2010

Commercial Space

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SPACE SECURITY

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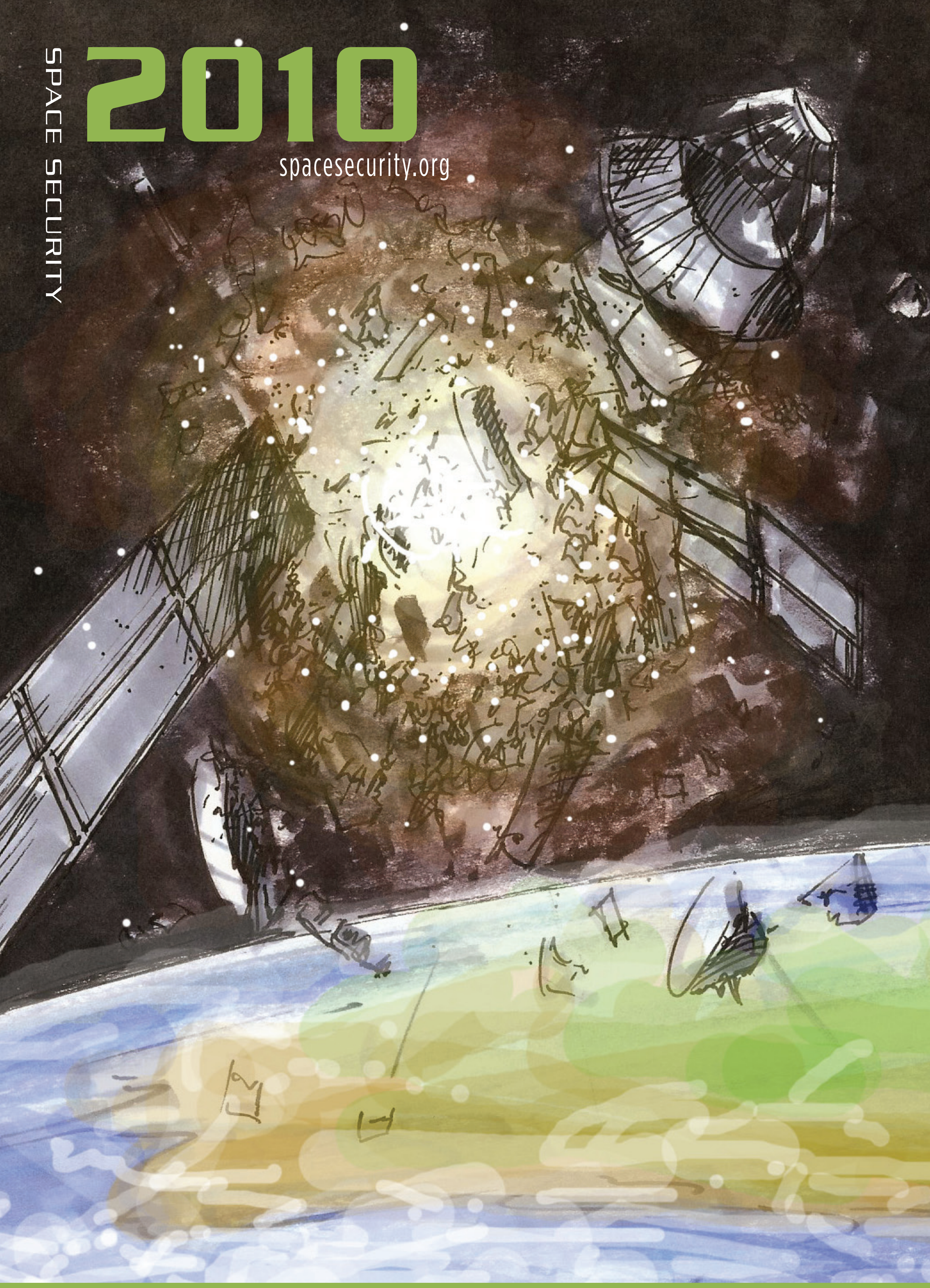

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ACRONYMS

3GIRS	Third Generation Infrared Surveillance Program (formerly AIRSS - US)
ABL	Airborne Laser (US)
ABLT	Airborne Laser Testbed
ABM	Anti-Ballistic Missile
AEHF	Advanced Extremely High Frequency system (US)
AFI	Air Force Instruction (US)
AIAA	American Institute for Aeronautics and Astronautics
ANGELS	Autonomous Nanosatellite Guardian for Evaluating Local Space (US)
ASAT	Anti-Satellite Weapon
ASEAN	Association of Southeast Asian Nations
ASI	Italian Space Agency
ATV	Automated Transfer Vehicle or Jules Verne (Europe)
BASIC	Broad Area Satellite Imagery Collection program (US)
BBG	Broadcasting Board of Governors
BMD	Ballistic Missile Defense
BNSC	British National Space Centre
BOC	Besoin Opérationnel Commun (Europe)
BSL	Basic Space Law (Japan)
BSP	Basic Space Plan (Japan)
BX-1	BinXiang-1 (China)
CASC	China Aerospace Corporation
CBERS	China-Brazil Earth Resource Satellite
CD	Conference on Disarmament
CFE	Commercial and Foreign Entities
CFSP	Common Security and Foreign Policy (Europe)
CNES	Centre National d'Études Spatiales (France)
CNSA	Chinese National Space Administration
COPUOS	United Nations Committee on the Peaceful Uses of Outer Space
COSPAS-SARSAT	International Satellite System for Search and Rescue
COTS	Commercial Orbital Transportation System (US)
CSA	Canadian Space Agency
CSpOC	Combined Space Operations Center
CSSI	Center for Space Standards & Innovation
DARPA	Defense Advanced Research Projects Agency (US)
DART	Demonstration of Autonomous Rendezvous Technology (US)
DBS	Direct Broadcasting by Satellite
DGA	Délégation Générale pour l'Armement (French Agency for Defense Development)
DISCOS	Database and Information System Characterising Objects in Space (Europe)
DLR	German Aerospace Center
DOD	Department of Defense (US)
DRDO	Defence Research and Development Organization (India)
DSCS	Defense Satellite Communications System (US)
DSP	Defense Support Program (US)

EADS	European Aeronautic Defence and Space Company
EC	European Commission
EELV	Evolved Expendable Launch Vehicle (US)
EGNOS	European Geostationary Navigation Overlay Service
EHF	Extremely High Frequency
EKV	Exoatmospheric Kill Vehicle
ELINT	Electronic Intelligence
EMP	Electromagnetic pulse (or HEMP for High Altitude EMP)
EORSAT	Electronic Intelligence Ocean Reconnaissance Satellite (Russia)
ESA	European Space Agency
ESDP	European Security and Defence Policy
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration (US)
FAST	Fast Access Spacecraft Testbed (US)
FCC	Federal Communications Commission (US)
FMCT	Fissile Material Cut-off Treaty
FOBS	Fractional Orbital Bombardment System (Russia)
FREND	Front-End Robotics Enabling Near-Term Demonstration (US)
FSS	Fixed Satellite Service
GAGAN	GPS and GEO Augmented Navigation (India)
GAO	Government Accountability Office (General Accounting Office until July 2004)
GEO	Geostationary Orbit
GEODSS	Ground-based Electro Optical Deep Space Surveillance
GEOSS	Global Earth Observation System of Systems
GLONASS	Global Navigation Satellite System (Russia)
GMES	Global Monitoring for Environment and Security (Europe)
GNSS	Global Navigator Satellite System
GOSAT	Greenhouse Gases Observing Satellite (Japan)
GPS	Global Positioning System (US)
GRAVES	Grande Réseau Adapté à la Veille Spatiale (France)
GSLV	Geostationary Satellite Launch Vehicle (India)
GSSAC	German Space Situatuional Awareness Center
HAARP	High Frequency Active Auroral Research Program (US)
HAARP	High Frequency Active Auroral Research Program (US)
HAND	High Altitude Nuclear Detonation
HEO	Highly Elliptical Orbit
IAA	International Academy of Astronautics
IADC	Inter-Agency Debris Coordination Committee
IADC	Inter-Agency Space Debris Coordination Committee
IAI	Israeli Aerospace Industries
ICBM	Intercontinental Ballistic Missile
IGS	Information Gathering Satellites (Japan)
IIRS	Indian Institute of Remote Sensing

ILS	International Launch Services
Inmarsat	International Maritime Satellite Organization
Intelsat	International Telecommunications Satellite Consortium
IOC	Initial Operating Capability
IRNSS	Indian Regional Navigation Satellite System
ISON	International Scientific Optical Network
ISRO	Indian Space Research Organisation
ISS	International Space Station
ITAR	International Traffic in Arms Regulation (US)
ITU	International Telecommunication Union
JAXA	Japan Aerospace Exploration Agency
JFC	Joint Force Commanders (US)
JHPSSL	Joint High-Power Solid-State Laser (US)
JSpOC	Joint Space Operations Center (US)
KARI	Korean Aerospace Research Institute
KEI	Kinetic Energy Interceptor
KSLV	Korean Space Launch Vehicle
LCROSS	Lunar Crater Observation and Sensing Satellite
LEO	Low Earth Orbit
M3MSat	Maritime Monitoring and Messaging Microsatellite (Canada)
MATRIX	Mobile Active Targeting Resource for Integrated Experiments
MDA	Missile Defense Agency (US)
MEJI	Mars Exploration Joint Initiative
MEO	Medium Earth Orbit
MEP	Multiple Engagement Payload (US)
MiDSTEP	Microsatellite Demonstration Science and Technology Experiment Program
Milstar	Military Satellite Communications System (US)
MIRACL	Mid-Infrared Advanced Chemical Laser (US)
MiTEX	Micro-satellite Technology Experiment (US)
MKV	Miniature Kill Vehicle (US)
MMOD	Micrometeoroid Orbital Debris
MPX	Micro-satellite Propulsion Experiment (US)
MSS	Mobile Satellite Service
MTCR	Missile Technology Control Regime
MUSIS	Multinational Space-based Imaging System (France)
NASA	National Aeronautics and Space Administration (US)
NATO	North Atlantic Treaty Organization
NEA	Near Earth Asteroids
NEC	Near Earth Comets
NEO	Near-Earth Object
NEOSSat	Near Earth Object Surveillance Satellite (Canada)
NFIRE	Near-Field Infrared Experiment satellite (US)
NGA	National Geospatial-Intelligence Agency (US)

NGO	Nongovernment Organization
NOAA	National Oceanic and Atmospheric Administration (US)
NORAD	North American Aerospace Defense Command
NRL	National Research Laboratory (US Navy)
NRO	National Reconnaissance Office (US)
NSSO	National Security Space Office (US)
NTM	National Technical Means
ORS	Operationally Responsive Space (US)
OST	Outer Space Treaty
PAROS	Prevention of an Arms Race in Outer Space
PGS	Prompt Global Strike program (US)
PHA	Potentially Hazardous Asteroid
PHO	Potentially Hazardous Object
PLA	People's Liberation Army (China)
PLNS	Pre-Launch Notification System
PPWT	Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects
PRS	Public Regulated Service (for European Galileo)
PSLV	Polar Satellite Launch Vehicle
QZSS	Quazi-Zenith Satellite System (Japan)
RAIDRS	Rapid Attack Identification Detection and Reporting System
RAMOS	Russian-American Observation Satellite program
RLV	Reusable Launch Vehicle
RORSAT	Radar Ocean Reconnaissance Satellites (Russia)
Roscosmos	Russian Federal Space Agency
SALT	Strategic Arms Limitations Talks
SAR	Synthetic Aperture Radar
SASSA	Self-Awareness Space Situational Awareness program (US)
SBI	Space-Based Interceptor
SBIRS	Space Based Infrared System (US)
SBL	Space Based Laser
SBSS	Space Based Surveillance System (US)
SBSW	Space-based Strike Weapon
SDA	Space Data Association
SHF	Super High Frequency
SHSP	Strategic Headquarters for Space Policy (Japan)
SIGINT	Signals Intelligence
SLEP	Service Life Extension Programs
SM-3	Standard Missile 3 (US)
SMOS	Soil Moisture and Ocean Salinily satellite (ESA)
SOCRATES	Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space
SSA	Space Situational Awareness
SSAEM	Space Situational Awareness Environmental Monitoring

SSN	Space Surveillance Network (US)
SST	Space Surveillance Telescope
STSS	Space Tracking and Surveillance System (US)
SUIRG	Satellite Users Interference Reduction Group
System F6	Future, Fast, Flexible, Fractionated, Free-Flying Spacecraft United by Information Exchange (US)
TCBM	Transparency and Confidence-Building Measure
TICS	Tiny Independent Coordinating Spacecraft program (US)
TIRA	German Tracking and Imaging Radar
TLE	Two-line elements
TSAT	Transformational Satellite Communications system (US)
TT&C	Tracking, telemetry and command
UAV	Unmanned Aerial Vehicle
UHF	Ultra High Frequency
UNGA	United Nations General Assembly
UNISPACE	United Nations Conference on the Exploration and Peaceful Uses of Outer Space
UNITRACE	United Nations International Trajectography Centre
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
USAF	United States Air Force
USML	United States Munitions List
VTOL	Vertical Take-Off and Landing aircraft
WGS	Wideband Global SATCOM
XSS	Experimental Spacecraft System (US)

CHAPTER FIVE

Commercial Space

This chapter assesses trends and developments in the commercial space sector, which includes manufacturers of space hardware such as rockets and satellite components, providers of space-based information such as telecommunications and remote sensing, and service operators for space launches. Also covered in this chapter are the developments related to the nascent space tourism industry, as well as the relationship between commercial operators and the public sector.

The commercial space sector has experienced dramatic growth over the past decade, largely as a result of rapidly increasing revenues associated with satellite services provided by companies that own and operate satellites, as well as the ground support centers that control them. This growth has been driven by the fact that space-based services that were once the exclusive purview of governments, such as satellite-based navigation, are now widely available for private individuals. In 2009 alone, the world satellite industry had revenues in excess of $160-billion.[1] As well, companies that manufacture satellites and ground equipment have contributed significantly to the growth of the commercial space sector. This includes both direct contractors that design and build large systems and vehicles, smaller subcontractors responsible for system components, and software providers.

This chapter also assesses trends and developments associated with access to space via commercial launch services. In the early 2000s, overcapacity in the launch market and a reduction in commercial demand combined to depress the cost of commercial space launches. More recently, an energized satellite communication market and launch industry consolidation have resulted in stabilization and an increase in launch pricing. Global revenues from 24 commercial launch events in 2009 were close to $2.5-billion,[2] almost duplicating the amount from five years before.[3]

This chapter also examines the relationships between governments and the commercial space sector, including the government as partner and the government as regulator, and the growing reliance of the military on commercial services. Governments play a central role in commercial space activities by supporting research and development, subsidizing certain space industries, and adopting enabling policies and regulations. Indeed, the space launch and manufacturing sectors rely heavily on government contracts. The impending retirement of the space shuttle in the US, for instance, will likely open up new opportunities for the commercial sector to provide launch services for human spaceflight. Conversely, because space technology is often dual-use, governments have sometimes taken actions such as the imposition of export controls, which have constrained the growth of the commercial market. There is also evidence that commercial actors are engaging governments on space governance issues, in particular space traffic management and best practices, and space situational awareness.

Space Security Impact

The multifaceted role that the commercial space sector plays in the provision of launch, communications, imagery, and manufacturing services, as well as its relationship with government civil and military programs, make this sector an important determinant of space security. A healthy space industry can lead to decreasing costs for space access and use, and may increase the accessibility of space technology for a wider range of space actors. This has a positive impact on space security by increasing the number of actors that can access and use space or space-based applications, thereby creating a wider pool of stakeholders with a vested interest in the maintenance of space security. Increased commercial competition in the research and development of new applications can also lead to the further diversification of capabilities to access and use space.

Commercial space efforts have the potential to increase the level of transnational cooperation and interdependence in the space sector, thereby enhancing transparency and confidence among international partners. Additionally, the development of the space industry could influence, and be influenced by, international space governance. To thrive, sustainable commercial markets must have the freedom to innovate, but they also require a framework of laws and regulations on issues of property, standards, and liabilities.

Issues of ownership and property may also pose a challenge to the growth of the industry. For example, while the non-appropriation clause of the Outer Space Treaty is generally understood to prohibit ownership claims in space, this clause also raises questions about the allocation and use of space resources, which are utilized by a variety of space actors but are technically owned by no one. The lack of clarity on the implications of this clause could stifle entrepreneurship and growth in the commercial space industry and future conflicts over the issue could decrease space security if not addressed in a timely manner.

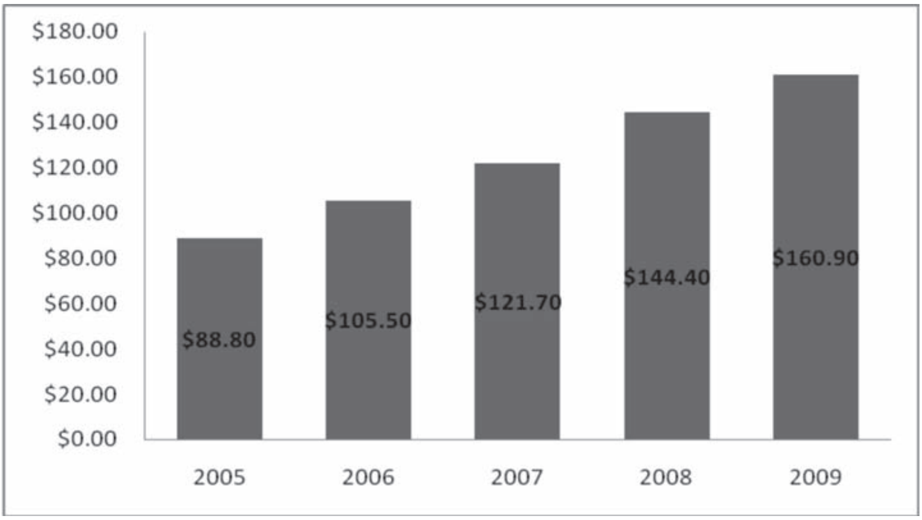
Growth in space commerce has already led to greater competition for scarce space resources such as orbital slots and radiofrequencies. To date, the International Telecommunication Union (ITU) and national regulators have been able to manage inter- and intra-industry tensions. However, strong terrestrial demand for additional frequency allocations and demands of emerging nations for new orbital slots will provide new challenges for domestic and international regulators. The growing dependence of certain segments of the commercial space industry on military clients could also have an adverse impact on space security by making commercial space assets the potential target of military attacks.

Trend 5.1: Continued overall growth in the global commercial space industry

Commercial space revenues have steadily increased since the mid-1990s, when the industry first started to grow significantly. Between 2008 and 2009 all four sectors of the satellite industry (ground equipment, satellite services, launch industry, and satellite manufacturing) grew, led by satellite services. Unlike the manufacturing and launch industry, satellite services such as telecommunications have seen growth that has been largely driven by commercial rather than government demand, in a trend that is rapidly being mirrored in other sectors.

The telecommunications industry has long been a driver of commercial uses of space. The first commercial satellite was the Telstar-1, launched by NASA in July 1962 for telecommunications giant AT&T.[4] Satellite industry revenues were first reported in 1978, when *US Industrial Outlook* reported 1976 Communication Satellite Corporation operating revenues of almost $154-million.[5] By 1980 it is estimated that the worldwide commercial space sector already accounted for $2.1-billion.[6] Individual consumers are becoming important stakeholders in space through their demand for telecommunications services, particularly Direct Broadcasting Services but also their use of global satellite positioning and commercial remote sensing images.

Figure 5.1: World satellite industry revenues by year (in $B)[7]



Today's space telecommunications sector emerged from what were previously government-operated bodies that were deregulated and privatized in the 1990s. For example, the International Maritime Satellite Organisation (Inmarsat, 1999) and International Telecommunications Satellite Organization (Intelsat, 2001) were privatized in 1999 and 2001 respectively.[8] PanAmSat, New Skies, GE Americom, Loral Skynet, Eutelsat, Iridium, EchoStar, and Globalstar were some of the prominent companies to emerge during this time. Major companies today include SES Global, Intelsat, Eutelsat, Telesat, and Inmarsat.

The 2000 downturn in the technology and communications sectors affected the commercial space sector, reducing market take-up of satellite telephony and creating overcapacity in the launch sector. The number of commercial satellite launches dropped from a peak of 38 in 1999 to 16 in 2001, but are beginning to recover and stood at 24 globally in 2009.[9] In 2009 revenues from commercial launch events increased about $520-million from their 2008 levels and the commercial launch market continues to be dominated by Russia and Europe, followed by the US (See Figure 5.5). In recent years, Europe and Russia have dominated the commercial launch market. As well, of the 36 commercially launched payloads in 2009, 20 satellites went to GEO[10] — a reflection of the growing demand for telecommunication services.

More satellite launches and a growing satellite services sector have a direct impact on the commercial manufacturing industry. Although satellite manufacturers continue to suffer from pressure to lower prices, strong demand for broadcasting, broadband, and mobile satellite services combined with a strong replacement market to drive an increase in orders that is projected to continue.[11] A total of 36 payloads were commercially launched into orbit in 2009, of which 24 provide commercial services and 12 perform civil government or military missions.[12]

The shape of the commercial space industry is beginning to shift as it becomes more global. Though still dominated by Europe, Russia, and the US, other countries like India and China are starting to become involved in this industry. India is reportedly positioning itself to compete for a portion of the commercial launch service market by offering lower-cost launches,[13] and it also intends to compete in the satellite manufacturing industry.[14] For the first time in 2007, China both manufactured and launched a satellite for another country, Nigeria's Nigcomsat-1.[15] Developing countries are the prime focus of these efforts.[16] Moreover, because it uses no US components, China is marketing its manufactured satellites as free of International Traffic in Arms Regulations (ITAR) restrictions, reportedly at prices below industry standard.[17] (See chapter 3 for details on ITAR.)

2009 Development

Consumer television services drive growth in space-based commercial sector

Overall, the largest space industry companies continued to exhibit rising revenue figures in 2009.[18] SES held fast to its projections of 5 percent growth, in spite of weaknesses in its ground services business and the soft North American market,[19] losing to Norway's Telenor a major capacity-lease contract with conglomerate Liberty Global's UPC.[20] Both SES and Telenor cited continued health in the European DTH market as a factor in the desirability of UPC's business.[21] Although there are fewer viewers, these numbers are offset by higher priced multi-room and high definition subscriptions.[22] SES stated that "satellite prices are holding steady in the worst cases and trending slightly upward otherwise."[23]

Eutelsat's revenue growth was 7.2 percent better than forecast for 2008-09.[24] Television subscriber services and higher contract-renew rates for government businesses were responsible for the increases, which existed even when the increased value of the US dollar relative to the Euro was removed from calculations.[25] The volume of orders rose at Thales but its revenue was flat.[26]

Consistent with these figures is India's report that the number of Indian households subscribing to DTH pay television rose by nearly 18 percent in the three months ending 31 March 2009 compared to 31 December 2008.[27] Although the Indian regulatory environment has created obstacles to non-Indian satellite fleet operators, ISRO and its Antrix commercial arm have allowed non-Indian systems into the market conditionally. The caveat is that the government operator can purchase the capacity for future resale to Indian subscribers.[28]

EADS Astrium was the big winner in 2009, reporting a 29 percent increase in revenue and a 22 percent increase in order backlog compared to the year prior.[29] However, some of this boost is attributable to catch-up payments for incentive milestones, paid to the company by unnamed commercial satellite customers.[30] Globalstar and Orbital Sciences both exhibited declines, the former in subscriber and revenue growth and the latter in revenue and profit related to satellite, launch vehicle, and missile defense programs.[31]

2009 Development

Economic crisis impacts some aspects of commercial space while others prove immune

Despite the declines suffered by global business in general, including some space industries, space insurance is becoming neither more expensive nor more difficult to obtain.[32] Space premiums totaled approximately $930-million, while paid-out claims came to $320-million. As a result, the space market is attracting new entrants, forcing premium rates downward. Because of the decline in global stock markets, insurers were forced to rely more heavily on premium income as a revenue source in 2009.[33] Space insurance has resisted the trend to raise premiums during the global economic crisis, apparent in other classes of insurance. In fact, rates have dropped from 2.5 percent to 2 percent for in-orbit insurance.

In an effort to reorganize its debt, Sea Launch filed Chapter 11 in US Bankruptcy Court, listing assets of up to $500-million against liabilities of more than $1-billion.[34] Although Sea Launch's troubles date back to a launch failure in 2007, the company attributed its bankruptcy filing to factors flowing from the global economic crisis, such as the weak commercial launch industry, skyrocketing hardware costs, the credit crunch, and intense competition from other launch providers.[35] Managers from the two companies selling US Delta and Atlas rockets also blame pricing for the soft launch market.[36] As well, the US division of ICO Global Communications filed for protection under Chapter 11 in an effort to recover investment costs associated with its ICO-G1 satellite and restructure the substantial debt associated with its hardware suppliers.[37]

ProtoStar filed for Chapter 11 bankruptcy protection in July, after problems with interference and frequency coordination.[38] The company's second Ku band satellite was scheduled to operate a mere half a degree away from the SES New Skies NSS-11 satellite.[39] The ITU determined that SES New Skies' claim had priority, making it unlikely that ProtoStar 2 could operate in the scheduled frequencies.

The decline of the US dollar had a negative impact on performance of some European aerospace contractors. The EADS Astrium space unit implemented front-end cost-cutting measures to offset the effects of both the decline of the dollar and the downturn in the global credit market.[40] Thales was in a better situation, as a smaller proportion of its revenues are subject to valuation swings based on the exchange rate. ILS actually benefited from currency exchange fluctuation; the drop in the Russian ruble's value against the US dollar gave ILS the necessary edge to capitalize on Russian government launch delays and to capture some of Sea Launch's lost business.[41]

President Obama signed into law the American Recovery and Reinvestment Act on 17 February 2009.[42] Satellite-based services are eligible to compete for grants and loans under the Act as part of President Obama's initiative to extend broadband communications to underserved communities in the US.[43] The Act has three stated goals: 1) create new jobs and retain existing ones, 2) drive economic activity and long-term growth, and 3) facilitate accountability and transparency in government spending.[44] Ideally, investment in broadband infrastructure will promote the creation of new jobs with equipment dealers, installers, customer care agents, spacecraft manufacturers, and launch firms.[45] To that end, the National Telecommunications and Information Administration (NTIA), US Department of Agriculture (USDA) Office of Rural Development, and the FCC hosted informational meetings to discuss the national broadband plan.[46]

As well, Australia's Prime Minister Kevin Rudd announced plans to invest approximately A$43-billion ($31-billion) in national broadband infrastructure.[47] The plan is to provide access to 100 megabits per second for 90 percent of Australian homes and businesses by 2018 and involves both private and public sector funding.[48]

2009 Development

Major satellite operators form coalition

EchoStar, Intelsat, SES, and Telesat formed a coalition to develop worldwide competition for the provision of commercial satellite launches in hopes that this will afford increased cost-effective access to space.[49] The coalition was formed in response to two developments that have restricted commercial access to space. First, the Atlas and the Delta are now manufactured by a single company, ULA, which sells almost its entire launch capacity to the US Government. Second, one of the world's most reliable launchers is manufactured in China, rendering it off-limits to US satellite companies.[50] In a similar vein, satellite operators launched an industry initiative, the Space Data Association Ltd. (SDA), "dedicated to sharing critical operational data in support of satellite operations, improving flight safety and preserving the space environment."[51] The SDA was incorporated in November 2009.

2009 Space Security Impact

The continued overall growth in the commercial space industry and the ever increasing revenues that are produced constitute a positive development for space security insofar as the pool of stakeholders with a direct interest in preserving space as a peaceful domain is steadily growing. Moreover, cooperative efforts in this industry and the resulting coalitions that lead to cost-effectiveness in commercial space operations will likely be conducive to greater space access. If demand for space resources such as orbital slots and radio frequencies exceeds supply, as is starting to be the case, the result could be friction among providers of commercial services. However, such friction need not necessarily be to the detriment of space security, as it could set the stage for a more coordinated and collaborative approach for the allocation of scarce space resources.

Trend 5.2: Commercial sector supporting increased access to space

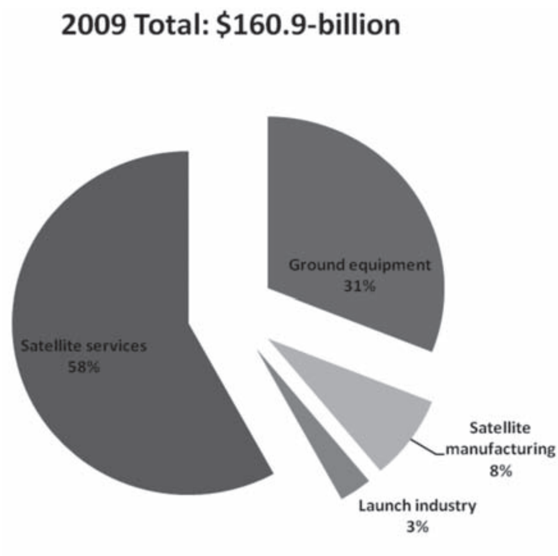
Space Launches

A commercial launch is defined as one in which at least one of the payload's launch contracts was subject to international competition, so that, in principle, a launch opportunity was available to any capable launch services provider. Russian, European, and American companies remain world leaders in the commercial launch sector, with Russia launching the most satellites annually, both commercial and in total. Generally, launch revenues are attributed to the country in which the primary vehicle manufacturer is based, except in the case of Sea Launch, which is designated as "multinational" and so a clear division of revenues among participating countries is harder to establish.

Commercial space access grew significantly in the 1980s. At that time, NASA viewed the provision of commercial launches more as a means to offset operating expenses than as a viable commercial venture. European and Russian companies chose to pursue commercial launches via standard rocket technology, which allowed them to undercut US competitors during the period when the US was only offering launches through its Space Shuttle.

Increasing demand for launch services and the ban of commercial payloads on the Space Shuttle following the 1986 Challenger Shuttle disaster encouraged further commercial launch competition. The Ariane launcher, developed by the French in the 1980s, captured over 50 percent of the commercial launch market during the period 1988-1997.[52] The Chinese Long March and the Russian Proton rocket entered the market in the early and mid-1990s. The Long March was later pressured out of the commercial market due to "reliability and export control issues."[53] However, China has opened the possibility of reentering the commercial spaceflight market.[54] Today Ariane, Proton, and Zenit rockets dominate the commercial launch market.

Figure 5.2: Worldwide satellite industry revenue by sector (2009).[55]



Japanese commercial efforts have suffered from technical difficulties and its H-2 launch vehicle was shelved in 1999 after flight failures.[56] Although the H-2 was revived in 2005, Japan lags behind Russia, Europe, the US, and China in global launches.[57] In May 1999 India's Augmented Polar Satellite Launch Vehicle performed the country's first Low Earth Orbit (LEO) commercial launch, placing German and South Korean satellites in orbit.[58]

Top commercial launch providers include Boeing Launch Services and Lockheed Martin Commercial Launch Services (vehicles procured through United Launch Alliance) and Orbital Sciences Corporation in the US; Arianespace in Europe; ISC Kosmotras, Polyot (with partners), and ZAO Puskovie Uslugi in Russia; Antrix in India; China Great Wall Industry Corporation in China; and international consortia Sea Launch, International Launch Service (ILS), Eurockot Launch Services GmbH, and Starsem. Sea Launch — comprised of Boeing (US), Aker Kvaerner (Norway), RSC-Energiya (Russia), and SDO Yuzhnoye/PO Yuzhmash (Ukraine) — operates from a mobile sea-based platform located on the equator in the Pacific Ocean. ILS was established as a partnership between Khrunichev State Research and Production Space Center (Russia), Lockheed Martin Commercial Launch Services (US), and RSC-Energiya (Russia). In 2006 Lockheed sold its share to US Space Transport Inc. Eurockot is a joint venture between EADS Space Transportation and Khrunichev, while Starsem is a joint venture between the Russian Federal Space Agency, TsSKB-Progress, EADS Space Transportation, and Arianespace. Commercial launch vehicle builder such as Space Exploration Technologies (SpaceX) have become increasingly active in research and development and are seeking to compete by providing cheaper, reusable launch vehicle systems such as the Falcon 9.

In addition to a proliferation of rocket designs, the launch sector has also seen innovations in launch techniques. For example, since the early 1990s companies such as the UK's Surrey Satellite Technology Ltd. have used piggyback launches — a small satellite is attached to a larger one to avoid costs for a dedicated launch. It is now also common to use dedicated launches to deploy clusters of smaller satellites on small launchers such as the Cosmos rocket and India's PSLV.

Commercial Earth Imagery

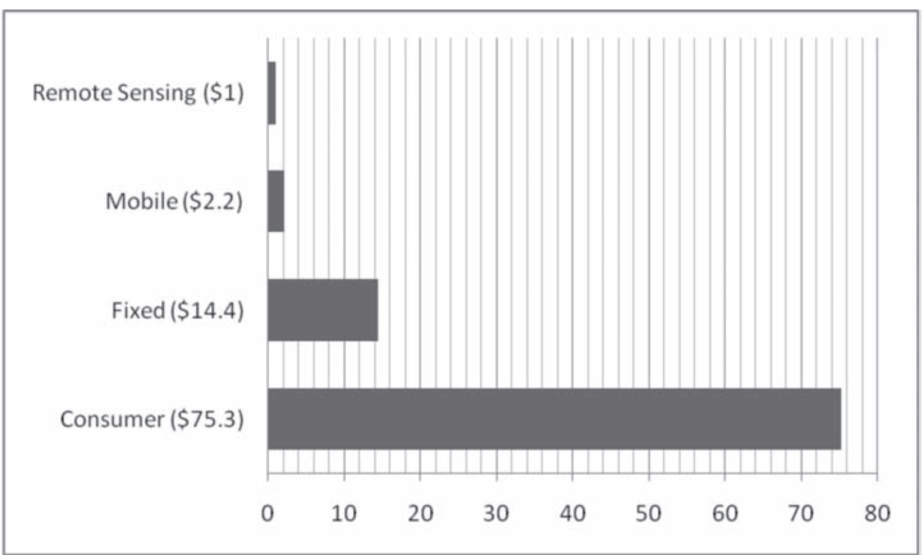
Until a few years ago only a government could gain access to remote sensing imagery; today any individual or organization with access to the Internet can use these services through Google Maps, Google Earth, and Yahoo Maps programs.[59] Currently several companies in Canada, France, Germany, Israel, Russia, and the US are providing commercial remote sensing imagery. The resolution of the imagery has become progressively more refined and affordable. In addition to optical photo images, synthetic aperture radar images up to one meter in resolution are coming on the market and a growing consumer base is driving up revenues. Security concerns have been raised, however, due to the potentially sensitive nature of the data.

Commercial Satellite Navigation

Initially intended for military use, satellite navigation has emerged as a key civilian and commercial service. The US government first promised international civilian use of its planned Global Positioning System (GPS) in 1983, following the downing of Korean Airlines Flight 007 that strayed over Soviet territory, and in 1991 pledged that it would be freely available to the international community beginning in 1993.[60] US GPS civilian signals have dominated the commercial market, but new competition may emerge from the EU's Galileo system, which is specifically designed for civilian and commercial use, and Russia's GLONASS.[61] China's regional Beidou system will also be available for commercial use.[62] (For further information on satellite navigations systems see Chapters 4 and 6.)

The commercial satellite positioning industry initially focused on niche markets such as surveying and civil aviation, but has since grown to include automotive navigation, agricultural guidance, and construction.[63] The core of revenues to the commercial satellite positioning industry is sales of ground-based equipment. Sales to commercial users first outpaced those to military buyers in the mid-1990s.[64] The commercial GPS market continues to grow with the introduction of new receivers that integrate the GPS function into other devices such as cell phones.[65]

Figure 5.3: 2009 worldwide satellite services revenue (in $B)[66]



Commercial Space Transportation

An embryonic private spaceflight industry continues to emerge, seeking to capitalize on new concepts for advanced, reliable, reusable, and relatively affordable technologies for launch to near-space and LEO. In early December 2004 the US Congress passed into law the "Commercial Space Launch Amendments Act of 2004." Intended to "promote the development of the emerging commercial human space flight industry," the Act establishes the authority of the Federal Aviation Administration (FAA) over suborbital space tourism in the US, allowing it to issue permits to private spacecraft operators to send customers into space.[67] In 2006 the European Space Agency (ESA) announced the "Survey of European Privately-funded Vehicles for Commercial Human Spaceflight" to support the emergence of a European commercial space transportation industry.[68]

The market for commercial space transportation remains small but has attracted a great deal of interest. By the end of 2009 seven private citizens had purchased and flown on orbital spaceflights through Space Adventures, which sells seats on the Russian Soyuz.[69] Prices for this opportunity are increasing, with Charles Simonyi paying $25-million for his trip in 2007 and $35-million for a second trip in March 2009.[70] Canadian Guy Laliberté is the latest private citizen to fly in space through Space Adventures. In June 2004 SpaceShipOne, developed by US Scaled Composites, became the first private manned spacecraft, but only conducted suborbital flights.[71] It was followed by SpaceShipTwo, unveiled in December 2009 and expected to carry passengers on suborbital flights starting in 2011. Still, the number of space tourists will be limited until prohibitively high costs are lowered. While the industry continues to face challenges — including a lack of international legal safety standards, high launch costs, and export regulations[72] — important liability standards are beginning to emerge. In 2006 the FAA released final rules governing private human spaceflight requirements for crew and participants.[73] Final rules were also issued for FAA launch vehicle safety approvals.[74]

Insurance

Insurance affects both the cost and risk of access to space. Insurance rates also influence the ease with which start-up companies and new technologies can enter the market.[75] Although governments play an important role in the insurance sector insofar as they generally maintain a certain level of indemnification for commercial launchers, the commercial sector assumes most of the insurance burden. There are two types of coverage: launch insurance, which typically includes the first year in orbit, and on-orbit insurance for subsequent years. Most risk is associated with launch and the first year in orbit. When covering launches, insurance underwriters and brokers discriminate among launch vehicles and satellite design so that the most reliable designs subsidize the insurance costs of the less reliable hardware.[76]

Following a decade of tumultuous rates due to tight supply of insurance and a series of industry losses, many companies abandoned insurance altogether, but recently there has been a softening of the launch insurance market.[77] The approximate premium for launch vehicles (as a percentage of launch costs) has recently been in the range of: Ariane-5, 6.5 percent; Atlas-5, 6.6 percent; Sea Launch, 7.5 percent; Chinese Long March, 7.9 percent; and Proton, 10.3 percent.[78] Terms have also become more restricted. Insurers do not generally quote premiums more than 12 months prior to a scheduled launch and in-orbit rates are usually limited to one-year terms and often do not cover events such as terrorism or "Acts of God."[79] It is possible that insurance costs may go higher in the future, owing to the risk caused by the significant increase in space debris in recent years.[80]

With the advent of space tourism, the space insurance industry may expand to cover human spaceflight. In the US, the FAA requires commercial human spacecraft operators to purchase third-party liability insurance, although additional coverage is optional. Each of the first two space tourists purchased policies for training, transportation, and time spent in space.[81]

2009 Development

Private human access to space slowly continues

The year 2009 saw another visit to the ISS by a private citizen. The latest spaceflight participant was Cirque du Soleil founder, Guy Laliberté.[82] The former clown used his visit to space as a platform to raise awareness about One Drop, an organization dedicated to freshwater access for all humankind.[83]

Private access to space took a front seat in the Augustine report. Norman Augustine and a panel of top-notch experts examined options available to support safe, affordable, and innovative human spaceflight, presenting their findings to the White House after three days of public hearings held in states housing NASA's major space centers — Texas, Alabama, and Florida.[84] The report, which came out in September, recommended extending the life of the ISS until 2020, but found overly optimistic the timetable for alternative transportation from earth to the station (Orion and Ares), which had been NASA's focus. Instead, the Augustine panel advocated reliance upon private sector transport for cargo and possibly crew.[85] (For further details on the Augustine Commission see Chapter 3.)

Those private sector alternatives continued development. Virgin Galactic successfully completed the first phase of tests of the rocket motor for its SpaceShip Two.[86] In August, Sir Richard Branson took his first flight in VMS Eve, the Virgin mothership that will launch the spaceships.[87] On 7 December 2009, SpaceShip Two made its debut at the Mojave Desert spaceport during a spectacular demonstration.[88] And SpaceX founder Elon Musk announced his company's interest in providing manned spaceflight to Mars — a far more ambitious goal than LEO missions.[89]

2009 Development

Investment in commercial space on rise

Perhaps partially in response to the Augustine report's recommendations regarding the private sector's future role in space transport, investment in commercial spaceflight is on the rise.[90] The Tauri Group, a Virginia consulting firm, and the Commercial Spaceflight Federation surveyed 22 companies involved in commercial human spaceflight and discovered that the total investment in that sector had risen by 20 percent last year to a collective total of $1.46-billion.[91]

Aabar Investments PJSC stepped up and bought a third of Virgin Galactic for $280-million.[92] Aabar is a company 71.23 percent owned by the International Petroleum Investment Co., which is itself fully owned by the government of Abu Dhabi. The transaction is subject to regulatory clearances in the US and is slated to utilize Abu Dhabi's proposed spaceport, to be built by Aabar, with funds committed to small satellite launch capability.

2009 Development

Commercial operators expand availability of imagery and satellite services

US President Obama approved a new electro-optical satellite imaging plan; the US National Geospatial-Intelligence Agency (NGA) intends to buy commercial imaging with ground resolution as fine as a quarter meter under the contracting vehicle EnhancedView, part of a larger satellite imagery strategy intended to service both the military and intelligence communities.[93] Obama's plan contemplates procurement of two imaging satellites and increased use of commercially available imagery.[94] Imagery provided by Germany's TerraSAR-X presently meets NGA's advertised specifications.[95]

Google Inc. and NASA cooperated to offer a new add-on to Google Earth — the "Live from Mars" update for Google Mars 3-D. The update incorporates features such as "watching orbital tracks of spacecraft in real-time, peeling back historical globe maps of Mars and taking a guided fly-around tour of the red planet."[96] Users can also go to the locations of some of NASA's landers and rovers. The imagery available is rapidly improving. Currently, GeoEye-1 is able to take pictures with a resolution of 50 centimeters; the company is developing GeoEye-2, capable of 25-centimeter resolution.[97] An Italian earth observation company, e-Geos, was formed to leverage the country's Cosmo-SkyMed radar satellite constellation into a viable commercial business.[98] E-Geos is funded by public and private investors.

Figure: 5.4: Commercial remote sensing satellites

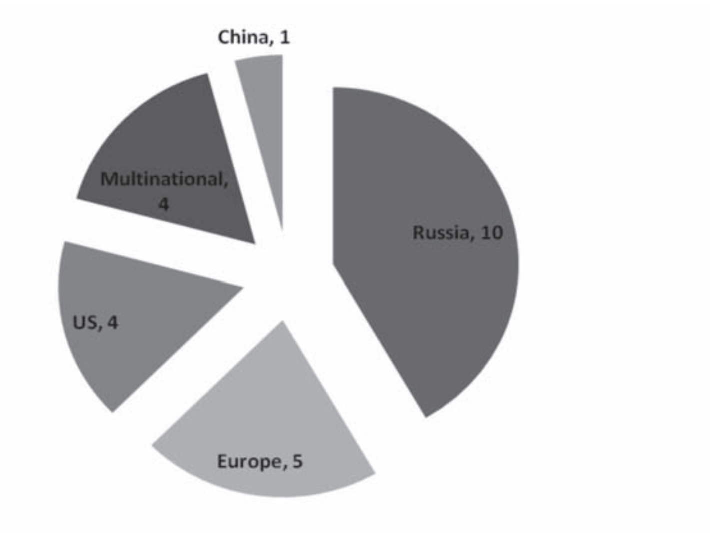
System	Operator	Current Satellites	Type	Highest Resolution (meters)
EROS	ImageSat International	EROS A	Optical	1.5
		EROS B	Optical	0.7
		EROS C	Optical	0.7
IKONOS	GeoEye	IKONOS-2	Optical	0.8
OrbView	GeoEye	OrbView-2	Optical	1,000
GeoEye	GeoEye	GeoEye-1	Optical	0.41
QuickBird	DigitalGlobe	EarlyBird	Optical	3
		QuickBird-1	Optical	1
		QuickBird	Optical	0.6
Radarsat	MDA	Radarsat-1	Radar	8
		Radarsat-2	Radar	3
SPOT	Spot Image	SPOT 2	Optical	10
		SPOT 4	Optical	10
		SPOT 5	Optical	2.5
WorldView	DigitalGlobe	WorldView-1	Optical	0.5
Disaster Monitoring Constellation	DMC International Imaging	AISAT-1 (Algeria)	Optical	32
		NigeriaSAT-1 (Nigeria)	Optical	32
		UK-DMC (United Kingdom)	Optical	32
		Beijing-1 (China)	Optical	4
TerraSar		TerraSar-X	Radar	1
RapidEye	RapidEye	RapidEye-1	Optical	6
		RapidEye-2	Optical	6
		RapidEye-3	Optical	6
		RapidEye-4	Optical	6
		RapidEye-5	Optical	6

2009 Development

New launchers with increased capacity under development

Ares, NASA's heavy lift launcher, had its first unmanned flight on 28 October 2009.[99] Despite this, the Obama administration ditched plans for the Ares series, instead committing $1-billion to develop another heavy lift launcher.[100] France, too, plans to support Arianespace for the development of a next-generation heavy lift rocket to replace Ariane 5. [101] Also on the drawing board in Europe is the Vega, a vehicle intended to service low-Earth orbit science and observation missions.

Figure 5.5: Commercial orbital launches by country in 2009[102]



On 13 July Space-X successfully launched to orbit a Malaysian earth observation satellite, its first commercial launch, onboard its Falcon-1 rocket.[103] Space-X will use Falcon-9 to launch its Dragon craft, hoping to transport cargo to and from the ISS. Masten Space Systems of Mojave, California, has developed a small, low-cost vertical-takeoff-and-landing (VTOL) launch vehicle, the Zombie. Although the number of companies and countries able to launch continues to increase, space insurers are concerned that the new entrants will also spur a rise in the number of in-orbit failures.[104]

2009 Space Security Impact

Increased access to space has both positive and negative impacts on space security. As more entities, both government and private, are able to reach space, the benefits of the resource spread, ideally in an equitable manner. However, increased access to space also translates into a more congested environment, thus further straining an already complex domain that lacks effective mechanisms for the allocation of scarce resources. Private access to space, although still at an embryonic stage, may yield a positive impact on space security as private citizens, many previously oblivious to the security challenges facing outer space, will expand the number of stakeholders with a vested interest in space security beyond governments and commercial operators. Such access may also challenge both the sustainability of the space environment as well as the applicability of international laws to the largely uncharted realm of space tourism.

Trend 5.3: Government dependency on the commercial space sector means that subsidies and national security concerns remain important

Government Support

Governments have played an integral role in the development of the commercial space sector. Many spacefaring states consider their space systems to be an extension of critical national infrastructure, and a growing number view their space systems as inextricably linked to national security. Full state ownership of space systems has now given way to a mixed system in which many commercial space actors receive significant government and military contracts and a variety of subsidies. Certain sectors, such as remote sensing or commercial launch industries, rely more heavily on government clients, while the satellite communications industry is commercially sustainable without government contracts. On the other hand, due to the security concerns associated with commercial space technologies, governments also play an active role in the sector through regulation, including export controls and controls on certain applications, such as Earth imaging.

A report commissioned by the FAA indicates that the success of the US commercial launch industry is viewed as "beneficial to national interests."[105] Indeed, the US Space Launch Cost Reduction Act of 1998 established a low-interest loan program to support the development of reusable vehicles.[106] In 2002 the US Air Force requested $1-billion in subsidies for development of Lockheed Martin's Atlas-5 and Boeing's Delta-4 vehicles as part of the Evolved Expendable Launch Vehicle (EELV) program.[107] To maintain the financial feasibility of the program, the 2005 Space Transportation Policy requires the Department of Defense (DOD) to pay the fixed costs to support both companies (since merged into the United Launch Alliance) until the end of the decade rather than forcing price-driven competition.[108] Similarly, the US Commercial Remote Sensing Space Policy directs the US government to "rely to the maximum practical extent on U.S. commercial remote sensing space capabilities for filling imagery and geospatial needs for military, intelligence, foreign policy, homeland security, and civil users" to "advance and protect U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and by sustaining and enhancing the U.S. remote sensing industry."[109]

The European Guaranteed Access to Space Program adopted in 2003 requires that ESA underwrite the development costs of the Ariane-5, ensuring its competitiveness in the international launch market.[110] The program explicitly recognizes a competitive European launch industry as a strategic asset and is designed to ensure sustained government funding for launcher design and development, infrastructure maintenance, and upkeep.[111] The 2007 European Space Policy "emphasizes the vital importance for Europe to maintain an independent, reliable and cost-effective access to space at affordable conditions…bearing in mind that a critical mass of launcher activities is a precondition for the viability of this sector."[112]

Russia's commercial space sector maintains a close relationship with its government, receiving contracts and subsidies for the development of the Angara launcher and launch site maintenance.[113] China's space industry is indistinguishable from its government, with public and private institutions closely intertwined.[114] The industries responsible for supporting China's space program fall under the auspices of the China Aerospace Science and Technology Corporation (CASC), which is directly linked to the government.

In many instances, governments are partnering with the private sector to subsidize the commercial development of systems also intended to meet national needs. For example, the US NGA's NextView program subsidizes commercial remote sensing to meet military needs for high-resolution images, which are then for sale commercially at a lower resolution.[115] Similarly, the commercial Radarsat-2 satellite was largely paid for by the Canadian Space Agency (CSA), by pre-purchasing $445-million in data, which is also sold commercially[116] in an arrangement similar to that for Germany's TerrSar-X remote sensing satellite.[117] Remote sensing is not the only instance of such partnering. The UK's Skynet-5 secure military communications satellite is operated by a private company, which sells its excess capacity.[118] However, partnering with the commercial sector often involves mixing national security considerations with private commercial interests. For instance, in 2008 the Canadian government intervened to block the sale of MacDonald, Dettwiler and Associates, maker of the Radarsat-2 satellite, to a US firm to protect national interests.[119]

Export controls

National security concerns continue to play an important role in the commercial space industry, particularly through export controls. Trade restrictions aim to strike a balance between commercial development and the proliferation of sensitive technologies that could pose security threats. However, achieving that balance is not easy, particularly in an industry characterized by dual-use technology. Space launchers and intercontinental ballistic missiles use almost identical technology, and many civil and commercial satellites contain advanced capabilities with potential military applications. Dual-use concerns have led states to develop national and international export control regimes aimed at preventing proliferation.

The Missile Technology Control Regime (MTCR), formed in 1987, is composed of 34 member states seeking to prevent the further proliferation of capabilities to deliver weapons of mass destruction by collaborating on a voluntary basis to coordinate the development and implementation of common export policy guidelines.[120] However, export practices differ among members. For example, although the US "Iran Nonproliferation Act" of 2000 limited the transfer of ballistic missile technology to Iran, Russia is still willing to provide such technology under its Federal Law on Export Control.[121] Most states control the export of space-related goods through military and weapons of mass destruction export control laws, such as the Export Control List in Canada, the Council Regulations (EC) 2432/2001 in the EU, Regulations of the People's Republic of China on Export Control of Missiles and Missile-related Items and Technologies, and the WMD Act in India.[122]

From the late 1980s to late 1990s, the US had agreements with China, Russia, and Ukraine to enable the launch from foreign sites of US satellites and satellites carrying American components. However, in 1998 a US investigation into several successive Chinese launch failures led to allegations about the transfer of sensitive US technology to China by aerospace companies Hughes Electronics and Loral Space & Communications Ltd. Concerns sparked the transfer of jurisdiction over satellite export licensing from the Commerce Department's Commerce Control List to the State Department's US Munitions List (USML) in 1999.[123] The new legislation treated satellite sales as weapons sales, making international collaboration more heavily regulated, expensive, and time consuming.

Exports of USML items are licensed under the ITAR regime, which adds several additional reporting and licensing requirements for US satellite manufacturers. As a result of such stringent requirements, the case has been made that "the unintended impact of the regulation change has been that countries such as China, Pakistan, India, Russia, Canada, Australia, Brazil, France, the United Kingdom, Italy, Israel, the Republic of Korea, Ukraine and Japan have grown their commercial space industries, while U.S. companies have seen dramatic losses in customers and market share."[124] Industries are therefore maneuvering around ITAR restrictions by purchasing ITAR-free satellites and launch services. China was able to launch the Chinasat 6B telecommunications satellite, built by Thales Alenia Space, in its Long March launcher because the satellite was built without US components. Thales Alenia Space is the only western company that has developed a product line deliberately designed to avoid US trade restrictions on its satellite components.[125]

Finally, because certain commercial satellite imagery can serve military purposes, a number of states have implemented regulations on the sector. The 2003 US Commercial Remote Sensing Policy sets up a two-tiered licensing regime that limits the sale of sensitive imagery.[126] In 2001 the French Ministry of Defense prohibited open sales of commercial Spot Image satellite imagery of Afghanistan.[127] Indian laws require the 'scrubbing' of commercial satellite images of sensitive Indian sites.[128] Canada has recently passed a regulatory regime that will give the Canadian government "shutter control" over the collection and dissemination of commercial satellite imagery due to national security or foreign policy concerns, and priority access in response to possible future major security crises.[129] Analysts note that competition among increasing numbers of commercial satellite imagery providers may eventually make shutter control prohibitively expensive.[130]

Commercial space systems as critical infrastructure

Space systems, including commercial systems, are increasingly considered to be critical national infrastructure and strategic assets. During the overcapacity of the 1990s, the US military began employing commercial satellite systems for non-sensitive communications and imagery applications. During Operation Enduring Freedom in Afghanistan in 2001 the US military used 700 megabytes per second of bandwidth, 75 percent of which was from commercial systems.[131]

The US DOD is the largest customer for the satellite industry, although it accounts for less than 10 percent of most large satellite operators' revenues.[132] By November 2003 it was estimated that the US military was spending more than $400-million each year on commercial satellite services.[133] By 2006 this figure had jumped to more than $1-billion a year for commercial broadband satellite services alone.[134] For instance, after the first three years of Operation Iraqi Freedom, it was reported that more than 80 percent of satellite bandwidth utilized by DOD was provided by commercial broadband satellite operators.[135] DOD is studying different acquisition methods to facilitate satellite service procurement.[136] To this end, a US Government Accountability Office report recommended that the US military be more strategic in planning for and acquiring bandwidth by, among other things, consolidating bandwidth needs among military actors to capitalize on bulk purchases.[137]

European states also view the space sector as a strategic asset "contributing to the independence, security, and prosperity of Europe."[138] Similarly, China's 2006 White Paper on Space Activities identifies the development of an independent space industry as a key component to its goals for outer space.[139]

Governance

While governments and industry have long worked together to develop and control the commercial space sector, there is evidence that they may also start working together to provide better governance in outer space. As noted in Chapter 3 of this volume, it has been hard to reach international consensus on a broad regulatory framework for outer space activities. Following the Chinese interception of one of its own satellites in 2007, Dave

McGlade, CEO of Intelsat, added his voice to those of several governments in calling for a code of conduct or rules of the road to provide norms and guidelines on space activities.[140] The importance of the private sector in space safety and governance issues has also been highlighted by the US government. Under a program called the Commercial and Foreign Entities (CFE) program, the US DOD is attempting to align government and industry resources to address growing space security challenges and to increase space situational awareness.[141] The program is intended to enhance safety, reduce risk, and contribute to the sustainable use of key orbits.[142] The draft EU Code of Conduct for Outer Space Activities[143], specifically addresses issues of harmful interference with space assets. However, it is not legally binding and the level of international support it receives when it opens for signatures in the latter half of 2010 remains to be seen.

2009 Development

Military dependence on the commercial sector continues to expand

Commercial satellite operators are investigating ways to create a more seamless interdependence between the public and private sectors for hosted payloads.[144] Noting the disparity in timeline from inception to actual launch between a completely private project and a government project, operators are working with manufacturers to develop in satellites a plug-and-play feature that would allow government customers to design hosted payloads to a standard interface, thereby allowing them to contract for space on an as-available basis.

Spacehab Inc. changed its name to Astrotech Corp. and is shifting its focus from offering payload processing services to commercial customers to offering similar services to the military.[145] Astrotech also plans to expand past its focus on prelaunch services, instead offering end-to-end mission assurance as part of a new venture called Astrotech-Syncomm. The new endeavor is in partnership with Space Florida, a public-private partnership driving economic development in Florida's space industry.

In the UK, Paradigm Secure Communications was established to provide satellite communication services to the Ministry of Defence with the operation of the Skynet 4 and 5 satellite fleets, supplying X-band, UHF, and other services to military users.[146] Now expanding to the US, Intelsat General was selected as the preferred distributor of those communication services on satellites operated by Paradigm to the US DOD.

2009 Development

Public-private partnerships on the rise

The interdependence between public and private space sectors continued to grow in 2009. Globalstar received credit backing from the French government, a development which prompted its competitors to claim that it was really a "disguised subsidy."[147] New Canadian regulations require better monitoring by firms that construct, mine, or work with industrial explosives in any way. Compliance with the new laws is creating new opportunities for satellite-based services in surveillance by the Iridium satellite network.[148] EADS Astrium formed a partnership with Kazakhstan Gharysh Sapary, a company connected to the Kazakh space agency.[149] The deal requires Astrium to build two Earth observation satellites and set up a satellite integration center in Astana, Kazakhstan, which will be operated as a joint venture and will market the images commercially. Aabar, Virgin Galactic's new partner, is a public-private partnership.[150]

Faced with budgetary cutbacks, NASA is ever more prone to work in tandem with private industry.[151] The Augustine panel recommended more reliance upon private sector transport going forward. Boeing has expressed its desire to research and develop commercially viable space transportation in partnership with NASA.[152] NASA and the US Air Force are developing a "technology roadmap" for a commercial reusable launch vehicle (RLV) industry, hoping to trigger progress toward low-cost, frequent, and reliable access to LEO.[153] Members of Congress representing Central Florida, home to the state's space industry, have introduced a bipartisan bill designed to minimize the negative impact anticipated by the space shuttle's impending retirement.[154] The bill establishes a competitive research and development "Centers of Excellence" program within NASA and creates university-based public-private partnerships to support commercial spaceflight research.

2009 Development

Revision of export controls considered in the US

In response to an often-voiced need for export-control reform, in June 2009 the US House of Representatives passed the Foreign Relations Authorization Act of 2010-11.[155] Now before the Senate Foreign Relations Committee, the bill grants authority to Presidents of the US to remove satellites and related components from the USML.[156] (For further details see Chapter 3.)

SES and Intelsat, with full support from Space Systems/Loral, asked Washington lawmakers to consider lifting the ban on the launch of US commercial satellites from China and India. Without Sea Launch as a viable launch option, the three companies would be forced to rely on either Ariane 5 or the Russian Proton.

2009 Space Security Impact

As the relationship between the public and private sectors becomes more collaborative and cooperative, the polarity between them decreases. This interdependence has a positive impact for space security as conceptions about what constitutes space security will merge and take into consideration the needs of the commercial sector as well as the security of states. As this mutual dependence deepens, multiple-use spacecraft built by commercial operators could become military targets, resulting in an overall decrease in security. On the other hand, the proliferation of dual-use or multi-use assets in space could make a military attack less useful and, therefore, less likely. The range of peaceful space applications could potentially decrease as the commercial industry, lured by profitable government contracts, might divert much of its research and developments efforts to military applications.