Acquisition Research Program:
Creating Synergy for Informed Change

US Space Acquisition: Is the US Loosing the Race?

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"In this new century, those who effectively utilize space will enjoy added prosperity and security and will hold a substantial advantage over those who do not. In order to increase knowledge, discovery, economic prosperity, and to enhance the national security, the United States must have robust, effective, and efficient space capabilities."

- US National Space Policy, 2006

Agenda

- Purpose:
  - Provide brief background on the rise of US space leadership
  - To describe and provide modest recommendations to three specific challenges impeding US Space Acquisition
    - Reliance upon immature technology
    - Requirements
    - Health of Space Industrial Base

Historical Background

- US engages in the Cold War
  - Need systems to deliver warheads at very long distances
    - Development of the Intercontinental Ballistic Missile (ICBM)
    - Similar technology used to develop Space Launch Vehicles
  - Need a means of obtaining information from denied areas
    - Shoot down of Gary Power's U2
    - Avoid political and diplomatic embarrassment
    - Political boundaries don't extend into space
  - Period of rapid development in: communications, weather, navigation, missile warning, and intelligence surveillance
    - Demonstrates the technological innovation of the US
    - However, systems primarily used in a strategic manner

Historical Background

- The Persian Gulf War
  - Iraq invades Kuwait 2 Aug 1990
  - Soviet trained and equipped military force
  - Satellites used as a force multiplier
    - Connected military forces, sensors and decision makers across the battle space
    - Collected data on operationally relevant conditions
    - Survey and target hostile forces
    - Enhanced command and control of forces in the field
  - Dismember Iraqi forces in days
    - We awaken the Chinese Dragon
    - Spurs on military modernization particularly in space

Historical Background

- To the present …
  - US more reliant on space assets than ever before
  - Rival nations and non-state adversaries recognize US superiority in space; also recognize are reliance
    - Actively working to close the gap & negate the US advantage
    - Modernization programs
    - Asymmetric warfare
    - Chinese SC-19 test against the Feng Yun (FY- 1C) weather satellite
  - US space systems acquisition suffering from
    - Over budget
    - Behind schedule
    - Under delivering on performance

US Space Acquisition

Fiscal Year			
	2003	***2007***	***2008***
Portfolio size			
Number of Programs	77	95	96
Total Planned Commitments	$1.2 Trillion	$1.6 Trillion	$1.6 Trillion
Commitments Outstanding	$742.2 Billion	$875.2 Billion	$786.3 Billion
Portfolio Indicators			
Change to Total RDT&E costs from first estimate	37%	40%	42%
Change to Total acquisition cost from first estimate	19%	26%	25%
Total acquisition cost growth	$183 Billion	$301.3 Billion	$296.4 Billion
Share of programs with 25 percent increase in program acquisition unit cost growth	41%	44%	42%
Average schedule delay in delivering initial capabilities	18 Months	21 Months	22 Months

Analysis of DOD Major Defense Acquisition Program Portfolios (Francis, 2009)

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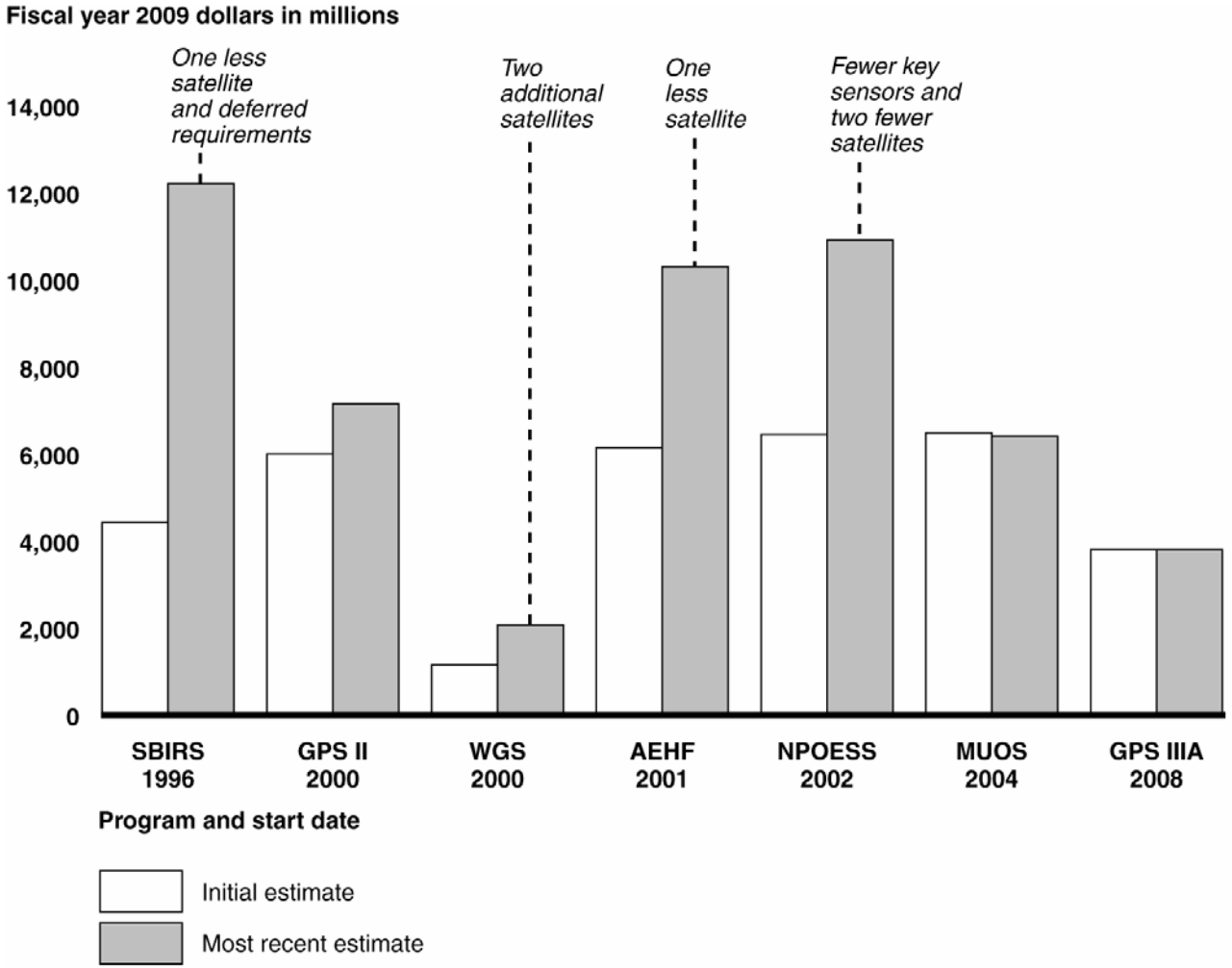

Source: GAO analysis of DOD data.

"Nothing threatens US military superiority in space more than a loss of ability to develop, field and sustain our space systems." – Lt. Gen Michael Hamel (USAF, Ret.)

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- ***Reliance on Immature Technology***
  - DOD funds more programs then they can afford
    - Many programs come into existence underfunded
    - 36% of program managers stated unstable funding as one the top obstacles to achieving success (Chaplain, 2006)
  - Creates an intensely competitive environment for fiscal dollars
    - Program managers must show “bang for the buck”
    - Temptation to rely on the “promise” of bleeding edge technology
      - 18% of program managers stated they relied upon immature technology

US Space Acquisition

- ***Reliance Upon Immature Technology***
  - Examples of space programs relying upon immature technology
    - Space Based Infra-Red (SIBRS)
    - Advanced Extremely High Frequency (AEHF)
    - National Polar-orbiting Operational Environmental Satellite System (NPOES)
  - These programs have experienced a 40% cost increase since their original estimation due in part to immature technology (Chaplain, 2006)

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- ***Reliance Upon Immature Technology***
  - Recommendation
    - Separate technology development from acquisition development
      - Employ the Technology Readiness Level (TRL) scale;
      - A number of Air Force programs are now applying TRL to their programs
      - Debate ongoing between DOD and GAO as to which TRL level should be used to incorporate new technology into a program
        - » GAO recommends level 7: technology tested in an operational environment
        - » DOD recommends level 6: demonstrates a prototype technology in a relevant end-environment

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- ***Requirements***
  - The "Grand Design"
    - Attempting to satisfy all user demands in a single design
    - Ineffective and maybe impossible
      - Many stakeholder's requirements come into conflict
      - Example using a hypothetical imaging bird:
        - » One user may have a requirement to penetrate dense jungle foliage
        - » Another user may have a requirement to perform broad area search across a large body of water
        - » Yet another user may have a requirement to detect thermal signatures emanating from caves

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- ***Requirements***
  - Adding or changing requirements as the program evolves
    - Possible causes
      - New technology has caught user's eye
      - Stakeholder attempting to solve a rapidly changing and dynamic problem
    - Stakeholder's may not understand the cost and schedule impacts to their "wish list"
    - Problem only amplifies when "we are asked to hold fixed performance, cost and schedule at the beginning on any space acquisition, thereby inexorably increasing program risk." (Rustan, 2005)

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- ***Requirements***
  - Recommendation
    - Empower program manager to negotiate and make trade offs with stakeholders
    - Employ evolutionary/spiral development
      - All needs/capabilities are not known up front
      - Rapid development and deployment of partial capability
      - Possible hidden costs and unique challenges?

US Space Acquisition (Requirements)

Performance Measure	Units of Measure	Project Scenario		
		Javelin	*Base Case Traditional*	*Base Case Spiral*
Duration to first requirement satisfied	Weeks	471	470	**397**
Duration to maximum requirements satisfied	Weeks	520	**518**	762
Total development cost	$1.0 Million	722	**719**	1,555
Requirements satisfied by deadline	Percent	**100**	91	18
Final requirements satisfied	Percent	**100**	91	91

Table 2: Performance Comparison of Three Simulated Acquisition Projects (Ford, Dillard, 2009)

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- ***Health of Space Industrial Base***
  - International Traffic in Arms Regulations (ITAR)
    - Brought about as a result of Chinese technological gains from the ASTAR II Launch
    - Intended to prevent technology “spill-over” and protect the technology superiority of the US
    - Largely failing to achieve objectives and is actually hurting the US Space Industrial Base
      - Encouraged nations to develop their space technology; some European companies advertise “ITAR free” components & space craft
      - Hampering companies ability to compete in the international market
        - » Have to apply for export license through Dept. of State; on average 106 days turn around time
        - » Some companies requiring RFP in 30 to 60 days so they can exclude the US w/o suffering economic consequences

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- ***Health of Space Industrial Base***
  - ITAR (Cont)
    - Encouraged foreign nations to cooperate with one another especially among European nations
    - China rapidly closing the technology gap
      - Successfully tested a anti-satellite interceptor
      - Developing its own navigation system
      - Conducted first manned flight
      - Completed first space walk

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- ***Health of Space Industrial Base***
  - Large dependence on the US Government
    - Between 2003 – 2006; 60 – 65% sales were to the US Government (Chao, 2008)
    - First tier contractors (Boeing, Lockheed, Northrop) do show profit revenues
    - Second and third tier contractors are showing minimal profit revenues (4 – 6%)
      - Many in the 2nd and 3rd tier leaving the industry because there isn't a strong enough business case or going bankrupt
      - Supplier's Excellence Association (SEA) predicting 50% of 2nd & 3rd tier contractors will "disappear"

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- ***Health of Space Industrial Base***
  - Recommendation
    - ITAR: conduct technical review to determine which technologies are truly critical
    - ITAR: provide ability to review cases in real time
    - Industry: Annually review the health of the Space Industrial Base
    - Industry: Incentivize 2nd and 3rd tier contractors to stay in the industry

Summary

- It is in the national security interest of the US to be a leader in space
- 3 key areas are proving to be a challenge in space acquisition
  - Immature technology
    - Program mangers using immature technology to compete for program dollars
    - Separate technology development from acquisition development
  - Requirements
    - The “Grand Design” near impossible to reach
  - Health of the Space Industrial Base
    - ITAR hurting industry development

Questions