

Who is in the Space Enterprise and what are their roles?

Reading:

- A. US National Space Policy, http://www.whitehouse.gov/WH/EOP/OSTP/html/OSTP_Home.html
- B. DoD Space Policy, <http://www.c3i.osd.mil/org/c3is/spacepol/index.html>
- C. NRO homepage, <http://www.nro.mil>
- D. NASA homepage, <http://www.nasa.gov/enterprises.html>
- E. Aerospace Integration
- F. State of the Space Industry 1999

Outline:

- A. The players
- B. Their functions
- C. US Government space budgets by year
- D. Role of the major players in space policy and their equities and issues
 - NASA
 - National Security Space
 - Air Force + (Navy and Army)
 - NRO
 - Commercial
- E. Impact of commercial space on everyone else

The players

Military - Fight and Win the Nation's wars

Organize, Train & Equip

- Air Force (the largest spender)
- Army, Navy
- BMDO, DARPA, DISA

Provide Combatant forces to supported CINCS

US Space Command

- Air Force Space Command (the largest spender)
- Naval Space Command
- Army Space Command

Intelligence - Provide timely information and data to support foreign, defense and economic policies

National Reconnaissance Office (NRO) (the largest spender)

NIMA

NSA

DIA

Army

Navy

Marines

Air Force

Civil -

NASA(the largest spender)

DOC (NOAA, Office of Space Commercialization)

DOT (FAA)

State Dept

DOE

Dept of the Interior (USGS)

Oversight

OSTP (National Science and Technology Council)

OMB

Congress (Intelligence Committees, Defense Committees, Independent Agency Committees)

Commercial

Launch hardware and services providers

Lockheed Martin

Boeing

Orbital Sciences Corp.

China

Russia

ArianeSpace

Satellite hardware providers

Hughes Electronics Corp.

Space Systems Loral

Lockheed Martin

Motorola

TRW

Boeing

OSC

Alcatel

Matra Marconi

Satellite Operators

Hughes Electronics Corp.

Lockheed Martin

Iridium

OSC

Boeing

INMARSAT

INTELSAT

Etc

Ground system operators, subsystem suppliers

Raytheon

Alliant etc.

International

Significant Space Programs (Government and Military and Commercial)

Russia

China

ESA

France

Germany

Italy

Japan

India

Israel

Other

Academia (Stanford, BU, Caltech, MIT, U of Colorado, Arizona State U etc.)
Federally Funded Research and Development Centers (APL, MIT Lincoln Lab, Aerospace, LANL, LLNL, Sandia, JPL)

Space Sectors- The Functions

Military

- Communications
- Environmental Monitoring
- Precision Navigation & Timing (for satellites & for Earth based users)
- Warning & Surveillance
- Space Control
- Launch
- Satellite Command & Control
- Space Weapons

Intelligence

- Communications
- IMINT
- MASINT
- SIGINT
- Launch
- Satellite Command and Control

Civil

- Communications
- Environmental Monitoring
- Navigation & Timing (for satellites)
- Launch
- Space Exploration
- Manned Space
- Remote Sensing

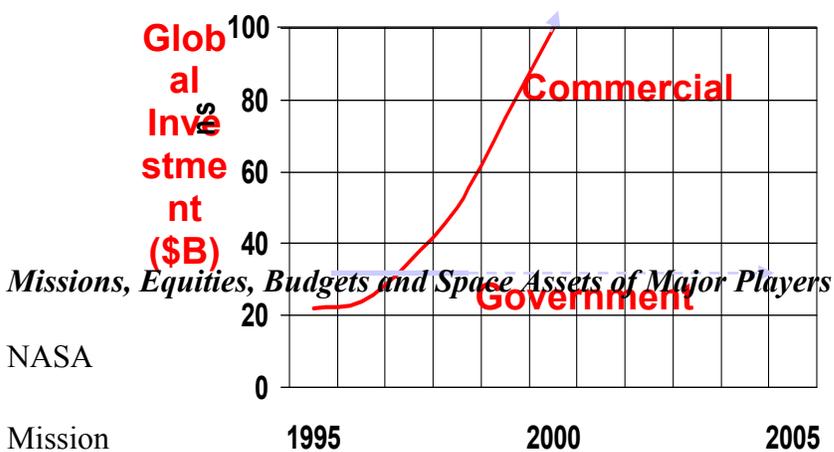
Commercial

- Communications
- Launch
- Remote Sensing
- Satellite command & control
- Navigation & Timing (for satellites)

US Government Space Budgets (Then Year Dollars)

FY	NASA	DoD	Other	Total
1986	7,165	14,126	368	21,659
1987	9,809	16,287	352	26,448
1988	8,302	17,679	626	26,607
1989	10,098	17,906	444	28,448
1990	12,142	15,616	387	28,145
1991	13,036	14,181	566	27,783
1992	13,199	15,023	624	28,846
1993	13,077	14,106	559	27,742
1994	13,022	13,166	465	26,653
1995	12,543	10,644	489	23,676
1996	12,569	11,514	707	24,790

Note the rise and decline of NASA as well as the rise and decline of the DoD
 However, note the growth of commercial markets (approx the same now)



Explore and develop space for human enterprise, increase knowledge about earth and space and conduct research in space and aeronautics.

Budget

About 12 billion for space

Space Assets

Human Space Flight

Space Shuttle

ISS

Space Science

Hubble Space telescope

Chandra Space Telescope

Galileo

Cassini

Many Mars missions

Earth Science

EOS-AM1

EOS-PM1

Etc

RLV

X-33

X-34

Communications

TDRS

Equities (see national space policy)

Human space flight, space science, earth science (with NOAA), RLVs.

Technology missions shared with AF and NRO.

NASA role in US Space Policy

Lead in R&D for civil space activities

E.g. deep space exploration (clear)

Human space flight (clear)

Reusable launch vehicles (not so clear...)

Focus on

Space Science with goal being science as opposed to operations like space weather , 4 themes:

1) Origins – Are we alone?, Where did we come from?

2) Exploration of the Solar System:

- Explain the formation of the Solar System & the Earth

- Seek the origin of life & its existence beyond Earth

- Chart our destiny in Solar System

3) Sun-Earth Connection:

- Understand the changing Sun and it's effects on the Solar System, life & society.

4) Structure & Evolution of the Universe:

- Explain the structure in the Universe & forecast our destiny.
- Explore the cycles of matter & energy in the evolving universe.
- Examine the ultimate limits of gravity & energy in the universe.

Earth Science with the goal being to obtain a scientific understanding of the entire Earth system on a global scale.

- practical goal to enable us to predict both short & long term changes in biosphere dynamics.

Human Space Flight with the goal of opening the space frontier by exploring, using and enabling the development of space and expanding the human experience into the far reaches of space.

Aerospace Technology with the goal of achieving the full potential of space for all human endeavors through affordable space transportation.

- Note the following points: The policy goals for NASA are to:
 - enhance knowledge
 - help understand human influence on the environment
 - conduct human space flight for scientific, commercial and exploration reasons
 - explore space technologies & applications in support of economic competitiveness.

Thus NASA will:

- 1) Operate ISS primarily as a means to support a future decision on the desirability of further human exploration (read Mars but this is the last mention in the space policy on human exploration of Mars).
- 2) Help develop an RLV to enable U.S. to leapfrog launch competitors
- 3) Focus on robotic exploration of Mars
- 4) Focus on reducing cost by innovative technologies (this arose from the concern that NASA focused only on science return not cost)
- 5) Always keep safety in mind for ISS & shuttle (i.e. there will be no more Challenger disasters)
- 6) Not compete with the private sector (especially JPL, a concern of the past)
- 7) Get out of non-core things that can be provided by the space section (i.e. space communication)

Clinton Administration

1993 -

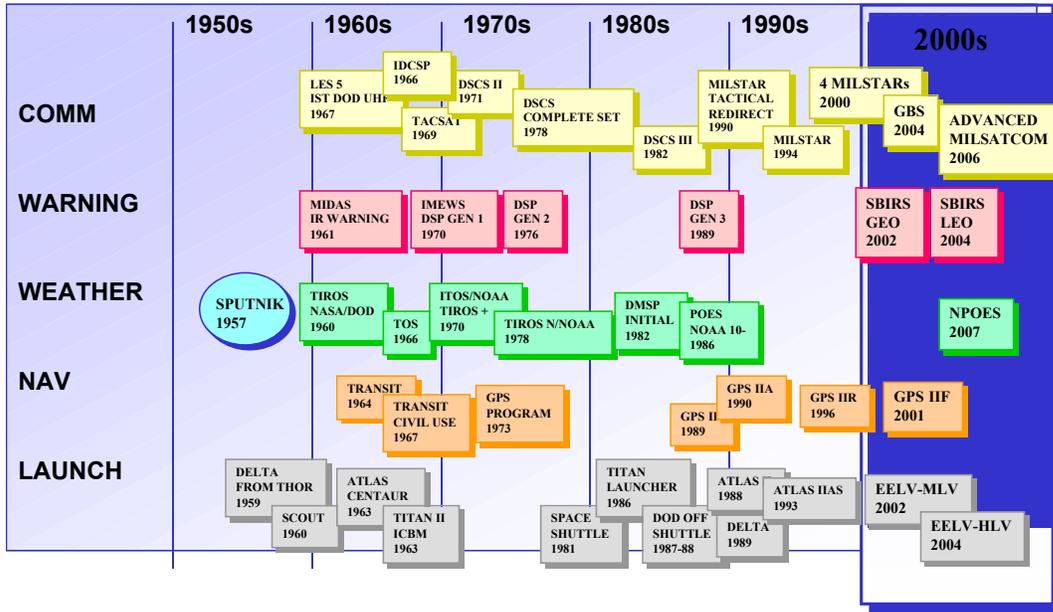
- *National security space activities shall contribute to US national security by:*
 - supporting right of self-defense of US, allies and friends
 - deterring, warning, and defending against enemy attack
 - assuring hostile forces cannot prevent our use of space
 - countering, if necessary, space systems and services used for hostile purposes
 - enhancing operations of U.S. and allied forces
 - ensuring our ability to conduct military and intelligence space-related activities
 - satisfying military and intelligence requirements during peace and crisis as well as through all levels of conflict

Department of Defense

Space Policy

- Supports and amplifies U.S. national space policy
- Space recognized as an operational medium (like land, sea and air)
- Space mission areas defined:
 - Space Support
 - Force Enhancement
 - Space Control
 - Force Application

The Next Air Force In Space

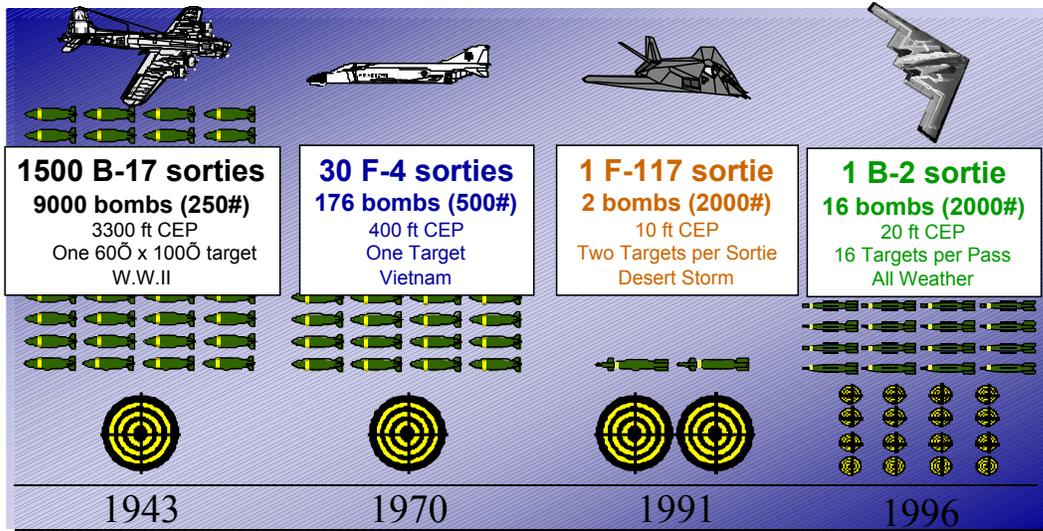


Air Force

Air Force budget for space & missiles is about 9 billion.

Air Force is executive agent for many space systems

Precision Engagement



SPACE IS AN ENABLER OF PRECISION ENGAGEMENT

Air Force Space Policy

Tenants

- *Spacepower will be as decisive in future combat as airpower is today*
- *The Air Force leads the integration of space throughout all joint operations*
- *Create fully integrated air and space forces that exploit the aerospace environment*

Air Force Space Policy

Objectives

- Integrate space into all facets of joint operations
- Develop the world's best spacelift and infrastructure
- Create effective TMD, NMD, and GMD capabilities
- Pursue international space cooperation for a global missile warning system

Navy Space Policy

- Space is an essential medium for the conduct of maritime operations. DON will integrate space into every facet of naval operations. The primary focus is to provide space-based support to the warfighter. Emphasis is placed on naval tactical requirements and operations

Army Space Policy

- Recognizes that Army is dependent on space systems, capabilities and products
- Space products are a force multiplier
- Space to be embedded in Army doctrine, training scenarios, wargames, exercises, and plans.
- Requires developing, maintaining, and enhancing Army space expertise, to include provision for training of space-knowledgeable soldiers and civilians.

NRO

NRO operates the nations reconnaissance satellites.

Budget is classified.

NRO is in the business of providing US global information superiority through global reconnaissance.

•From the National space policy:

- satellite photoreconnaissance for intelligence collection and arms control.
- satellite reconnaissance for planning and conduct of military operations.
- satellite reconnaissance for mapping and for disaster relief.
- reconnaissance includes signals & measurements and signature intelligence.

•Equities are in the business of reconnaissance and intelligence.

- Advanced Systems and Technology directorate has recently released innovation initiatives to develop leap frog space technologies.
<http://www.nro.odci.gov/background.html>

Commercial (worldwide)

- Worldwide space revenues, 1998 ~\$97.6 billion
- Growth of use of space assets ~34%/yr.
- Percentage of space industry revenue from commercial (worldwide) (1998) ~64%
- commercial already dominant
- Amount invested in space last decade ~\$17-19billion
- ~\$2billion/yr. (small compared to government)
- Amount estimated in next decade ~\$40billion @~\$4billion/yr.
- Biggest revenue source for 2000 ~\$11billion
- International direct to home services

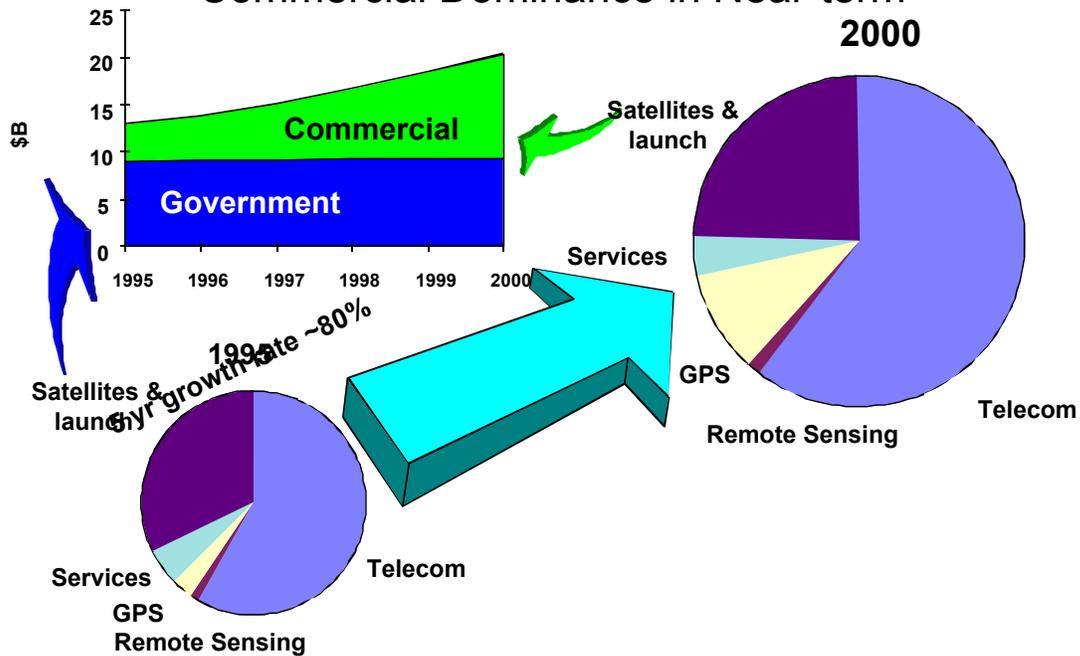
• Market for global telecommunications seems large given:

- 1)60% of world does not have basic phone service.
- 2) less than 5% of world population has a PC.

• This perceived large growth in commercial industry is driving the government to consider partnerships.

Space Industry

Commercial Dominance in Near-term



Why Partner?



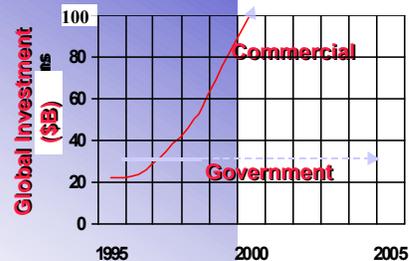
\$0.5 Trillion to be spent on space 1996 - 2000
... only about 30% government



1,500 - 1,800 satellites to be launched next 10 years ...
only about 25% government

**Over \$100 billion US dollars
invested in space today**

Over 580 active satellites (200+ US satellites)



The Government does not drive the space market

US Space Policy for commercial calls for:

- Support and enhance US economic competitiveness while protecting US national security. {this has shifted from economic first to national security first in grey areas}
- Purchase of commercial space services where feasible and noncompetitive with private sector by government. {This is to allow the commercial industry to grow. An interesting issue is how strongly the national security exception is pushed especially in the case of telecommunications. A clear military need for them but also a concern about how reliable the commercial people will be}
- US will not subsidize commercial space. {This flies in the face of the launch range policy}
- US will transfer technology to the private sector. {This explicitly recognizes the key government role in developing much of the technology behind the commercial success, e.g. ACTS satellite.}
- US will aim for free and fair trade in commercial launch services. {Long term policy goal which conflicts with national security goals and foreign policy goals}.

Commercial industry top issues that have been on space policy (1999):

- "Politicizing" of space in the US , e.g. "Chinagate".

- Technology transfer impediments to free trade.
 - Very long licensing times by US State Dept.
 - Integration of Air Traffic Control and Space System control as space constellations grow.
 - Declaring outerspace a free trade zone to encourage R&D and manufacturing in space.
- First three issues arise from the collision of the national security and commercial space policies.
- A fundamental issue for the commercial people is the uncertainty generated in the markets by the US government actions. E.g. Rejection of Hughes request to launch on Long March was unexplained. Licensing of hyperspectral data to commercial users is still underway with no clear resolution.
 - Uncertainty increases financial risk which increases cost of borrowing money. This is an issue that governments do not have to deal with.
 - Thus the biggest issue for commercial people is free trade associated with stability of policy.
 - There are huge implications for national security.