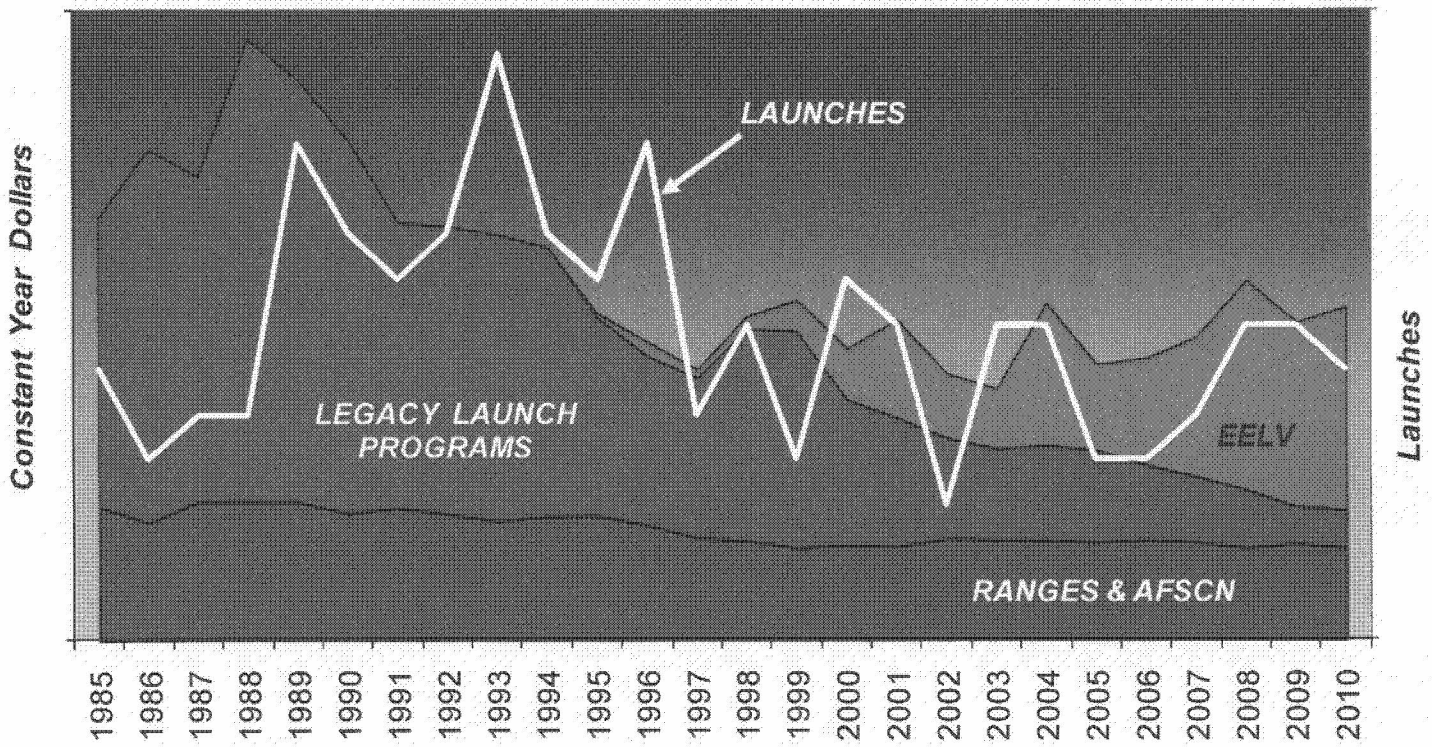
NSS Funding of Space Launch



- *Current launch investment remains below legacy levels*
- *Within EELV, fixed infrastructure costs dominate*

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1994 Moorman Study To EELV

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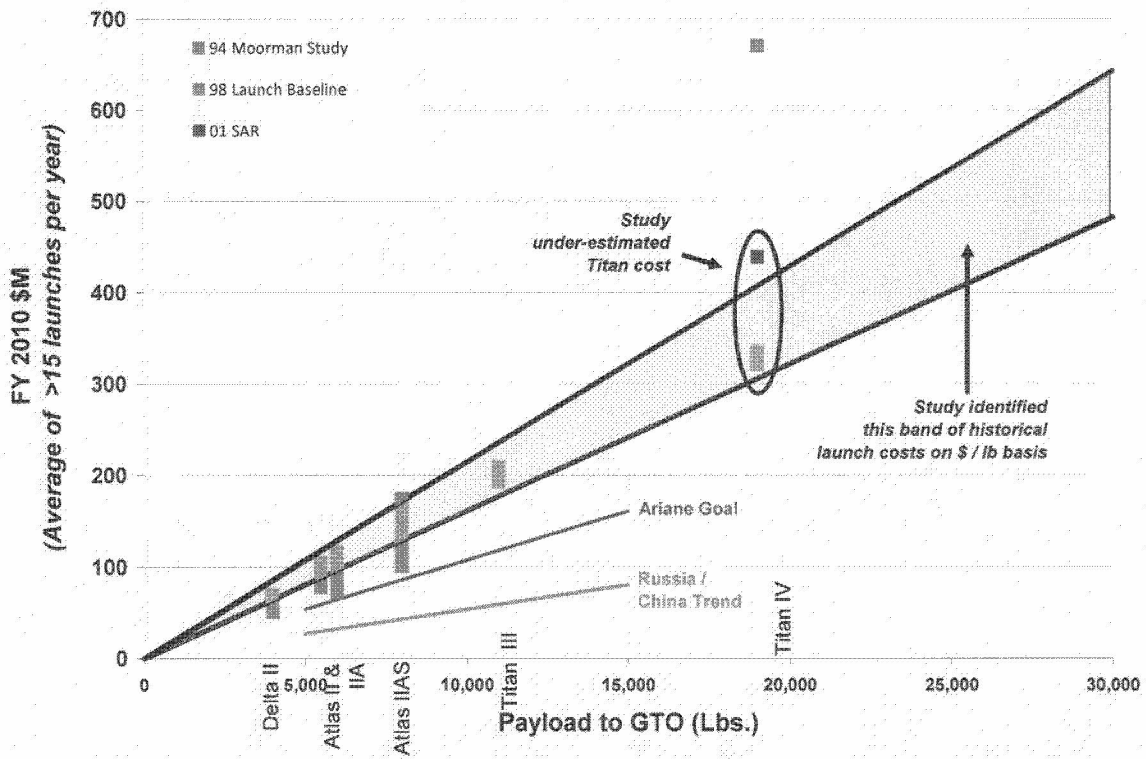
Pre-EELV Price vs. Performance Plot



Plot included in Moorman Study from DoD Space Launch Systems Bottoms Up Review

- ***1980-1994 : NSS Average 8 launches per year + Non-NSS Average 7.5 per year***
- ***Moorman Study found a single provider modular (common core) family of vehicles to be the most cost effective alternative to meeting the nation's expendable launch vehicle requirement.***
- ***Nov 1997 AF decision was to pursue two providers ($500M provided to each for development) – based on a revised assessment of the commercial market for vehicles doubling 1994 projection***
- ***EELV program initiated in FY98***

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EELV Suppliers

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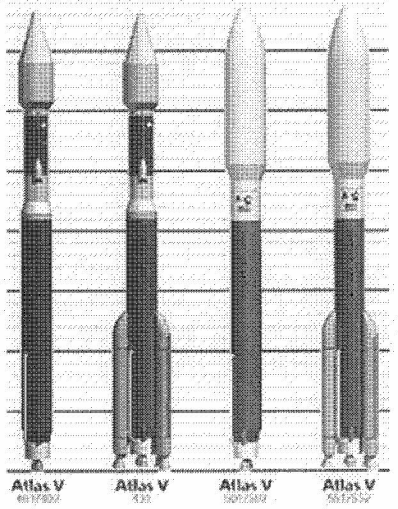
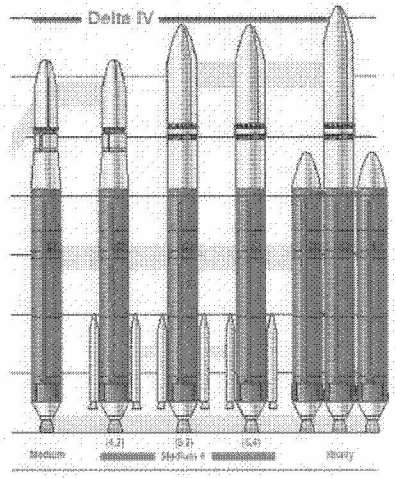
- **Atlas V**
  - Contract with United Launch Alliance
  - Lockheed Martin Heritage
  - Main Engine: RD-180 from RDA
    - RP-1 & Liquid Oxygen
  - Upper Stage: RL-10A from PWR
    - Liquid Hydrogen & Liquid Oxygen
  - Solid Rocket Motors from Aerojet



- **Delta IV**
  - Contract with United Launch Alliance
  - Boeing Heritage
  - Main Engine: RS-68 from PWR
    - Liquid Hydrogen & Liquid Oxygen
  - Upper Stage: RL-10B from PWR
    - Liquid Hydrogen & Liquid Oxygen
  - Solid Rocket Motors from ATK



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EELV Initial Assumptions

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- Extrapolating mid- 90's trends led to perception of market supporting two competitors; leading to a change of strategy
- Significant price advantage of large lot material buys
- 30 NSS orders in 5 years (2000-2004) (RFP was for 34 & Proposals were for 30)
- Large world-wide commercial demand & EELV would have a ~60% market share

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EELV Business Case

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EELV Buy-1 Reality

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- Lot buy provided material discounts
- RFP for 34 NSS missions, revised to 30 but only 28 awarded
- Only 13 of the 28 orders placed 2000-2004 and 3 launches 2002-2006
- Only 21 of the 28 Buy 1 orders were placed in 10 years
- Large commercial demand did not materialize and neither did EELV's market share projections

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EELV Realized Business

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Historical Buy 1 Booster Recurring Production Cost Break-out (ELS component of cost)

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2. OSD CA Estimated Future Resource Requirements

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EELV Component of ULA

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OSD CA ELC Cost Estimate

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Atlas V(4X1)* Recurring Production Labor ELS Component

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Major ULA Supplier Prices

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OSD Cost Assessment EELV Estimate

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OSD CA Estimate indicates prices have reverted to historical levels;
Slope has flattened and Delta IV Heavy price is considered a transient condition

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Mission Assurance Costs

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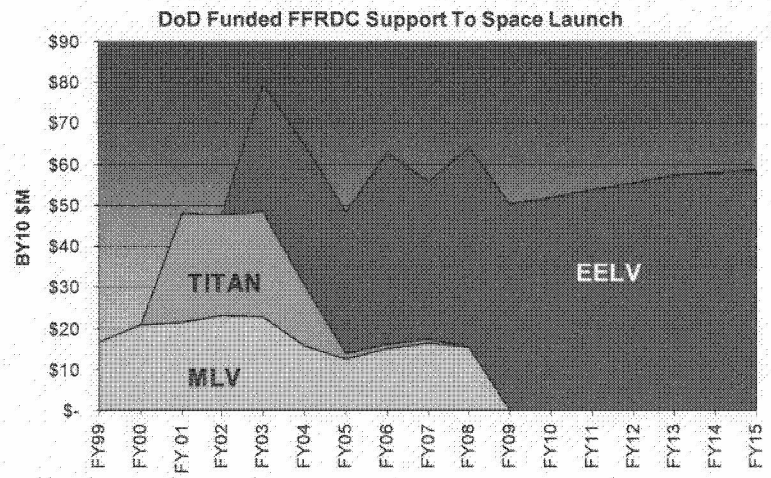

Sources: AF Congressional Briefings

- **EELV Mission Assurance funding to FFRDC ramp-up continues**
- **Mission Assurance is open ended by nature**
  - **Each problem identified can carry a permanent workload increase for both the contractor and the government office**
  - **Contractor has little incentive to disagree if they are compensated for additional workload**
- **Currently pay for 292 Aerospace FTE for National Security Space**
  - **Equates to 25% of ULA SEPM FTE & 11% of ULA Total NSS FTE**

Challenge for leadership is identifying "How Much Is Enough?" and ensuring risks are retired appropriately

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Technology Refresh

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- *Key components perceived to be likely costs*
  - *Delta IV System Integration Lab – for hardware in loop testing ($30M)*
  - *Launch Infrastructure - facility and material upgrades to maintain launch system (~$35M / yr)*
  - *Ordnance - obsolete, discontinued material replacement (~$5M / yr)*
  - *Upper Stage Engine – rework inventory engines for mission assurance ($20M / yr for 3 yrs) + engine shelf life extension for inventory ($10M / yr for 2 yrs)*
  - *Avionics & Ground Computer System Upgrade – technology refresh of flight control system hardware at point where major upgrade to common architecture for Atlas and Delta vice piece part replacement for obsolesce is best path ($200M)*
  - *Upper Stage Engine Design Effort – not required for flight operation, this would be industrial design capability effort for new engine to replace 1950's design RL-10 ($350M) - NOT INCLUDED IN OSD CA ESTIMATE*

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Estimate vs. Budget

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3. Compare projected with realized cost savings of ULA

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Budget Adjustments For ULA Savings

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- Restructuring Agreement allows for comparison of ULA to a Boeing / Lockheed Martin baseline
- Difference equates to savings and is attributed to all contracts

~ $150M AF budget reduction starting in FY11 assumes more savings than Restructure Agreement proposed and is applied against a 2010 baseline

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4. Assessing production and launch capacity

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Demand vs. Theoretical Capacity

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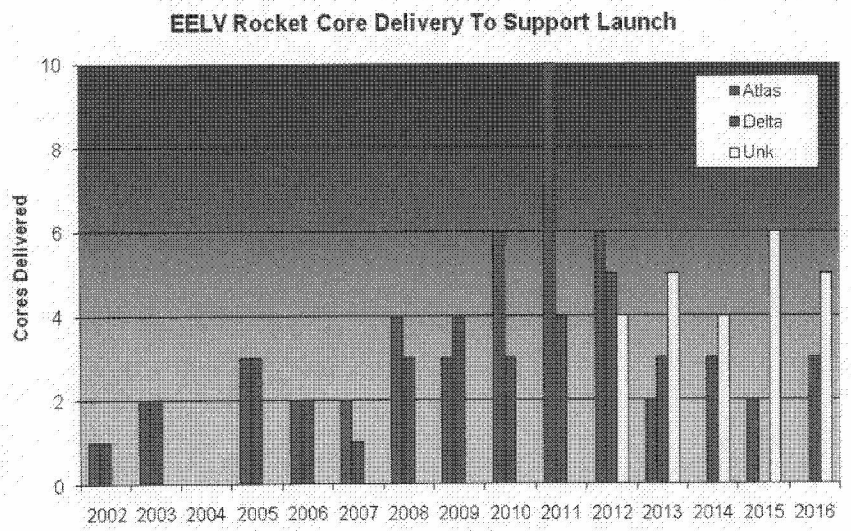
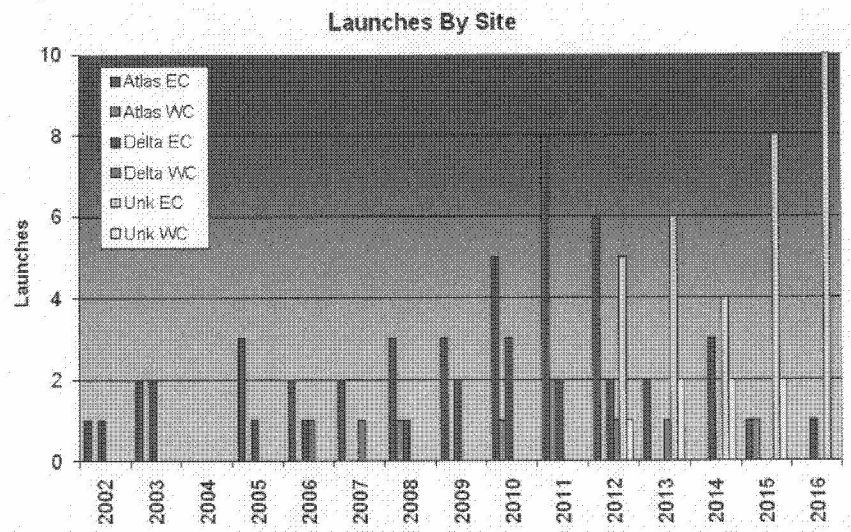


Capacity limit 10 / yr for both Atlas V and Delta IV



ELC funds 4 / yr for each Atlas V and Delta IV
Options exist to increase capability by either increasing staffing and/or balancing booster types and/or balancing launch sites

Projected demand well within ULA theoretical production capacity

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EELV Pad Usage

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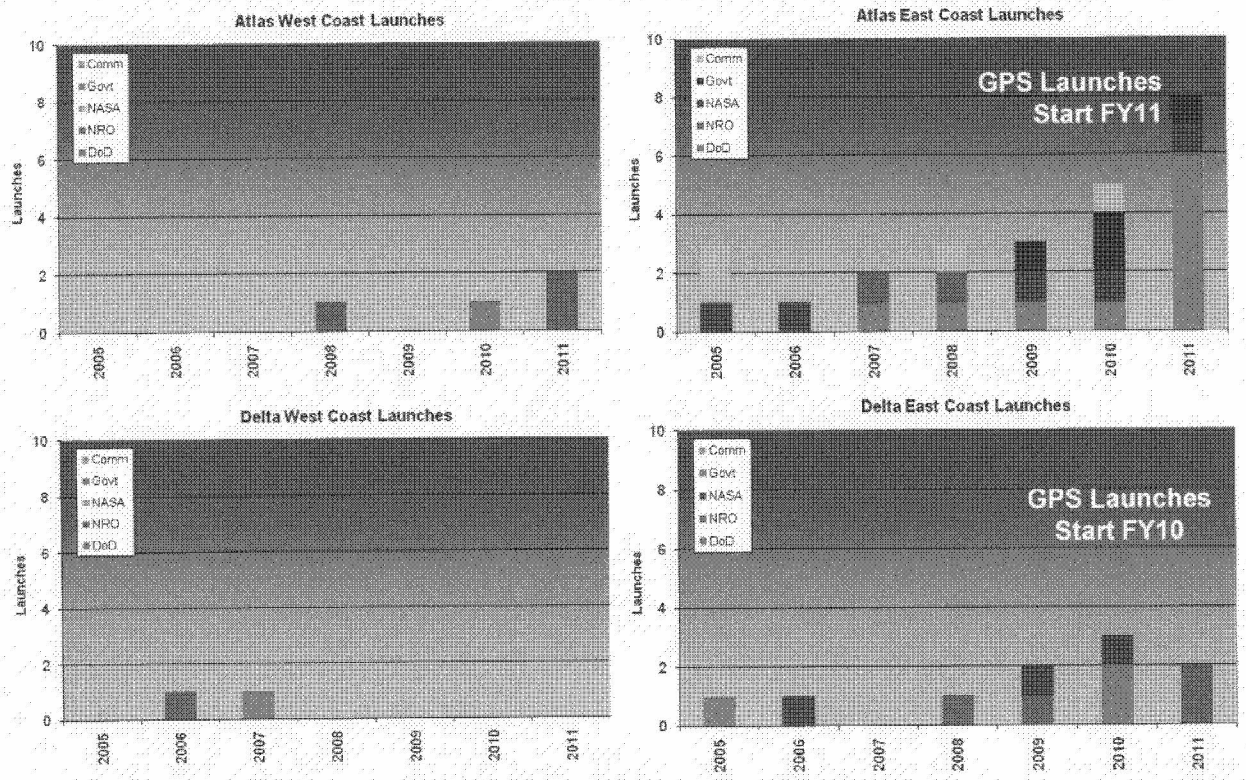

FYs 10-11 Launch Sequence Challenging

13 EC Atlas launches planned

NROL OCT-DEC 2010 Challenge

EC Delta IV: GOES-P (Mar) / GPS-IIF-01 (Jun) / NROL-32 (Oct)

WC Atlas: NROL-41 (Oct)

WC Delta IV: NROL-49 (Dec)

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Launch Yield – A Queuing Problem

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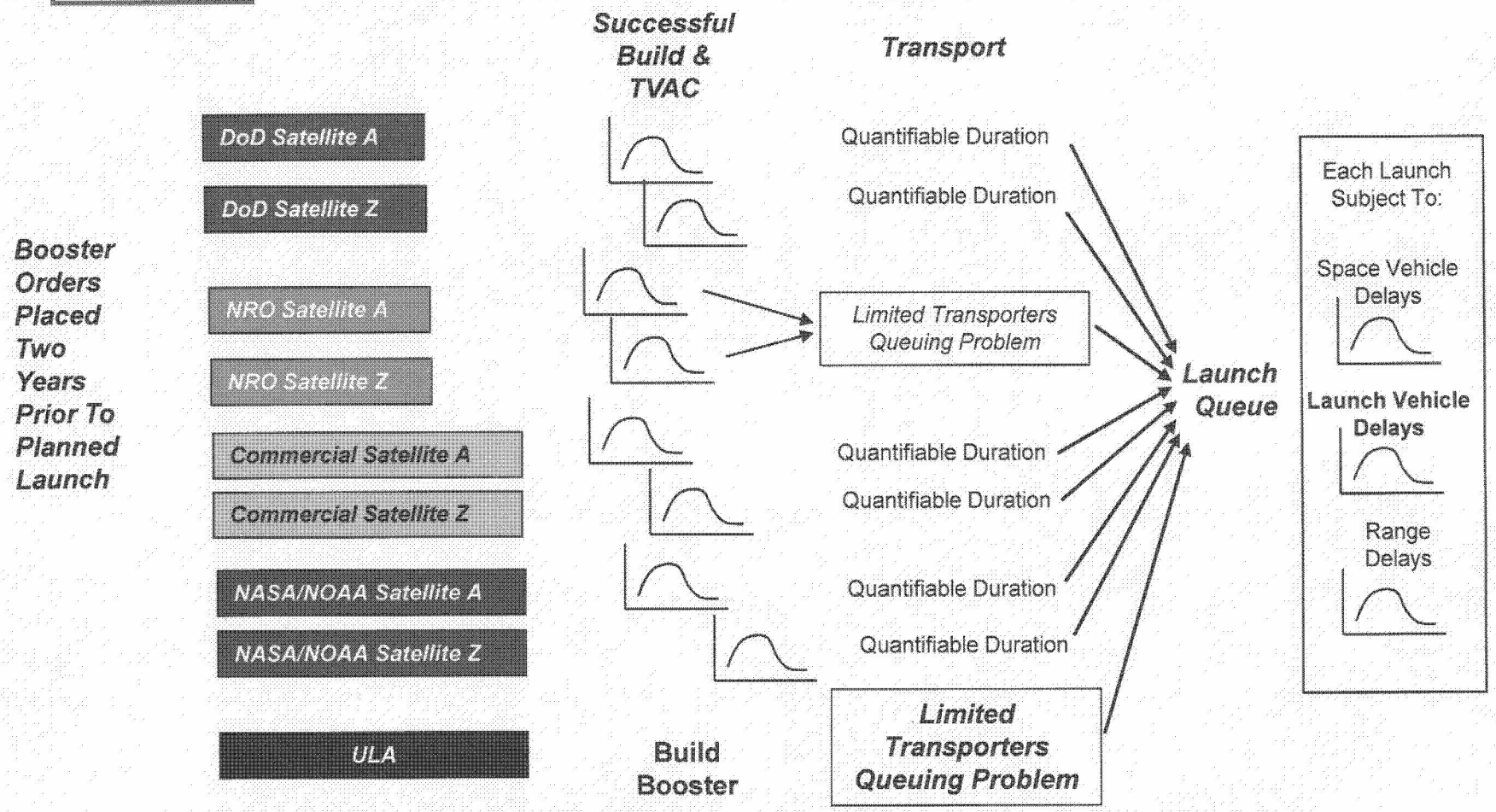

Most Factors Beyond EELV Program Control
Developing Model with SPO and ULA Assistance

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5. Evaluation of alternative acquisition strategies - TBD

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FY2014 Business Case For Space-X

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Consolidate to Delta Only Line

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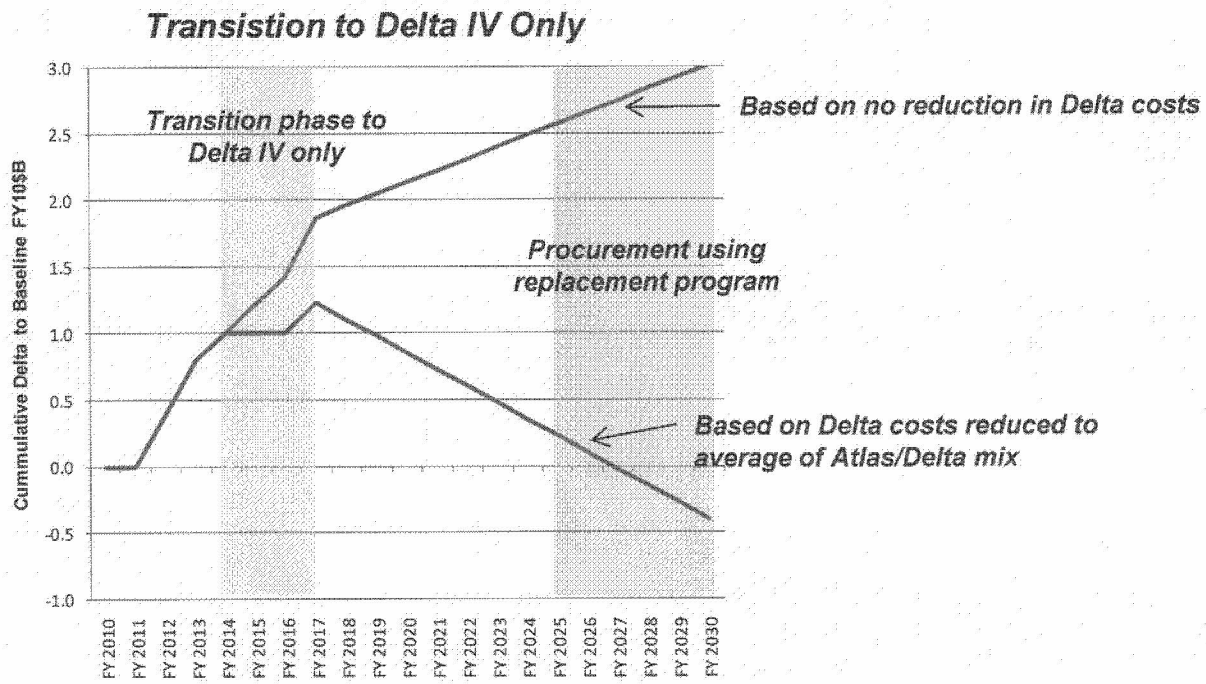

- **Key Assumptions:**
  - $1B Total Investment in FYs12-14 for 2nd Delta Pad @ CCAFS
  - Atlas last buy FY14 , planned final launch FY16 (hold pad available half of FY17)
  - 26% Reduction in ULA ELC Staffing
  - 6 Booster purchases per year beyond FY15

Assuming Delta IV prices can be driven significantly down, breakeven point is not likely before new program

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Future Considerations

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- Purchase plan has been 2 year lead time although actual long lead material purchased 3+ years before launch
- Declining demand stressing industrial base
  - Lack of clarity on NASA path forward requires PWR to quote fixed priced engine contracts assuming no NASA work
  - "Buy 1" Contract lot buy allowed contractors to manage subcontracts
  - [redacted] (b)(4)
- Efforts to provide realistic satellite readiness dates should improve yield

Without a significant policy change, significant cost reductions are unlikely

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Launch Environment Summary

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	Pre EELV Environment 1998 & Earlier	EELV Buy 1 Environment 1998 - 2010	Current EELV Environment 2011 & Beyond
Payload Requirement	4K - 20K Lbs to GTO	10K - 30K Lbs to GTO	
Boosters	Different Programs for Several Size Classes	One Program Based on Common Core	
Launch Pad Infrastructure	AF 45th Space Wing of Responsibility	Contractor Responsibility	
Orders	Lot Buys	Lot of 30	Single buys

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Government oversight for Mission Assurance and role as the dominant customer has returned launch to the Pre-EELV scenario.

Therefore, a return to historical prices range should not be a surprise, but still below historical considering lower launch rates

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Summary

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- We know how we got here
- We understand the costs
- We have a baseline against which we can evaluate acquisition strategy options
- We are beginning to understand capacity challenges
- We are ready to assist in the evaluation of acquisition strategy options

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Back-up

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Total Program Element History

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	Pre EELV Environment 1998 & Earlier	EELV Buy 1 Environment	Current EELV Environment Buy 2 and Beyond
Boosters	Contracts with Industry	Fixed Priced Contracts with Industry	Fixed Price ELS Contract(s)
Program Management, Engineering, Launch			Cost Plus ELC Contract(s)
Launch Pad Infrastructure	AF 45th Space Wing Responsibility		
Ranges		AF 45th Space Wing Responsibility	AF 45th Space Wing Responsibility

Direct Comparison of Costs Over Time Periods Addressed in Presentation

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Contracting History

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- **Pre-EELV**
  - Contracts with Vendors for Booster + Launch Services
  - Infrastructure was covered by 45th Space Wing of the Air Force
- **Buy 1, 2, 2.5, Now Contracts**
  - Separate fixed price contracts with Boeing and Lockheed Martin for Launches
  - Price is complete package (Booster + Launch Services + Infrastructure)
  - Buy 1 was large (~30) lot buy for AF and NRO
  - Buy 2, 2.5, Now are additional NRO launch contracts (total of 6)
- **ELS (Launch Services)**
  - Fixed price contracts for boosters only
  - Referred to as Buy 3 contracts
- **ELC (Launch Capabilities)**
  - Separate contracts with Boeing and Lockheed Martin, merged into ULA
  - Covers "Everything but the booster": Engineering + Launch Services + Infrastructure
- **NRO Companion Contracts**
  - Separate contracts with ULA for additional services and Mission Assurance

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5th Booster Cost Comparison

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ELS Estimate Assumptions

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ELS Price Comparison

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If EELV Matched History, Where Would Prices Be?

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Projected ELS Price Trend

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Program Office Costs

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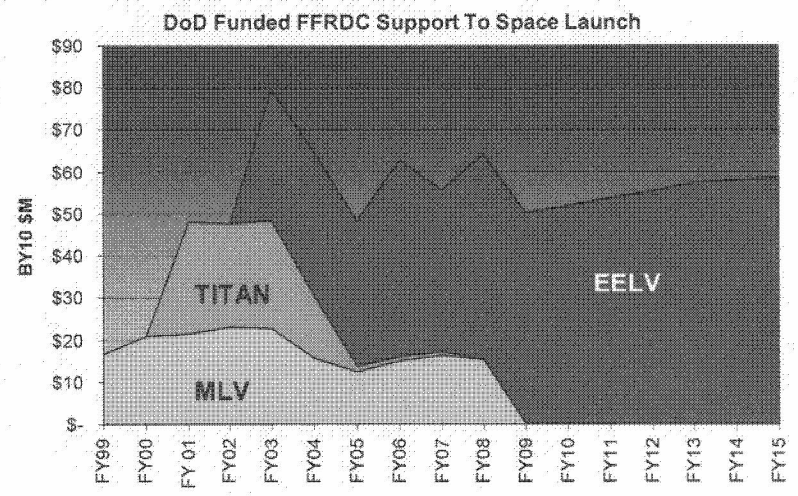
- **Program Office Costs**
  - Included in AF Budget
  - Program Office: $10M / yr (FY10) - Inflating @ 3.8%
  - FFRDC & SETA Support: $73.5M / yr (FY10) - Inflating @ 5%
  - $20M / Yr in withholds

- **FFRDC Support Size Comparison to Prime**
  - ULA has 1,148 SEPM for ELC + NRO companion contracts
  - 292 Aerospace FTE for NSS
    - 25% of ULA SEPM
    - 11% of ULA Total NSS Effort
  - Program Office Study Ongoing



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PWR RS-68 Engine Deliveries

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Alternative Launch Systems

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- **Assume policy is to retain EELV for NRO systems as a minimum**
- **Marginal analysis of satellite switch from EELV to Alternative**

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- **Cost:**
  - Falcon 9 quote (thru 3/31/10) of $51.5M to LEO
  - Falcon 9 qualification testing
  - Government Mission Assurance costs
  - Other costs (ex. Communications Infrastructure modification)
- **"Insurance"**
  - Assumptions: EELV Reliability* 96% Commercial Reliability* 40% - 90% Satellite Cost $1.5B
  - EELV Failure = $1.5B x (.04) = $60M
  - Commercial Failure Lo = $1.5B x (.10) = $150M Commercial Failure Hi = $1.5B * (.60) = $900M
  - Potential Commercial Cost Penalty $90M - $840M (without consideration of operational impact)

* Source: AEROSPACE

Marginal Savings Less Than Commercial Cost Without Consideration Of Commercial Reliability and Mission Assurance

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