Apr 25th, 2:00 PM - 5:00 PM

Paper Session I-A - An International Perspective of ELV's

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AN INTERNATIONAL PERSPECTIVE OF ELV'S

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Development, management and operations of an indigenous space launch capability has been a prestigious but increasingly expensive luxury affordable by a handful of independent, technologically advanced nations. The development of todays international launch capability began in the 1950's as a military competition between the United States and Russia, with China and Japan entering the fray in the 1960's. Instead of trying to meet all market demand ESA focused on meeting a specific weight range and type of payloads (commercial GTO communications satellites), and enabled flexibility through multiple manifesting. Accordingly, the launch capability developed by ESA focused on simple launch operations and a modular but focused launch capability. The U.S. Air Force seeks to gain similar operational advantages through their proposed Evolved ELV approach.

The international space community is at a crossroads where no single nation can afford to maintain the full range of existing space transportation infrastructure and conduct an active science, exploration, and exploitation of space program. An international strategy is emerging between the spacefaring nations to increase international cooperatives whereby each nations unique attributes, technological capabilities, national goals and available funding for space activities can be maximized. The International Space Station and the Earth Observing Satellite Program are two outstanding examples of the potential for international cooperative ventures. The ISS may afford an opportunity to further expand this trend in cooperation to ELV's through the consideration of the international ELV capability. Russia and the United States currently each maintain and operate as many as four different vehicle production lines, launch pads and launch teams to meet an increasingly shrinking demand for placing peyloads over 10,000lbs into low earth orbit. (U.S.: Shuttle, Titan IV, Atlas-Centaur, Delta; Russia: Zenit, Proton, Soyuz) Japan, China and ESA maintain an additional five launch pads and 4 vehicle configurations to meet the same stable or dwindling market demand. An international strategy focusing on reducing this duplication of resources in the transportation area could make resources available to expand revenue producing technological and commercial benefits from the use of space goods and services rather than on expensive maintenance of duplicative underutilized launch capecity.

The emerging market end supplier capability for smaller payloads (under 5-6,000 lbs to LEO) offers an opportunity to try a different paredigm. There are a variety of U.S. and international entities interested in developing launch capability to meet this new market demand. By allowing commercial ventures, rather than government funded development of launch capability to emerge to meet this demand , market forces rather than national pride and prestige may enable greater international cooperation and less chance for duplicative and costly national systems. The presentation overview international launch capability and a discuss market trends and next generation U.S. launch strategies to meet the international launch demand into the next decade.

AN INTERNATIONAL PERSPECTIVE OF EXPENDABLE LAUNCH VEHICLES

PRESENTED
AT

32nd SPACE CONGRESS
COCOA BEACH, FLORIDA
APRIL 1995

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XL-95-20-3 02/09/95

32nd SPACE CONGRESS

- **INTERNATIONAL EXPENDABLE LAUNCH VEHICLE**
  - DOMESTIC FLEET
  - INTERNATIONAL FLEET
  - LAUNCH CAPACITY
- **LAUNCH MARKET DEMAND**
  - U.S. CIVIL / DOD / COMMERCIAL PAST - CURRENT - FUTURE
  - PROJECTED INTERNATIONAL COMMERCIAL MARKET
    - **CONSERVATIVE**
    - **POTENTIAL BIG AND LITTLE LEO CONSTELLATIONS**
- **TRENDS FOR THE FUTURE**
  - INTERNATIONAL COOPERATION
  - NEW SYSTEMS: DOD EVOLVED ELV AND NASA RLV

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INTERNATIONAL EXPENDABLE LAUNCH VEHICLES
(EXISTING)

VEHICLE	PERFORMANCE (LBS) LEO 1/	GTO	GSO	(i = 90°) POLAR	PAYLOAD FAIRING (FT DIA)	LAUNCH SITES
ESA						
ARIANE 4	10,800 - 21,100	4,190 - 9,260		8,580 - 16,900	13.1	Kourou (2 Pads)
ARIANE 5	39,600 (390 NM / 28.5°)	13,000 - 15,000 (430 NM / 98.6°)		26,400 (430 NM / 98.6°)	17.7	
JAPAN						
M-3S-II	1,720 - 1,940 (31°)	1,140 (31°)	460	1,300 - 1,500	8.2	Kagoshima (M-series) (1 Pad)
M-5	4,000 (31°)	2,680 (31°)	1,080	2,860	8.2	Tanegashima (H-series) (1 Pad)
H-II	23,000 (30°)	8,800 (28°)	4,800	14,500	13.1, 15.1	
CHINA						
LONG MARCH 2C, 2D, 2E	7,040 - 20,430	2,200 - 7,430	270 - 3,300	3,860	7.2, 11.0, 13.8	Xichang (1 Pad)
LONG MARCH 3, 3A	11,000 - 15,800	3,300 - 5,500	1,600 - 2,700		9.8, 11.0, 13.1	Jiuquan (1 Pad)
RUSSIA						
KOSMOS (SL-8)	3,100 (400 KM / 51.6°)				12	Plesetsk (1 Pad) Kapustin Yar (1 pad)
PROTON (SL-12, -13)	46,000 (51.6°)	12,100 (28.5°)	4,850		12, 13.5	Baikonour (2 of 4 Pads Operational)
TSYKLON (SL-14)	6,200 - 7,900				7, 8.9	Baikonour / Plesetsk
MOLNIYA (SL-6)				4,000	9	Baikonour (2 Pads)
SOYUZ (SL-4)	15,400 (51.8°)			(20 KM / 99°)	13.5	Plesetsk (1 Pad)
ZENIT (SL-16)	30,300 (51°)	11,420	3,384	25,090 (99°)	12.8, 13.5	At Least 1 Pad
ENERGIA (SL-17)	194,000 (51.6°)		40,000	176,000 (98°)	13	3 Pads
INDIA						
PSLV	6,600 (216 NM / 43°)	990 (18°)		2,200 (486 NM / 99°)	10.5	Shriharikota (1 Pad)

1/ 100 NM CIRCULAR ORBIT 28.5° INCLINATION UNLESS OTHERWISE NOTED

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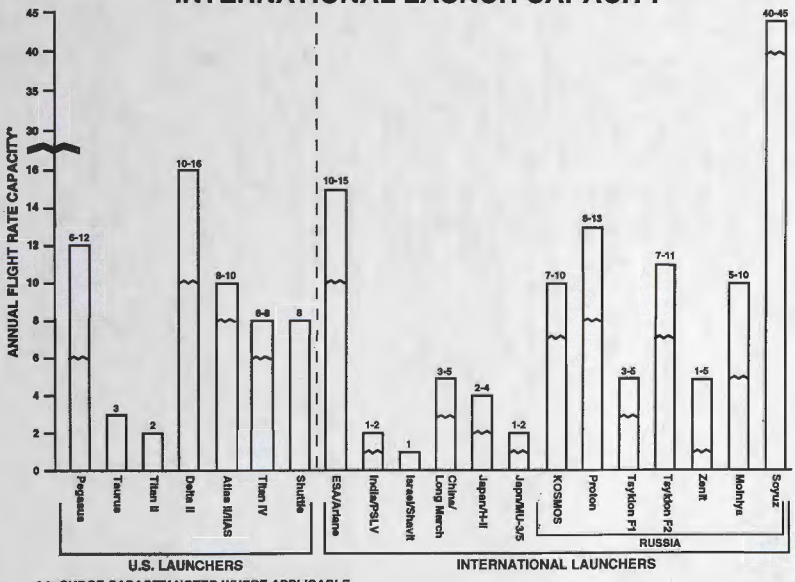

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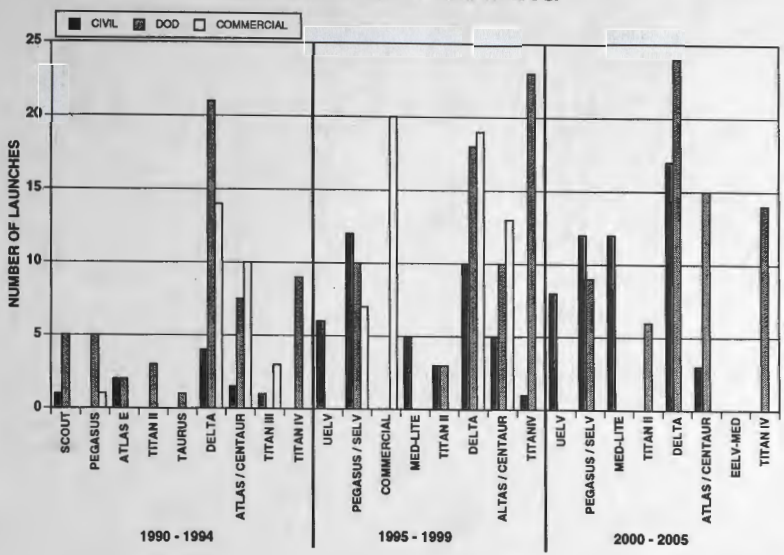
U.S. LAUNCH PLANNING



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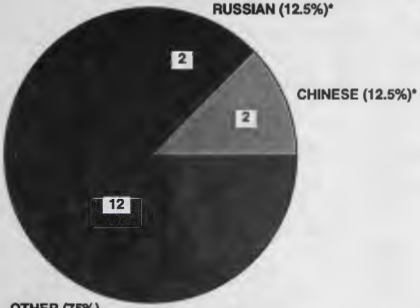
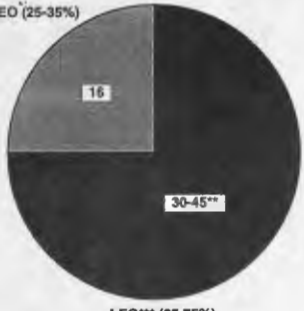
PROJECTED INTERNATIONAL COMMERCIAL SATELLITE LAUNCH MARKET

1996 - 2000



GTO / GEO
SATELLITE MARKET
PER YEAR



GTO / GEO + LEO
SATELLITE MARKET
PER YEAR

** PER AGREEMENT, SOME EXCEPTIONS APPLY*

*** POTENTIAL SURGE TO 100-150 / YEAR IF TELEDESIC-LIKE PROPOSAL OR OTHER PROPOSED CONSTELLATIONS IMPLEMENTED*

**** RUSSIAN / CHINESE SHARE TO BE LIMITED TO 50% BY INTERNATIONAL AGREEMENT*

PROPOSED LOW TO INTERMEDIATE EARTH-ORBIT COMMUNICATIONS SYSTEMS

SYSTEM NAME	COMPANY	NUMBER OF SPACECRAFT	SPACECRAFT WEIGHT	DEPLOYMENT/ FIRST LAUNCH*	COMMENTS
LEO-ONE USA	DBX (U.S.A.)	48	TBD	1997*	Filed Amended FCC Application in Late 1994 for Global, Non-Voice Store and Forward Data Service
TEMISAT	Telespazio (Italy)	6 - 8	<100 lbs	1999	Italian Commercial Data Relay Service
GLOBALSTAR[1]	Loral Cellular Systems Corp. (U.S. Based Multi-Nat'l)	48	1,000 lbs	1997	LEO, Position Location, Voice & Data Services; FCC License Granted
IRIDIUM[1]	Motorola (U.S.A.)	66	1,500 lbs	1998	LEO, Position Location, Voice & Data Services; Launches on Delta, Proton, Long March; FCC License Granted
ARIADNE	Russia / Ukraine	25	TBD	TBD	Joint Venture Under Consideration. Small SATS in LEO for Cheap Communications. Launch on Tsyklon.
ODYSSEY[1]	TRW Inc. (Joint U.S. / Canada)	12	4,000 lbs	1998*	4 Spacecraft in 3 Orbital Planes, Voice & Low Data Rate Services, Intermediate Circular Orbits; FCC License Granted
ORBCOMM[1]	Orbital Sciences Corp. (U.S.A.)	26	330 lbs	1995*	FCC License Filed for Data-Only System; Launched on Pegasus
STARNET	Starsys Inc. (U.S.A.)	24	TBD	1998*	FCC Filer for Data-Only Services
TELEDESIC	Teledesic Corp. (U.S.A.)	840 - 1,000	1,750 lbs	1999*	LEO, Broad-Band Video, High Rate Data; Filed with FCC for Pioneer Preference Under Ka-Band, Fixed Satellite Services
INMARSAT-P	Inmarsat (U.K.)	10 - 12	4,000-5,000 lbs	1998	Mobile Telephone Service Satellites in Intermediate Orbits
SIGNAL	Russian Republic	48	660 lbs	TBD	Under Consideration
LEO ONE	LEO One PanAmerica (Mexico)	12 - 36	350 lbs	1995*	Little LEO; Russian Preferred Launcher (3 at a time)
TAOS	Aerospatiale / CNES (France)	5	330 lbs	1995*	Mobile Position Reporting and Remote Monitoring
LEOCOM/LEOSTAR	Italspazio / ESA (Italy)	30 - 40	TBD	TBD	Under Consideration

** INDICATES DATE OF FIRST LAUNCH RATHER THAN COMPLETED DEPLOYMENT*

NOTE[1]: INCLUDED IN PROJECTED INTERNATIONAL COMMERCIAL SATELLITE LAUNCH MARKET

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