

Satellite Industry Developments

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FOREWORD

The Malaysian Communications and Multimedia Commission (SKMM) is working on a number of special industry research reports planned for the year of 2008 and it is my pleasure to present to you the industry research report on Satellite Industry Developments.

The report features a brief overview on the satellite industry developments, history of communications satellite systems in earth's orbit, and an understanding of the basic components of the satellite value chain. There is an analysis of revenue contributions and forecasts on world satellite industry performance, including breakdown by main industry segments of satellite manufacturing, satellite launch, ground equipment and satellite services segment.

The three sub-segment satellite services comprising Fixed Satellite Services (FSS), Mobile Satellite Services (MSS) and Broadcasting Satellite Services (BSS) are also assessed in terms of services development, trend of take up and new applications, emerging demand, including challenges and the opportunities going forward. This report also provides a snapshot on emerging satellite services including Global Earth Observation System of Systems (GEOSS) and Global Monitoring for Environment and Security (GMES).

There is also a discussion highlighting the development of satellite communications systems and satellite-based communications services in Malaysia. In light of local developments, the SKMM would like to thank the officers and management of service providers who have contributed to provide a perspective of the industry towards the writing of this report.

A soft copy of this report can be obtained from the SKMM website at:

http://www.skmm.gov.my/what_we_do/Research/industry_studies.asp

I trust this report will provide useful information to the readers and we look forward to hearing your feedback, which will help us improve our industry reports in the future. Please send your comments to webmaster@skmm.gov.my

Thank you.



Datuk Dr. Halim Shafie
Chairman
Malaysian Communications and Multimedia Commission (SKMM)

EXECUTIVE SUMMARY

In a worldwide communications services scenario where the service of providing voice, data and video is increasingly merging to be delivered over same devices that can be used anytime and anywhere, the satellite industry is deemed yet another means of communications. Such industry trend augurs well for satellite communications services.

The two basic elements of a communications satellite are the space segment comprising the spacecraft and launch mechanism; and the other, the ground segment of earth station and network control centre of the entire satellite system. Satellites today are light weight and smaller in size; carry more transponders offering higher capacity; and provide higher bandwidth. Today, Low Earth Orbit (LEO), Medium Earth Orbit (MEO) and Geostationary Earth Orbit (GEO) continue to be home to hundreds of telecommunications satellites.

The four major satellite industry segments are satellite manufacturing and satellite launch, ground equipment providers satellite services. The satellite services segment contributes 60% or USD73.9 billion to worldwide satellite industry revenue of USD123 billion in 2007. Satellite services grew 18.1% in 2007 largely due to the growth of satellite television and Direct Broadcast Satellite (DBS). Satellite launch segment contributes 3% or USD3.2 billion (growth of 18.5%) while ground equipment providers part is 28% or USD34.3 billion (growth of 19.1%). Only the satellite manufacturing segment saw 3% decrease in revenue to USD11.6 billion due to an increase in the number of relatively cheaper micro-satellites launched in 2007.

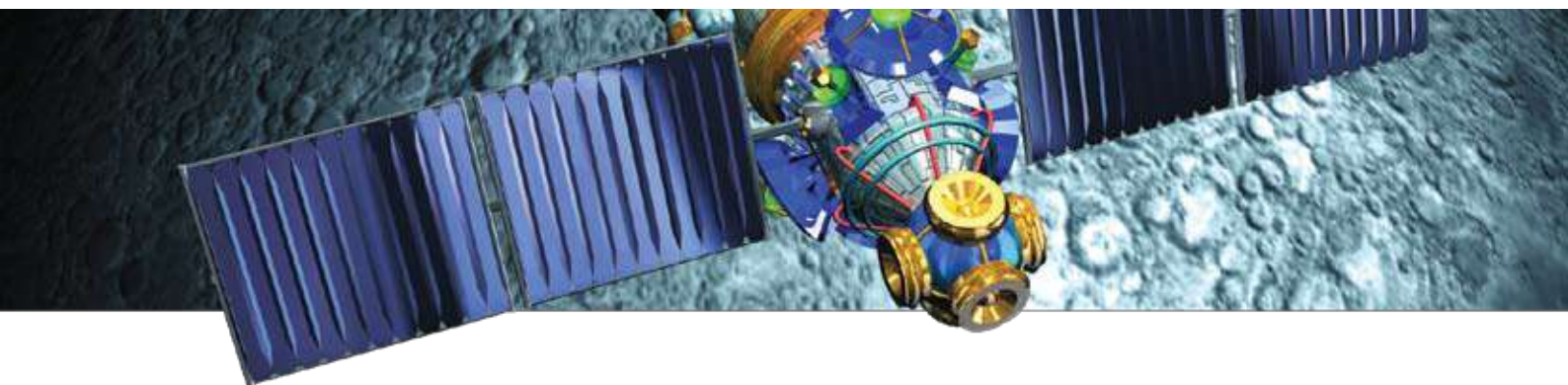
Satellite services segment comprises the three major sub-segments of Fixed Satellite Services (FSS), Broadcasting Satellite Services (BSS) and Mobile Satellite Services (MSS). Top FSS operator in 2007 by revenue is SES Global with revenue of USD2.35 billion in 2007, top in MSS is Inmarsat

charting revenue of USD0.58 billion, and top BSS operator is DirectTV Group Inc., with USD17.2 billion.

Despite setbacks due to launch failures, the FSS sub-segment managed moderate growth on back of strong economic growth in many regions enabling increased satellite demand. Digital Video Broadcasting-Satellite-Second Generation (DVB-S2) with Adaptive Coding and Modulation (ACM) is one advancement; providing efficient coding and data rates utilisation. By March 2008, Hughes Network Systems (HNS) reported having shipped more than 400,000 satellite Very Small Aperture Terminal (VSAT) terminals with DVB-S2 and ACM capabilities. Viasat and iDirect, among others, have reported active deployment for DVB-S2.

Consolidation drives by SES Global, Intelsat, and Loral and privatisation of FSS companies such as Intelsat and Eutelsat S.A. see the FSS segment with three to four truly global FSS operators, complemented by a host of regional players, especially in Asia. Overall, the mergers and joint ventures have improved flexibility and market access for the operators, including sale and application of capacity at C and Ku bands.

The year 2008 will be especially important for the FSS industry, with 17 to 20 units of satellite to launch. Out of these, three are the first satellites for Protostar; backed by private investors, VINASAT-1 from Vietnam and Venesat from Venezuela. In 2007, the combined revenue of 38 FSS companies totalled USD8.5 billion. This is concentrated at the top four FSS operators which are Intelsat, SES, Eutelsat and Telesat generating 70% of total revenues¹. Overall demand for FSS capacity² increases by almost 6% a year from 2006-2015, with the largest demand growth for satellite capacity to come from consumer-oriented services, broadcasting and network communications services.



¹ "What is ahead in 2008 for the FSS and MSS Industries" by SatMagazine.com, January 2008

² Futron Corporation forecast

Satellite services revenue from the broadcasting industry saw 18.6% growth in 2007 to USD57.5 billion. Satellite radio portion is small at USD2.1 billion in 2007. There are 92 TV platforms in service covering more than 100 countries, with 80 national TV platforms and seven regional platforms primarily in the Middle East, Africa, Central and Eastern Europe and Latin America. Direct-To-Home (DTH) services now reach 95 million homes with current excess of 1,000 TV channels. Industry observers see DTH audience doubling subscriber base to 180 million by 2017. High Definition TV (HDTV) is seen as a driver for broadcast satellite services and a prime market differentiator for keeping existing customers and gain new ones. Regarding satellite as the most cost effective way of delivering digital TV, cost of Set-Top-Boxes (STBs) dropped by more than 80% in the last six years.

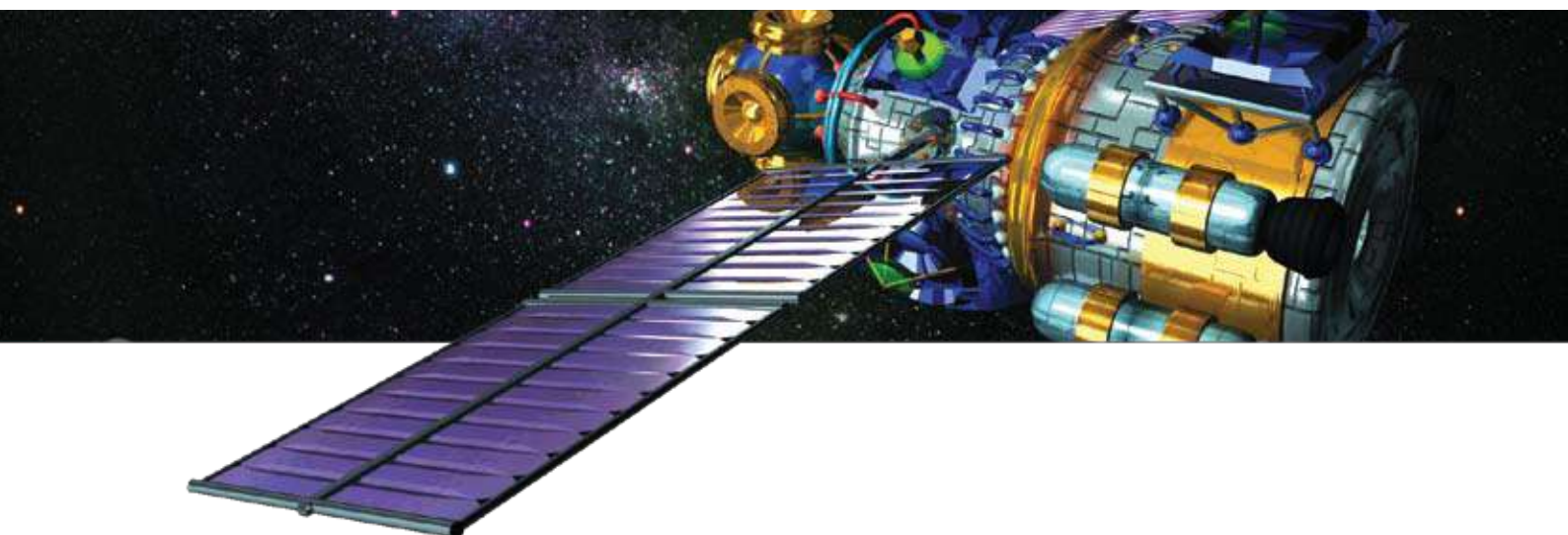
Overall, MSS applications cover mobile satellite telephony, mobile satellite-based navigation system, and mobile satellite broadband. Satellite phones pose high cost, from USD700 onwards and expensive pulse rate starting from USD0.99 cents. The gap in attractiveness between satellite phone and cellular phone increased in late 1990s, when cellular phone also provided options to surf the net, play music and exchange photos. Recent industry analysis see the global market for Global Positioning System (GPS) to rise above USD22 billion by 2008. Boosting the satellite navigation industry includes lower prices and more applications.

Broadband Global Area Network (BGAN) introduced by Inmarsat at end of 2005 is the latest mobile satellite communications service to provide broadband access for those whose jobs take them to remote locations. It is a portable device and so far, most advanced commercial communication satellites launched, aimed to deliver services at speed up to half megabit in a highly compact, easy-to-use form and affordable terminal. BGAN users can connect their laptop to the Internet at speeds up to 492Kbps anywhere and anytime.

Emerging satellite services such as Broadband Global Area Network (BGAN), Earth Observation Systems including Global Earth Observation System of Systems (GEOSS) and Global Monitoring for Environment and Security (GMES), hybrid triple play and digital signage, not only create opportunities for satellite business to expand, but also utilise these medium in ways that previous satellite services were unable to accomplish. Satellite communications play an important role in the telecommunications industry, especially in crisis management scenarios. Even when disruption or congestion of cellular networks occurs, satellite acts as backhaul for contingency and extensions to cellular networks (ranging from 2G, 3G and upcoming 4G).

Malaysia's first regional satellite system called MEASAT (Malaysia East Asia Satellite) is operated by MEASAT Satellite Systems Sdn Bhd (MSS) and owned by MEASAT Global Berhad (MGB). The MEASAT fleet comprises MEASAT-3, MEASAT-2 and AFRICASAT-1 satellites covering 145 countries or 80% of the world's population across Asia Pacific, Middle East, Europe and Australia. The fleet will be further enhanced in third quarter 2008 with the launch of MEASAT-3a. Other Malaysian satellites launched are TiungSat-1 in 2000 and soon to be launched RazakSat-1 which are micro-satellites for earth observation purposes.

While growth in broadband subscribers in Malaysia increased by 53% to 1.4 million subscribers in 2007, satellite broadband represents only 0.2% of subscribers. As with all operators, the satellite service providers also need to provide reliable service at affordable price to consumer and this has become a major challenge as more investment will be needed to improve the overall network. Recognition of the importance of user centricity in design and provisioning of products and services go a long way to attract and maintain take up and demand for satellite industry.



INTRODUCTION

In a worldwide communications services scenario where the service of providing voice, data and video is increasingly merging to be delivered over same devices that can be used anytime and anywhere, the satellite industry is deemed yet another means of communications. The search for seamless communications solutions to link ever expanding global operations or communications needs for government, corporate and individual alike in an increasingly connected world with little factor in distance is also blurring the boundaries of satellite communications with terrestrial communications, including broadcast.

Such trend augurs well for satellite communications, which is usually seen as the “last resort” or “niche” player that is used when all else fails and high price is no longer a barrier without option. For example, urban areas are usually linked with more economically viable communications services that offer better options in terms of quality of service, bandwidth and myriad commercially robust applications. Satellite benefits of instantly covering wide area in a single sweep upon setup are usually more cost-effective for rural areas or areas where terrestrial means of communications is not available or in case of emergencies.

In today’s world where big populations and countries with geographic limitations for terrestrial options are demanding and can afford better communications, the satellite option is then a viable and opportune one for even mainstream communications. This is provided the distribution platforms stakeholders and authorities can work for mutual benefit, and advanced or basic products and services developed for the regional and global satellite marketplace can trigger the desires of users for take up.

Satellite Communications System

A satellite in general is anything that orbits around something else, for example, the moon orbits the earth. In a communications context, a satellite is basically a specialised wireless receiver or transmitter that is launched by a rocket and placed in orbit around the earth³. A communications satellite system is a setup of microwave receiver, repeater and regenerators in orbit around the earth that receives, amplifies and redirects analogue and digital signals contained within a carrier

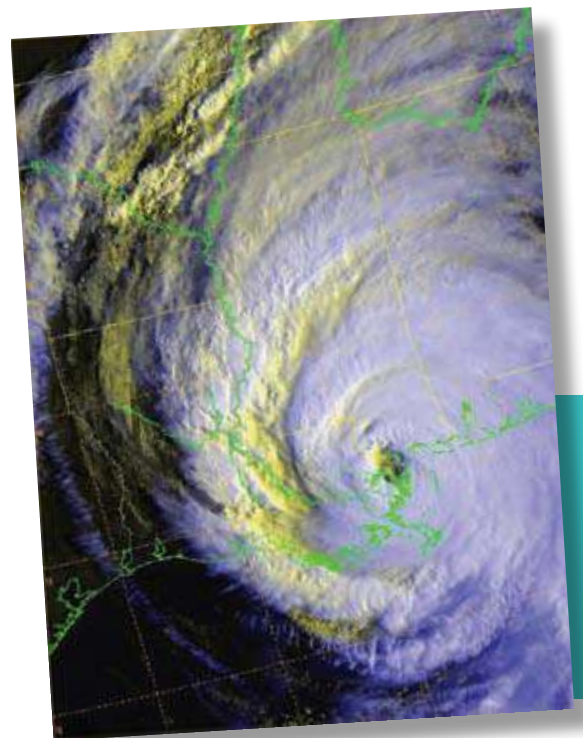
frequency. It is one of the most significant spin offs from the space programmes and has made a major contribution to the trends in international communications. The data transferred most often corresponds to voice (telephone), video (television) and digital information.

The basic elements of a communications satellite system are the two aspects of the space segment and ground segment. The space segment consists of the spacecraft and launch mechanism while the ground segment comprises the earth station and network control center of the entire satellite system.

History of Satellite Communications

First Satellite Launched by Regions/ Country

The Sputnik, launched in 1957, changed communications forever. As a technical achievement, Sputnik caught the world’s attention by successfully launching the world’s first satellite. Subsequently, a year later, US launched Explorer I. Thereafter, there have been many more satellite launches by countries in various regions offering a wider range of services over greater coverage areas, with greater capacity upon more advanced technology.



³ Searchmobilecomputing.com

First Satellite Launched by Countries in Various Regions

Region	Year	Description and Uses
Europe		
Soviet Union	Sputnik I 4 Oct 1957	<ul style="list-style-type: none"> - Size of a basketball, weighing 183 pounds; 98 minutes to orbit the Earth on its elliptical path; - Ushered in new political, military, technological, and scientific developments and led directly to the creation of National Aeronautics and Space Administration (NASA); - Identified the density of high atmospheric layers by measuring orbital change and provided data on radio-signal distribution in the ionosphere (uppermost part of the atmosphere); and - Provided the first opportunity for meteoroid detection, as a loss of internal pressure due to meteoroid penetration of the outer surface is evident in temperature data sent back to Earth.
North America		
US	Explorer I (Satellite 1958 Alpha) 31 Jan 1958	<ul style="list-style-type: none"> - Launched from Cape Canaveral (now Cape Kennedy) in Florida by the Jupiter C vehicle⁴; - Placed in orbit with a perigee of 224 miles and an apogee of 1,575 miles for 114.9 minutes; and - The primary science instrument was a cosmic ray detector designed to measure the radiation levels in Earth's orbit. The existence of these radiation belts was confirmed by another US satellite launched two months later, and became known as the Van Allen Belts.
Australia and Oceania		
Australia	WRESAT 29 Nov 1967	<ul style="list-style-type: none"> - Developed by the then Weapons Research Establishment (Salisbury, South Australia) and the Department of Physics at the University of Adelaide in South Australia; - Weighing 45kg and has shape of a cone with a length of 1.59 meters and a mouth diameter of 0.76 meters; - Remained connected with the third rocket stage and has an overall length of 2.17 meters; - Circled the earth on a nearly polar course, until it reentered the atmosphere after 642 earth revolutions on 10 January 1968, over the Atlantic; and - The battery-operated satellite sent data during its first 73 orbits around the earth.
Asia		
Japan	Osumi 11 Feb 1970	<ul style="list-style-type: none"> - Launched at 04:25 UTC (Universal Time, Coordinated) with a Lambda 4S-5 rocket by Japan's National Space Development Agency (NASDA), now part of Japan Aerospace Exploration Agency (JAXA); and - Weighed 24kg and orbited the Earth with a perigee of 323km and an apogee of 2,440km, with an inclination of 31.0°; decayed from orbit and returned to Earth in 2003.
South America		
Brazil	Brasilsat A1 8 Feb 1985	<ul style="list-style-type: none"> - Built by Hughes, based on the HS-376 bus design, and launched by Arianespace; - Stationed at 65 degrees west longitude and provide telecommunications services to Brazil; - Hughes Communications moved Brasilsat A1 satellite to 79 degrees west longitude to ease demand for domestic C-band capacity; is available via Hughes's Video Timeshare Service; and - In October 1995, Hughes acquired the payload capacity of Brasilsat A1 from Embratel of Brazil, which stationed the satellite at 63 degrees West.
Middle East and North Africa		
Israel	Ofeq 1 19 Sep 1988	<ul style="list-style-type: none"> - Launched on Shavit rockets from Palmachim Airbase in Israel, on the Mediterranean coast; - Possessed a weight of 155kg and circled the earth on an orbit with a perigee of 249km and an apogee of 1,149km on a course bent around 142.9 degrees; and - The Low Earth Orbit (LEO) satellites complete one earth orbit every 90 minutes. The launches made Israel the ninth nation to gain the capability. Both the satellites and the launchers were designed and manufactured by Israel Aerospace Industries (IAI).
Africa		
South Africa	Sunsat 23 Feb 1999	<ul style="list-style-type: none"> - Micro-satellites launched by American space agency, NASA, weight of 10kg to 100kg; - Primary mission objectives are imaging, world wide store-and-forward email communications, and satellite engineering research; and - Secondary mission objectives are studies of the earth magnetic field, gravity field, atmosphere and ionosphere.

Source: Various websites

⁴ A special modification of the Redstone ballistic missile that was designed, built, and launched by the US Army Ballistic Missile Agency (ABMA)

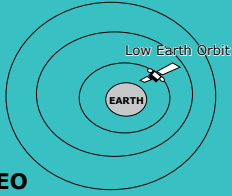
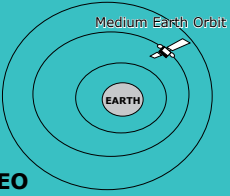
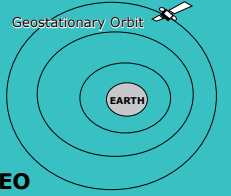
Satellite Orbits and Frequency

Types of Orbit

Satellite height is a major factor in its utility for use within a communications system. It determines the orbit period, the time that the satellite is visible to a ground station, the footprint (coverage area on earth's surface), the propagation delay of signals to and from the satellite, and the path attenuation.

There are three categories of distance from the earth for satellite orbits and accordingly satellites, which are Low Earth Orbit (LEO), Medium Earth Orbit (MEO) and Geostationary Earth Orbit (GEO). These have various characteristics and offer advantages as well as disadvantages.

Comparison of Satellite Systems as a Function of Orbit

Characteristics	LEO	MEO	GEO
			
Satellite height (km)	600 – 1,500	9,000 – 11,000	35,800
Orbital Period (hour)	1 – 2	6 – 8	24
Number of Satellites	40 – 80	8 – 20	2 – 4
Two-way propagation delay (milliseconds)	10 – 15	150 – 250	480 – 540
Satellite life (years)	3 – 7	10 – 15	10 – 15
Elevation angle	Medium	Best	Good
Visibility of satellite	Short	Medium	Permanent
Handheld Terminal	Possible	Possible	Restricted
Handover	Frequent	Infrequent	None
Cost of satellite	Maximum	Minimum	Medium
Gateway Cost	Highest	Medium	Lowest
Network complexity	Complex	Medium	Simplest
Radio frequency output power	Low	Medium	High
Propagation loss	Low	Medium	High

Source: Handbook of Antennas in Wireless

Frequency Selection

Lower frequencies experience lower attenuation. To minimise the power that must be generated onboard the satellite, the downlink frequency is chosen to be lower than the frequency for the uplink. Various frequency bands are allocated to satellite transmission.

Frequency Band Allocated to Satellite Transmission

Frequency	Uplink/Downlink	User	Service
UHF	400 / 225MHz	Military	Mobile
L-band	1.6 / 1.5GHz	Commercial	Mobile
S-band	3 / 2GHz	Commercial	Satellite control
C-band	6 / 4GHz	Commercial	Fixed
X-band	8 / 7GHz	Military	Fixed / Mobile
Ku-band	14 / 12GHz	Commercial	Fixed
Ka-band	30 / 20GHz	Commercial	Fixed
Ka-band	44 / 20GHz	Military	Fixed / Mobile

Source: Handbook of Antennas in Wireless

Satellite Industry Segments

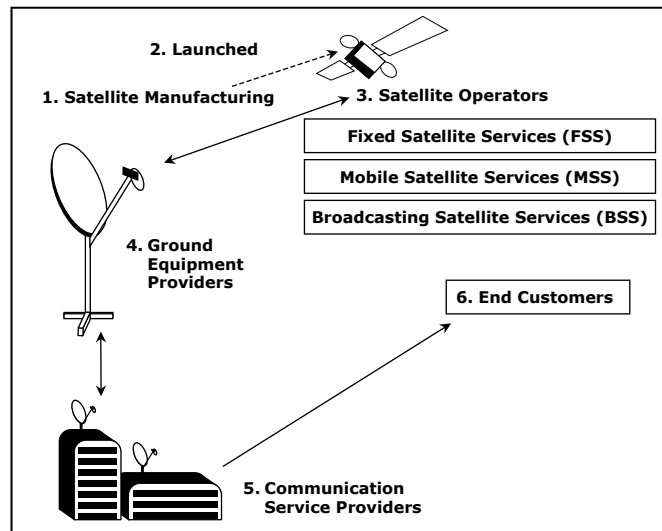
The satellite industry comprises the four segments of satellite manufacturing, satellite launch, satellite services and ground station equipment providers. The satellite manufacturing segment includes commercial satellite manufacturing activity for both commercial and government customers while the satellite launch segment sends satellites to space for both commercial and government-owned payload⁵. The "big five" large satellite manufacturers compete among themselves⁶ and these are Lockheed Martin, Boeing, Northrop Grumman Corporation, Thales Alenia Space, Alliant Techsystems Inc. (ATK)⁷; so do small satellite manufacturers which in cases do compete for traditional large business or payload business.

Satellite operators compete within sub-segments such as FSS, MSS, and BSS. Other sub-segments include digital audio radio services, broadband, and Earth imaging. However, there is little competition across sub-segment lines, for example, between FSS and MSS operators.

The ground equipment providers provide ground segment equipment and network control for communications service provider setup and

maintaining their network supplying full package communication services to end customers. There is intra-segment competition among launch service providers, ground equipment manufacturers and ground service providers.

Basic Satellite Value Chain



Source: Adapted from <http://pcquote.brand.edger-online.com>

No	Satellite Value Chain	Trend and Clarification
1.	Satellite Manufacturing	• Satellite Manufacturing; Component and Subsystem Manufacturing.
2.	Launch Industry	• Launch Services • Vehicles Manufacturing • Component and Subsystem Manufacturing
3.	Ground Equipment Providers	• Mobile Terminals & Gateways, Control Stations, VSATs, DBS Dishes, Handled Phones, Digital Audio Radio Service (DARS) equipment, Global Positioning System (GPS) Primary-Use Hardware.
4.	Satellite Operators	<ul style="list-style-type: none"> • Finance satellite construction and its launch; • Operator addresses specific customer markets because each satellite has transponders designed to cover a specific geographic region, or "footprint"; • Transponder capacity is leased to customers such as service providers, television broadcasters, corporations and governments; • Three main types of satellite services: <ul style="list-style-type: none"> - Fixed Satellite Services such as broadband, private networks, remote sensing; - Mobile Satellite Services providing mobile data, voice and video; and - Broadcasting Satellite Services such as Satellite Television and Satellite Radio.
5.	Communication Service Providers providing services through satellite	• Typically either telephony or broadband Internet companies lease capacity from satellite operators; install and maintain the resulting network; and sell full package communication services to end users.
6.	End Customers	<ul style="list-style-type: none"> • Organisations and individuals using satellite communication services; • Very large customers, primarily government agencies and international companies, sometimes act as their own service providers, operating their own ground station equipment; and • Smaller organisations, including Small & Medium size Enterprises (SME) and Small Offices/Home Offices (SOHOs) work with service providers rather than manage their own infrastructure.

Source: www.gilat.com

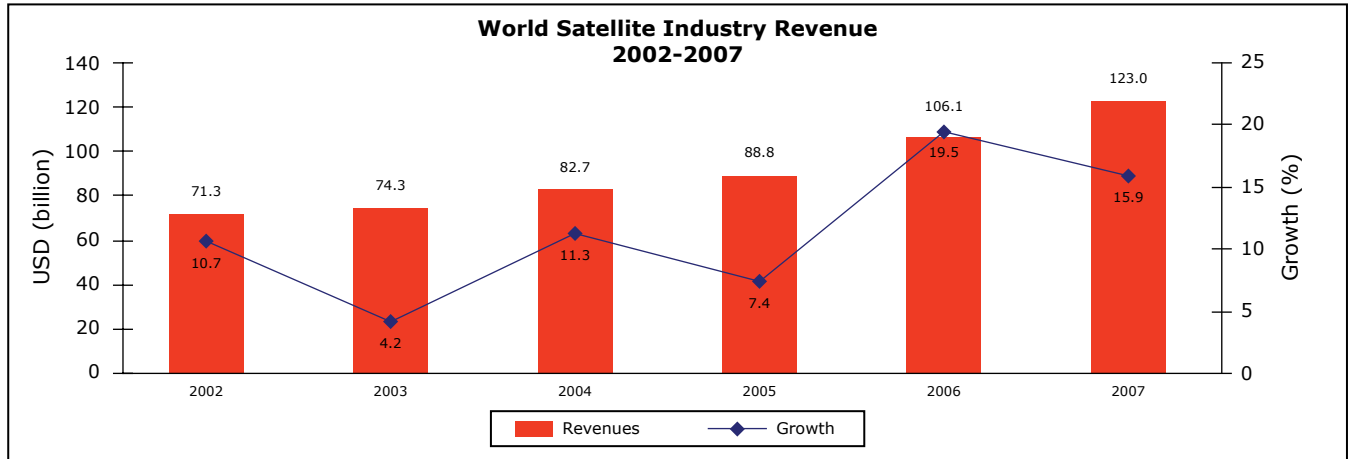
⁵ Satellite payload refers to the communication subsystem that carries out communications mission. Satellite operators can offer government to place its own designed transponders on their commercial telecommunications satellite

⁶ Via Satellite Magazine, December 2007

⁷ "Top 50 Space Industry Manufacturing and Services" by Space News, 6 August 2007

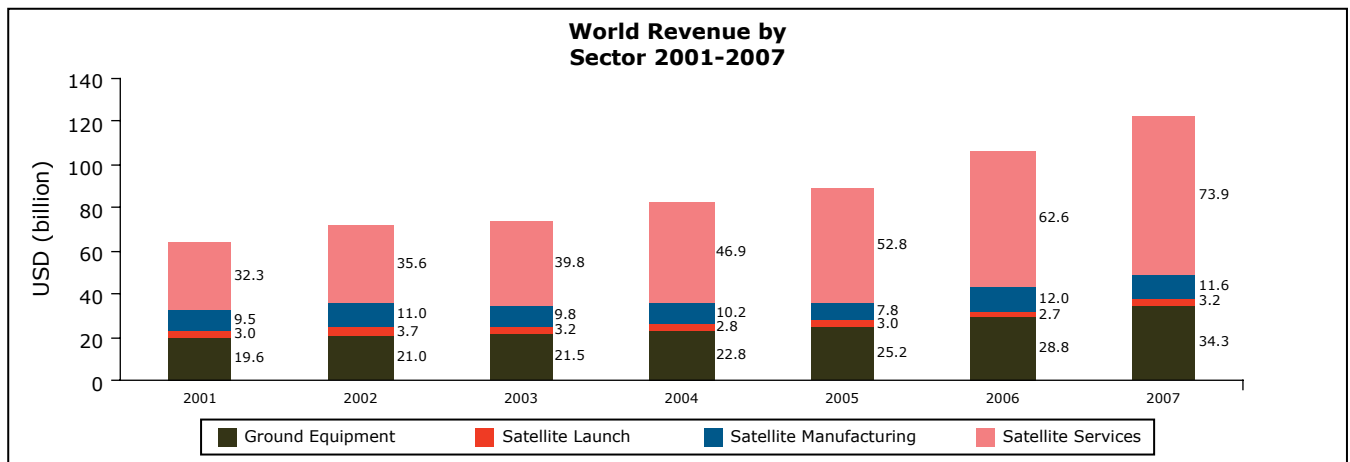
Satellite Industry Revenue

Worldwide satellite industry revenue saw a Compound Annual Growth Rate (CAGR) of 11.5% for the period of 2001 until 2007. In 2007, the industry achieved USD123 billion worth of revenue, a growth of 15.9% from 2006. This is lower compared with a 19.5% increase from 2005 to 2006.



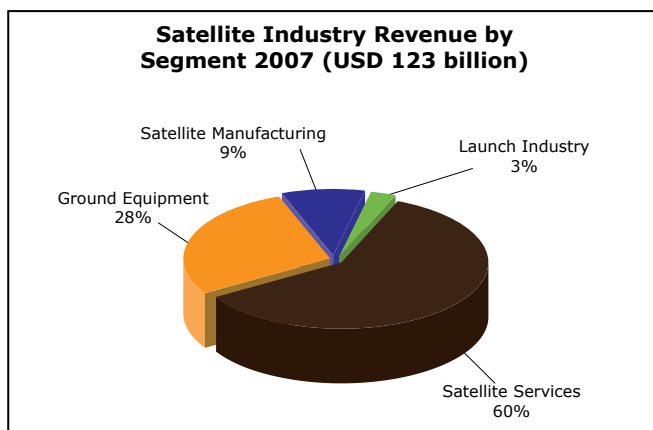
Note: Revenue in real-year US dollars (not adjusted for inflation)

Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008



Note: Revenue is in real-year US dollars (not adjusted for inflation)

Source: "State of Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008

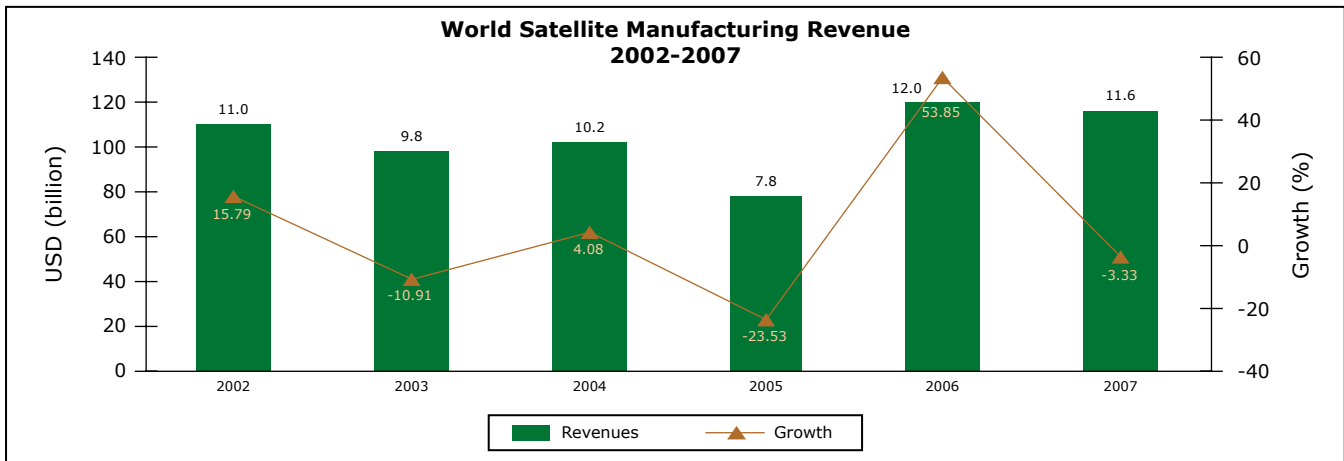


Source: "State of Satellite Industry Report" by Satellite Industry Association (SIA)

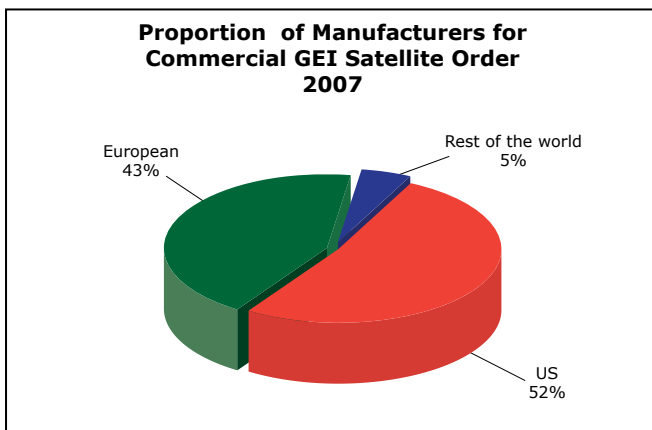
Satellite Manufacturing Segment

Despite more satellites launched in 2007 than in 2006, satellite manufacturing revenues declined slightly from USD12 billion in 2006 to USD11.6 billion in 2007. One reason for decline is the higher proportion of micro-satellites launched that has lower revenue than spacecraft. In 2007, out of the 102 satellites launched, 16 were micro-satellites, compared to nine in 2006. Satellite manufacturing is for both commercial and government customers. Government payloads generate 75% of total manufacturing revenue⁸.

⁸ In 2006



Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008



Source: State of the Satellite Industry Report by Satellite Industry Association (SIA) and Futron Corporation, June 2008

Revenue from commercial customers increased a worldwide 27% from USD3 billion in 2006 to USD 3.8 billion in 2007.

Commercial demand for satellite manufacturing is growing faster than that by government, with 21 new commercial GEO satellite orders reported in 2007 (25 in 2006). US manufacturers service 52% of these orders, European manufacturers 43% and others at 5%.

Satellite Launch Segment

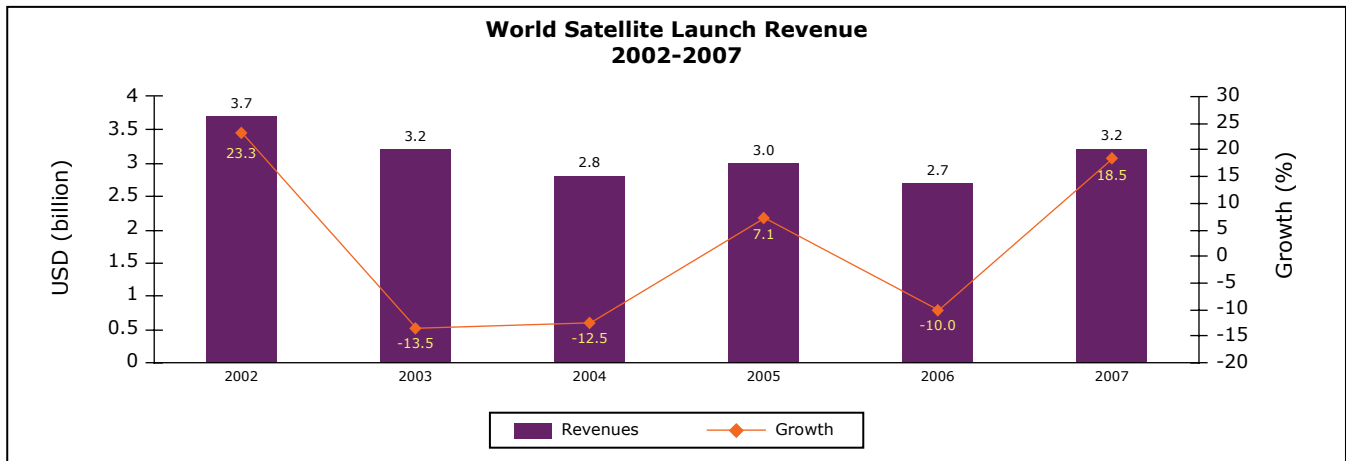
Worldwide satellite launch services revenue grew to USD3.2 billion in 2007, up 19% from 2006. In 2007, a total of 102 satellites were launched worldwide, with 16 comprising micro satellites and 49 commercial launches (versus 41 in 2006). New manufacturing contracts for satellites result in an increase in launch contracts – launches trail manufacturing by a year or so. On average, there are 15 big orders on the commercial side, with industry expecting this to increase to 20 to 22 a year for at least a few years.

In general, the industry segment⁹ is optimistic on transponder pricing to rise. Fixed satellite transponder fill rates grew from 58% in 2004 to 70% in 2007. Transponder agreement revenues, which include contracts for use of capacity on a full or partial transponder basis, grew 25% in 2006 versus only 4% in 2005. New developments in this segment include the anticipation of a new propulsion system that is more environmentally friendly.

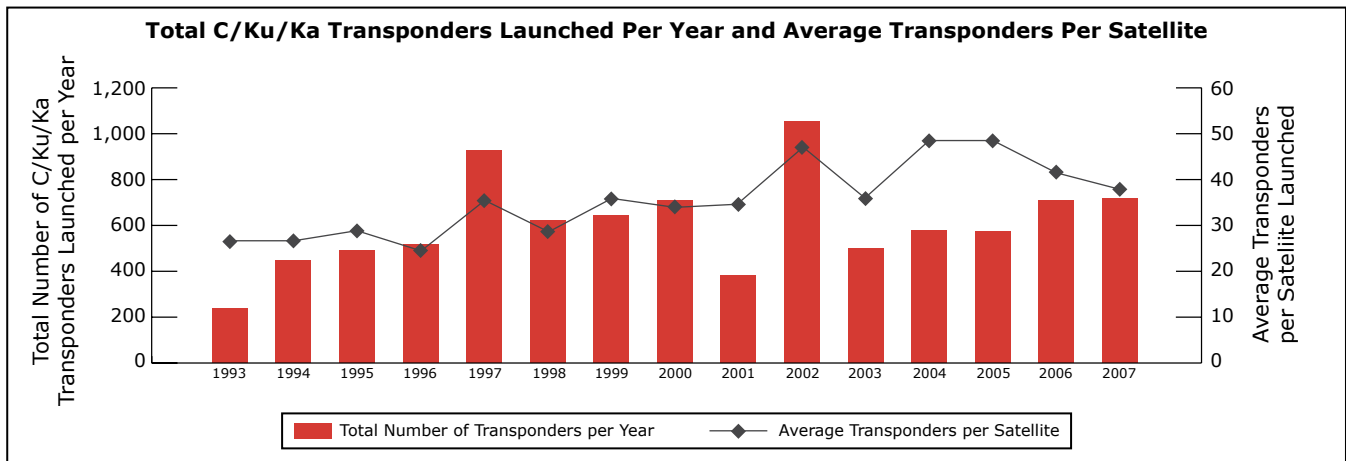
Launch failures are an inherent risk factor in the satellite launch segment. This reverberates to impact insurance companies, and directly affects the delicate balance of supply and demand in the downstream businesses that the satellite supports.



⁹ Satellite Industry Association (SIA)



Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008



Source: "Strategic Planning and Resource Guide" by Via Satellite, 15 October 2007

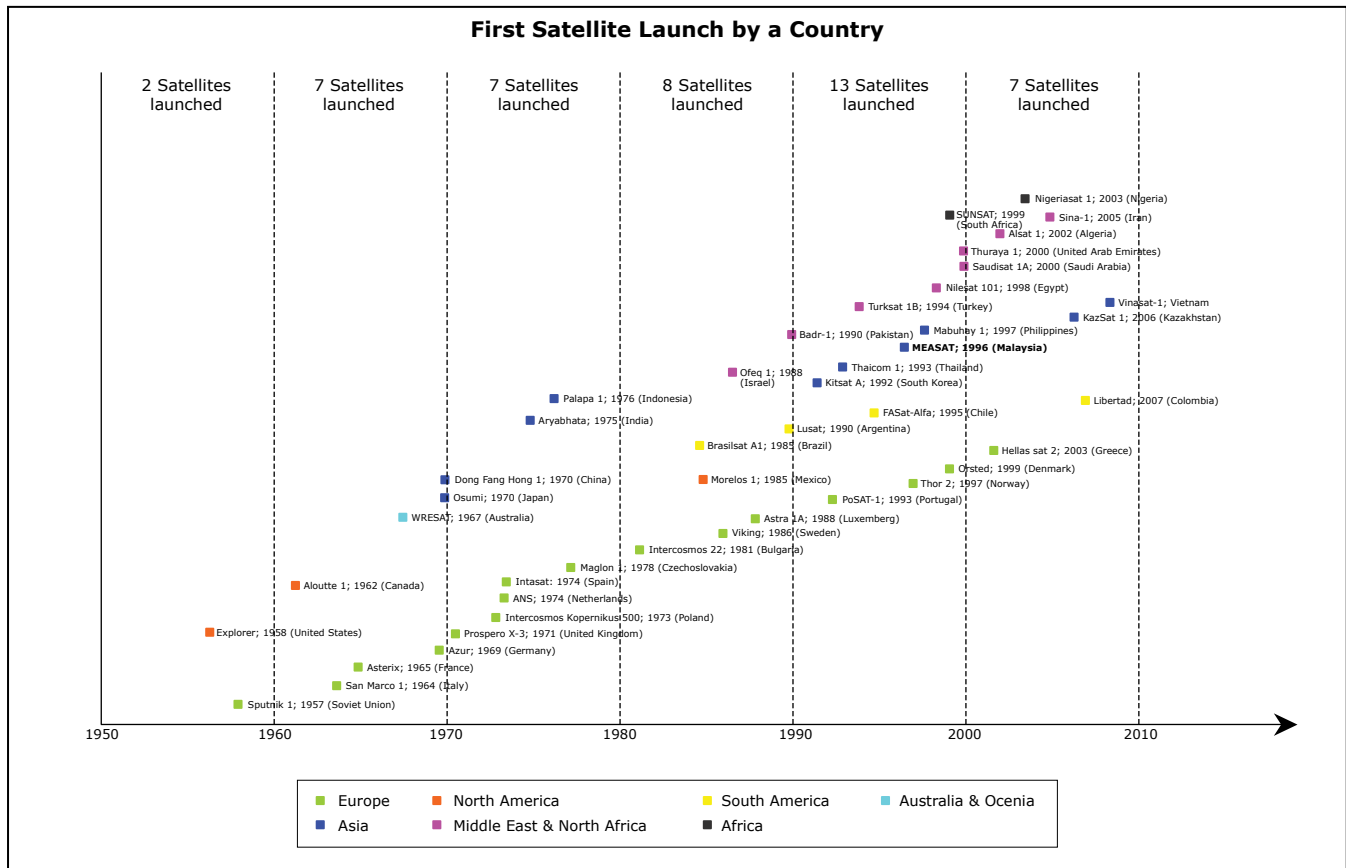
Historical Trend of First Launch by Country

Of note in the launch segment is that, the trend over the last 50 years which show satellite launches to be a rather widespread development in recent decades compared to the start of the industry, where only selected developed countries could afford such platforms. In a half century period from 1950 to 2010, there is a total of 43 first launches of satellites in 43 countries. The first third of this time period from mid-1950s to 1970 saw the developed countries of North America and Europe, Japan, apart from Russia and China among the forerunners in space research and technology, launching satellites into space for communications purposes, including broadcast services.

The period from 1970 to 1990s, the Asian countries with wide land masses or "fragmented" with many islands such as India and Indonesia respectively started employing the satellite platform. South American countries such as Mexico and Brazil, and

others such as Pakistan fall into this category. In the last two decades including the current, first satellite launches record at 13 satellites for the period of 1990 until 2000, and to seven satellites for the period of 2000 until 2010.



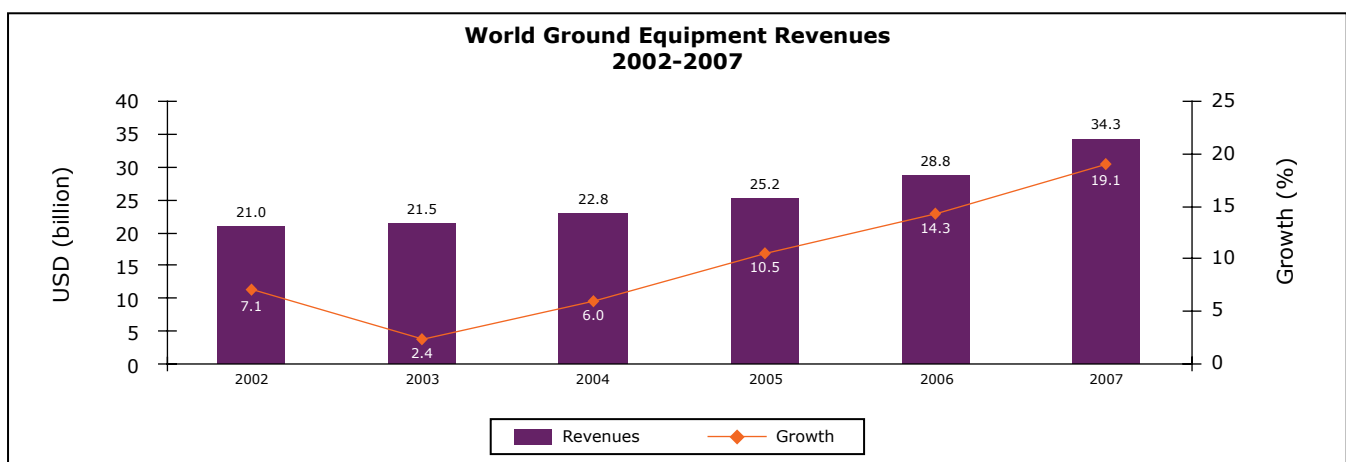


Source: Various websites

Ground Equipment Segment

Ground equipment segment continues as the second largest segment of the satellite industry, with revenue of USD34.3 billion in 2007, up 19.1% from 2006. The growth in revenues comes mostly from the consumer equipment sector. For example, price of hardware such as satellite TV and radio receivers increasing as more applications and services are added in package.

The number of end-user terminals grew 15% in 2007, primarily in broadband segment in the US in 2006 and 2007. Mobile satellite TV is currently offered only in Korea and Japan, although service is pending in the US and Europe.



Note: Includes - Gateways, Network Operations Centers (NOCs), Satellite News Gathering (SNG) equipment, flyaway antennas, and Very Small Aperture Terminals (VSATs); and Consumer Equipment — Satellite TV dishes, satellite radios, satellite phones, and select GPS devices

Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008

Terminals in Service	2006	2007	Annual Growth (%)
Satellite TV	88,737,915	100,507,651	13
Satellite Radio	1,773,729	1,833,126	3
Mobile Satellite Services	14,152,212	18,022,951	27
Mobile Satellite TV	565,300	683,700	21
End-User Broadband	750,000	950,000	27

Note: For consumer services, terminal number estimates are based on reported subscriber numbers

Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008

Satellite radio interference causes satellite operators millions of losses a year. Interference is reported to most commonly come from satellite newsgathering trucks, VSAT networks, satellite Internet services and also from faulty ground equipment. Satellite system should be entrusted highly to trained personnel. Interference can be caused by equipment malfunction, human error, an adjacent satellite, cross polarisation and terrestrial services.

Companies are entrusted also to train their staff and be aware of the requirements necessary to reduce interference. The Satellite Users Interference Reduction Group (SUIRG) represents both the private and public sector to solve increasing problems of satellite RF interference.

Antennas

The design of antennas for satellite applications differs from other applications. A satellite antenna must be designed to withstand the dynamic mechanical and thermal stress. Design constraints are imposed by the satellite size, shape, and weight.

A satellite antenna can provide the communication link not only between stations on earth but also between antennas from other satellites. The signal is beamed into space by an uplink antenna,

electronically processed onboard the satellite, sent back to earth using the downlink antenna, received by the earth station antenna and processed by the electronic receiver.

Antennas from input and output ports to the satellite communications systems are divided into space segment and ground segment. A spacecraft with onboard communications equipment in conjunction with a Telemetry, Tracking, and Telecommand (TT&C) earth station forms the space segment, whereas the hub or gateway station and a number of other types of earth stations form the ground segment. The types of antennas used in satellite systems depend on a number of factors, which to a large extent, are related to the distance between the satellite and the earth (the satellite position either in LEO, MEO or GEO).

Amplifiers

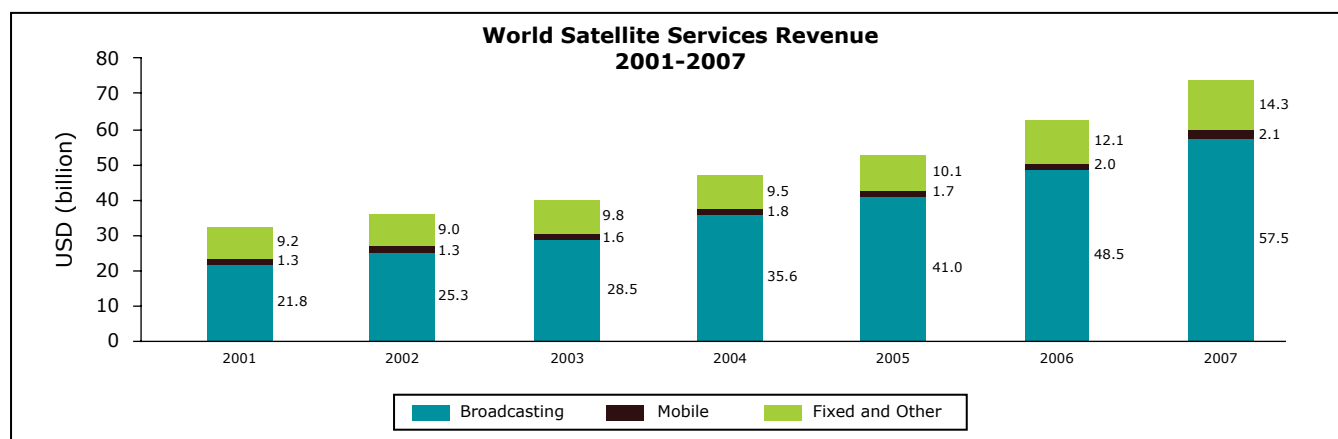
Amplifiers play an important role in satellite communications as well as terrestrial applications. It is for internal use and powered by voltage from the receiver. In other words, a High Power Amplifier (HPA) is used to amplify a signal before it is transmitted to the satellite. There are various means of doing this and the type of amplifier chosen depends on factors such as linearity, efficiency, reliability and cost.

Purpose of Satellite Amplifiers	Two Types of Amplifier
1. To counteract losses in a long cable.	1. The low-noise masthead amplifier which can boost the faint signal from an aerial while adding the minimum amount of unwanted electrical "noise". This type is normally installed on the aerial mast or in the roof space close to the aerial. 2. The "Set-Back" amplifier which is used to boost the fairly strong RF signal from receiver to another TV set.
2. To allow user to split the signal without incurring losses.	
3. To get the signal level above the tuner "threshold" without swamping it with analogue signal.	

Source: www.satcure.co.uk

Satellite Services Segment

In 2007, the satellite services revenue worldwide totalled USD55.4 billion, with 75% contribution from satellite television and Direct Broadcast Satellite (DBS). Revenue growth in 2007 was 18% from USD46.9 billion in 2006. Satellite television overall saw more subscribers¹⁰ - up 13% from 2006, to surpass 100 million subscribers globally. The Fixed Satellite Services sector revenue also includes transponder agreement revenues which continue to grow in 2007.



Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008

	Revenue (USD billion)						
	2001	2002	2003	2004	2005	2006	2007
Broadcasting	21.8	25.3	28.5	35.6	41.0	48.5	57.5
-satellite Radio (DARS)	0	0	0.1	0.3	0.8	1.6	2.1
-satellite TV (DBS/DTH)	21.8	25.3	28.4	35.3	40.2	46.9	55.4
Mobile*	1.3	1.3	1.6	1.8	1.7	2.0	2.1
Fixed and Other**	9.2	9.0	9.8	9.5	10.1	12.1	14.3
-End-User Broadband	0.3	0.2	0.3	0.2	0.3	0.3	50.4
Total	32.3	35.6	39.9	46.9	52.8	62.6	73.9

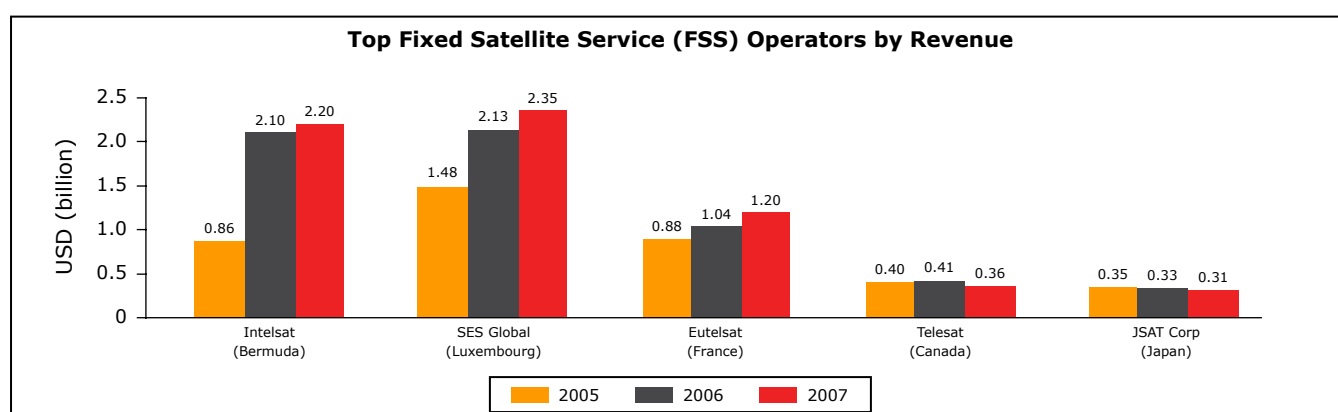
*Mobile Satellite Services: telephony and data

** Fixed Satellite Services/Other: Transponder agreements, network management services; Remote Sensing and end-user broadband

Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008

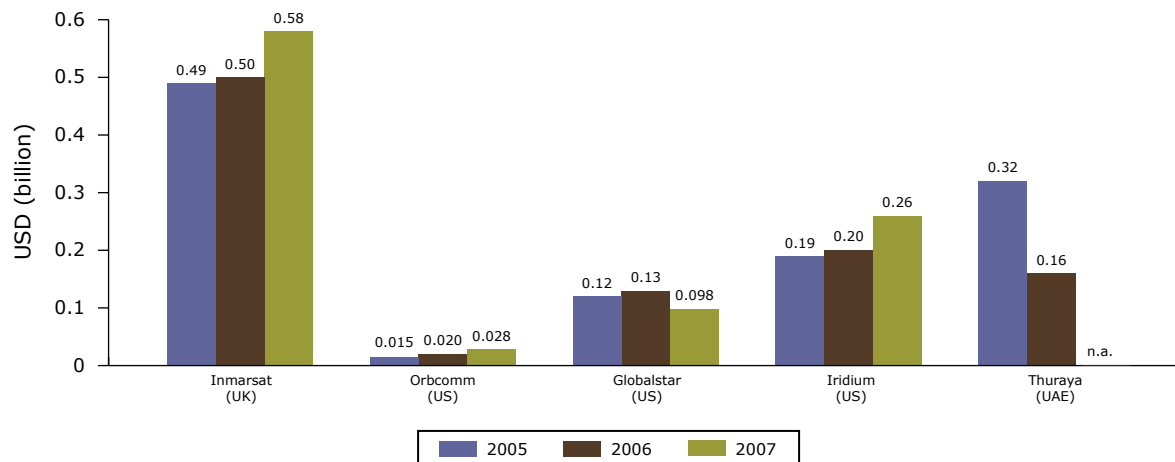
Top Satellite Service Operators

Based on an analysis on company financial reports, the top FSS operator in 2007 by revenue is SES Global with USD2.35 billion in 2007, top in MSS is Inmarsat charting revenue of USD0.58 billion, and top in BSS operator is DirectTV group of US, with USD17.2 billion.



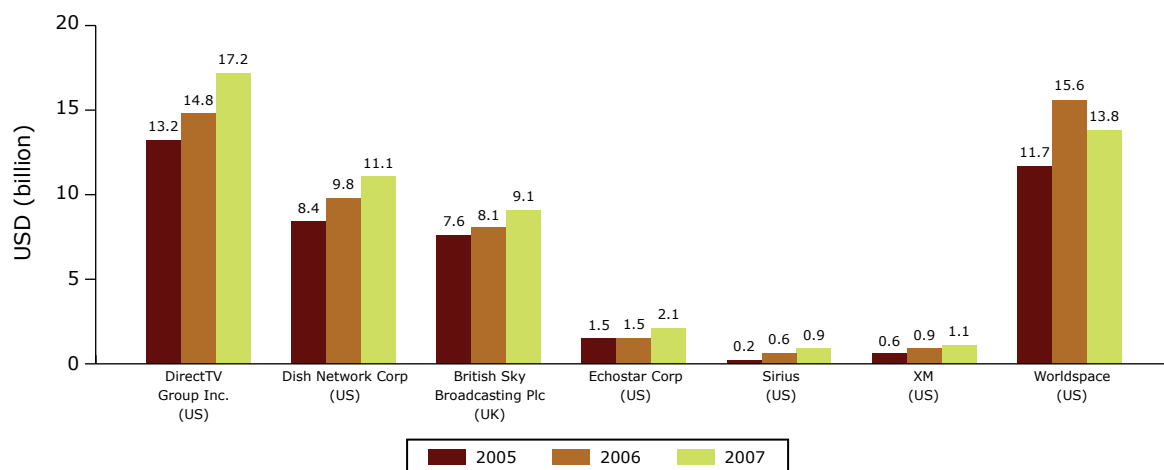
Source: Company annual reports or accounts

¹⁰ Futron Corporation

Top Mobile Satellite Service (MSS) Operators by Revenue

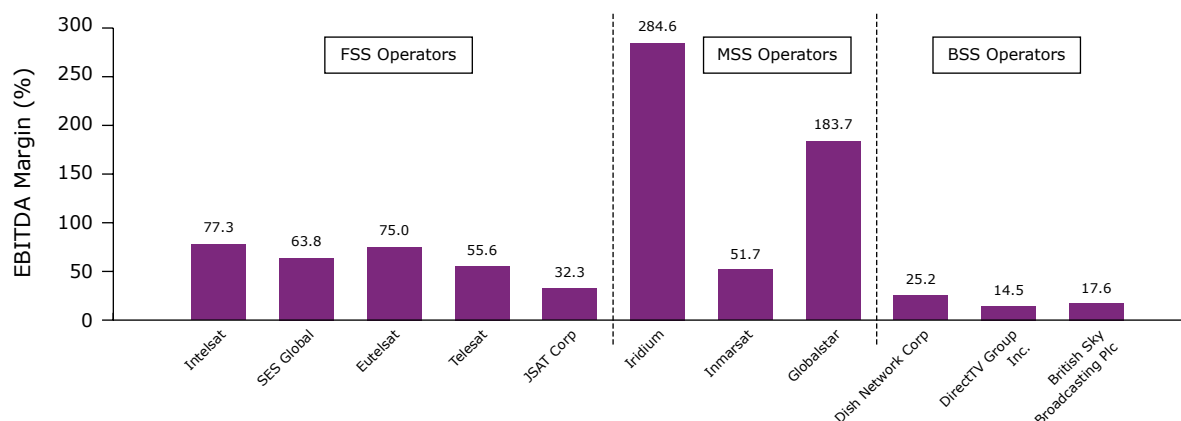
n.a. not available

Source: Company annual reports or accounts

Top Broadcasting Satellite Service (BSS) Operators by Revenue

Note: XM and Sirius merged in 2008

Source: Company annual reports or accounts

Top Satellite Service Operators - FSS, MSS, BSS EBITDA Margin 2007

EBITDA Margin is EBITDA as a percentage, where total EBITDA divided by total revenue.

Note: Only operators with positive EBITDA margin included. EBITDA margin for JSAT Corporation for year ended March, 2006.

Source: Company annual reports

FIXED SATELLITE SERVICES (FSS)

FSS is a radio communication service between earth stations at given positions when one or more satellites are used¹¹ usually located at GEO orbit. FSS markets ride on the applications of video and military markets, and the growing demand for mobile cellular backhaul. Areas with limited terrestrial infrastructure and demand for higher bandwidth mobile wireless services in many markets drive wireless backhaul via satellite. Industry analysts expect the cellular backhaul via satellite market to grow at a Compound Annual Growth Rate (CAGR) of 8.4% between 2006 and 2011.

Cellular Backhaul via Satellite Deals 2007

Satellite and Technologies Companies	Cellular GSM/CDMA company	Location/Country
1. Sat GE	PT Telkom	Indonesia
2. Intelsat	MSTelcom	Angola & Safaricom in Kenya
3. Gilat Satellite Networks	Vivo	Brazil
4. Hughes Networks Services, with Eutelsat	Telma	Madagascar
5. ProtoStar anchor-customer lease agreement for PlanetSky, ViaSat Inc. and Verso Technologies backhaul system	Telikom PNG Ltd	Papua New Guinea

Source: NSR Research and Consulting Company

Trend in 2008

With up to 20 units of satellite to be launched, FSS industry in 2008 is expected to be active. This is due to newcomers from Angola and New Zealand acquiring their first communications satellite; and established operators, namely Intelsat, SES, and Eutelsat to launch replacements for aging satellites in-orbit and to open new orbital slots. Others like ABS, Nilesat, MEASAT, Quetzat, SES New Skies and Eutelsat are also expected to make such expansions in 2008.

From Crisis to Moderate Growth

Launches and satellite failure do happen and the FSS segment faced crisis as a result of failed launches such as Russia's Soyuz U on 15 October 2002 and Ariane 5ECA on 11 December 2002. This results in exceptional operating expenses, expensive

replacements and setback time. Optimistically, new technology called Telemetry Prognostics by Failure Analysis can predict malfunction or failures before they take place.

Despite such setbacks, the FSS segment managed moderate growth on back of strong economic growth in many regions enabling increased satellite demand. Innovations will further strengthen satellite offerings and dramatically improve efficiency of the service. DVB-S2 with Adaptive Coding and Modulation (ACM) is one advancement; providing efficient coding and data rates utilisation. By March 2008, Hughes Network Systems (HNS) reported having shipped more than 400,000 satellite VSAT terminals with DVB-S2 and ACM capabilities. Viasat and iDirect, among others, have reported active deployment for DVB-S2.

Mergers and Acquisitions

Commercial satellite has come a long way but competition is strong from other technologies such as cable and broadband. Consolidation drives by SES Global, Intelsat, and Loral are deemed an emerging global FSS tripod. Privatisation of FSS companies such as Intelsat and Eutelsat S.A in 2001 sees the FSS segment with three to four truly global FSS operators, complemented by a host of regional players, especially in Asia. Overall, the mergers and joint ventures have improved flexibility and market access for the operators, including sale and application of capacity at C and Ku bands.



¹¹ Fixed Satellite Services (FSS) as defined by the ITU Radio Regulations- Article 1, Definitions of Radio Services, Section III- Radio services

Mergers and Acquisitions		
Companies	Year	Remarks
BC Partners and Intelsat	Feb 2008	BC Partner completed the acquisition of Intelsat
Loral Space & Communications and Telesat	Oct 2007	Loral Space & Communications and PSP Investments acquired
Intelsat and PanAmSat Holding Corporation	Jul 2006	Telesat Canada, and combined Loral Skynet into the company Intelsat bought PanAmSat to create the world's largest provider of FSS
SES Global and New Skies Satellite (NSS)	Mar 2006	SES Global completed the acquisition of New Skies Satellites (NSS)
Joint Venture and Strategic Partnerships		
Companies	Year	Remarks
Eutelsat and ViaSat	Jan 2008	Eutelsat to collaborate with ViaSat to develop further satellite broadband markets in Europe and the United States
Intelsat and JSAT International	2007	Joint interest resulting in launch of Horizon 2 satellite in December 2007, which increases video and IP-based content distribution for the continental US, the Caribbean and parts of Canada
Intelsat and APT	2005	Agree to market each other's satellite capacity and ground resources in the Asian region including China

Source: SIA, Companies website

Very Small Aperture Terminals (VSATs) FSS into the Future

Satellite VSAT is already popular as a service and getting more so as it continues to offer enterprise and government agencies flexibility and reliable communications solutions, both nationally and internationally. VSAT applications include point of sale, file distribution, database access, Internet access and environmental monitoring.

Thanks to an increasing demand for VSAT connections for branch offices of enterprises, demand for Virtual Private Network (VPN) for enterprises is growing and increasingly replacing traditional corporate networks. Satellite based VPN provides a company with cost-effective communication by utilising the shared infrastructure of public Internet VPN.

The year 2008 will be especially important for the FSS industry, with 17 to 20 units of satellite to launch. Out of these, three are the first satellites for Protostar which are backed by private investors, VINASAT-1 from Vietnam and Venesat from Venezuela.

In 2007, the combined revenue of 38 FSS companies totalled USD8.5 billion. This is concentrated at the top four FSS operators which are Intelsat, SES, Eutelsat and Telesat generating 70% of total revenues¹². Overall demand for FSS capacity¹³ increases by almost 6% a year from 2006-2015, with the largest demand growth for satellite capacity to come from consumer-oriented services, broadcasting and network communication services.

BROADCASTING SATELLITE SERVICES (BSS)

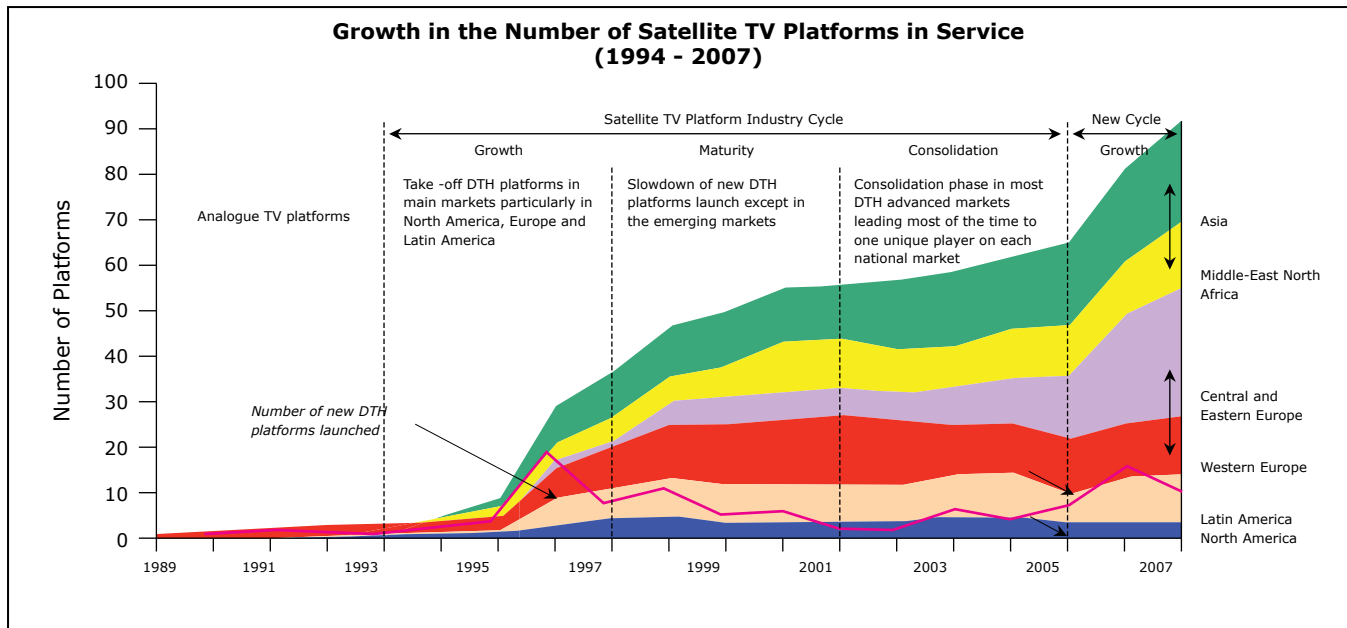
Broadcasting started as a satellite application in 1960s when AT&T satellite Telstar transmitted live TV pictures between the US and Europe. Over the years, the power and bandwidth available from spacecraft increased considerably to allow the use of simpler, more compact and cheaper earth stations¹⁴. This development facilitates satellite services such as TV newsgathering; deployment of TV Receive Only (TVRO) antennas at broadcasters' premises; and VSATs providing access to small businesses.

¹² "What is ahead in 2008 for the FSS and MSS Industries" by SatMagazine.com, January 2008

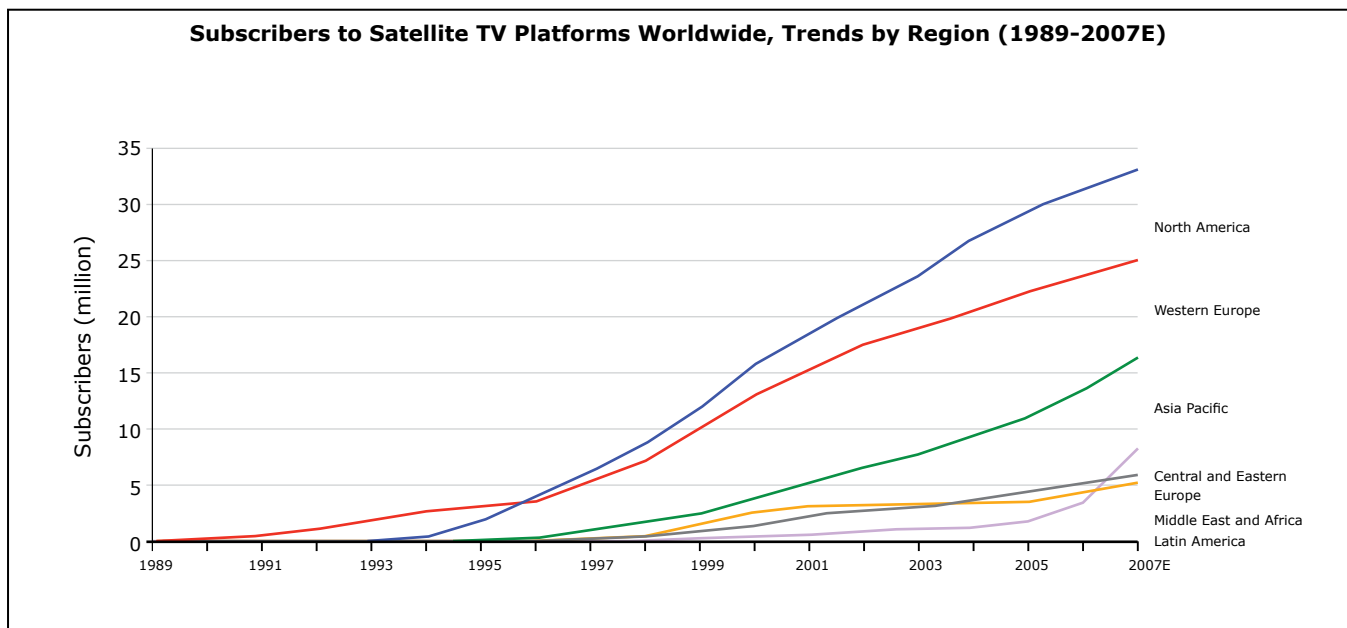
¹³ Futron Corporation forecast

¹⁴ An earth station or ground station is the surface-based (terrestrial) end of a communications link to an object in outer space. It is used to communicate with communications satellites, and is called satellite earth stations or teleports. Where the communications link is used mainly to carry telemetry or must follow a satellite not in geostationary orbit, the earth station is often referred to as a tracking station.

Satellite TV Platforms



Source: Euroconsult



Source: Euroconsult

Tailoring the satellite business model to measurable demand where revenue flows are matched to the finite lifespan of a satellite is best seen in satellite-delivered TV¹⁵. The satellites used are often custom designed for this purpose, with satellite design moderated to changing broadcast needs and requirements. Satellite services revenue from the broadcasting industry saw 18.6% growth in 2007 to USD57.5 billion; outpacing the 2005 growth of 15.2%. Satellite radio portion is small at USD2.1 billion in 2007.

¹⁵ Via Satellite Magazine, May 2008

	Broadcasting Satellite Services (BSS) Revenue (USD billion)						
	2001	2002	2003	2004	2005	2006	2007
-Satellite Radio (DARS)	0	0	0.1	0.3	0.8	1.6	2.1
-Satellite TV (DBS/DTH)	21.8	25.3	28.4	35.3	40.2	46.9	55.4
Total Revenue	21.8	25.3	28.5	35.6	41.0	48.5	57.5

Source: "State of the Satellite Industry Report" by Satellite Industry Association (SIA) and Futron Corporation, June 2008

There are 92 TV platforms currently in service covering more than 100 countries, with 80 national TV platforms and seven regional platforms primarily in the Middle East, Africa, Central and Eastern Europe and Latin America. DTH now reaches 95 million homes with current excess of 1,000 TV channels. Industry observers see DTH audience doubling subscriber base to 180 million by 2017.

As DTH services grow quickly in many parts of the world, High Definition TV (HDTV) is seen as a driver for broadcast satellite services and a prime market differentiator for keeping existing customers and gain new ones. Reports indicated HDTV channels via satellite worldwide grew 150% from 2006 to May 2008; growth of 350% is forecasted for 2013. Majority of the countries worldwide have satellite TV platform as their sole digital delivery providers.

Regarding satellite as the most cost effective way of delivering digital TV, cost of Set-Top-Boxes (STBs) dropped by more than 80% in the last six years. The emerging markets of India, Central Europe and Latin America and the Chinese market are expected to boost the industry further.

Internet Protocol Television (IPTV)

Apart from entertainment, IPTV has other uses. For example, SatEd which focuses on distance learning in Asia and Africa uses IPTV to deliver educational content to remote areas. International Telecommunication Union (ITU) has recently announced the first global standard for IPTV developed by the Focus Group on IPTV (FG IPTV). Standards for IPTV are crucial to tap market potential and global audience. Vendors such as Cisco are delivering IPTV solutions by a variety of next-generation video services like interactivity, time-shifted video, video on demand, networked-based Personal Video Recording (nPVR) and targeted ad insertion.

Satellite Radio

XM and Sirius satellite radio launched services in 2000. Satellite radio offers uninterrupted, near CD-quality music beamed to radio from space. In February 2007, XM Radio and Sirius Radio announced plans to merge into a single satellite radio company due to financial constraints. This is expected to lead to lower prices and more programming choices for consumers. There are eight million subscribers to XM Radio and six million tuning in to Sirius Radio. WORLDSPACE satellite radio, also one of the world leading satellite-based digital radios, recently secured additional financing to launch its European mobile service in the Italian market and business development activities in others.

Next Generation Radio

Car manufacturers have installed satellite radio receiver for a few years now. Several models of portable satellite radio receivers come from a variety of electronics companies. For example in Europe, car drivers can experience digital satellite radio in their vehicles. The anticipated demand is reflected from a collaboration effort between a car manufacturer and digital satellite-based provider. Therefore, high quality radio broadcast, multilingual radio, music, video data and telematics services are directly sent to consumers in their automobiles, trucks, homes and offices as well as their mobile devices. What sets it apart from the conventional radio is the system design allowing users continuous coverage wherever they take their cars in Europe. Also, commercial advertising is removed, giving users freedom to enjoy different kinds of channel and content to customised programming.

Digital Cinema

Digital cinema is a new approach to making and showing movies using bits and bytes to record, transmit and replay images, rather than using chemicals on film. The main advantage of digital technology is that it can store, transmit and retrieve a huge amount of information exactly as it was originally recorded. The final movie can be distributed via hard drives, Digital Versatile Disc (DVD) or satellite and projected using a digital projector instead of a conventional film projector. Satellite coverage is already available and can assure the establishment of a world-wide content distribution network.

Bollywood is aggressively opting for a digital roll-out, due to digital cinema offering effective curbing of piracy versus traditional cinema delivery, where a movie is most likely to be pirated when its celluloid prints are in transit. US-based Hughes Network Systems is working with film makers in Bollywood to transfer film to a digital medium, which is then beamed via satellite or cable to all the theaters at once. This reduces distribution costs; ensures movie transmitted as encrypted data, and decrypted at the projection system itself and is therefore protected. Other global players include French electronics giant Thomson, tied up with Videsh Sanchar Nigam

Limited (VSNL), an Indian telecom company, to offer end-to-end solutions for digital cinema, including distribution of films through satellite as well as digital rights management of films.

Newsgathering

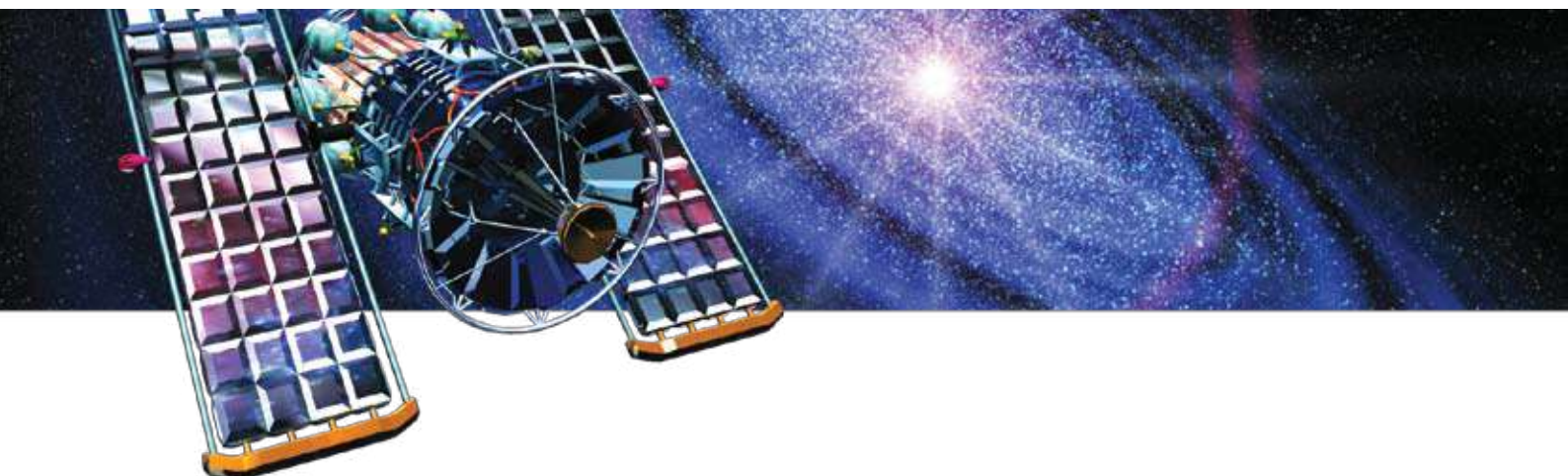
Today, newsgathering via satellite is providing freedom for journalists and broadcasters to provide feeds not from a live camera or play out from a tape but through using sophisticated mobile facilities that provide much more than real time TV contribution.

The equipment used to broadcast reports back to the newsroom is smaller, lighter, portable and meets International Air Transport Association (IATA) baggage restrictions. Satellite dishes made from carbon fibre can be dismantled to small pieces and loaded into flight cases for stress free transportation. Antenna also aligns automatically with the satellite reducing the need for highly skilled operator. The equipment is reliable, flexible, and may be used in a certain location or mounted onto a vehicle. Satellite providers offering Satellite Newsgathering (SNG) products are mostly those broadcasters dedicated to minute-by-minute coverage of breaking news.

MOBILE SATELLITE SERVICES (MSS)

Mobile Satellite Services (MSS) is telecommunication services delivered via satellite to or from mobile intermediate or end users using portable terminals. MSS terminals are moveable and can be mounted on a ship, an airplane, an automobile or even be carried by an individual as a hand-held device pack.

MSS extends mobile communications beyond the range of constraints of terrestrial based wireless systems that allows mobile-to-fixed and mobile-to-mobile voice and data communications worldwide. It can be used in remote areas where wired network does not exist to serve public safety needs where terrestrial lines and portable radios are unavailable or became ineffective during emergency situations.

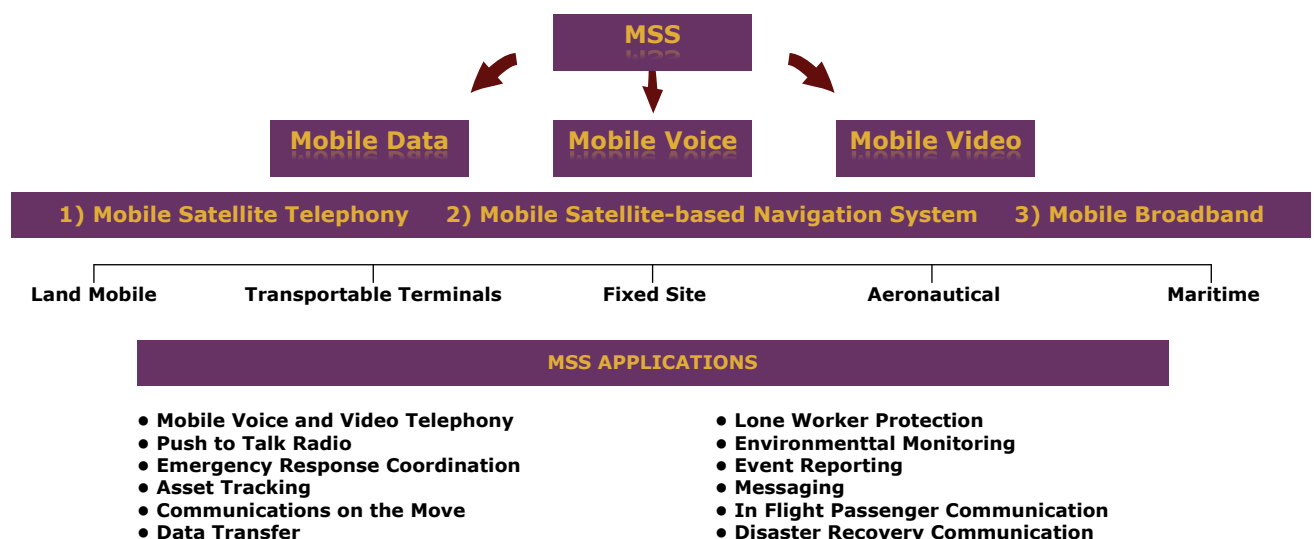


The recent China earthquake indicated the need for unfixed terminals to stay connected in a catastrophe. In Malaysia, satellite-based technologies have long waited to compete with other type of connections, especially in rural areas where Internet access or telephone connection does not reach. MSS is expected to fill the gaps in wireless voice telephony and complement existing terrestrial wireless, while some of them will compete directly with existing terrestrial services. However, it is not deniable that MSS needs further advancement before it can compete with wired services.

MSS existing services include voice, video, low and high speed data, fax and paging. The most promising application is portable satellite telephones enabling phone service anywhere on the globe. However, such portable satellite telephones cannot compare with terrestrial cellular phones in the mainstream market. Although MSS systems can offer capabilities that are not available from terrestrial networks, they do have limitations that include high airtime costs, latency, line-of-sight requirement and lack of interoperability.

Benefits of MSS	Limitations of MSS
<p>Relatively Small – Unlike the conventional satellite system, MSS terminal can be in a size of a laptop.</p> <p>Easily Transportable – Not only because of its size, the idea of MSS is to have a satellite terminal that can be easily moveable.</p> <p>Terrain Independence – MSS can provide communications in areas where terrestrial networks are not available.</p> <p>Access Diversity – Satellite network can access terrestrial based communications network via geographically gateways.</p>	<p>High Airtime Costs – Mobile satellite services comparatively are more expensive than non-satellite based services. This may be due to the cost of launching and setting up a satellite system and the market for MSS is still short of demand from end-user.</p> <p>Latency – Because of the distance involved it usually takes up to one second for a signal to travel from earth to satellite and return. However, MSS companies are trying to solve this matter.</p> <p>Line-of-Sight Requirement – MSS services, be it a handheld devices or small terminals, require the user to maintain line-of-sight with the satellite to have a successful and quality communication.</p> <p>Lack of interoperability – Ordinarily, satellite phone users require the same type of satellite phones in entire group to communicate properly.</p>

Source : Various Websites



Source : Various Sources

MSS Applications

Overall, the MSS applications cover mobile satellite telephony, mobile satellite-based navigation system and mobile satellite broadband.

Mobile Satellite Telephony



Initially satellite phones are used by military and government only. Most private end-users avoid satellite phones since MSS handsets generally do not work indoors.

Satellite phone pose high cost, ranging from USD700 and above and expensive pulse rate which starts from USD0.99 cents. The gap in attractiveness between satellite phone and cellular phone increased in late 1990s, when cellular phone also provided options to surf the net, play music and exchange photos.

The US Federal Communications Commission (FCC) granting use of Ancillary Terrestrial Component (ATC) improves the satellite phone market as the phone can work in ATC or terrestrial mode in vehicle and in satellite mode elsewhere. Despite this, the MSS market face limitation in coverage. Only small increment in demand is expected since users are happy with single mode satellite phones and will

keep another terrestrial-based phone for daily usage.

As for satellite-based aeronautical communications, FCC has declined to lift the ban on in-flight phone use, to avoid further objection from passengers, requesting airlines to focus on satellite broadband for Internet access services for laptops and blackberry. Jet and government aircrafts will still be the largest user of satellite phone besides laboratories and construction factories which are located in the middle of desert like in Iraq or Pakistan.

In Malaysia, satellite phones are used similarly like in overseas, either for emergency or to stay connected when located in places beyond terrestrial network. As for now, satellite phones are used in different ways under different conditions compared to their cellular counterparts.

Portable Satellite Phone	Terrestrial Cellular Phone
Coverage in rural areas	Coverage limited to transmission tower coverage
Rely on mostly LEO's orbit satellite	Rely on Transmission tower
Newly launched Mobile Packet Data Services (MPDS) – subscriber pay as per usage- to overcome high cost	Prepaid and Post-paid
Hard to get signals if in building / in vehicle	Get signals in big cities but cannot make calls from sea or desert
Expensive – lowest price at USD700 and USD0.99 cents per pulse rate	Most operators only charge around USD0.10 cents to USD0.35 cents
Reaching to more than a million	3.3 billion users with 49% penetration rate

Source: ITU, Inmarsat Corp, Stratos Global Corp

Satellite-Based Navigation System



The usage of navigation devices is becoming increasingly popular and reaching near necessity. Recent analyses by experts see the global market for Global Positioning System (GPS) to rise above USD22 billion by 2008. Factors boosting the satellite navigation industry include lower prices, and more applications.

Factors Affecting Growth in Navigation Services System Market	
Popularity of navigation devices worldwide	Declining Prices of cost of components and end products
Availability	Wider coverage
Supporting software availability	Low barrier for companies to enter the market
Interoperability between GPS, Global Orbiting Navigation Satellite System (GLONASS) and upcoming GALILEO	Maturing Technology in Integrated Circuits (IC) and other components

Source: Various websites

Currently, Japan has the highest in-vehicle navigation system penetration followed by North American and European countries. Prices are expected to drop in the commercial telematics market as China global shipment of portable GPS is projected to grow to 40% or 12.3 million units; contributed by an increase in domestic demand. With this development of navigation market in countries like China and India, majority of navigation systems are anticipated to be shipped in Asia Pacific by 2012. It is expected that mobile phones and portable GPS will continue to converge with an estimated 20 million navigation enabled mobile phones shipped worldwide in 2007.

GALILEO, the latest European navigation programme is likely to be fully operational in 2013; to combine all GPS and European Geostationary Navigation Overlay Service (EGNOS) functions and thus the availability of use without geographical limits. From an economic perspective, GALILEO is expected to yield at least tens of billions of Euros in its first 15 years of operation from equipment sales and services.

Leading the Asia market, China Satellite Navigation System which is planned for 2010 will add to the current navigation constellation namely, US GPS, Russian GLONASS and European GALILEO. China's Beidou aims to be covering all of Asia with its five satellites in GEO and 30 satellites in MEO. In Malaysia, Frost & Sullivan sees the Malaysian market for navigation system having low penetration but has high potential in the long term.

Important Figures in Navigation System Market (Forecast for 2008)

Global GPS Market -USD22 billion	Asia Market: Global Shipment for GPS, Taiwan leads with 19 million. China at second place with 12.3 million
Global shipment for navigation enabled mobile phones – 20 million	One in 71 cars has navigation system in Malaysia

Source: Various websites

Mobile Satellite Broadband



Broadband Global Area Network (BGAN), introduced by Inmarsat at the end of 2005, and widely called as BGAN is the latest mobile satellite communication serve to provide broadband access for those whose jobs take them to remote locations. It is a portable device and so far, most advanced commercial communication satellite launched, aimed to deliver services at speed up to half megabit in a highly compact, easy to use form and affordable terminal.

BGAN makes it possible for users to connect their laptop to the Internet at speed up to 492Kbps anywhere and anytime. It supports IP services as well as circuit-switched and Integrated Services Digital Network (ISDN).

BGAN Competitive Advantages

Global Coverage – accessible in Europe, Africa, the middle East, Asia, North and South America	Highly Compact – BGAN terminals are compact, lightweight and can be carried as easily as laptops
Simultaneous voice and Broadband data – BGAN device allows an access to internet and make calls at the same time	Ease of use – BGAN is designed for simplicity and needs no technical expertise to set up; connects directly to satellite
Flexibility – Supports the latest IP services as well as traditional circuit-switched voice and data	Completely Secure – BGAN supports all major Virtual Private Network and today's complicated encryption standards

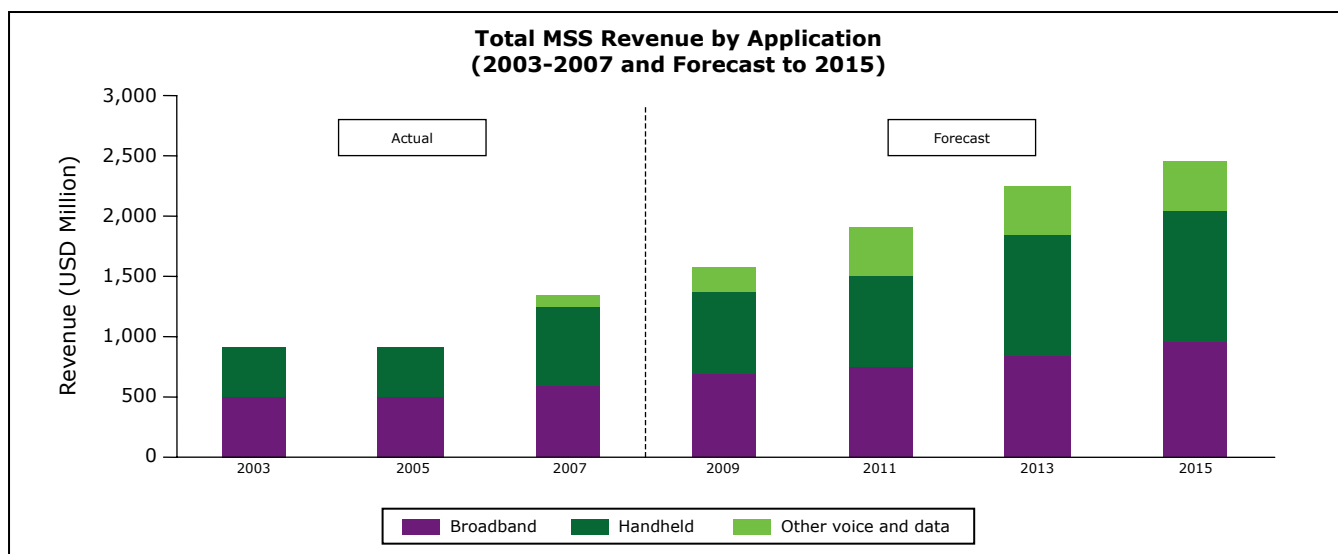
Source: Inmarsat, April 2007

Although satellite-based broadband in Malaysia has started to give Malaysians an idea about connecting to Internet by using satellite broadband services, it is still not common to see someone with a mobile terminal like BGAN portable terminal. With drivers from overseas' development in this field, mobile satellite broadband can finally take up and perhaps, more local companies will take part in this sector in the next few years.

Overview of MSS Segment

MSS segment has shown a growth and is acknowledged as a segment with a role to play in the future of communications, especially in areas where terrestrial telecommunications services cannot reach. Strong increase in demand from government and military markets due to activities in the Middle East and as a communication for emergency relief after hurricane Katrina, Tsunami and earthquake in Asia has propelled the segment market to rebound.

World MSS revenue posted an increase to USD2.1 billion in 2007 from USD2 billion in 2006. With an increase in demand for MSS in all major segments, over 2.8 million MSS terminals are expected to be deployed globally by 2016, compared to only 1.06 million in 2006¹⁶. The revenue for leading MSS operators with satellites in orbit grew from USD1,067 million in 2006 to approximately USD1,207 million in 2007; posting an increase of 13%.

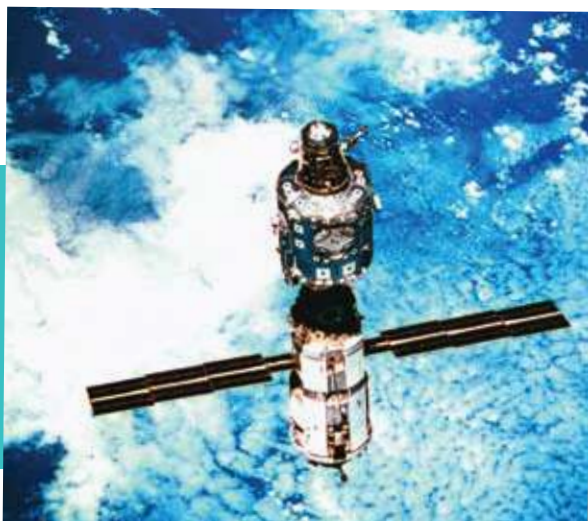


Note: These figures exclude Orbcomm and ATC

Source: Euroconsult 2007

Data applications were the main source of growth in 2007 with higher speed data services from the new BGAN, FleetBroadband and SwiftBroadband. The number of handheld MSS phones in use increased by around 50,000 in 2006 reaching 600,000 at the end of 2007. Many industry experts estimate that

revenues from handheld services may remain flat during 2008, at only around USD350 million as subscribers in North America may prefer to wait for cheaper handheld services which are expected to be launched some time in 2008 or early 2009.



Industry players see revenue in MSS sector can always boost up whenever there is an event that can bring the 'special effect' as what happened in 2005 such as the tragic year of hurricane Katrina. However, increased competition in the handset market coupled with expanded terrestrial cellular footprints in some part of the world is forcing MSS companies to re-examine their business strategies. All major players in the industry are currently preparing for MSS customers' shifting usage patterns due to unexpected events that require mobile satellite communications services.

¹⁶ These figures exclude ATC and Orbcomm, the latter with 225,000 low bit rate terminals installed in 2006

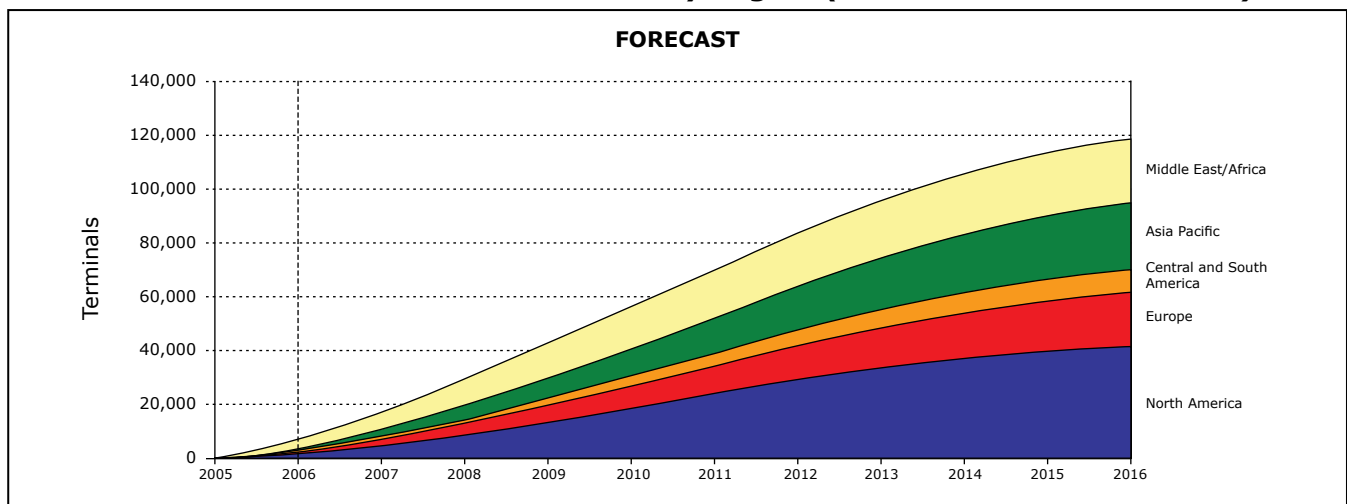
EMERGING SATELLITE SERVICES

New Emerging Market Segment for MSS Broadband

When Fleetbroadband was introduced in September 2007 and followed by Swift 64 in October 2007, it is becoming clearer that maritime and aeronautical broadband markets are the major drivers for future growth. Industry analysts predict that revenue from those sectors will grow from USD120 million in 2007 to USD640 million in 2013 for aeronautical communication market; and USD530 million in 2007 to USD980 million for maritime broadband. This state of market will drive more mobile satellite broadband terminals to be provisioned by MSS operators.

Malaysia maritime and aeronautical industry can take advantage of this development of new product segment in MSS industry. It not only increases the effectiveness of communications in these respective areas, but also likely has the potential to generate new market segment and demand-supply factors for profitability contribution to the whole communications industry. Nevertheless, most Malaysia's maritime segment has been using Inmarsat mobile satellite services many years ago.

Mobile Satellite Broadband Terminals by Region (2005 and Forecast to 2016)



Source: WGET Conference, Stratos Global Corporation, November 2007

Development in Satellite Communications

Asia Pacific

Inmarsat has stated their plan to address Malaysia's growing demand for satellite communications. Malaysia's mobile satellite communications are estimated to be worth more than RM50 million over the last five years. Singapore Telecommunications Limited (SingTel) has launched the global maritime satellite broadband service in Asia, offering a maritime broadband service with global coverage which is seamless over all major shipping routes worldwide. This is seen as the world's first satellite broadband solution integrated with secure private network.

Europe, Middle East, Africa (EMEA)

The European Commission has proposed to have a single system for selecting mobile satellite services across Europe. Under the proposed system, the Commission would do away with the current 27 mobile satellite services markets and replace them with a single pan-European market, run by up to three operators. If this is going to be adopted, mobile satellite services such as broadband, emergency communications via satellite phone and also mobile-TV are expected to develop throughout Europe under the single selection system starting from 2009.

Earth Observation Systems

Earth observation systems consist of instruments and models designed to measure, monitor and predict the physical, chemical and biological aspects of the Earth system. Buoys floating in the oceans monitor temperature and salinity; meteorological stations and balloons record air quality and rainwater trends; sonar and radar systems estimate fish and bird populations; seismic and Global Positioning System (GPS)¹⁷ stations record movements in the Earth's crust and interior. Some 60-plus high-tech environmental satellites scan the planet from space. These are equipped with powerful computerised models that can generate simulations and forecasts; and the early warning systems issue alerts to vulnerable populations.

Global Earth Observation System of Systems (GEOSS)

GEOSS is being built by the Group on Earth Observations (GEO). It is a step toward addressing the challenges articulated by United Nations Millennium Declaration and the 2002 World Summit on Sustainable Development, including the achievement of the Millennium Development Goals. The purpose of GEOSS is to achieve comprehensive, coordinated and sustained observations of the Earth system, in order to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behavior of the Earth system.

The satellite industry is expected to benefit from the increasing activities arising from concerns of global warming and earth conservation in green environment movements all around the world.

Global Monitoring for Environment and Security (GMES)

GMES is a joint initiative from the European Space Agency and the European Commission providing information services regarding the environment and security. GMES will be based on observation data received from Earth Observation satellites and ground based information that is coordinated, analysed and prepared for end-users. Through GMES, the state of our environment and its short term, medium and long-term evolution will be monitored to support policy decisions or investments.

GMES is a set of services for European citizens helping to improve their quality of life regarding environment and security. GMES will be built up gradually, starting with a pilot phase which targets the availability of a first set of operational GMES services by 2008 followed by the development of an extended range of services which meet user requirements.

Hybrid Triple Play

Satellite is efficient for delivering large data and video distribution. However, satellite is less cost effective compared to cable modem and Digital Subscriber Line (DSL) for broadband/voice services. This drives an interesting trend to bring both technologies of satellite and terrestrial in one application, which today is termed "hybrid triple play".

The driving principles of hybrid triple play are to take individual strength of both satellite and terrestrial technologies and come out with effective solution for the end user, by using the broadcasting power of satellite for television, and the efficient two-way pipe of copper-based DSL for broadband Internet access and voice¹⁸. This application allows all three services of broadband, TV and telephony to be integrated into a single box in the home for consumers.



¹⁷ The GPS (Global Positioning System) is a "constellation" of 24 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location

¹⁸ As defined by Patrick French of Northern Sky Research (NSR) in *SatMagazine.com*, May 2008

Telcos such as AT&T in US and Telefonica in Latin America have been successful in rolling out triple play services. As exemplified by Orange, France Telecom, the company offers DSL broadband services and recently launched triple play service of broadband access, television and telephony mainly in the city and town centres. Orange faced challenges in term of time constraints, technical issues, investment and infrastructure upgrade but by working with Eutelsat to supply capacity on its Atlantic Bird-3 and Hot Bird satellites, Orange is reported begin broadcasting its Orange TV offered over satellite. This shows that with smart partnership between telcos and satellite providers, end users can receive a variety of high quality entertainment, communications and information services.

Digital Signage

As content becomes digital, the nature of entertainment and marketing also experience explosion of impacts. Digital signage provides consumers with display screen to view as a form of out-of-home advertising installed in public spaces to inform, entertain or advertise to a more targeted audience at specific location at specific time.

Digital signage creates opportunities for advertisers to utilise the medium and reach consumers in ways that traditional advertisements are unable to accomplish. With digital signage, content can be exchanged without effort, provides true mobility without limitation of location, and opportunity to use

visual quality, more diversified content, animations and interactivity to attract customers. However, Internet has become a major threat to digital signage, especially with offerings of DSL, Wireless Fidelity (Wi-Fi) and other broadband services.

Therefore, there is a need to educate public to accept digital signage as a new form of emerging media. Satellite players such as Hughes Network Systems (HNS), Microspace and Mainstream Date have developed broad partnership to help customers find their complete turnkey solutions for tailored digital networks, thus offer opportunities for satellite business.



Digital Signage in Malaysia

Market	Description	Digital Signage – who, where and for what
Retail	Includes grocery and convenience stores, gas stations, drug stores, medical offices, hypermarkets, supermarkets, car dealership, quick-serve and chain restaurants	<ul style="list-style-type: none"> The Kayu Nasi Kandar Restaurant with its very own Kayu Channel Mydin with its very own in-store multimedia TV network; Mydin TV
Banking and Financial Institutions	Includes banks, financial and investment services, and insurance	<ul style="list-style-type: none"> Maybank Group, HSBC Bank Malaysia Bhd and Ambank Bhd build effective digital signage located in their nationwide branches
Entertainment	Includes theatres, cineplex, sport centres, stadium, recreation and leisure centres, and fitness centres.	<ul style="list-style-type: none"> Genting Resorts World Bhd equips First World Plaza with its own customised in-house digital signage Aquaria Kuala Lumpur Convention Centre (KLCC) projected digital signage at the main entrance and three 61-inch plasma screens placed along Aquaria KLCC wall

Source: SatMagazine.com, Click Grafix Sdn Bhd, Various websites

New Developments in Satellite

Clearly, satellite communication has a bright future due to new technologies, with ability to provide broad coverage, mobile services and direct services to consumers. It can also supply cost-effective broadcasting services, together with the ability to provide instantaneous re-deployment of capacity, instantly providing communications infrastructure, and avoid costly, time-consuming trenching operations, leading to overall flexibility and reliability.

On May 2008, tests done by researchers at Swedish firm, Fraunhofer-Gesellschaft, reported a 100-fold increase in the amount of information that can be transported when data is transmitted via laser, compared to radio signals. The experiment has led to suggestion that perhaps in the future, we could see laser broadband satellite services as a viable solution for high-speed data transmitted, covering more than 5,000km in space without any errors.

Comparison of Current and Future System Characteristics for Satellite Communications Systems

System Characteristic	Current	Future
Platform size	Large/Heavy	Smaller/Light Weight
Orbit	Geostationary	LEO and MEO
Constellation	One to Several Satellites	10s to 100s of Satellites
Sat/Sat Connectivity	None (except for TDRSS); Bent-Pipe Operations	Cross Links; On-Board Processing
Complexity	Primarily on Ground	Primarily on Satellite
Protocol layers	Only Layers 1 and 2	All 7 Layers

Source: SatMagazine.com, Click Grafix Sdn Bhd, Various websites

Regulatory Issues and Standards Bodies

Specifically, an Open Skies policy allows service providers to choose any satellite operator or satellite service provider to distribute the specific services to the specific service area(s) required for their end-users (national and international)¹⁹. Countries in Asia on Open Skies policies for their domestic satellite industry are namely Malaysia, Australia, Hong Kong, Indonesia, Japan and Philippines. This opens new avenues for partnerships and alliances to foster optimum profitability for stakeholders and users alike in the communications arena. Nevertheless, short term setbacks include non-consistent competition levels amongst countries with and without the policy, which is a limitation especially for satellite operators in regional positioning for their products and services. Mitigation of this requires co-operation, understanding for mutual benefits and appropriate governmental policies.

Spectrum for satellite communications is a key issue. This scarce resource has to be used in optimum to satisfy requirements of new applications and systems. Cooperation between countries, governments and private sectors is essential to facilitate spectrum utilisation and interference to ensure efficient use of spectrum.

Standard bodies such as European Telecommunications Standards Institute (ETSI) require full participation from satellite players not only in standardisation activities, but also to keep track of new and emerging satellite systems to facilitate the progress of the services, in compliance with existing and planned standards.

SATELLITE COMMUNICATIONS SERVICES IN MALAYSIA

Malaysian Satellites

Malaysia's first regional satellite system called MEASAT (Malaysia East Asia Satellite) is operated by MEASAT Satellite Systems Sendirian Berhad (MSS) and owned by MEASAT Global Berhad (MGB). The MEASAT fleet comprises MEASAT-3, MEASAT-2 and AFRICASAT-1 satellites covering 145 countries or 80% of the world's population across Asia Pacific, Middle East, Europe and Australia. The fleet will be further enhanced in third quarter 2008 with the launch of MEASAT-3a. Working with select media partners including ASTRO, Ascent Media in Singapore and Pacific Century Matrix of Hong Kong, MEASAT provides a complete range of broadcast services including standard definition and high definition video playout, up-linking, fibre and co-location services. MEASAT effectively provides satellite communications services to broadcasters in Asia, DTH platform and telecom operators.

¹⁹ "Market Access Principles and Open Skies Policy" by The European Satellite Operators' Association (ESOA)

MEASAT Satellite Fleet

Satellite	Started Year	Areas Covered	Description
MEASAT-2	14 Nov 1996	East Asia, Eastern Australia, Guam and the mainland United States via Hawaii.	<ul style="list-style-type: none"> - Serves up to four 72MHz C-band and nine 48MHz Ku band transponders. - Provides C-band broadcasting and telecoms services at orbital slot of 148° East.
MEASAT-3	12 Dec 2006 - from the Baikonur Cosmodrome, Kazakhstan	Over 70% of world population in an area bounded by Eastern Europe and Africa in the West, and Japan, Australia and Middle East.	<ul style="list-style-type: none"> - Located at 91.5° East hotspot with the purposes to support the region's top broadcasting and telecommunications companies. - Three high powered C-band designed for specific applications, combine reach and power, while Ku-band provides DTH quality capacity across South Asia, Indonesia and Malaysia.
AFRICASAT-1	Jan 2008	Enables expansion of the MEASAT satellite coverage over Africa.	<ul style="list-style-type: none"> - Provides 12 high powered C-Band transponders, and up to four high powered Ku-Band transponders, over Africa for telecommunications and broadcasting applications at 46° East orbital locations. - Operated from the main MEASAT satellite control facility located in Cyberjaya, just outside of Kuala Lumpur, Malaysia.
MEASAT-3a	To be launched in 2008	Region bounded by Africa and Eastern Europe in the West, through to Japan and Australia in the East.	<ul style="list-style-type: none"> - Provides in-orbit redundancy at the 91.5° East orbital location; additional 12 C-Band transponders in areas covered, with 12 Ku-Band transponders and high powered spot beams focused on Malaysia and Indonesia. - Designed to provide satellite coverage for Direct to Home Video and Data services.

Source: www.measat.com

Government efforts to develop space satellite technologies since a decade ago has resulted in Malaysia's first micro-satellite, TiungSat-1 launched in 2000, which provides Malaysia information on earth resources, land use and environmental haze pollution as well as weather patterns²⁰. In addition to commercial land and weather imaging payloads, the satellite offers FM and FSK amateur radio communication. TiungSat-1 was developed as a collaborative effort between the Malaysian government and Surrey Satellite Technology Limited of UK.

Astronautic Technology (M) Sendirian Berhad (ATSB), wholly-owned by Ministry of Finance Malaysia, has pioneered a successful technology transfer programme starting with TiungSat-1. ATSB has a greater role to play in edging Malaysia efforts to facilitate space science and technology. ATSB's other projects are Tsunami early warning systems, robotic telescope, vigilant systems and dosimeter satellite (an in-house, small spacecraft programme for new engineers to learn about satellites). In moving forward, ATSB is strategically poised to continue support satellite programmes for Malaysia and enhance further its technology transfer role involving both satellite and space related (advanced technology) product development for the nation.

Other Malaysian Satellites

Satellite	Started Year	Areas Covered	Description
TiungSAT-1	26 Sep 2000 - Launched from Baikanor, Kazakhstan	Optimum coverage for the Malaysian region.	<ul style="list-style-type: none"> - Released into its orbit and the communication between the earth's controls systems at the ATSB21 Earth Control Station situated at Universiti Kebangsaan Malaysia (UKM). - Operates at the Earth's lower orbit at an altitude of 650km and inclined at 60 degrees. - Launched with three missions namely; for Earth observations; scientific Cosmic-Ray Energy Deposition Experiment (CEDEX) as well as for simple communication application. - Equipped with a Multi Spectral Earth Imaging Camera system and Meteorological Earth Imaging camera system with a resolution of 72m and 1.2km respectively.

²⁰ ATSB website, news reports

²¹ Astronautic Technology (M) Sendirian Berhad (ATSB) is responsible in developing this first programme.

Other Malaysian Satellites

Satellite	Started Year	Areas Covered	Description
RazakSAT-1	To launch in Sep 2008 - from a US military base in Kwajalein Atoll; in the Pacific	Near equatorial regions.	- Will be operating and orbiting around the ground segment in Malaysia which consists of Mission Control Station (MCS) and Image Receiving and Processing Station (IRPS).

Source: <http://www.atsb.my>, news reports and websites

Malaysian Direct-To-Home (DTH) Services

Asia Pacific DTH Subscription

Country	3Q 06	3Q 07	Growth %
	million		
Australia	1.17	1.35	15.4
India	1.49	2.31	55.0
Indonesia	0.17	0.27	58.8
Japan	3.73	3.66	-1.9
Malaysia	1.94	2.17	11.9
New Zealand	0.67	0.73	9.0
Philippines	0.11	0.12	9.1
South Korea	1.98	2.12	7.1
Thailand	0.40	0.46	15.0

Source: Informa Telecoms & Media

The most visible satellite communications service in Malaysia is the direct to home broadcast services operated by ASTRO. It offers 107 TV channels and Astro-on-Demand. Residential subscriber base is 2.27 million or 40% of Malaysian homes. Indeed, the DTH subscription in Malaysia is considered among the highest in the world in the Ku-Band. Its radio business has 10.6 million listeners over its eight stations each week. ASTRO leases transponder capacity from MEASAT.

Other Satellite-based Communications Services in Malaysia

Examples of satellite-based communications services available in Malaysia are those of Telekom Malaysia Berhad (TM)²², which offer a variety of satellite-based communications services such as global communications services through Inmarsat – offering voice, data, fax and telex services.

Such services are available to the maritime users and land users in any location that require portable, fast and instantaneous communications setup. TM is the point of service activation for Malaysian flagged vessels.

TM Satellite Earth Stations and Teleports

1. Kuantan satellite earth station
2. Cyberjaya satellite earth station
3. Wangsa Maju teleport
4. Melaka teleport
5. Labuan teleport
6. Sabah teleport
7. Sarawak teleport

Comparison of Current and Future System Characteristics for Satellite Communications Systems

Standard	Services	Services Application
Inmarsat A	Voice, Data (64Kbps), fax and Telex	1. Internet and Intranet
Inmarsat B	Voice, Data (64Kbps), fax and Telex	2. E-mail
Inmarsat C	Data (600Bps) and Telex	3. Video conferencing
Inmarsat M	Voice, Data (2.4Kbps) and Fax	4. SCADA and telemetry
Inmarsat mini M	Voice, Data (2.4Kbps) and Fax	5. Large FTP (File transfer)
Inmarsat GAN	Voice, Data (128Kbps), mobile packet data services and fax	6. Store and forward video/audio
Inmarsat BGAN	Voice, Data (500Kbps), mobile packet data services and fax	Services Charges 1. Deposit RM3000 refundable/account 2. Activation fee RM150 per terminal 3. Access fee RM240 per annum 4. Stamp duty RM10 per agreement
Inmarsat Fleet	Voice, Data (128Kbps), mobile packet data services and fax	

Source: <http://www.tm.com.my>

²² <http://www.tm.com.my>

Other TM services via satellite include Very Small Aperture Terminal (VSAT) services; Digital Satellite News Gathering (DSNG), which is the latest technology in the market uplinking news by pumping live telecasts from location, without cable feed or required on short notice, to a satellite earth station; and satellite turnaround services that deliver live or delayed programmes from one region to another.

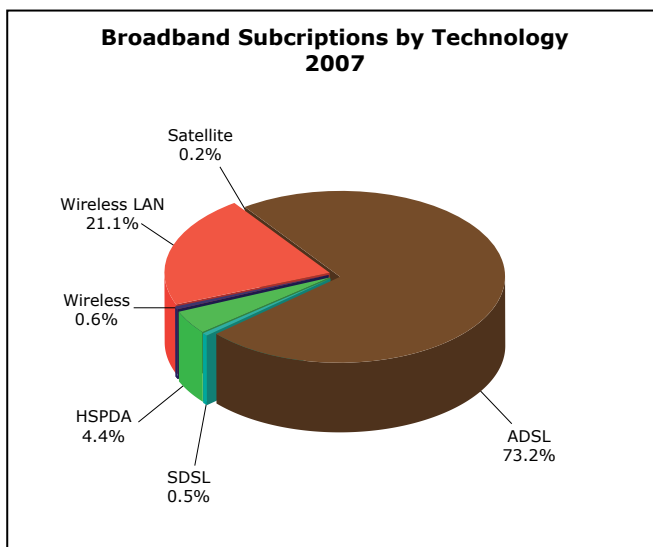
In Malaysia, the VSAT users include government usage; corporate users such as banks, small and medium industries and enterprises, universities, SchoolNet Projects and other private networks like petrol stations. Maxis Communications Berhad has started its own satellite-based broadband that offers customised service to meet various requirements and expectations from users.

Maxis VSAT Broadband Service	
Name	SkyWay™ VSAT
Service Description	Broadband Data and Voice
Users	<ul style="list-style-type: none"> • Corporations with many branches requiring broadband Data and Telephony • Corporations or communities in remote areas without telephone connectivity • Corporations requiring Internet access in rural areas

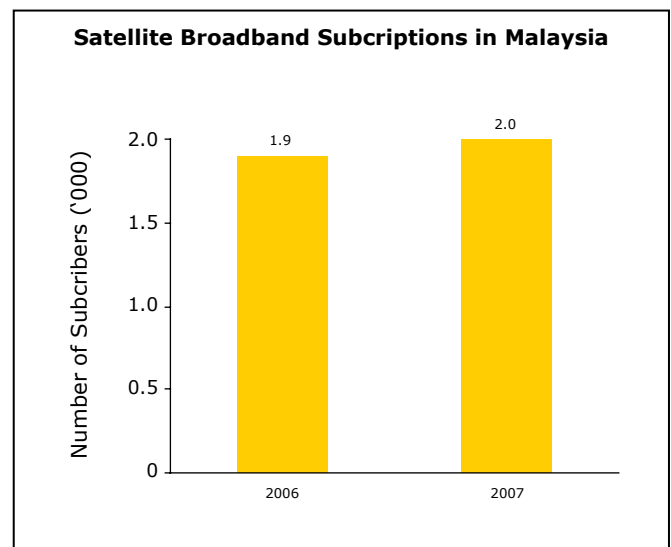
Source : Maxis Communications Berhad

While growth in broadband subscribers in Malaysia increased by 53% to 1.4 million subscribers in 2007, satellite broadband represents only 0.2% of subscribers. Nevertheless, the number of satellite subscribers grew from 1,900 subscribers to 2,000 as at 2007.

E-Government projects can be a big driver to boost adoption of broadband via satellite in Malaysia. An example is the case when SMART Digital Communications Berhad provides two-way satellite broadband to schools throughout the country using space segment on Loral Skynet's Telstar 18 satellites at 138° East.



Source: Industry, SKMM



Source: Industry, SKMM

CONCLUSION

The satellite services segment is a satellite industry growth driver; stimulating consumer demand for new and exclusive content, specifically in the broadcast and mobile sub-segments. As such, existing and new players are creating additional distribution platform to meet the demand of very large marketplaces before other technologies move in.

Satellite providers need to provide reliable service at affordable price to consumer and this has become a major challenge as more investment will be needed to improve the overall network. Recognition of the importance of user centricity in design and provisioning of products and services go a long way to attract and maintain take up and demand for satellite industry.

ACRONYMS

ADSL	Asymmetric Digital Subscriber Line
ASIASAT	Asia Satellite Telecommunications Company Ltd
BER	Bit Error Rate
C/N	Carrier/Noise
CEDEX	Cosmic-Ray Energy Deposition Experiment
DARS	Digital Audio Radio Service
DBS	Direct Broadcast Satellite
DSNG	Digital Satellite News Gathering
DTH	Direct-To-Home
DVB-S2	Digital Video Broadcasting-Satellite-Second Generation
DVD	Digital Versatile Disc
EBITDA	Earning Before Income, Tax, Depreciation and Amortisation
FG IPTV	Focus Group on IPTV
GHz	Gigahertz
hr	hour
I/N	Interference/Noise
IC	Integrated Circuits
IDR	Intermediate Data Rate

IP	Internet Protocol
IPTV	Internet Protocol Television
ISDN	Integrated Services Digital Network
ITN	Independent Television Network
ITV	Independent Television
km	kilometer
LCTDMA	Low-Cost Time Division Multiple
MCS	Mission Control Station
MHz	Megahertz
MPDS	Mobile Packet Data Services
MPEG	Moving Pictures Expert Group
nPVR	networked-based Personal Video Recording
PAL SME	Phase Alternating Line Small & Medium Enterprises
SNG	Satellite Newsgathering
SOHOs	Small Offices/Home Offices
SUIRG	Satellite Users Interference Reduction Group
TVRO	TV Receive Only
VSAT	Very Small Aperture Terminal
VSNL	Videsh Sanchar Nigam Limited

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