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Commercial Space

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ACRONYMS

3GIRS	Third Generation Infrared Surveillance Program (U.S.)
ABL	Airborne Laser (U.S.)
ABM	Anti-Ballistic Missile
AEHF	Advanced Extremely High Frequency system (U.S.)
AFSSS	Air Force Space Surveillance System
AIA	Aerospace Industries Association (U.S.)
ALTB	Airborne Laser Test Bed
ARMS	African Resources Management Satellite
ASAT	Anti-Satellite Weapon
ASEAN	Association of Southeast Asian Nations
ASI	Agenzia Spaziale Italiana
ATC	Ancillary Terrestrial Component
ATRR	Advanced Technology Risk Reduction
AU	African Union
BMD	Ballistic Missile Defense
BOC	Besoin Opérationnel Commun (Europe)
CALT	China Academy of Launch Vehicle Technology
CASC	China Aerospace Science and Technology Corporation
CBERS	China-Brazil Earth Resource Satellite
CD	Conference on Disarmament
CMB	Cosmic Microwave Background
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 (U.S.)
CPGS	Conventional Prompt Global Strike
CSA	Canadian Space Agency
CSM	Conjunction Support Message
CSO	Composante spatiale optique (Optical Space Component)
CSpOC	Combined Space Operations Center
DARPA	Defense Advanced Research Projects Agency (U.S.)
DART	Demonstration of Autonomous Rendezvous Technology (U.S.)
DGA	Délégation Générale pour l'Armement (French Agency for Defense Development)
DLR	German Aerospace Center
DMC	Disaster Monitoring Constellation
DOD	Department of Defense (U.S.)
DRDO	Defence Research and Development Organisation (India)
DSCS	Defense Satellite Communications System (U.S.)
DSP	Defense Support Program (U.S.)
EC	European Commission
EELV	Evolved Expendable Launch Vehicle (U.S.)
EGNOS	European Geostationary Navigation Overlay Service

EHF	Extremely High Frequency
EIAST	Emirates Institute for Advanced Science and Technology
EKV	Exoatmospheric Kill Vehicle
ELC	Electronic Systems Command
EMP	Electromagnetic pulse (or HEMP for High Altitude EMP)
EO	Earth Observation
ESA	European Space Agency
ESC	Electronics Systems Center (U.S.)
ESD	Electrostatic Discharge
ESDP	European Security and Defence Policy
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration (U.S.)
FCC	Federal Communications Commission (U.S.)
FMCT	Fissile Material Cut-off Treaty
FOBS	Fractional Orbital Bombardment System (Russia)
FREND	Front-End Robotics Enabling Near-Term Demonstration (U.S.)
GAGAN	GPS and GEO Augmented Navigation (India)
GAO	Government Accountability Office (General Accounting Office until July 2004) (U.S.)
GEO	Geostationary Earth Orbit
GEOSS	Global Earth Observation System of Systems
GGE	Group of Governmental Experts (UN)
GLONASS	Global Navigation Satellite System (Russia)
GMES	Global Monitoring for Environment and Security (Europe)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System (U.S.)
GRAVES	Grande Réseau Adapté à la Veille Spatiale (France)
GSLV	Geostationary Satellite Launch Vehicle (India)
GSO	Geosynchronous Orbit
GSSAC	German Space Situational Awareness Center
HAARP	High Frequency Active Auroral Research Program (U.S.)
HAND	High Altitude Nuclear Detonation
HCT	Hall Current Thruster
HEO	Highly Elliptical Orbit
HTV	Hypersonic Test Vehicle
IADC	Inter-Agency Debris Coordination Committee
IADC	Inter-Agency Space Debris Coordination Committee
ICBM	Intercontinental Ballistic Missile
ICESat	Ice, Cloud and Land Elevation Satellite
IGS	Information Gathering Satellites (Japan)
ILS	International Launch Services
Intelsat	International Telecommunications Satellite Consortium
IOC	Initial Operating Capability

IOV	In-Orbit Validation
IRIS	Internet Router in Space
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 Regulations (U.S.)
ITSO	International Telecommunications Satellite Organization
ITU	International Telecommunication Union
JAXA	Japan Aerospace Exploration Agency
JFCC Space	Joint Function Component Command for Space
JHPSSL	Joint High-Power Solid-State Laser (U.S.)
JMS	JSpOC Mission System (U.S.)
JSpOC	Joint Space Operations Center (U.S.)
KSLV	Korean Space Launch Vehicle
LEO	Low Earth Orbit
LRO	Lunar Reconnaissance Orbiter
LTE	Long-Term Evolution
MDA	Missile Defense Agency (U.S.)
MEO	Medium Earth Orbit
MiDSTEP	Microsatellite Demonstration Science and Technology Experiment Program
Milstar	Military Satellite Communications System (U.S.)
MIRACL	Mid-Infrared Advanced Chemical Laser (U.S.)
MiTEX	Micro-satellite Technology Experiment (U.S.)
MSX	Midcourse Space Experiment
MTCR	Missile Technology Control Regime
MUOS	Mobile User Objective System
MUSIS	Multinational Space-based Imaging System (France)
NASA	National Aeronautics and Space Administration (U.S.)
NATO	North Atlantic Treaty Organization
NEA	Near Earth Asteroids
NEC	Near Earth Comets
NEO	Near-Earth Object
NFIRE	Near-Field Infrared Experiment satellite (U.S.)
NGA	National Geospatial-Intelligence Agency (U.S.)
NOAA	National Oceanic and Atmospheric Administration (U.S.)
NPO	Science and Production Association (Russia)
NRL	National Research Laboratory (U.S. Navy)
NRO	National Reconnaissance Office (U.S.)
NSA	National Security Agency (U.S.)
NSAU	National Space Agency of Ukraine
NSP	National Space Policy (U.S.)
NSSO	National Security Space Office (U.S.)

NTM	National Technical Means
ONE	Operational Nanosatellite Effect (U.S.)
ORFEO	Optical and Radar Federated Earth Observation
ORS	Operationally Responsive Space (U.S.)
OST	Outer Space Treaty
OTV	Orbital Test Vehicle (U.S.)
PAROS	Prevention of an Arms Race in Outer Space
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, and of the Threat or Use of Force against Outer Space Objects
PSLV	Polar Satellite Launch Vehicle
PTSS	Precision Tracking Space System
QZSS	Quazi-Zenith Satellite System (Japan)
RAIDRS	Rapid Attack, Identification, Detection, and Reporting System
RAMOS	Russian-American Observation Satellite program
RF	Radio Frequency
RFI	Radio Frequency Interference
Roscosmos	Russian Federal Space Agency
SALT	Strategic Arms Limitations Talks
SANSA	South African National Space Agency
SAR	Space-based Radar
SATCOM	Satellite Communications
SBIRS	Space Based Infrared System (U.S.)
SBL	Space Based Laser
SBSS	Space Based Space Surveillance (U.S.)
SDA	Space Data Association
SELENE	Selenological and Engineering Explorer
SHF	Super High Frequency
SMDC	Space and Missile Defense Command (U.S.)
SPR	Space Posture Review
SSA	Space Situational Awareness
SSN	Space Surveillance Network (U.S.)
SSS	Space Surveillance System (Russia)
STSC	Scientific and Technical Subcommittee (UN)
STSS	Space Tracking and Surveillance System (U.S.)
TCBM	Transparency and Confidence-Building Measure
TDRS	Tracking and Data Relay Satellite
TICS	Tiny, Independent, Coordinating Spacecraft Program (U.S.)
TSAT	Transformational Satellite Communications system (U.S.)
TT&C	Tracking, telemetry and command

UCS	Union of Concerned Scientists
UHF	Ultra High Frequency
UNGA	United Nations General Assembly
UNIDIR	United Nations Institute for Disarmament Research
UNISPACE	United Nations Conference on the Exploration and Peaceful Uses of Outer Space
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
USAF	United States Air Force
USCYBERCOM	United States Cyber Command
USML	United States Munitions List
USSTRATCOM	United States Strategic Command
WGS	Wideband Global SATCOM
WISE	Wide-field Infrared Survey Explorer
XSS	Experimental Spacecraft System (U.S.)

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 customers. In 2010 alone, the world satellite industry had revenues in excess of $168-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. Revenues from 23 commercial launch events in 2010 were close to $2.45-billion,[2] an increase of $43-million over 2009.[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 retirement of the space shuttle in the U.S., 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 impact 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 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.

Growth in space commerce has already led to greater competition for scarce space resources such as orbital slots and radio frequencies. To date, the ITU and national regulators have been able to manage inter- and intra-industry tensions. However, strong 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: The global commercial space industry continues to experience overall growth, but seeks creative solutions to offset probably future downturn

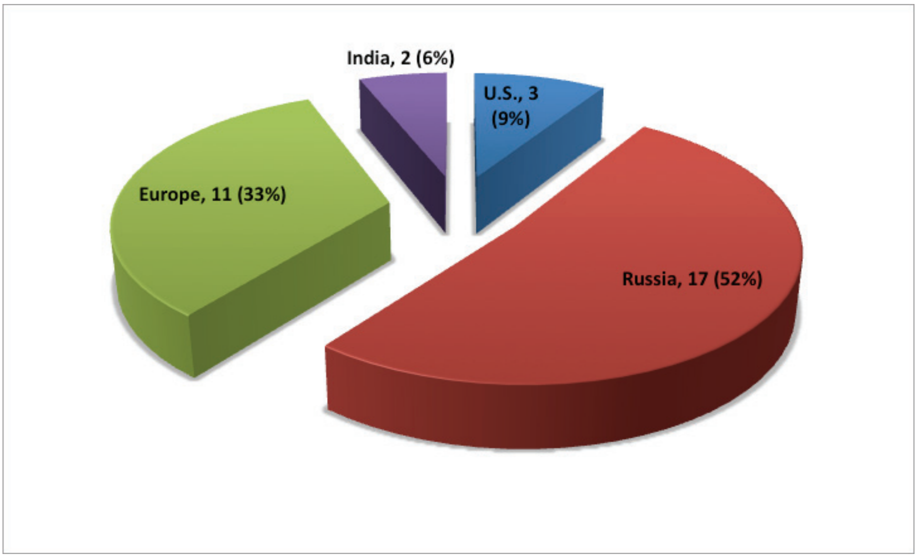
Commercial space revenues have steadily increased since the mid-1990s, when the industry first started to grow significantly. The satellite industry is made up of four major segments: ground equipment, satellite services, launch industry, and satellite manufacturing, with satellite services accounting for approximately 60 per cent of total worldwide revenues.[4] Between 2009 and 2010, the ground equipment and launch industry segments remained steady with, respectively, 31 per cent and 3 per cent of total revenues. Satellite manufacturing decreased slightly in 2010 to 6 per cent from 8 per cent in the previous year; satellite services grew from 58 per cent to 60 per cent.[5] Growth in services such as telecommunications has been largely driven by commercial rather than government demand; this trend is 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.[6] Satellite industry revenues were first reported in 1978, when Communication Satellite Corporation claimed 1976 operating revenues of almost $154-million.[7] By 1980, it is estimated that the worldwide commercial space sector already accounted for revenues of $2.1-billion.[8] Individual consumers are becoming important stakeholders in space with their demand for telecommunications services, particularly Direct Broadcasting Services, but also global satellite positioning and commercial remote sensing images.

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) and International Telecommunications Satellite Organization (Intelsat) were privatized in 1999 and 2001, respectively.[9] 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.

More satellite launches and a growing satellite services sector have a direct impact on the commercial manufacturing industry. Although satellite manufacturers continue to experience pressure to lower prices, strong demand for broadcasting, broadband, and mobile satellite services and a strong replacement market drive an increase in orders that is projected to continue.[10] Of the 110 payloads carried into orbit in 2010, 33 provide commercial services and the remaining 77 perform civil government, nonprofit, or military missions.[11]

Figure 5.1: Commercial payloads launched by country in 2010[12]



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

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. The sector has since recovered, with 33 global launches in 2010.[18] The commercial launch market continues to be dominated by Russia and Europe, followed by the U.S. Currently, satellite operators are tapping into the strong demand for new services to compensate for a possible decrease in new satellite orders, as described below.

2010 Development

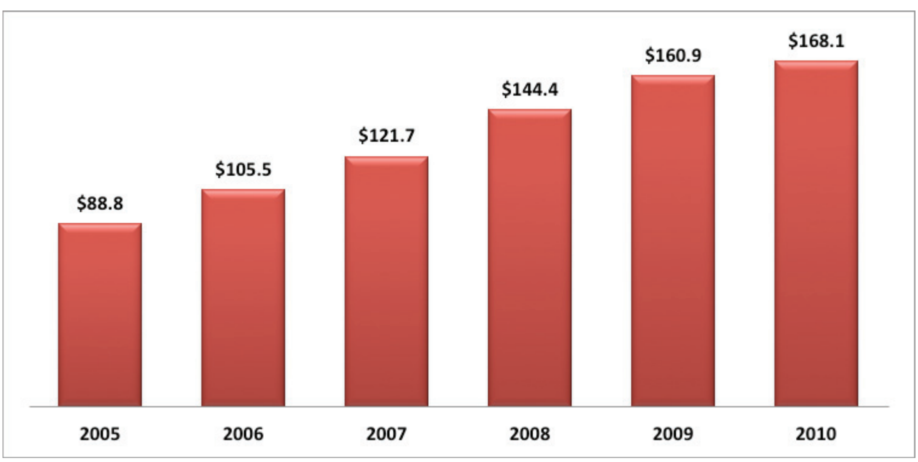
New applications in response to Federal Communications Commission (FCC) Ancillary Terrestrial Component regulations could help compensate for downturn

In the face of decreased orders for satellite fleet replenishment, manufacturers and launch providers are looking to the robust demand for new services to facilitate new satellite orders.[19] One such sector is Mobile Satellite Services (MSS). Despite an antenna malfunction, MSS operator LightSquared launched its first satellite in November 2010.[20] The company intends to roll out the first coast-to-coast hybrid wireless network, positioning itself to compete with AT&T Inc. and Verizon Wireless in the provision of mobile services.[21] The company's satellite operations will be integrated with a ground-based network utilizing Long-Term Evolution (LTE) technology.[22]

LightSquared will provide nationwide services from its commercial launch date through satellite coverage and roaming partnerships, as it continues to extend its footprint while expecting partners will begin launching LightSquared-enabled products during the second half of 2011. The company's enabled devices include data cards, embedded modules, personal hotspots, and routers — scheduled to become available during the second half of 2011. By 2012, LightSquared's service hopes to expand to incorporate smart phones and other innovative next-generation devices.

Per its commitment to supporting the National FCC Broadband Plan, it expects to cover at least 100 million Americans by 31 December 2012, 145 million by the end of 2013, and 260 million by the end of 2015. In November 2010, LightSquared filed its ATC (Ancillary Terrestrial Component) Modification Request with the FCC, asserting that its business plan had evolved and explaining how it remained in compliance with the FCC's Integrated Service Rule.[23] That rule ensures that MSS operators seeking to provide terrestrial service achieve the purposes for which the ATC regime was enacted by establishing gating criteria that guarantee that the added terrestrial component will remain ancillary to the principal MSS offering.[24] Rather than granting the requested modification, the FCC instead granted a conditional waiver to LightSquared, allowing it to go forward with its plans while meeting certain delineated criteria.[25]

Figure 5.2: World satellite industry revenues by year (in $B)[26]



It remains unknown whether and how the FCC's possible MSS rule change will affect LightSquared's plan.[27] In July, the FCC adopted a Notice of Proposed Rulemaking and Notice of Inquiry to promote investment and deployment of terrestrial wireless facilities in two ways: 1) by amending spectrum allocation tables to create co-primary fixed and mobile wireless allocations next to current satellite allocations for 40 MHz in the 2.1 and 2.2 GHz bands; and 2) by employing the FCC's spectrum leasing rules to all MSS spectrum.[28] Ultimately, the FCC granted the company a conditional waiver of its Integrated Service Rule.[29]

In December 2010, AT&T reported that it had experienced a 5,000 per cent increase in its data traffic, mainly due to the growing customer desire for smart phones;[30] the requirement for cellular telephone backhaul is another factor driving new growth.[31] Analyst firm Creative Strategies estimates that by 2012 smart phones will account for 65 per cent of all phones sold in the U.S. To compensate for the voracious appetite these devices have for data and the increase in wireless data traffic, operators are reconfiguring infrastructure and including backhaul in business planning.[32]

2010 Development

Significant growth in commercial remote-sensing business

The commercial remote-sensing industry continues to expand substantially, but is changing its business model. It lessened its dependence upon sales to the military and government, instead expanding into urban planning, natural resource exploitation, agriculture, mapping and navigation, transportation, and scientific study of the Earth's climate.[33] Euroconsult estimates a growth spurt of 27 per cent per annum since 2007 for sales of commercial data.[34] This shift in market dynamics prompted German satellite-imagery provider RapidEye to announce in September that it is seeking a new investor to sustain it during its transition, to invest in new market development, to upgrade and improve current systems, to initiate development of new geo-information products and services, and to prepare for the second generation of satellites.[35]

At the Symposium on Earth Observation Business held in Paris in September, Surrey Satellite Technology Ltd. (SSTL) announced that the construction of a one-meter third-generation Disaster Monitoring Constellation (DMC) to operate on a lease basis for the provision of commercial imagery was being considered.[36] SSTL and Blue Planet have reportedly been courting Microsoft and Google as possible investors for this type of high-accuracy satellite constellation, which the companies believe could drive down the cost of commercial satellite imagery by a factor of 10 or more.[37]

2010 Development

Top satellite supplier Space Systems/Loral evaluates ways to offset imminent sales decrease

On 5 November, Loral Space and Communications, owner of Space Systems/Loral (SS/L), announced that a sale or spinoff of its satellite manufacturing subsidiary is likely.[38] SS/L had become the top commercial satellite supplier worldwide after emerging from its 2005 Chapter 11 bankruptcy.[39] Now it is considering a change in ownership or an initial public offering[40] to offset the imminent decrease in sales,[41] as new orders for satellites drop. To that end, SS/L began a dialogue with the U.S. Securities and Exchange Commission in November.[42] The decision is largely contingent upon the actions of satellite operator Telesat — in which Loral has a 64 per cent stake — which could decide to pursue a stock offering, eventually triggering the transaction.[43]

Space Security Impact

The diversification of space applications has an overall positive impact on space security. The development of new products and services lessens dependence upon one facet of commercial activity, thus helping to insulate against fluctuations in specific markets. A great positive impact can be found in the remote-sensing sector, which has developed new markets. Increased access to space assets and applications has both positive and negative impact. On the one hand, the pool of stakeholders with a direct interest in preserving space as a peaceful domain is steadily growing. On the other, issues of congestion, competition, and spectrum management become more pressing as commercial space activity increases and could potentially result in friction among providers of commercial services.

Trend 5.2: Commercial sector supports increased access to space products and services

Space Launches

For a launch to be considered commercial, at least one of the payload's launch contracts must be subject to international competition; thus, in principle, a launch opportunity is available to any capable launch services provider. Russian, European, and U.S. 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. However, Sea Launch is designated "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 U.S. competitors during the period when the U.S. 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 per cent of the commercial launch market during the period 1988-1997.[44] The Chinese Long March and the Russian Proton rocket entered the market in the early and mid-1990s. Although the Long March was pushed out of the commercial market because of "reliability and export control issues,"[45] China has opened the possibility of reentering it.[46] Today, Ariane, Proton, and Zenit rockets dominate the commercial launch market.

Japanese commercial efforts have suffered from technical difficulties and its H-2 launch vehicle was shelved in 1999 after flight failures.[47] Although the H-2 was revived in 2005, Japan lags behind Russia, Europe, the U.S., and China in global launches.[48] In May 1999, India's Augmented Polar Satellite Launch Vehicle performed the country's first LEO commercial launch, placing German and South Korean satellites in orbit.[49]

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 U.S.; 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 Services (ILS), Eurockot Launch Services GmbH, and Starsem. Sea Launch —

comprised of Boeing (U.S.), 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 (U.S.), and RSC-Energiya (Russia). In 2006, Lockheed sold its share to U.S. 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 builders 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 U.K.'s Surrey Satellite Technology Ltd. have used piggyback launches, in which a small satellite is attached to a larger one. It is now also common to use small launchers such as the Cosmos rocket and India's PSLV to deploy clusters of smaller satellites.

Commercial Earth Imagery

Until a few years ago only a government could access 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.[50] Currently several companies in Canada, France, Germany, Israel, Russia, and the U.S. 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 U.S. government first promised international civilian use of its planned Global Positioning System in 1983, following the downing of Korean Airlines Flight 007 over Soviet territory, and in 1991 pledged that it would be freely available to the international community beginning in 1993.[51] While GPS civilian signals have dominated the commercial market, new competition may emerge from the EU's Galileo system, which is specifically designed for civilian and commercial use, and Russia's GLONASS.[52] China's regional Beidou system will also be available for commercial use.[53] (For further information on satellite navigation 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.[54] Sales of ground-based equipment provide the core of revenues to the commercial satellite positioning industry. Commercial users first outpaced military buyers in the mid-1990s.[55] 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.[56]

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 December 2004, the U.S. Congress passed 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 U.S., allowing it to issue permits to private spacecraft operators to send customers into space.[57] In 2006, the ESA announced the "Survey of European Privately-funded Vehicles for Commercial Human Spaceflight" to support the emergence of a European commercial space transportation industry.[58]

The market for commercial space transportation remains small, but has attracted a great deal of interest. In September-October 2009, Canadian Guy Laliberté became the seventh and latest private citizen to fly in space through Space Adventures, which sells seats on the Russian Soyuz.[59] 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.[60]

In June 2004, SpaceShipOne, developed by The Spaceship Company, a joint venture between Scaled Composites and the Virgin Group, became the first private manned spacecraft, but only conducted suborbital flights.[61] It was followed by SpaceShipTwo, unveiled in December 2009 and expected to carry passengers on suborbital flights. Although a specific date for the first private flights on SpaceShipTwo has not yet been confirmed, Virgin Galactic, a subsidiary of the Virgin Group, has already started taking booking for sub-orbital flights at a cost of $200,000.[62] While the industry continues to face challenges — including a lack of international legal safety standards, high launch costs, and export regulations[63] — important liability standards are beginning to emerge. In 2006, the FAA released a set of rules governing private human spaceflight requirements for crew and participants.[64] Final rules were also issued for FAA launch vehicle safety approvals.[65]

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.[66] 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.[67]

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.[68] The approximate premium for launch vehicles (as a percentage of launch costs) has recently been in the following range: Ariane-5, 6.5 per cent; Atlas-5, 6.6 per cent; Sea Launch, 7.5 per cent; Chinese Long March, 7.9 per cent; and Proton, 10.3 per cent.[69] Terms have also become more restricted. Insurers do not generally quote premiums earlier than 12 months prior to a scheduled launch and in-orbit rates are usually limited to one-year terms. 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.[70]

With the advent of space tourism, the space insurance industry may expand to cover human spaceflight. In the U.S., 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.[71]

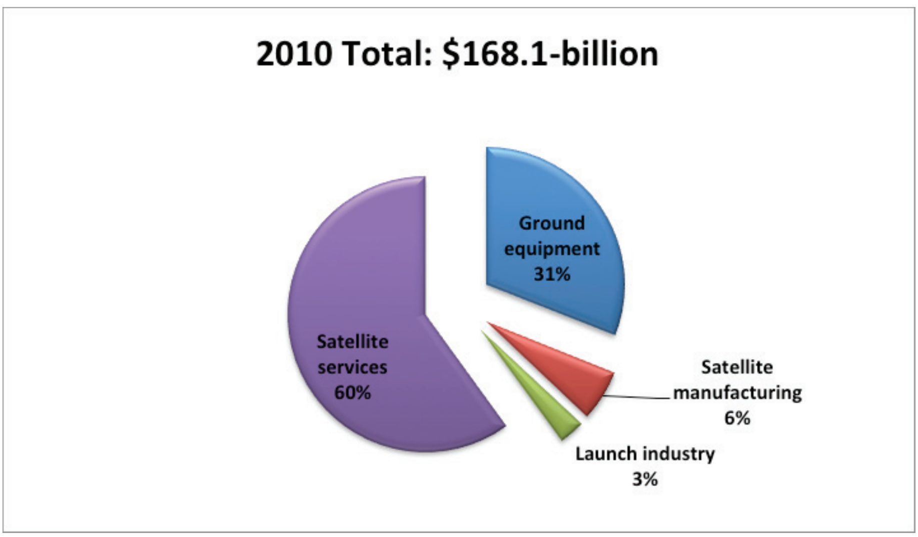
2010 Development

Two new services bring high-speed Internet to underserved markets

With pockets of Europe and the Mediterranean still lagging behind the digital age in terms of Internet connectivity, in 2010, two companies launched satellites with new technology capable of providing broadband via satellite.[72] On 26 November, Avanti Communications, a startup U.K. company, launched the first European spacecraft dedicated to providing broadband Internet access via satellite.[73] With the $159-million satellite, the company plans to serve Europe, the Middle East, and Africa and hopes for a base of up to 1.2 million customers.[74]

Between mid-November and late December, Eutelsat launched three satellites to provide broadband service to Europe, the Mediterranean, and North America.[75] The third of these, a $475-million satellite primarily targeting the European market, is larger than Avanti's and is capable of providing broadband to two million homes. Although already available in the U.S., the new services are the first outside that market to operate on a new transmission frequency providing true broadband speeds.[76] The satellite, called Ka-Sat, will provide ample coverage for Europe with 80 spot beams, which allow for frequencies to be reused in various regions without interference, resulting in increased capacity.[77] Both Avanti and Eutelsat plan to market through Internet providers rather than directly to end-users.[78]

Figure 5.3: Worldwide satellite industry revenue by sector (2010)[79]



A related new enterprise is Google's initiative to bring high-speed Internet to remote areas of the developing world by promoting effective FCC management of spectrum resources and comprehensive review of competition rules.[80] The company put out its Request for Information in February to help identify interested communities.[81] Google is planning to build and test ultra-high speed broadband networks in a small number of trial locations across the U.S. It hopes to transmit data at Internet speeds more than 100 times faster than what most Americans have access to today with 1 gigabit per second, fiber-to-the-home connections, and to offer service at a competitive price to at least 50,000 and potentially up to 500,000 people.[82]

2010 Development

Use of small satellites increases, providing a possible new market for dedicated launcher

Small satellites are proving useful in a variety of scenarios: academic, military, civil, and commercial.[83] These versatile miniatures can access space either as a secondary payload or on a dedicated, expendable launch vehicle.[84] As small satellites fill the manifests for more and more launches, Interorbital Systems (IOS), a company based at the Mojave Air and Spaceport, is developing a launch vehicle dedicated to the launch of these small satellites and the kits that rocket will lift. The launcher under construction, Neptune 45, is a modular system built of standard modules common to the design of predecessor IOS launch vehicles.[85] The company plans to carry out its first orbital launch in 2011from Tonga, hoping to decrease standard spaceport launching fees.[86]

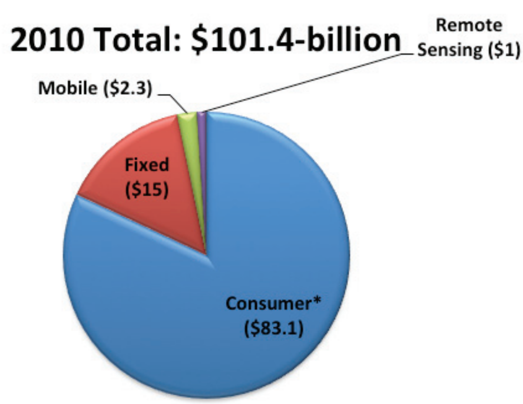
2010 Industry Updates

Recognizing the imperative for reasonable development time and lower costs, SpaceX will respond to a NASA study and offer guarantees on future heavy-lift launches (150 tons to orbit @ < $300M/launch).[87] The SpaceX Dragon capsule successfully reentered the Earth's atmosphere on 8 December, becoming the first privately owned spacecraft recovered from orbit. This achievement places SpaceX at the forefront of private space transport to the ISS.[88] In 2008, SpaceX won the right to resupply cargo to the ISS as a part of NASA's Commercial Orbital Transportation System (COTS), along with Orbital Sciences Corp (OSC).[89]

Also as a part of COTS, Thales Alenia was working on the cargo module Cygnus for OSC.[90] Thales expected to deliver the module, essentially a new spaceship,[91] in time for the February 2011 COTS qualification flight.[92] As well, Thales Alenia committed to supply three more communications payloads of Russian ISS satellites, continuing longstanding ties to the Russian space sector.[93] The satellites will expand direct-to-home services and develop new broadcasting markets such as high-definition and 3-D television, and replace aging spacecraft. The result will be increased access to the global market for Russian firms.[94]

With the Commercial Crew Development (CCDev) competition, NASA is stimulating the private sector to develop and demonstrate safe, reliable, and cost-effective transportation to deliver first cargo, and ultimately crew, to LEO and the ISS.[95] Originally funded with $50-million, CCDev is now distributing $200-million. To date, seven companies are vying for these funds: ATK, Blue Origin, Boeing, OSC, Sierra Nevada Corporation, SpaceX, and United Launch Alliance.[96]

Figure 5.4: 2010 worldwide satellite services revenue (in $B)[97]



* Includes satellite TV, satellite radio, and consumer satellite broadband.

At the Spaceport America runway dedication in Las Cruces on 22 October, Sir Richard Branson publicly declared Virgin Galactic's intentions to go orbital, despite the likely timeframe of 9-18 months before actual suborbital spaceflight participant operations.[98] In addition, Branson discussed the possibility of point-to-point transportation, an application achievable by suborbital vehicles such as SpaceShipTwo, in which the craft would launch from a spaceport in one country and land halfway around the world in another, in significantly less time than traditional aircraft.[99] Virgin Galactic completed its fourth glide test over the California desert in mid-January 2011.[100]

In April, the Space Data Association, formed by commercial operators to support data-sharing to better facilitate space situational awareness, entered into a contract with AGI, its technical advisor.[101]

Three years after launching the competition, Google Lunar X Prize (GLXP) closed its registration, reporting that 24 teams had registered for the race to the Moon.[102] GLXP hosts interactive events for competitors and observers, such as Friday Funday Q & A sessions, Photoshop contests, and submissions of YouTube videos.[103] One innovative team, the Rocket City Space Pioneers, builds its business model on the purchase of a SpaceX Falcon 9 launch for $60-million, reselling excess capability on the rocket for twice the price.[104]

2010 Development

Intelsat satellite Galaxy-15 goes adrift following malfunction, reestablishes contact nearly nine months later

As described in Chapter 1, on 4 April Galaxy 15 suffered an anomaly which left it drifting without contact across the western edge of the arc of satellites used by cable programmers.[105] In April, Intelsat sent over 200,000 commands to the satellite in an unsuccessful attempt to either turn off its communications payload or maneuver it to stop the drift.[106] Service was not affected as Intelsat successfully transitioned service from Galaxy 15 to Galaxy 12.[107] On 29 December, Intelsat announced that it had regained full control of Galaxy 15.[108] On 13 January 2011, Intelsat announced that it would be moving Galaxy 15 to an orbital slot at 93W for a full systems checkout.[109] Afterwards, the satellite could be put back into service in its original slot. In an effort to avert similar events in the future, the company uploaded new software. After testing and relocating the satellite in safe mode while still in-orbit, the company will determine its functionality.[110]

Space Security Impact

Developing underserved markets also creates more stakeholders with a vested interest in space security. The malfunction of the Galaxy-15 satellite showed how to responsibly manage an unexpected event that might otherwise have had a detrimental effect on space security. That the satellite corrected according to design has a positive impact upon security. The event also provides the industry with a working model of how to respond to similar problems transparently and collaboratively. The commercial sector's continued development has a positive impact upon access to space, but also comes at the price of congestion. Furthermore, developing regulations for private international corporations, including those venturing into the uncharted realm of space tourism, might be as challenging as regulating state activities in space.

Trend 5.3: Continued government dependency on the commercial space sector develops interactions between public and private sectors

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. Due to the security concerns associated with commercial space technologies, governments still 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 a successful U.S. commercial launch industry is viewed as "beneficial to national interests."[111] The U.S. Space Launch Cost Reduction Act of 1998 established a low-interest loan program to support the development of reusable vehicles.[112] In 2002, the U.S. Air Force requested $1-billion in subsidies for development of Lockheed Martin's Atlas-5 and Boeing's Delta-4 vehicles, under the Evolved Expendable Launch Vehicle (EELV) program.[113] The 2005 Space Transportation Policy required the 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 force price-driven competition.[114] The U.S. Commercial Remote Sensing Space Policy directs the U.S. 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."[115]

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.[116] The program explicitly recognizes a competitive European launch industry as a strategic asset and is intended to ensure sustained government funding for launcher design and development, infrastructure maintenance, and upkeep.[117] 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."[118]

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.[119] China's space industry is indistinguishable from its government, with public and private institutions closely intertwined.[120] 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 U.S. National Geospatial-Intelligence Agency's (NGA) NextView program included subsidies for commercial remote sensing to meet military needs for high-resolution images, which are then for sale commercially at a lower resolution.[121] The commercial Radarsat-2 satellite was largely paid for by the Canadian Space Agency, which spent $445-million to pre-purchase data that is also sold commercially.[122] This arrangement is similar to that for Germany's TerrSar-X remote sensing satellite.[123]

Remote sensing is not the only instance of such partnering. The U.K.'s Skynet-5 secure military communications satellite is operated by a private company, which sells its excess capacity.[124] 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 U.S. firm, citing national interests.[125]

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, 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.[126] However, export practices differ among members. For example, although the U.S. "Iran Nonproliferation Act" of 2000 limited the transfer of ballistic missile technology to Iran, Russia's Federal Law on Export Control still allowed it.[127] 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.[128]

From the late 1980s to the late 1990s, the U.S. had agreements with China, Russia, and Ukraine to enable the launch from foreign sites of U.S. satellites and satellites carrying U.S. components. In 1998, a U.S. investigation into several successive Chinese launch failures led to allegations of the transfer of sensitive U.S. 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 U.S. Munitions List (USML) in 1999.[129] In effect this placed satellite sales in the same category as weapons sales, making international collaborations more heavily regulated, expensive, and time consuming.

Exports of USML items are licensed under the International Traffic in Arms Regulations (ITAR) regime, which adds several additional reporting and licensing requirements for U.S. 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."[130] Industries are maneuvering around ITAR restrictions by purchasing ITAR-free satellites and launch services. For instance, China was able to launch the Chinasat 6B telecommunications satellite, built by Thales Alenia Space, on its Long March launcher because the satellite was built without U.S. components. Thales Alenia Space is the only western company that has deliberately designed a product line to avoid U.S. trade restrictions on its satellite components.[131]

Finally, because certain commercial satellite imagery can serve military purposes, a number of states have implemented regulations on the sector. The 2003 U.S. Commercial Remote Sensing Policy set up a two-tiered licensing regime, limiting the sale of sensitive imagery.[132] In 2001, the French Ministry of Defense prohibited open sales of commercial Spot Image satellite imagery of Afghanistan.[133] Indian laws require the 'scrubbing' of commercial satellite images of sensitive Indian sites.[134] With the Remote Sensing Space Systems Act, which came into force on 29 March 2007, Canada adopted a regulatory regime that gives the Canadian government "shutter control" over the collection and dissemination of commercial satellite imagery and priority access in the event of future major security crises.[135]

Commercial space systems as critical infrastructure

Space systems, including commercial systems, are increasingly considered to be critical national infrastructure and strategic assets. During the 1990s, the U.S. military began employing commercial satellite systems for non-sensitive communications and imagery applications.

The U.S. DOD is the single largest customer for the satellite industry, although it accounts for less than 10 per cent of the revenue of most large satellite operators.[136] By November 2003, it was estimated that the U.S. military was spending more than $400-million each year on commercial satellite services.[137] By 2006, this figure had jumped to more than $1-billion a year for commercial broadband satellite services alone.[138] For instance, three years after Operation Iraqi Freedom began, it was reported that more than 80 per cent of satellite bandwidth utilized by DOD was provided by commercial broadband satellite operators.[139] A 2003 U.S. General Accounting Office report recommended that the U.S. military be more strategic in planning for and acquiring bandwidth by, inter alia, consolidating bandwidth needs among military actors to capitalize on bulk purchases.[140]

European states also view the space sector as a strategic asset "contributing to the independence, security, and prosperity of Europe."[141] And China's 2006 White Paper on Space Activities identified the development of an independent space industry as a key component of its goals for outer space.[142]

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, 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.[143] The importance of the private sector in space safety and governance issues has also been highlighted by the U.S. government. Under the SSA Sharing Program, previously called the Commercial and Foreign Entities program, the DOD is attempting to align government and industry resources to address growing space security challenges and increase space situational awareness (see chapter 2 for further information). The draft EU Code of Conduct for Outer Space Activities[144] specifically addresses harmful interference with space assets, but is not legally binding; the level of international support it will receive when it opens for signatures is unclear.

2010 Development

Changes to U.S. Space Policy affect U.S. space companies and create uncertainty at NASA

On 28 June, the U.S. released its new National Space Policy, which focuses on maintaining a robust and competitive industrial base in the U.S. and specifically seeks partnerships with the private sector to enable commercial spaceflight capabilities for the transport of crew and cargo to and from the ISS. In furtherance of U.S. exploration objectives, the policy's "bold new approach to space exploration," which in effect cancels the NASA Constellation lunar program, argues for the development of a new heavy lift vehicle.[145] However, the net effect may be uncertainty for U.S. companies and the space industry worldwide.[146] One change is that private companies servicing the ISS will not be required to launch from Kennedy Space Center, but will have the discretion to determine the site that works best.[147] Generally, the shift in NASA's mandate should provide stimulation for private launch companies and those involved in commercial human spaceflight.[148]

SpaceX has gained credibility as a viable means of transport for NASA. By successfully reentering Earth's atmosphere, SpaceX joined a club that previously included only five nations: the U.S., Russia, China, Japan, and India. SpaceX is now a credible option for ISS transport.[149] Not only was this SpaceX flight the FAA's first-ever commercial license to reenter a spacecraft from Earth orbit, it was also the first under NASA's COTS program and the first flight of an operational Dragon spacecraft. SpaceX CEO Elon Musk said he could be launching station crews within three years of NASA approval. SpaceX has a $1.6-billion contract with NASA for 12 supply runs, while OSC has a $1.9-billion contract for eight.[150]

2010 Development

Export credit agency financing makes projects viable

Export credit agency financing, or financing supported by governmental departments and/or agencies,[151] has become a viable source of funding for new satellite projects.[152] Faced with bleak prospects in the aftermath of three large bankruptcy reorganizations (Iridium, Globalstar, and ICO Global Communications), manufacturers turned to another source of money to back second-generation constellations: export credit agencies.[153] While the availability of financing has revitalized the industry during difficult economic times, it is not without its critics. Some see the loans as government subsidies used to support nationals and direct business.[154]

2010 Development

The European launch sector scrutinizes Arianespace, considers changes in governance and shareholding structure

Although Arianespace benefitted from a successful 6-for-6 launch year in 2010, the consortium faces the challenge of decreased revenues[155] and increased expenses related to two new launch vehicles, the Soyuz 2 medium lifter and the Vega light booster. It has requested governmental aid[156] and the European launch community is examining both Arianespace's governance and shareholding structure.[157] Germany leads a group of ESA countries in a renewed call for private ownership of Arianespace. France, whose CNES owns 32.5 per cent of the company's stock at present, leads a group supporting control by public entities.[158] Still others would remain with the status quo — a mixed public-private shareholding setup — but with a different governance mechanism.[159]

2010 Development

ISS partners agree to publish interface standards for interoperable spacecraft docking

In an initiative that will allow engineers anywhere in the world access to information to build docking systems for the current ISS and future missions, the ISS Multilateral Coordination Board has approved a standards for a common docking interface[160] and ISS partners published the new set of standards.[161] All that is needed to download the information is an Internet connection.[162] The standards provide what is necessary to dock both crewed and uncrewed vehicles to the ISS. The standards do not provide specific data regarding actual technology, but measurements and force loads describing physical interfaces.[163] Technology transfer is not an issue, with standards available to China and India as well as commercial companies.[164]

Space Security Impact

Increased interaction between the public and private sectors in collaborative space projects has an overall positive impact upon space security. However, this impact is somewhat offset by the uncertainties caused by changes in U.S. Space Policy. Still, these interactions, often more intricate than simple partnerships, better spread the risks among actors and can supply a more cost-effective distribution of public services/public goods. Furthermore, the publication of ISS docking standards provides sustainable access to states and companies beyond the ISS partners, without sacrificing national security. And it potentially increases the number of stakeholders with a vested interest. A negative impact could result if hosted payloads make commercial assets a target, but no such developments in this area are noted for 2010.

Trend 5.4: Commercial space operators gradually embrace cyberspace capabilities

The link between cyberspace and outer space is becoming increasingly important for commercial operators as they seek to capitalize on emerging technologies that enable space-based Internet Protocol-enabled services. Although still in the early stages of development, these services are expected to deliver cost-effective connectivity for military and commercial users.

A key driver for the development of such technologies has been a partnership between the U.S. military and the commercial sector. The Internet Router in Space (IRIS) Joint Capability Technology Demonstration is a DOD demonstration program managed by a Cisco-led team that also includes Intelsat General.[165] The nature of the government-commercial partnership is innovative as, "rather than Department of Defense dictating requirements to industry, the consortium would design, develop and launch the capability at its own expense to meet their market forecast."[166]

IRIS, launched on board Intelsat-14 in 2009,[167] was designed to support network services for voice, video, and data communications.[168] The most significant advantage over conventional satellite technology is that the system eliminates the need to send data to and from an extra ground station, which can be expensive and time-consuming.

2010 Development

Aerospace e-business platform Exostar providing cloud services to the space industry

Exostar, long a provider of software applications to the aerospace and defense industries, transitioned from traditional log-in formats to its cloud-based Managed Access Gateway in July.[169] In addition, in October the company announced a new version of its supply chain management application, SCP2, raising the bar for aerospace and defense supply chain collaboration.[170]

However, by making cloud services available to the industry, Exostar is feeling the brunt of concerns voiced by the U.S. Aerospace Industries Association (AIA).[171] Although cloud computing makes possible increased collaboration and communication between small or mid-sized companies and much larger ones, the AIA has identified concerns related to security, availability, and interoperability, such as "controlling who can access data in the cloud, assuring the services are uninterrupted, and ensuring applications are portable between cloud providers."[172] Despite these concerns, the U.S. government is transitioning into the cloud to reduce costs and boost efficiency.[173]

2010 Development

Cisco's Internet Router in Space is an immediate hit

In an effort to transform the satellite industry, Cisco developed IRIS, an Internet Router in Space.[174] By eliminating the need to downlink and uplink data to/from an extra ground station, IRIS should prove more cost effective and less time consuming.[175] In addition, it should extend IP access to areas not covered by traditional methods – either ground or 3G.

Cisco first launched a satellite providing IRIS to the U.S. DOD in November 2009.[176] Demand for IRIS during its evaluation period exceeded company projections and Cisco offered commercial capability by the middle of 2011, sooner than originally anticipated.[177] IRIS manages traffic and processes signals aboard the spacecraft Intelsat 14, rather than using traditional satellite networks that rely on ground-based equipment. Government users, including the military, comprise the bulk of IRIS users.[178]

Space Security Impact

The commercial space community is made more efficient by the increased availability of internet services in terrestrial contexts such as cloud services. As the American Institute of Aeronautics and Astronautics notes, the security, availability, and interoperability of such services are an ongoing concern for end-users. Internet routers in space, such as Cisco's IRIS space router, eliminate the need to downlink and uplink data to/from a ground station; thus threats can be minimized and financial and time costs better managed.