

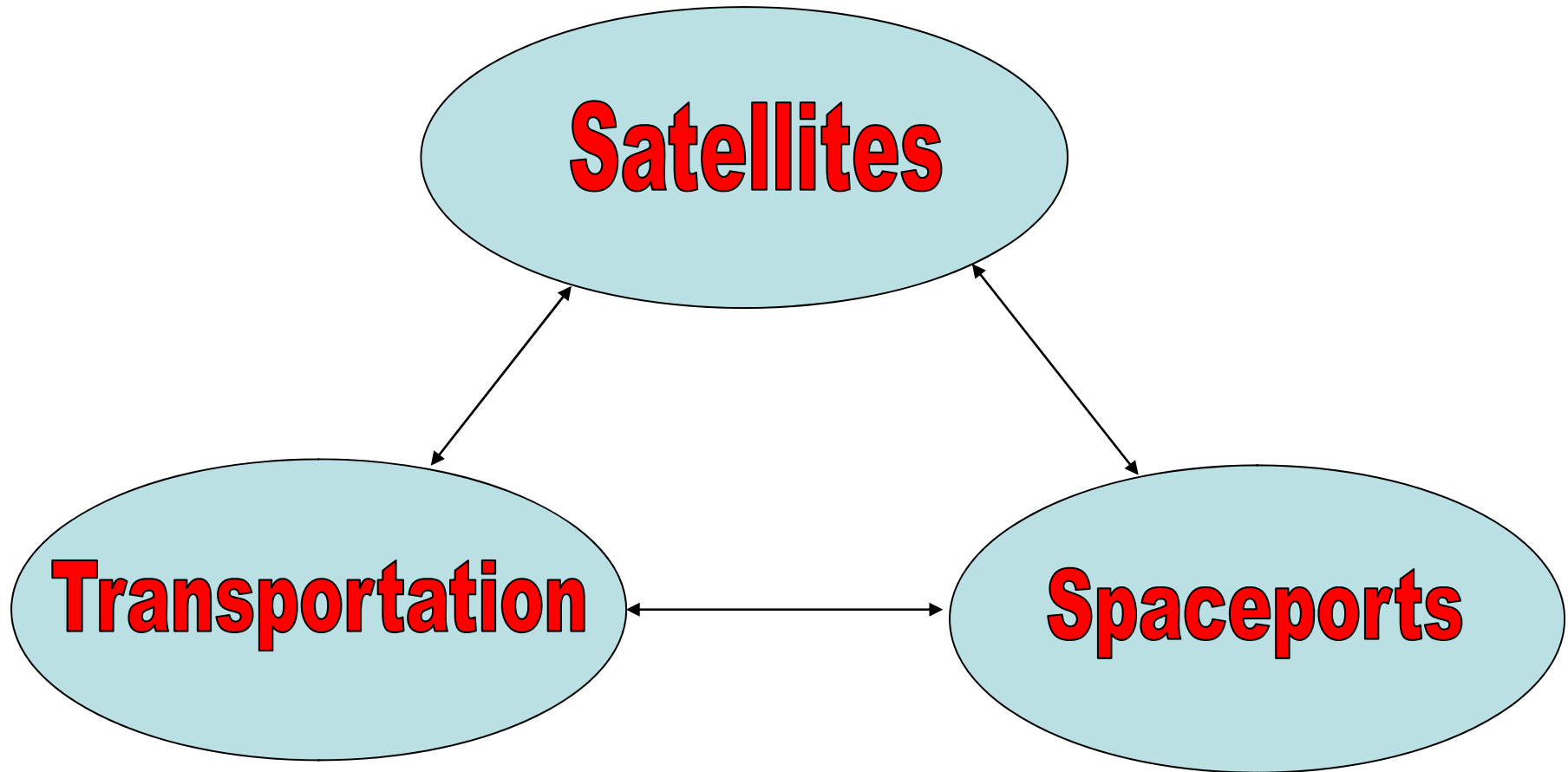


US Space Transportation Industry Outlook

Department of Commerce
Office of Space Commercialization
And
Federal Aviation Administration
Office of Commercial Space Transportation



Space Transportation Architecture





Examples of Commercial Space Transportation and Spaceport



Air Launch



Sea Launch



Launch Sites



Ground Launch



Reusable Launch Vehicles



Suborbital Rockets



National Space Policy, 2006

- **The National Space Policy states that for five decades, the United States has led the world in space exploration and use and has developed a solid civil, **commercial**, and national security foundation.**
- **Space activities have improved life in the United States and around the world, enhancing security, protecting lives and the environment, speeding information flow, serving as an engine for **economic growth**, and revolutionizing the way people view their place on earth, in the solar system and the universe.**
- **Space has become a place that is increasingly used by a host of nations, consortia, **businesses, and entrepreneurs**, and is to be protected.**



National Space Policy, continued..

- **The policy states that in this century, those who effectively **utilize space** will enjoy added **prosperity** and security and will hold a substantial advantage over those who do not.**
- **Freedom of action in space is as important to the United States as land, air and sea power. In order to increase knowledge, discovery, **economic prosperity** and to enhance national security, the United States must have robust, effective and efficient space capabilities.**
- **The fundamental goals of this policy are to strengthen the nation's space **leadership**, ensure that space capabilities are available and enable unhindered operations **in and through space.....and enable a dynamic, globally competitive domestic commercial space sector....****



Current Outlook

- **The U.S has robust space capabilities, growing even more.**
- **U.S. space strategy and policymaking is transparent to the world.**
- **Robust U.S. government and industry processes enabling space ventures are in place.**
- **The U.S. is experienced in usage of and reliance on space enabled services**
- **In place are strategic partnerships between government, industry and academia.**



Space Commerce

- **The US is currently the leader in metrics used to globally rank spacefaring countries based on:**
 - **Ability to provide structure, guidance and funding;**
 - **Ability for people to develop use for space apps and technology;**
 - **Ability to commercially finance and deliver space products, services.**
- **The large US economy enables early adoption of satellite and other space-enabled services.**
 - **US-operated applications have created large and growing markets.**
- **The US has a well known legal and regulatory structure for cultivating space business.**
 - **End goal is commercial space growth.**
- **The US offers transparency regarding space strategy, policy, spending.**
 - **No ambiguity on government and commercial plans for space.**



Satellite Outlook



Satellite Manufacturing Trends

- **US satellite manufacturing production has rebounded from the mid-2000's slump.**
- **Over the last 10 years, approximately 50% of all global satellite manufacturing has occurred in the US.**
- **The US share of satellites manufactured between 1998 and 2007 was 557 satellites, a greater volume than all other satellite manufacturing countries combined.**



Satellite Manufacturing Challenges

- **Overall US satellite manufacturing has declined from an all-time high in the late 90's.**
- **The global projection is a flat market in commercial orbital requirements through 2015.**
- **Foreign countries are currently developing indigenous satellite manufacturing capabilities.**



Space Transportation Outlook



US Space Transportation Trends

- **US Space Transportation Systems (USSTS) continue to lift the most mass and volume to designated orbits.**
- **USSTS achieve the greatest variety of orbital destinations.**
- **The US had 29% of the global market share, on average, for the past 5 years.**
- **There are currently 9 ELVs in operation.**
- **There are currently 12 ELVs under development.**
- **The US has the only operating RLV (21 others in development).**
- **There are currently 6 LEO launch vehicles for small payloads available.**



US Space Transportation Challenges

- **US orbital launches are decreasing from 37% late 90's.**
- **Launch forecast is flat through 2015.**
- **Russian and Indian launch rates are increasing.**
- **Russia exceeds (42%) the US (18%) in launches and remains a dominant commercial launch leader globally (2003-2007).**
- **China has recently overtaken Europe in the number of launches per year.**
- **The US is challenged by international competition with Japan, Israel and India entering the commercial launch market.**
- **South Korea, Japan, Brazil and India are increasing their satellite launches using indigenous technology development.**
- **US launch providers have struggled to compete with lower foreign launch prices.**




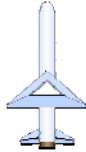






Commercial Transportation Systems

Companies with Active FAA Launch Licenses:

- **Lockheed Martin - Atlas V (4,950- 8,670 kg)**
- **Boeing - Delta IV (9,150 – 22,560 kg)**
- **Boeing - Delta II (900- 6,100 kg)**
- **Sea Launch - Zenit 3SL (6,100 kg)**
- **Orbital Sciences –Pegasus XL, Taurus (440 kg, 1 590 kg, respectively)**



Available US ELVs

	Small			Medium	Intermediate		Heavy	
								
Vehicle	Minotaur	Pegasus XL	Taurus XL	Delta II	Delta IV	Atlas V	Delta IV Heavy	Zenit-3SL
Company	Orbital Sciences	Orbital Sciences	Orbital Sciences	ULA	ULA	ULA	ULA	Sea Launch
First Launch	2000	1990	1994	1990	2002	2002	2004	1999
Stages	4	3	4	3	2	2	2	3
Payload Performance (LEO)	640 kg (1,410 lb)	440 kg (970 lb)	1,590 kg (3,505 lb)	6,100 kg (13,440 lb)	9,150 kg (20,170 lb) (Delta IV M) 13,360 kg (29,440 lb) (Delta IV M+ (5,4))	12,500 kg (27,560 lb) (Atlas V 402) 20,520 kg (45,240 lb) (Atlas V 552)	22,560 kg (49,740 lb)	N/A
Payload Performance (LEO polar)	340 kg (750 lb) (SSO)	190 kg (420 lb) (SSO)	860 kg (2,000 lb) (SSO)	3,600 kg (7,930 lb)	7,510 kg (16,550 lb) (Delta IV M) 11,300 kg (24,920 lb) (Delta IV M+ (5,4))	7,095 kg (15,640 lb) (Atlas V 402) 14,095 kg (31,075 lb) (Atlas V 552)	22,560 kg (49,740 lb)	N/A
Payload Performance (GTO)	N/A	N/A	430 kg (950 lb)	2,170 kg (4,790 lb)	4,300 kg (9,480 lb) (Delta IV M) 7,020 kg (15,470 lb) (Delta IV M+ (5,4))	4,950 kg (10,910 lb) (Atlas V 401) 8,670 kg (19,120 lb) (Atlas V 551)	12,980 kg (28,620 lb)	6,100 kg (13,500 lb)
Launch Sites	VAFB, Wallops	VAFB, Wallops, CCAFS	VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	Pacific Ocean

Data Sourced: FAA/AST and Futron Corp

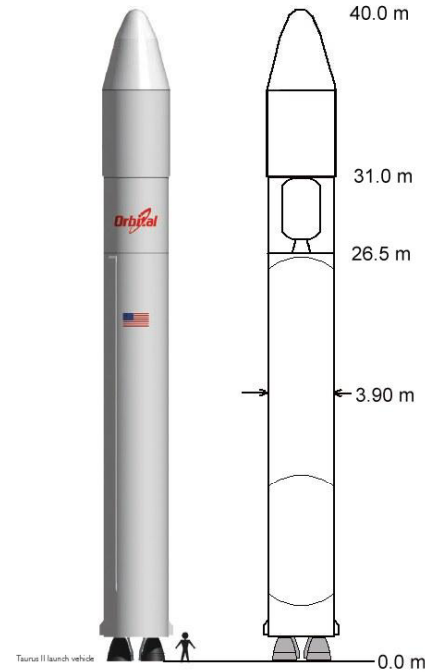


US Transportation Systems in Development- ELV's

- **ATK Launch Vehicle (1360 kg) –Alliant Techsystems**
- **Aquarius (1,000 kg) –Space Systems/Loral**
- **Eagle S (580 kg) – E'Prime**
- **FALCON SLV (840 kg) – LM, Michoud**
- **Nanosat Launch Vehicle – (10 kg) Garvey Spacecraft**
- **Sprite SLV (481kg) – Microcosm, Inc**
- **Minotaur IV & V (1750 kg; 670 kg) – Orbital Sciences Corp**
- **Falcon 1 (475kg) – SpaceX**
- **Falcon 9 (27,500 kg) –SpaceX**
- **Taurus 2- (6,000 kg)- Orbital Sciences Corp**
- **QuickReach-(450 kg)- AirLaunch LLC**
- **Z-1 (5 kg) - Zig Aerospace, LLC**



NASA Commercial Orbital Transportation Systems – Funded Programs



Vehicle

Falcon 9 - SpaceX

Taurus II – Orbital Sciences

LEO:

24,750 kg

5,500 kg

GTO:

9,650 kg



US Transportation Systems in Development- RLV's

- **BSC Spaceship (6 people, 65 mi) – Benson Space Company**
- **New Shepard (3 people, 63 mi) – Blue Origin**
- **Neptune (3175 kg) – Interorbital Systems**
- **Rocketplane XP (6 people, 62 mi) – Oklahoma Spaceport**
- **K-1 Rocketplane Kistler (5,700 kg) – RpK**
- **SpaceShipTwo (8 people 62 mi) – Scaled Composites, LLC, Virgin Galactic, Spaceship Company**
- **Michelle-B (1000 kg estimate) – TGV**
- **Crew Transfer Vehicle (3 people or 910 kg to LEO) – T/Space**
- **Lynx (2 people, 37 mi) - Xcor**



Spaceports



U.S. Spaceports

Commercial and Government

Active and Proposed Launch Sites



Data Sourced: FAA/AST and Futron Corp



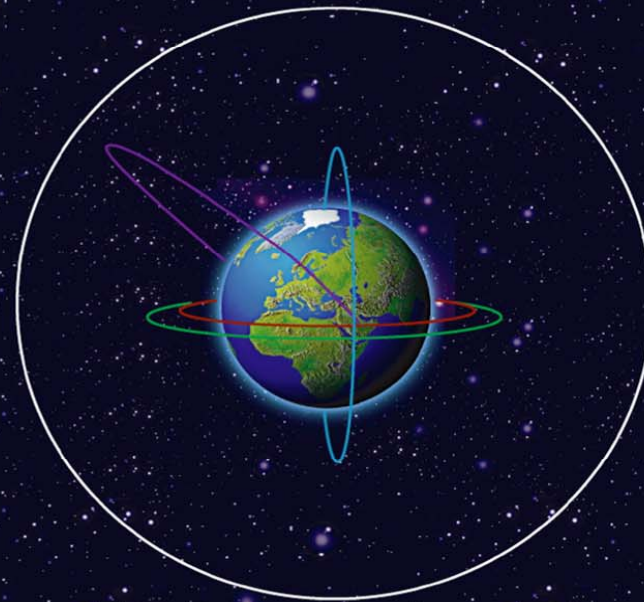
US Spaceports

<u>State</u>	<u>Non-Federal</u>	<u>Federal</u>	<u>Proposed</u>
• California (4)	2	2	
• Florida (4)	1	2	1
• New Mexico (2)		1	1
• Texas (3)	1		2
• Virginia (2)	1	1	
• Offshore (2)	1	1	
• Alaska (1)			
• Wyoming (1)			1
• Washington (1)			1
• Wisconsin (1)			1
• Oklahoma (1)	1		
• <u>Alabama (1)</u>			<u>1</u>
Total:	7	7	8



US Spaceports Enable Commercial Orbital Destinations

US spaceports offer access to numerous orbital inclinations.





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