



Solid Rocket Motor (SRM) Congressional Interest

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December 2009**

Agenda

- Congressional Interest
 - History of Congressional Involvement
 - FY 2010 NDAA Language
- April 2, 2009 SRM Industrial Capabilities Report to Congress
 - Synopsis of Report
 - Findings
- Challenges with Achieving Congressional Request
- Department's Approach Summary
Conclusions

Congressional Interest

DoD Interest in SRMs

- Generally, DoD interested in industrial base issues before Congress
- SRMs clearly falls into this category
- DoD SRM historical interest
 - Department's Strategic Advisory Group (1994)
 - DoD industrial capabilities assessment (1996)
 - SRM Interagency Working Group (2000)
 - Industrial Policy SRM IB assessment in 2004 & 2006

Congressional Language/Interest

- FY 2007 National Defense Authorization Act
“The SecAF shall modernize MM III ICBMs...assets required to maintain a sufficient supply of launch test assts and spares to sustain the deployed force of such missiles through 2030”
- FY 2007 Senate Report 110-155
“...The committee is concerned that following completion of this modernization program and capability of the defense industrial base to modernize or replace these ICBMs will be severely diminished...directs the Dept of the AF to conduct a study...and the benefits associated with developing a life extension program for the MM III system similar to the Trident II D5 Life Extension Program”
- FY 2009 National Defense Authorization Act
“The House and the Senate Committees on Appropriations....In the interim, the Air Force is encouraged, at a minimum, to continue a warm line status for Minuteman III propulsion systems and to use funds provided for fiscal year 2009 to initiate a Minuteman III motor life extension program.”

2008 NDAA SRM Language

- Section 1050 of the National Defense Authorization Act, Public Law 110-181, dated January 28, 2008 required the Department of Defense to “submit to the congressional defense committees a report on the status, capability, viability, and capacity of the solid rocket motor industrial base in the United States.”

Recent Events That Impacted SRM Industrial Base

- Cancellation of the Kinetic Energy Interceptor program
- Procurement limits on Ground Based Interceptor
- End of Minuteman III Propulsion Replacement Program (PRP)
- Uncertainty in Air Force Minuteman III warm-line program
- Uncertainty in NASA Ares program

FY 2010 NDAA Language

Bill Language (Sec. 1078):

- **SRM IB Sustainment Plan:** SECDEF review and establish plan to sustain SRM IB, including ability to maintain & sustain currently deployed strategic & missile def systems and to maintain intellectual and engineering capacity to support next gen rocket motors as needed (NLT 1 Jun 2010)
 - Sec 1078 plan should also identify capability requirements and production capacity to support such requirements (**Rpt Lang**).
 - Review SRM plans/programs of other agencies (NASA), to determine how/if they assist DoD in maintaining a SRM IB (**Rpt Lang**)



**FY 2010
NDAA Conf Rpt**

Statement of Managers Report Language:

- **Spend Plan:** SECDEF provide expenditure plan for FY10 to sustain SRM IB in FY10 (NLT 1 Feb 2010)

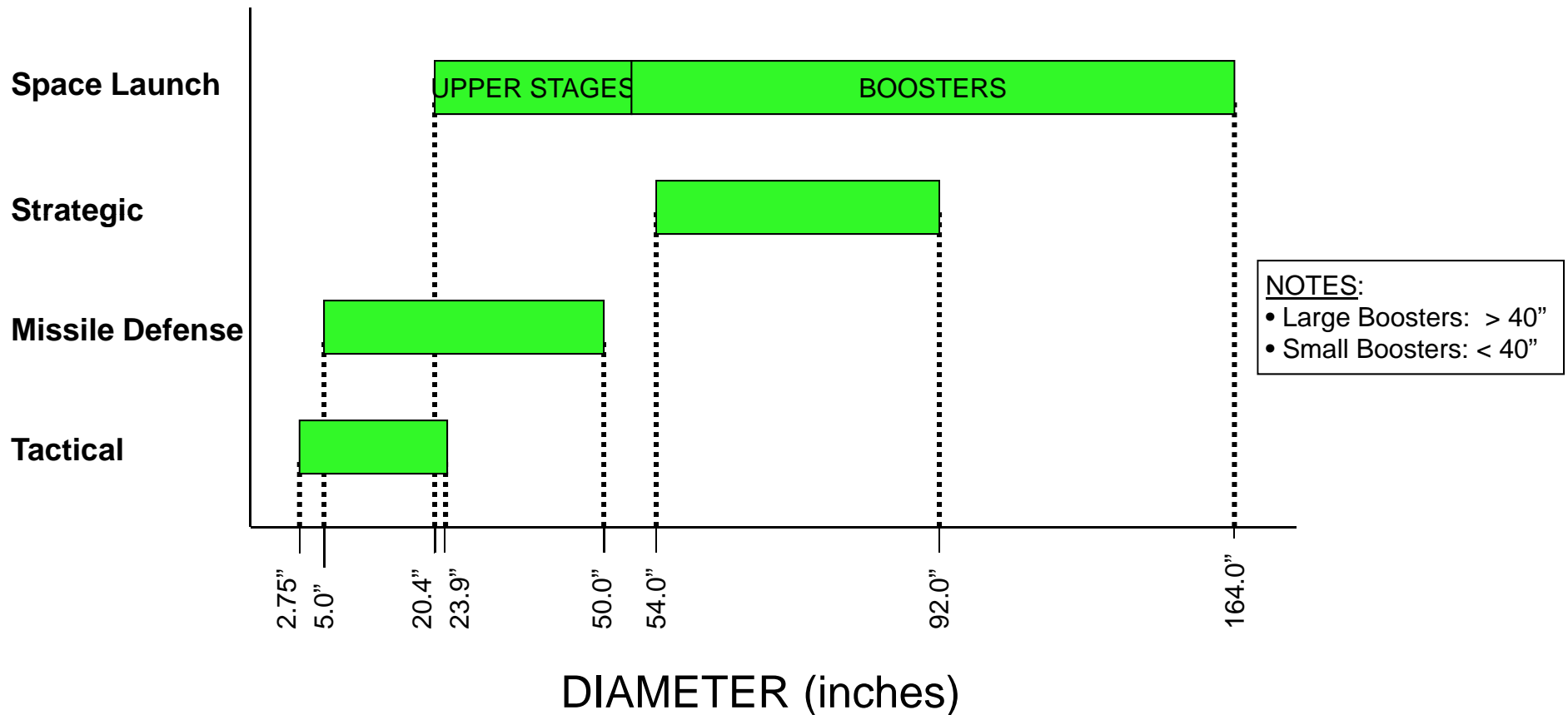
SRM Industrial Capabilities
Report to Congress
dated April, 2, 2009

SRM Business Segments

- Space Launch (e.g., Shuttle boosters, Atlas solid rocket booster, and Delta boosters)
- Strategic (Minuteman III and D-5)
- Missile Defense (e.g., PAC-3, KEI, and GMD)
- Tactical (e.g., AMRAAM, AIM-9X, Hellfire, and TOW-2)

Solid Rocket Motor – Industry Composition

RELATIVE SRM SIZE BETWEEN MISSION TYPES



Source: Web research, Rocket Propulsion Elements, Sutton & Biblarz, BAH Analysis

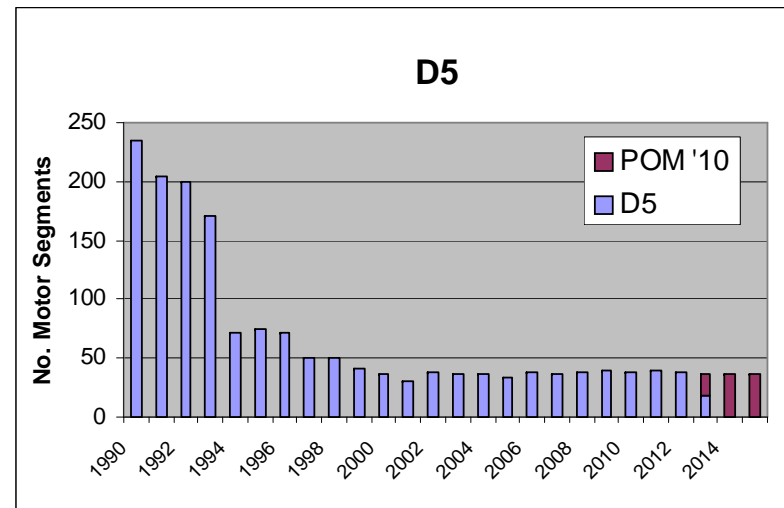
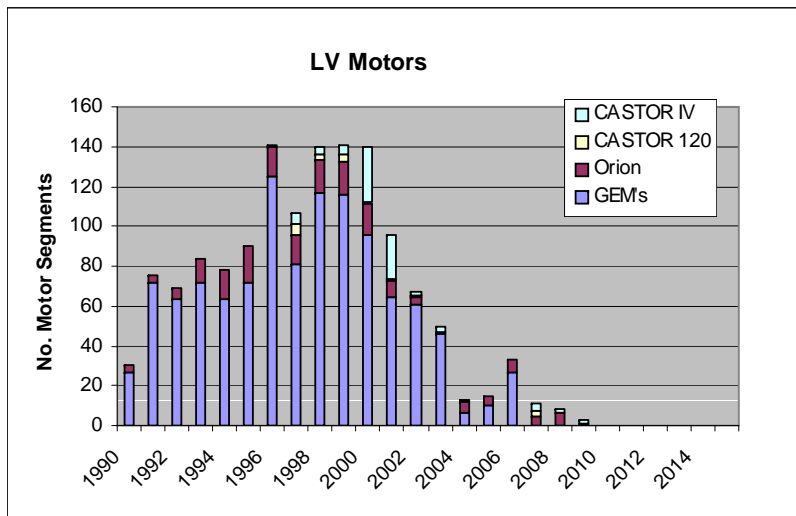
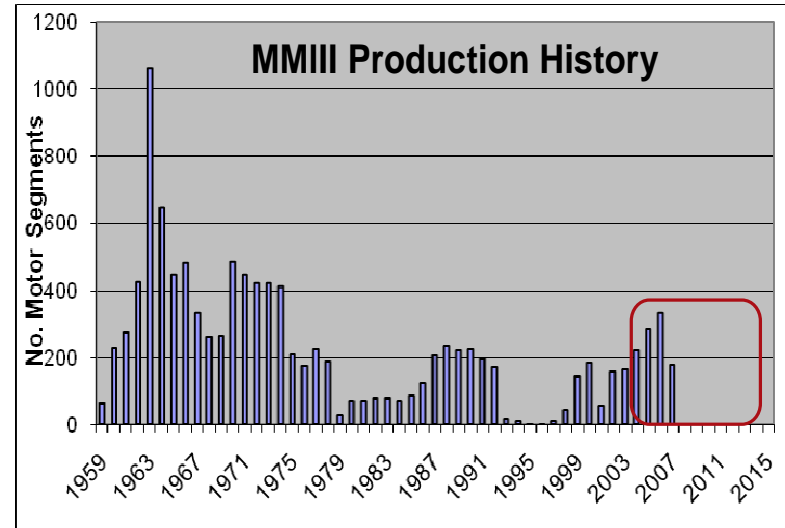
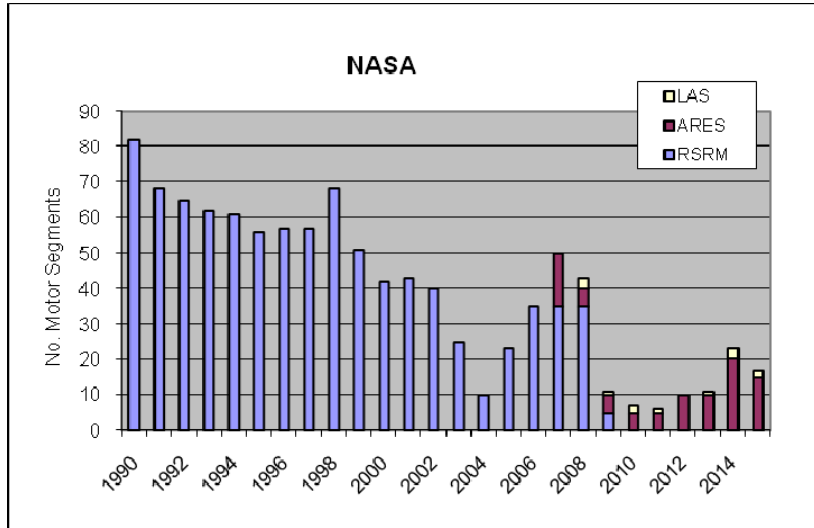
Comparing Space Shuttle RSRM to other SRMS

Missile Program	Pounds of Propellant	Equivalent # of SRMS to Equal One Space Shuttle RSRM
Space Shuttle RSRM	1,106,059	1
Trident II D-5	110,200	10
Minuteman III (MM III)	66,642	17
Ground Missile Defense (GMD)	43,469	25
Kinetic Energy Interceptor (KEI)	20,026	55
Patriot Advanced Capability-3 (PAC-3)	350	3,160
Guided Multiple Launch Rocket System (GMLRS)	216	5,121
Advanced Medium-Range Air-to-Air Missile (AMRAAM)	113	9,788
Hellfire	20	55,303
Javelin	3	368,686

NASA man-launched space systems a key player in large SRM sector and propellant subtier base.

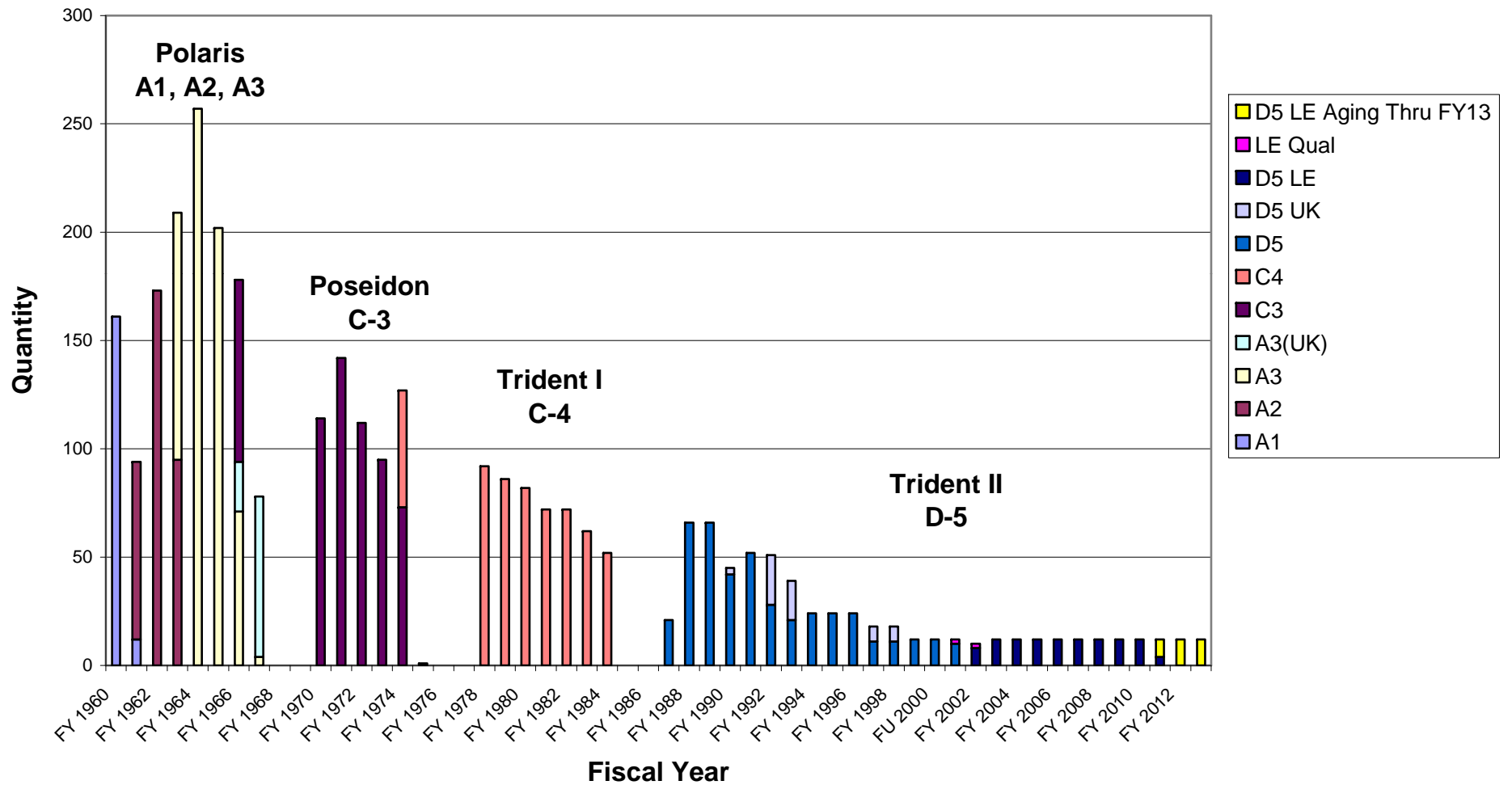
SRM Demand

Large SRM Production Decline



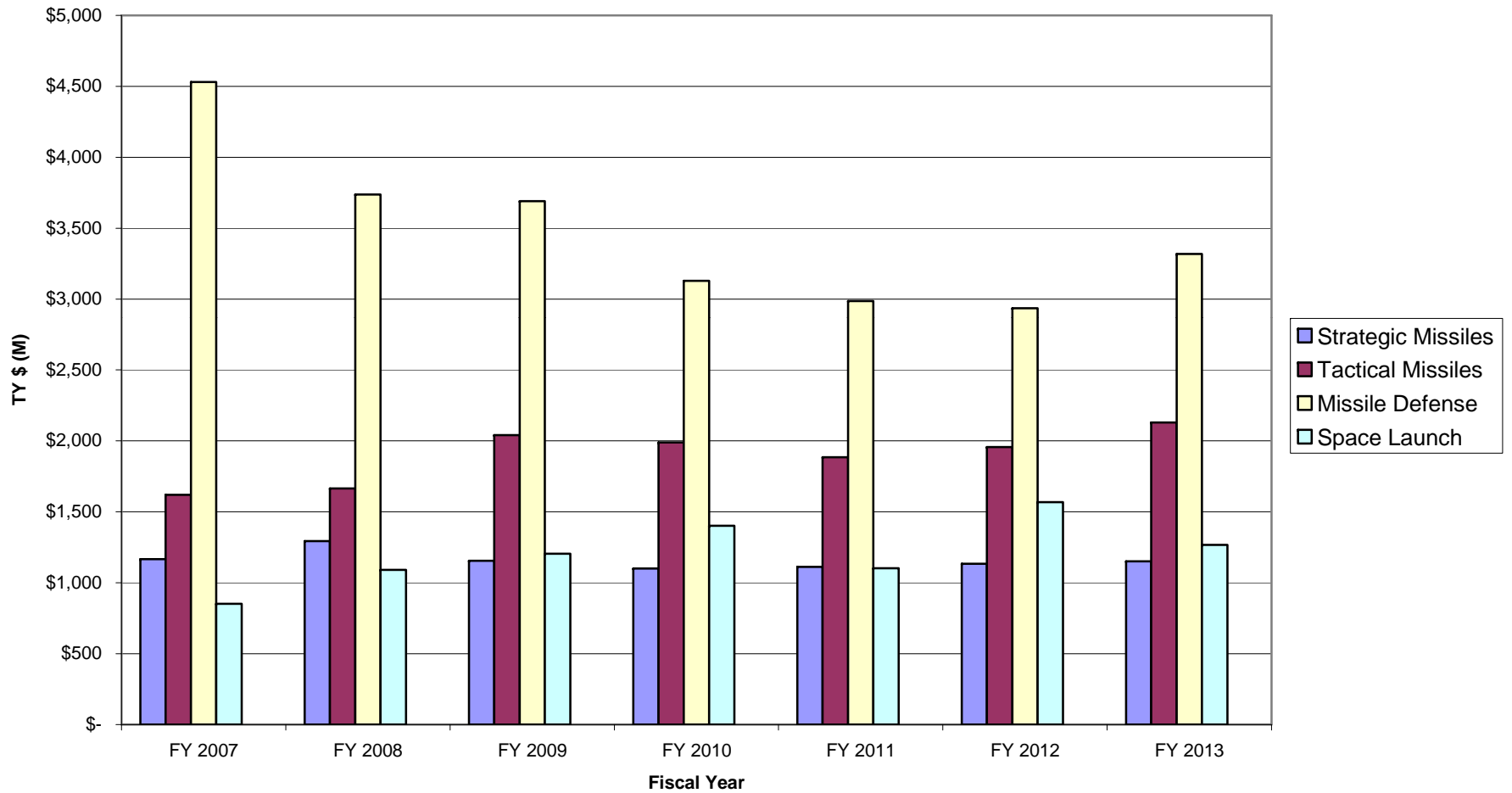
Source: ATK

Navy Sub-Launched Ballistic Missile SRM History



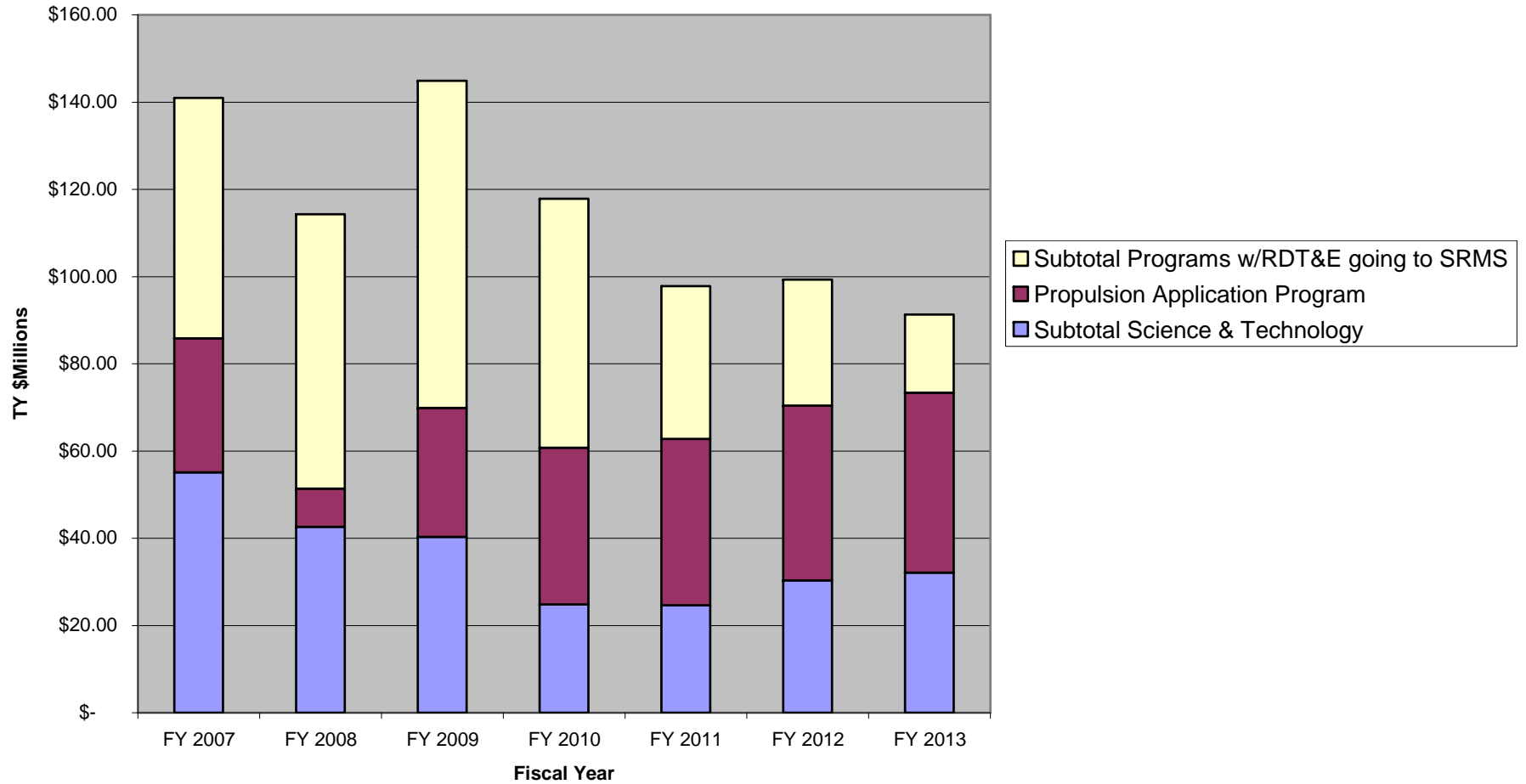
Source: Navy D-5 Program Office

Missile Procurement by Segment



Source: Source: DoD FY 2009 President's Budget dtd, February 2008

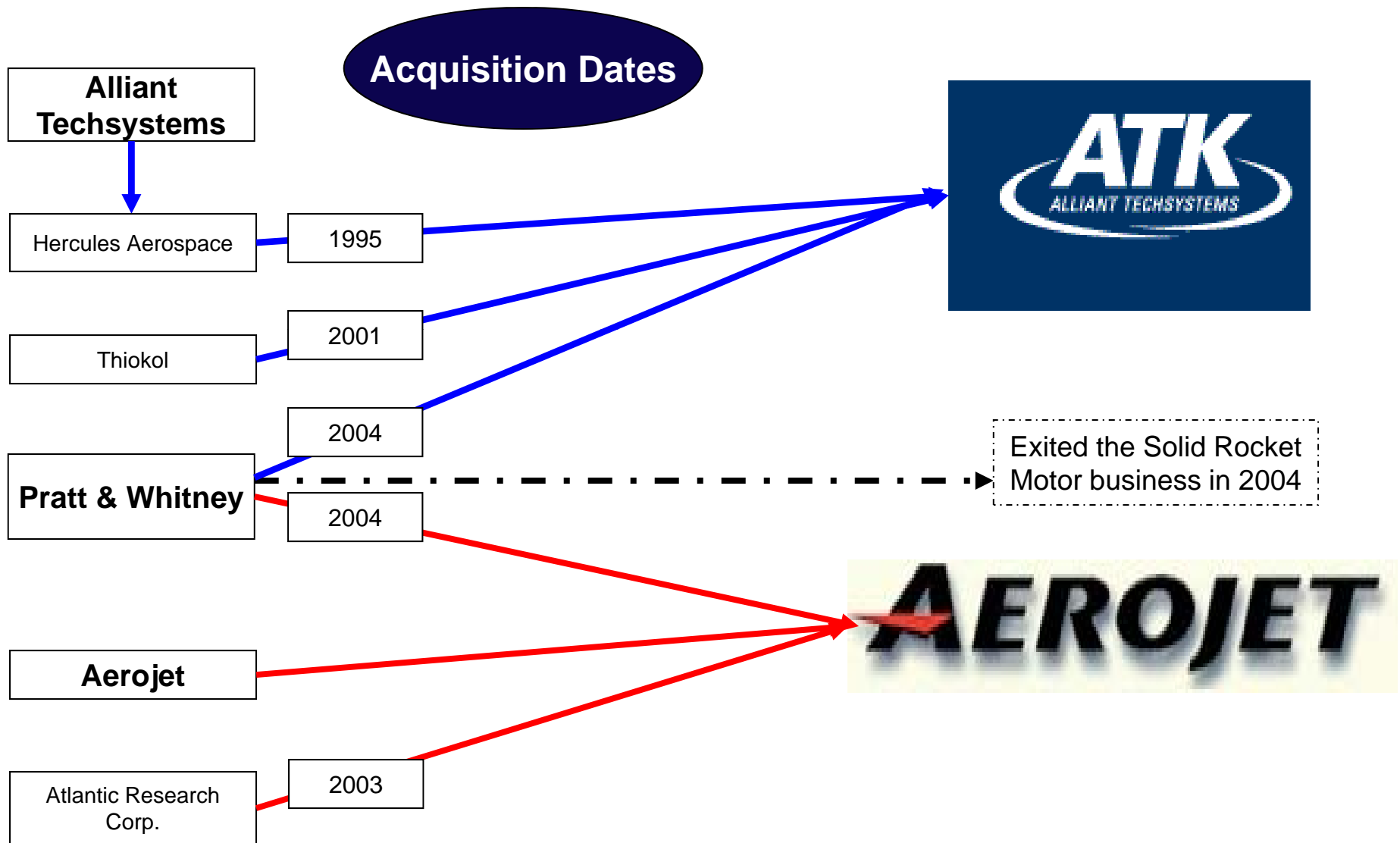
DoD Research and Development Funding



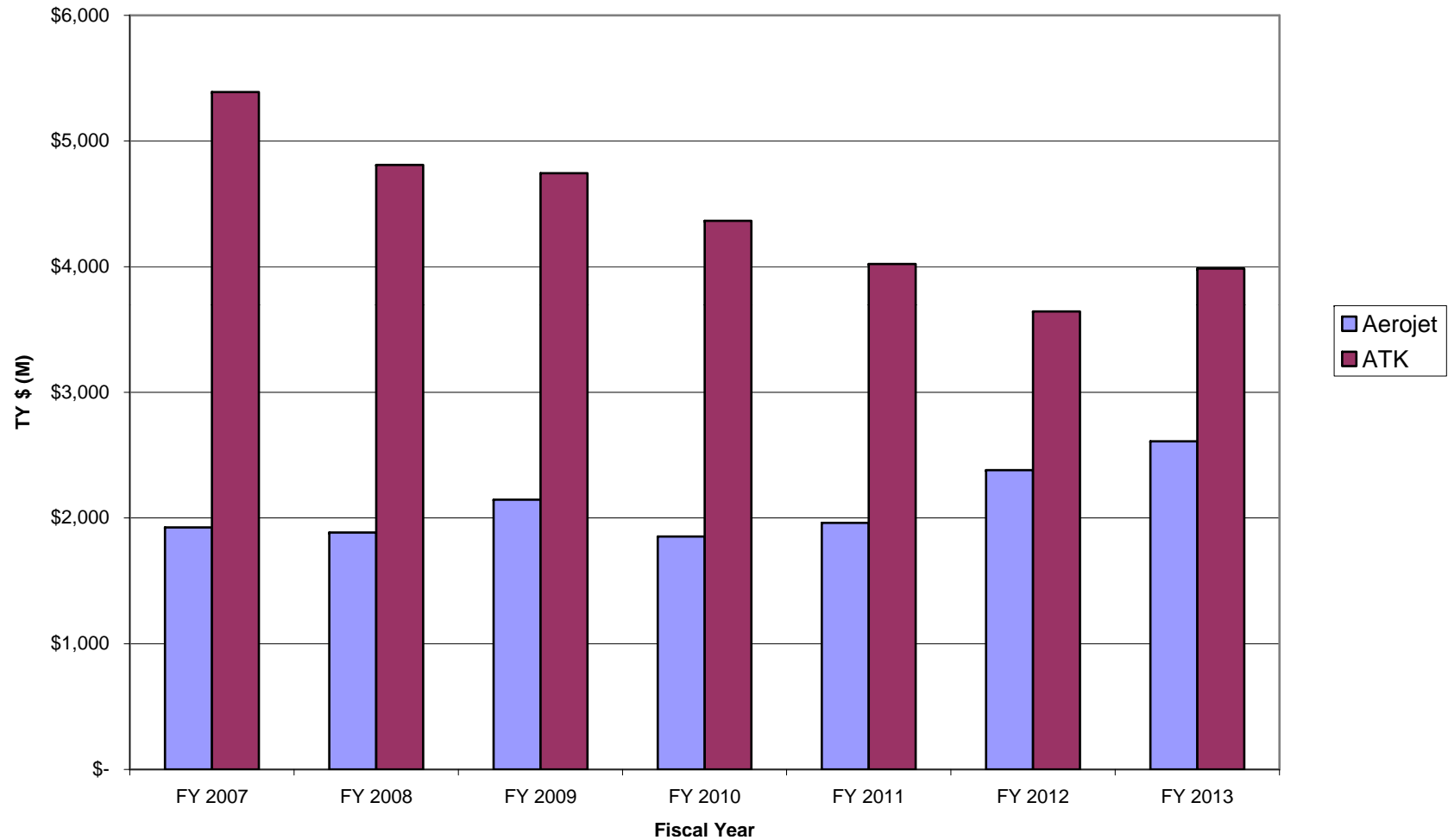
Source: DoD FY 2009 President's Budget dtd, February 2008

SRM Primes

Consolidation in the SRM and Related Industries



DoD Missile Procurement by Prime Contractor

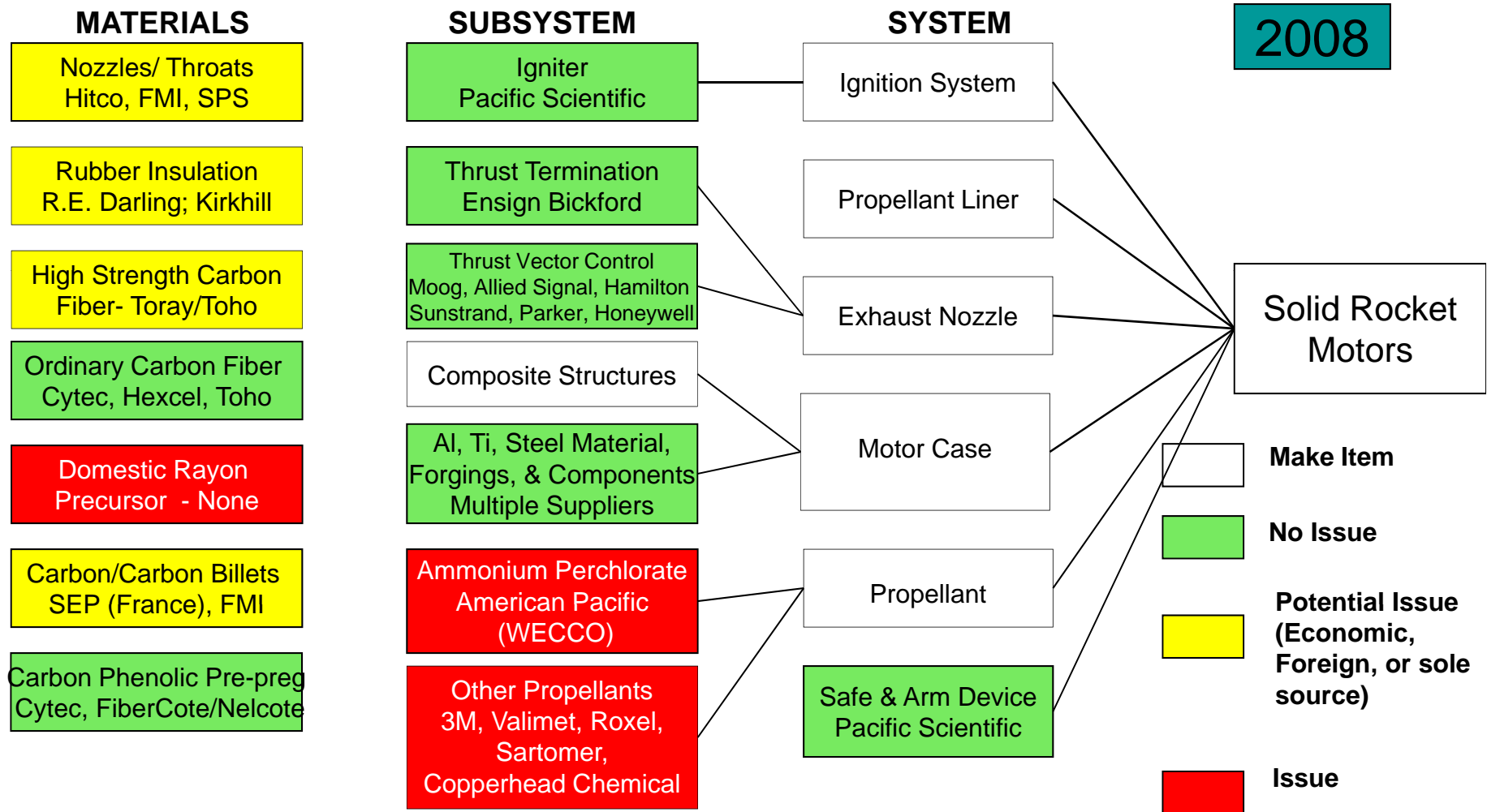


Source: Source: DoD FY 2009 President's Budget dtd, February 2008

SRM Subtier Suppliers

Large System Sub-tier Suppliers & Niche Providers – ATK and Aerojet Assessment

2008



Selected SRM Issues

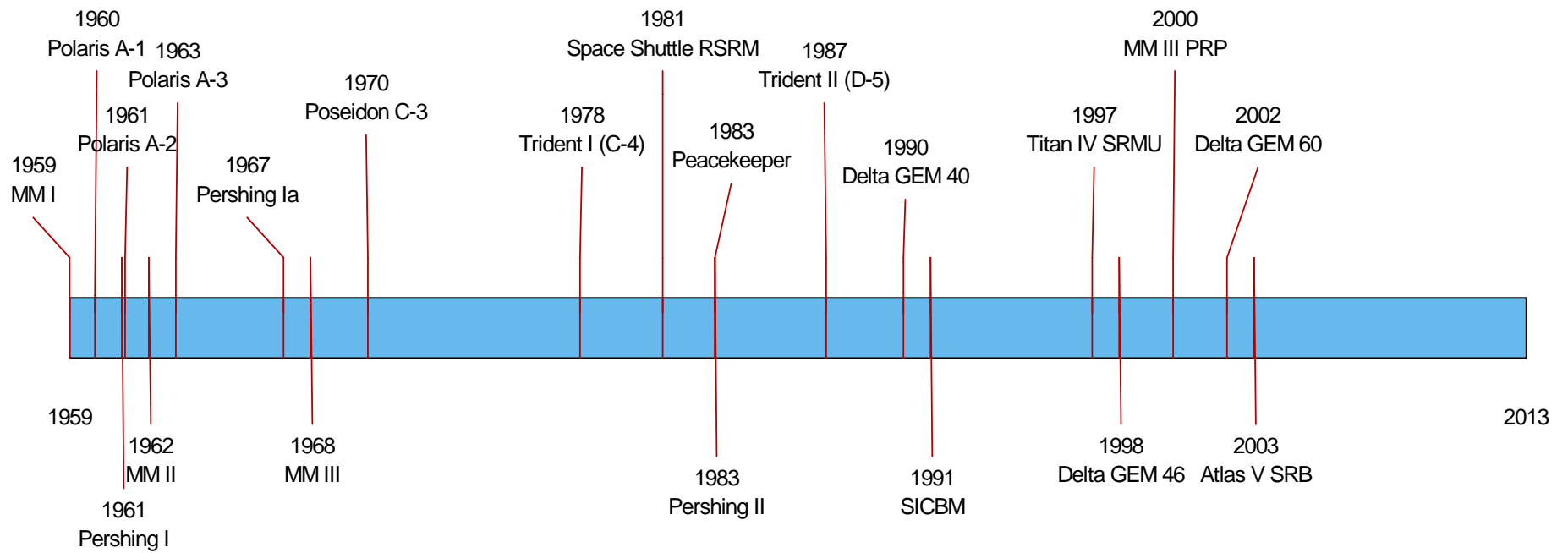
- Limited Competitive Opportunities
- Graying SRM Workforce

Limited Competitive Opportunities

- DoD new missile programs
 - Joint Air-to-Ground Missile (JAGM)
 - Conventional Prompt Global Strike (CPGS) *
- NASA new programs
 - Ullage Setting Motor (part of Ares program)

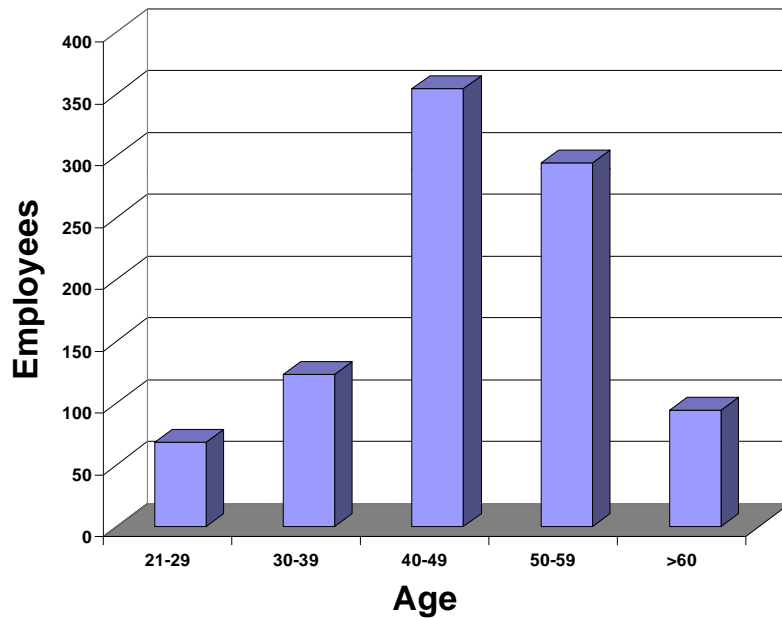
* CPGS is a DoD-Wide demonstrator

Large SRM History



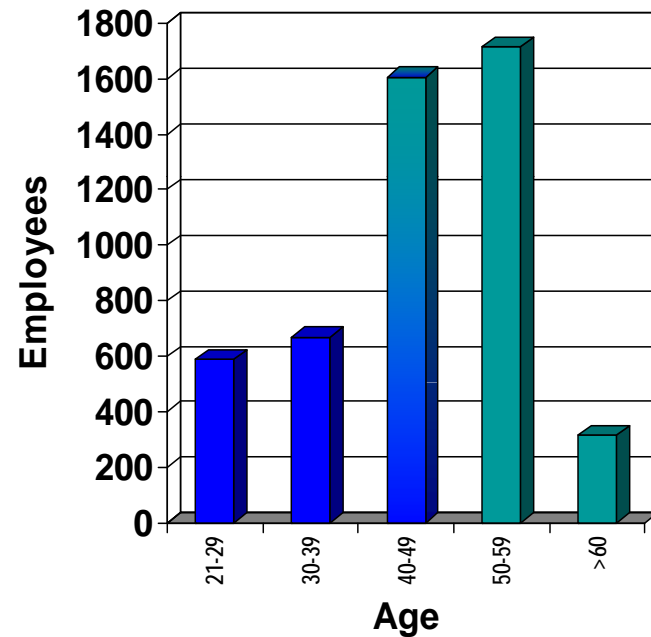
SRM Prime Contractor Age Distribution

Aerojet Age Distribution



20% of workforce is < 40 years old

ATK Age Distribution



26% of workforce is < 40 years old

Note: Aerojet Data reflects Sacramento Facility & ATK data reflects Space Systems Division

Source: Aerojet & ATK

Summary Conclusions

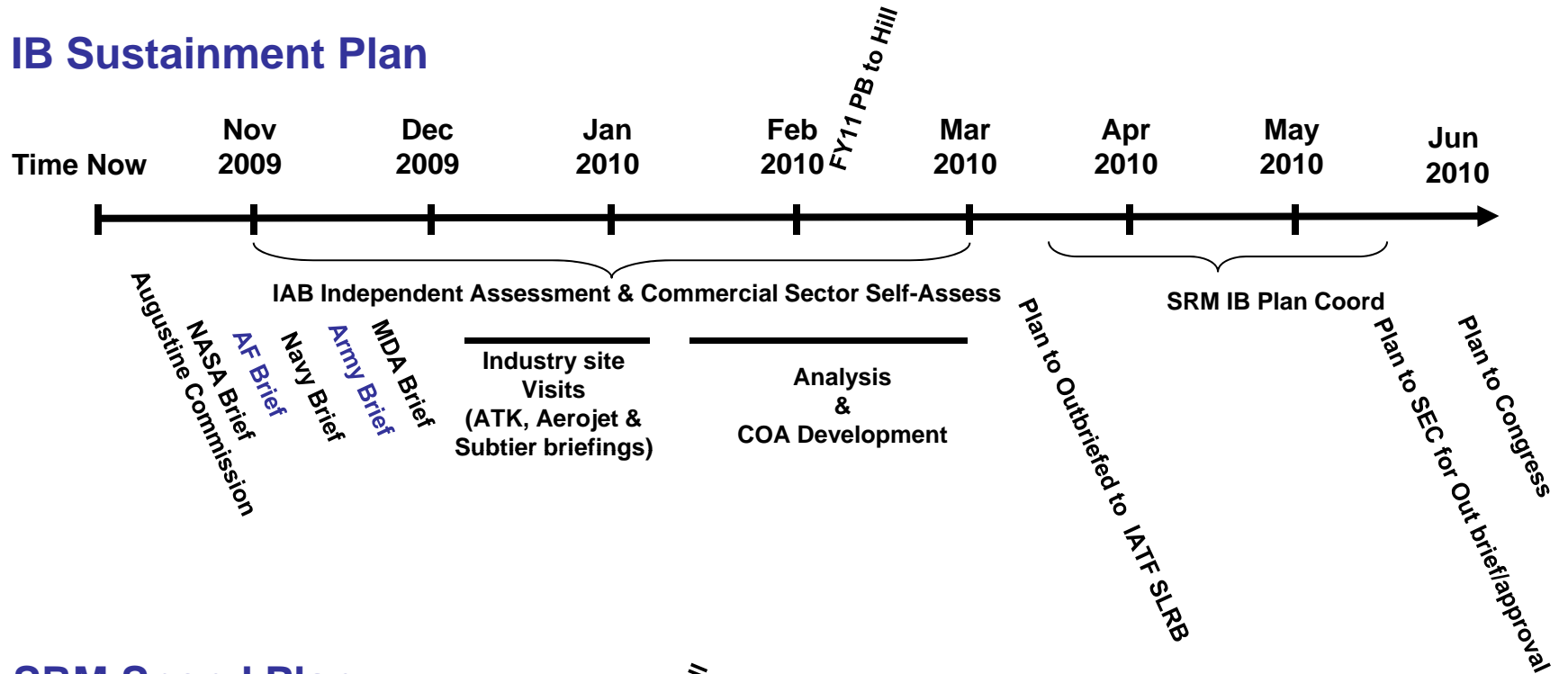
- SRM industry currently capable of meeting most technological and production needs
- Declining demand for large SRMs and limited competitive opportunities:
 - Will make it hard to attract and retain skilled engineering and manufacturing expertise
 - May result in further consolidation
 - Two primes to one, or
 - Further rationalization of large SRM facilities
- Delays in NASA Ares program could have significant impact on large SRM prime and propellant subtier industrial base

The lack of meaningful production orders and new SRM development in the next decade is not conducive to the long-term well-being of the SRM industry

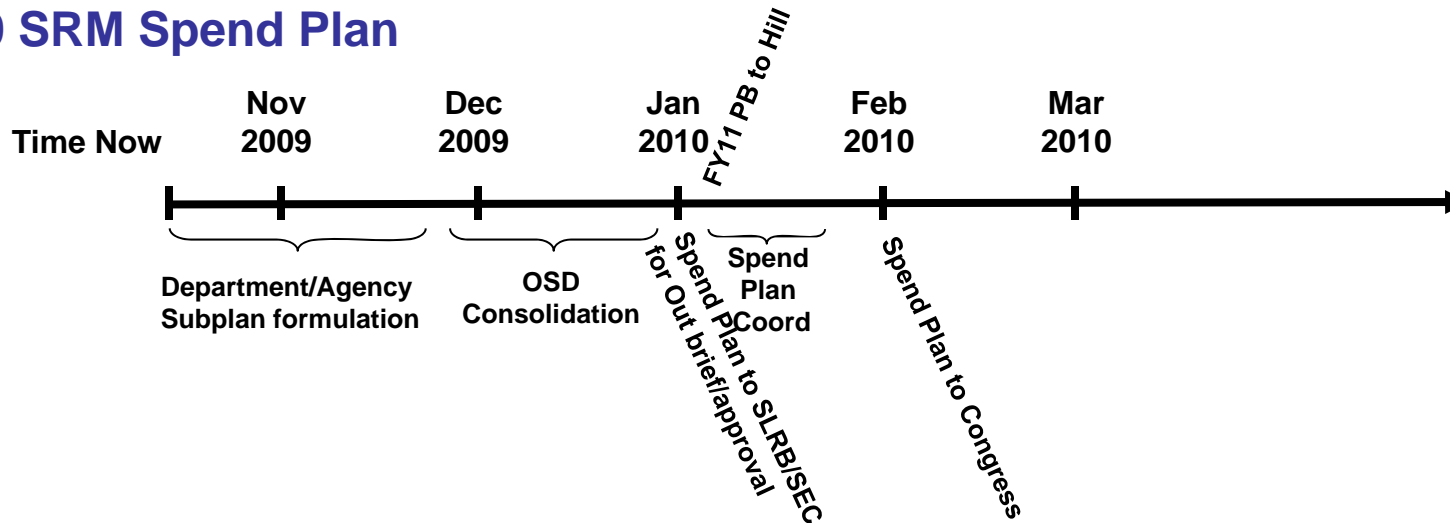
Challenges for Meeting Congressional Deadline

SRM IB IATF Timeline

SRM IB Sustainment Plan



FY10 SRM Spend Plan



Challenges

- NPR, BMDR, QDR report-out Jan 2010 timeframe
 - NPR, BMDR, QDR implementation strategies will take time to formulate...potential for lack of clear guidance/direction related to SRMs
- NASA future direction dependent on Guidance from White House – timeline uncertain
- Commercial Sector Cooperation – rationalization, consolidation, diversification
- FY10 SRM Expenditure Plan will not be informed by SRM IB Sustainment Plan assessment/ analysis activities
 - FY10 execution may conflict w/ SRM IB Sustain Plan

Department's Approach to Addressing FY 2010 NDAA Language

SRM IB Task Force Organization

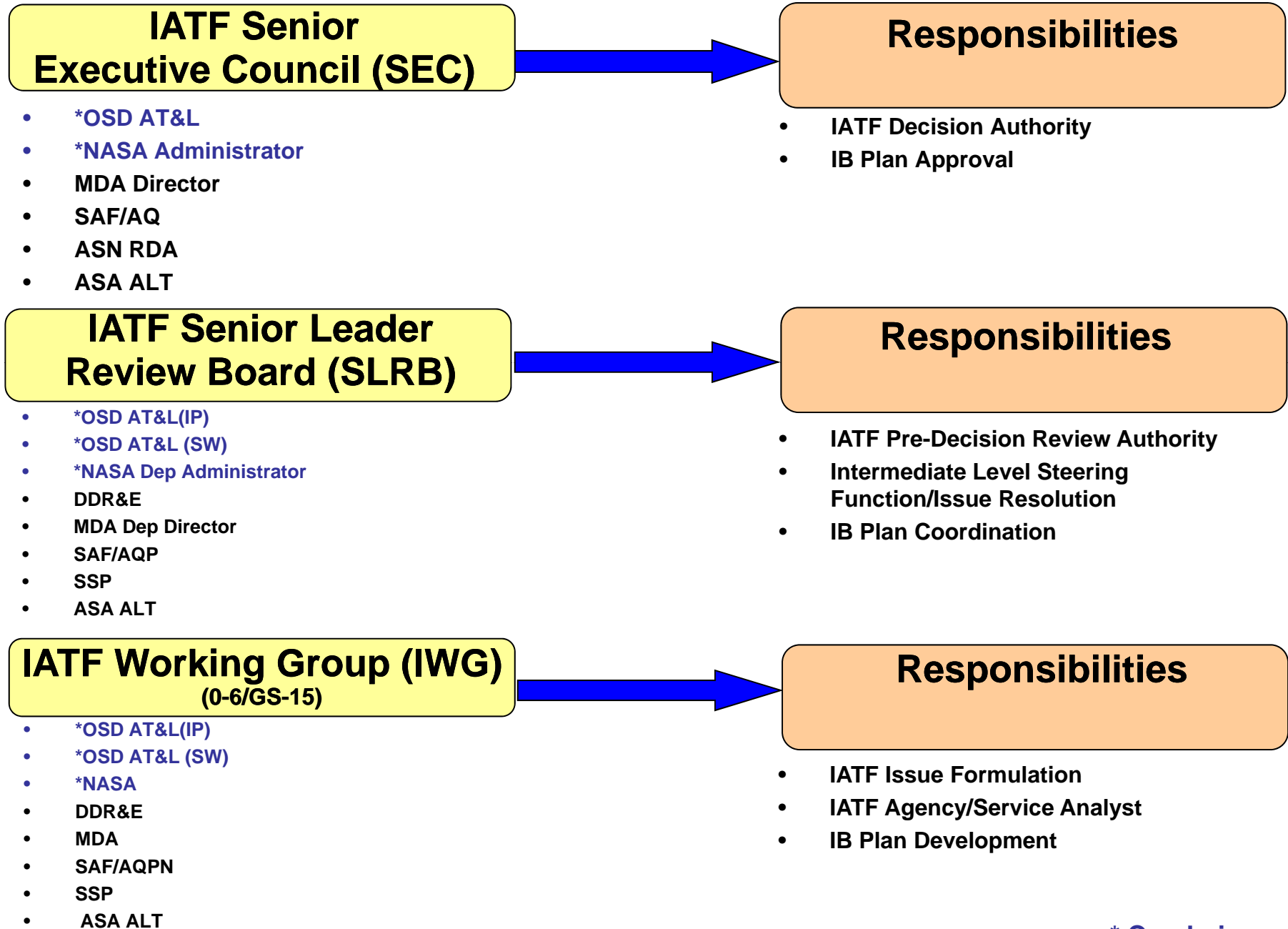
SRM IB Sustain Plan

- 3-Tiered Interagency Task Force (IATF)
- Co-chairs: AT&L and NASA
- Participants: OSD, NASA, MDA, AF, Army, Navy

FY10 Spend Plan

- DoD Execution Year (DEY) IPT
 - Subset of IATF

SRM IB IATF



Methodology (Process)

(SRM IB Sustainment Plan)

- Identify Task Force Participants
- Draft/Approve Terms of Reference and Study Guidance
- IATF Working Group (WG) perform assessment
 - Service briefs, NASA briefs, MDA briefs, Industry briefs, site visits, analysis of programming & budgeting
 - Govt analysis and industry self-assessment of commercial sector consolidation, rationalization & diversification opportunities
- Independent Study (parallel activity)
- IATF WG Dev Plan
 - Integrates Govt assessment, commercial sector self assessment & indep study results
- Outbrief SLRB/SEC
- Staff SRM IB Sustainment Plan

Methodology (Content)

(SRM IB Sustainment Plan)

- Identify IB capabilities req'd to sustain IB
- Identify current SRM programs (current demand)
- Identify future SRM programs—next gen SRM systems and their dev/prod timing (future demand)
- Gap Analysis: Assess if current programs (demand) and timing of future programs is adequate to sustain the IB
- Trade Space: Industry self assessments of opportunities rationalize/consolidate/diversify
- Capability Gap: Determine what capabilities will be lost given current/future investments
- Develop investment strategy to address capability gap

Methodology

(FY10 SRM Expenditure Plan)

- Identify DoD Execution Year (DEY) IPT Participants
- Draft/Approve Guidance to Services/Agencies
 - NPR, BMDR, QDR, PR11, Start FO will also inform work
- Services/Agencies develop spend plans
- OSD Integrate spend plans
 - Deconflict/Propose execution guidance where req'd
- Outbrief to SLRB/SEC
- Staff FY10 SRM Expenditure Plan

What's Been Done

- Identified Service and Agency Points of Contact who will actively participate in the IATF organizational structure
- Services and Agencies briefed current/projected programs that influence SRM industry (S&T, R&D, Production)
- Initiated identification of recent & ongoing studies/analyses that identify at risk industrial capabilities required for sustainment of SRM industry going forward & those required to sustain existing systems (at the prime and subtier level)
- Scheduled SRM prime contractors briefs for December

We have a lot to do

Back-ups

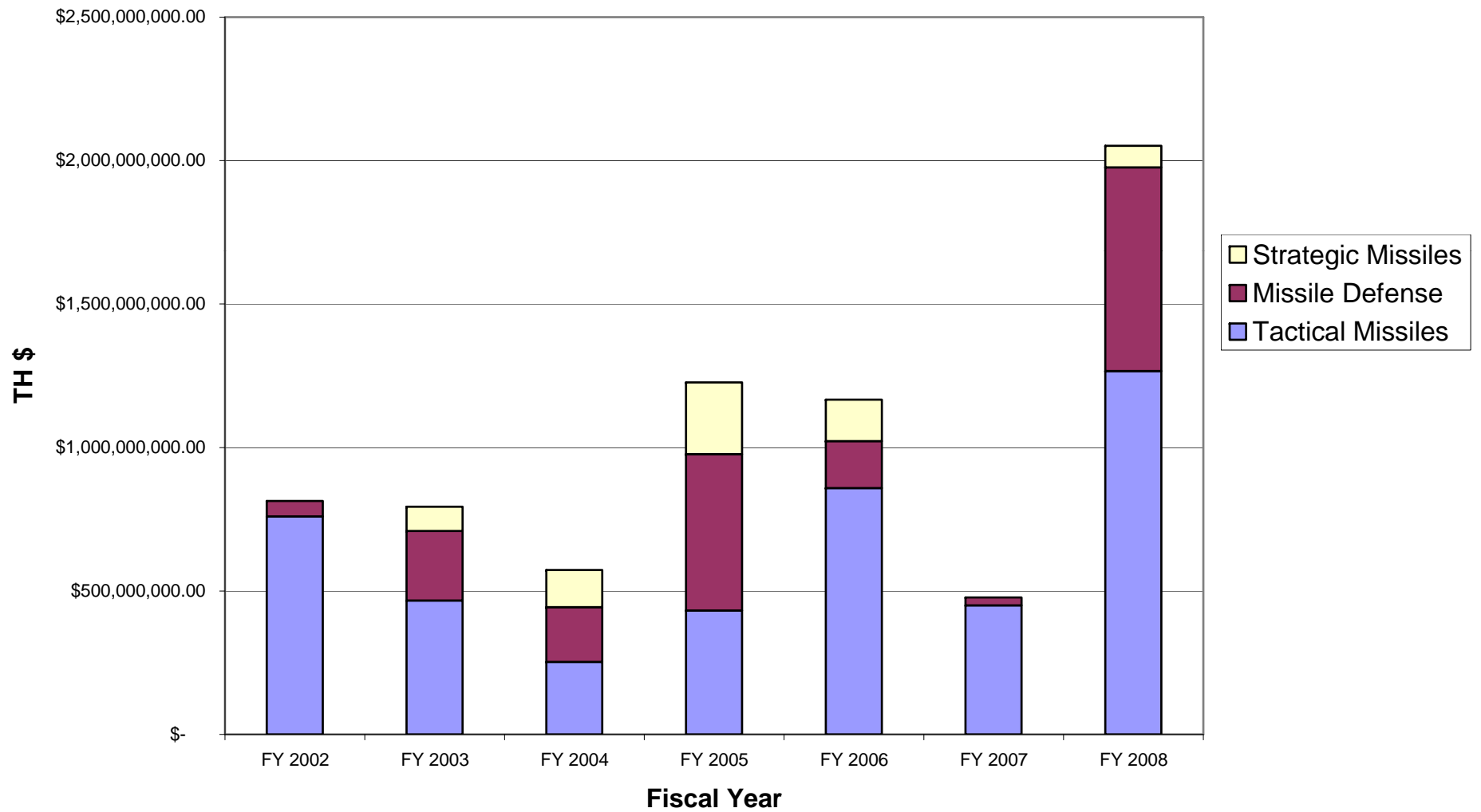
Space Systems Group Utah Location Workforce

Location	Oct '08	Reduction In Force	Oct '09
Bacchus	949	153 (24 in April '09) (129 in October '09)	758
Promontory	3489	624 (258 in April '09) (366 in October '09)	2847
Clearfield	235	53 (22 in April '09) (31 in October '09)	181
Total	4673	830	3786

SRM IB Report Content

- An assessment of the ability to maintain the Minuteman III intercontinental ballistic missile through its planned operational life.
- An assessment of the ability to maintain the Trident II D-5 submarine launched ballistic missile through its planned operational life.
- An assessment of the ability to maintain all other space launch, missile defense, and other vehicles with solid rocket motors, through their planned operational life.
- An assessment of the ability to support projected future requirements for vehicles with solid rocket motors to support space launch, missile defense, or any range of ballistic missiles determined to be necessary to meet defense needs or other requirements of the United States Government.
- An assessment of the required materials, the supplier base, the production facilities, and the production workforce needed to ensure that current and future requirements could be met.
- An assessment of the adequacy of the current and projected industrial base support programs to support the full range of projected future requirements identified in paragraph (4).

Foreign Military Sales



Source: DCSA 1200 System data

NASA SRM Forecast

NASA Solid Motor Forecast	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Constellation Program													
Ares I First Stage (segments/year)		5	5	10	10	10	10	10	10	10	10	10	10
Ares V Booster (segments per year)						5	5	5	10	20	20	20	20
Launch Abort System (LAS) (#/yr)	6	3	6	2	2	2	2	2	2	2	2	2	2
Abort Motor	1	1	2	2	2	2	2	2	2	2	2	2	2
Jettison Motor	2	1	2	2	2	2	2	2	2	2	2	2	2
Attitude Control Motor	3	1	2	2	2	2	2	2	2	2	2	2	2
Booster Deceleration Motor (BDM) (#/yr)		5	1	1	8	16	16	16	16	16	16	16	16
Booster Tumbling Motor (BTM) (#/yr)		5	1	1	4	4	4	4	4	4	4	4	4
Ullage Settling Motor (USM) (#/yr)	2	3	8	8	16	16	16	16	16	32	32	32	32
Booster Separation Motor (BSM) #/yr								5	5	32	32	32	32
NASA Launch Services Program													
Atlas 5	2	1	0	2									
Delta II	4	3	2	1									
Delta IV	1	1	0										
Taurus	1	1	0										
Pegasus	1	0	0										
Small class (unassigned)				1 to 2	1	1	1						
Medium class (unassigned)						0	2						
EELV class (unassigned)				1	1	3	1						
Commercial Orbital Transportation Services (COTS)													
Castor 30 - Taurus II				3	3	3	3	3					

Source: NASA

Military EELV (Delta IV & Atlas V) Solid Rocket Booster Procurement Calendar Year History & Forecast

Name	Supplier	Booster Details	Booster											
			2003	04	05	06	07	08	09	10	11	12	13	14
GEM-60 (Delta IV)	ATK	60 in dia HTPB				4		6		2	2	1	2	1
SRB (Atlas V)	AeroJet	61in dia HTPB					2		5	5	1	2	1	2
Number of Boosters Procured						4	2	6	5	7	3	3	3	3

Note: After 2010, numbers are estimations based on recent historical manifest statistics

Source: US Military Satellite Manifest, Small World Communications, 18 June 2008

Commercial EELV (Delta IV & Atlas V) Solid Rocket Booster Procurement Calendar Year History & Forecast

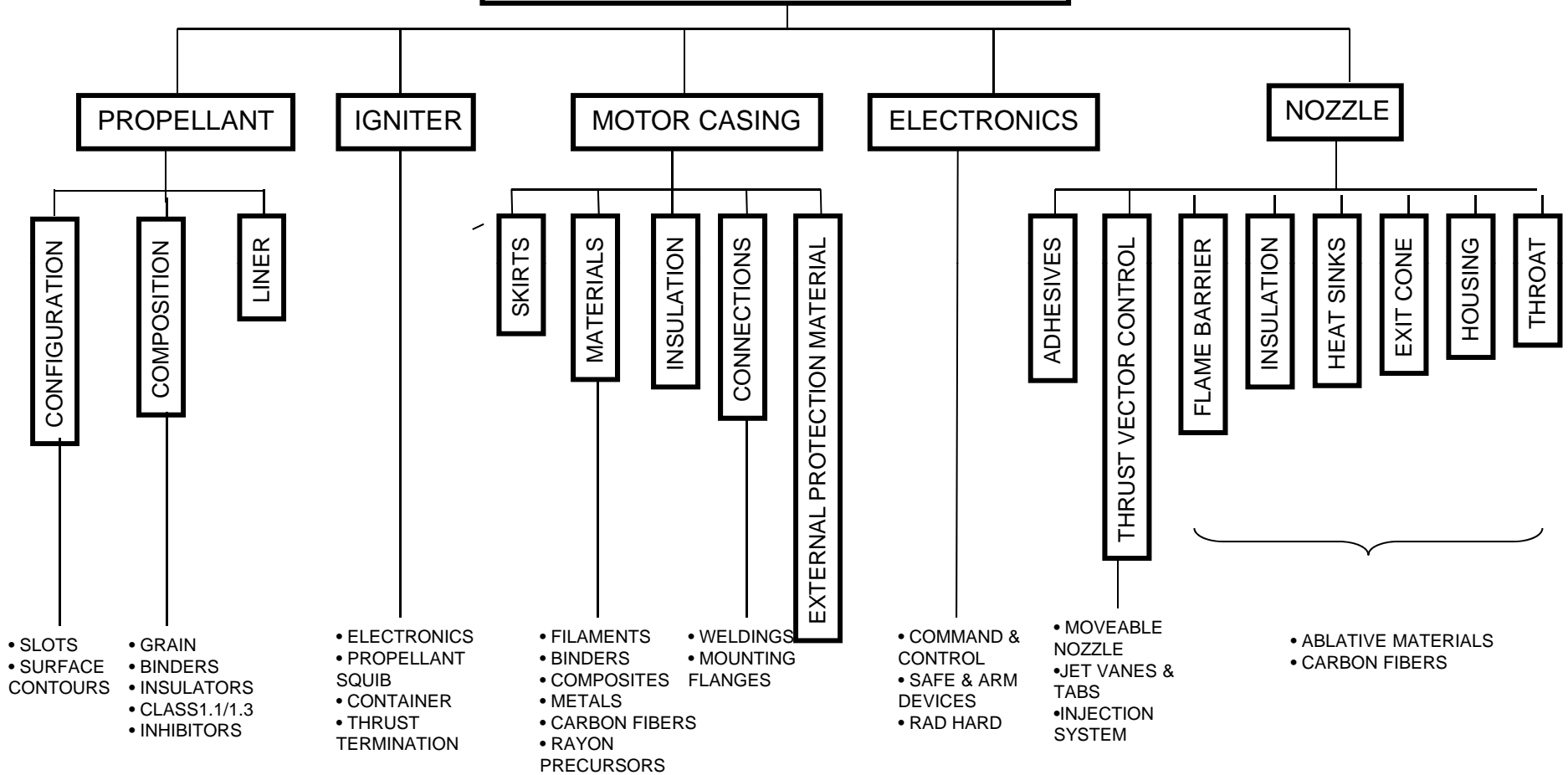
Name	Supplier	Booster Details	2003	04	05	06	07	08	09	10	11	12	13	14
GEM-60 (Delta IV)	ATK	60 in dia HTPB								1		1		1
SRB (Atlas V)	AeroJet	61in dia HTPB	2	2	3	6			2	1	2	1	2	1
Number of Boosters Procured			2	2	3	6			2	2	2	2	2	2

Note: Historical commercial launches were primarily Atlas V vehicles

Source: US Military Satellite Manifest, Small World Communications, 18 June 2008

Solid Rocket Motor

Key Subsystems & Components



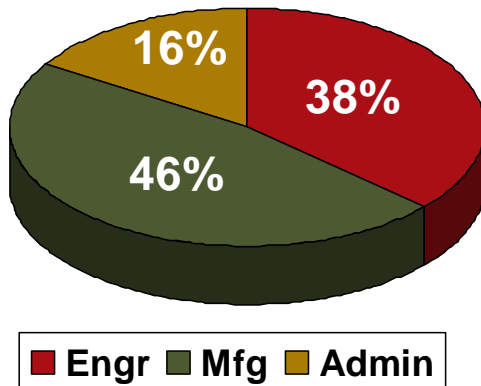
Source: *Rocket Propulsion Elements, Sutton & Biblarz*

SRM Percent of Missile Unit Cost

Missile Segment	Program	% SRM cost to Unit Cost
Tactical	AMRAAM	3
Tactical	GMLRS	13
Tactical	AMRAAM	3
Tactical	Hellfire II	3.8
Tactical	Hellfire Longbow	2.5
Tactical	NLOS PAM est.	3.3
Missile Defense	SM-6	20
Missile Defense	SM-3	8
Missile Defense	PAC -3	3
Strategic	MM III	29
Strategic	Trident II D5	21
Strategic	Peacekeeper	33
Strategic	SICBM	32

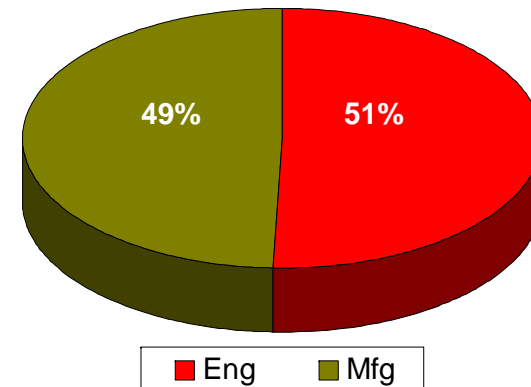
ATK and Aerojet Skill Distribution

ATK Skill Distribution



Average age for ATK design engineer is 46
Average age for ATK production labor is 51

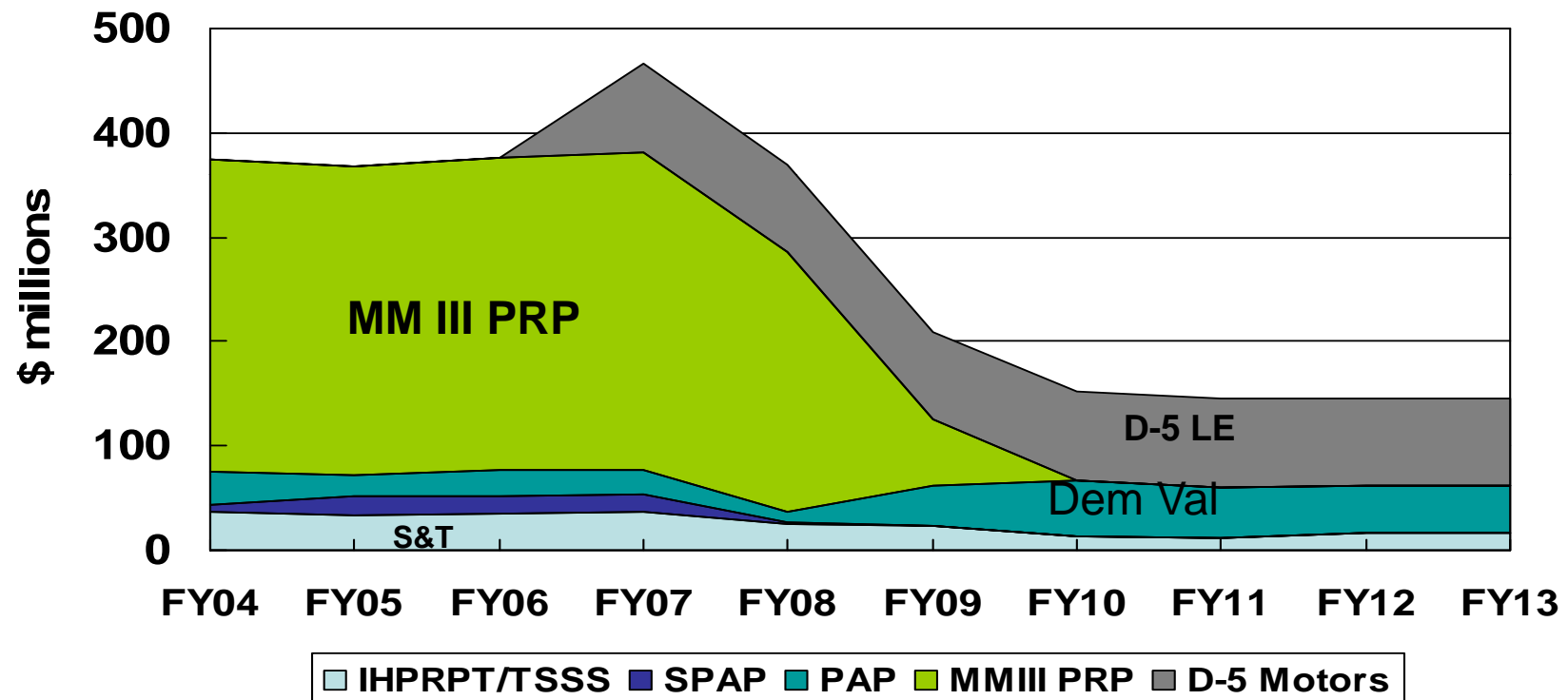
Aerojet Skill Distribution



Average age for Aerojet engineer is 46
Average age for Aerojet manufacturer is 48

Source: ATK and Aerojet

Strategic Propulsion S&T and ICBM/SLBM Sustainment Funding



Large reduction in projected Production and S&T funding ICBM Dem-Val

Source: DoD DDR&E