Next Generation Broadband Satellite Networks

A Market & Technology Assessment Report

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List of Exhibits
Executive Summary

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Next Generation Broadband Satellite Networks:

A Market & Technology Assessment Report

In this update to 1997's highly regarded ***Satellite Data Networks: The Internet's Next Frontier***, Pioneer Consulting will reassess the satellite data systems market, providing strategic insights into the complex broadband telecommunications marketplace. The major players and their proposed systems will be profiled, the demand for international bandwidth will be forecast, and the impact of new technologies will be determined.

This new report will apply Pioneer's exclusive International Demand Model, the first of its kind to calculate demand generated by Internet, corporate data, and voice traffic, to provide detailed assessments of individual countries and regions and their particular demands for connectivity and capacity. This model, developed through careful quantitative analysis and close collaboration with industry economists and network engineers, was first introduced in Pioneer's submarine cable study, Worldwide Submarine Fiber Optic Systems.

Highlights of the Research Include:

- Impact of the Internet and Web-based Applications on International Bandwidth
- Developments in Broadband Satellite Technology
- Impact of the World trade Organization (WTO) Accords on the International Telecommunications Marketplace
- Profiles of LEOs, MEOs and Ka-Band GEOs, and Assessments of their Viability in the Competitive International Telecoms Market
- Competitive Assessment of Satellite versus DSL, Cable Modems & Terrestrial Broadband Wireless (TBW)
- The Role of ATM in the Satellite Data Systems Markets

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Executive Summary

E-1 Introduction

The broadband satellite market is poised to usher in a new era in telecommunications. Whereas traditional satellite networks have been limited to specialized private VSAT networks, low-bandwidth services and DTH video, newly proposed broadband satellite systems promise to offer service comparable to current broadband terrestrial solutions. The increasing worldwide demand for more bandwidth and Internet access has created an extremely lucrative market for telecommunications system operators and service providers. Banking on the continued growth in the broadband sector, a large number of new and existing satellite operators have proposed ambitious broadband satellite networks utilizing recent advances in satellite technology and spectrum allocation. These proposed broadband satellite networks plan to change the way that users communicate with each other by offering direct broadband satellite access to every potential user for virtually the same price, regardless of location.

During the early 1990s however, satellites were often considered white elephants of the newly emerging digital telecommunications world. Extremely expensive to manufacture and deploy, nearly impossible to repair, costly to manage and severely limited in bandwidth, satellites appeared incapable of supporting new digital services. By 1995, the satellite market had announced a number of high-profile gambits and had taken important steps towards achieving new status in the digital era. Continued satellite development and a trickling investment flow in the late 1990s have allowed the industry to forge ahead with ambitious plans for deployment. Today it is clear satellites will be a player in the digital revolution, and will benefit from such technological advances as emerging digital compression, on-board digital signal processing, fast-packet and ATM switching, narrow spot beams for frequency reuse, multicast technologies and new forms of propulsion and battery power. A satellite's ability to provide communications infrastructure for whole regions and continents virtually overnight gives the industry an advantage over its terrestrial counterparts. The potential to reach areas of low subscriber density without costly construction of terrestrial networks also make satellites a viable competitor in the telecommunications arena. Based on these positive attributes, broadband satellite systems should be able to carve out niche market segments in a number of areas.

Although the apparent strengths of satellite technology seem prime for the broadband market, satellite technology is fraught with a unique set of dangers and uncertainties. Though capable of integrating nearly every advance in digital technology, satellites remain extremely expensive to manufacture, deploy and operate. They require upfront investments in the billions of dollars, without guarantees of revenues or success. Satellite transmission cost is generally more expensive relative to fiber and wireless options. Recent highly publicized launch failures highlight the risk and uncertainty associated with satellite deployment. In

addition, the long planning cycles (5-10 years) run counter to the fast-paced competitive telecommunications marketplace. The submarine fiber optic cable market has been able to diversify because of new entrants' ability to reduce planning cycle times to one year and deployment times to six to eight months. With markets and technology changing so quickly, this kind of flexibility is nearly essential. A broadband satellite system in the development stages today will not be fully operational until 2002-2005. Considering the meteoric rise of high bandwidth applications, it is nearly impossible to say what the telecommunications market will look like in 2005, making judgments difficult on how to design systems. Satellite manufacturers are hedging their bets by designing systems to simply provide digital broadband capacity on demand, for whatever application, rather than specific services. Other concerns in the broadband satellite market include:

- Security: Satellites have always been susceptible to interception. If corporations are expected to transmit their international data networks over satellites, reliable forms of encryption will be essential. Given the international nature of satellite transmissions, standardized forms of strong encryption technology may be difficult to develop.

- On-board switching and processing technology creates services, but also presents important network management issues: With fiber optic networks in place internationally, satellite operators must convince potential customers that their networks are equally reliable. Fiber optic network operators, however, can easily repair broken cables or malfunctioning nodes. Satellite operators must build in redundancy and spares at a high cost.

- The broadband satellite ground station market is in its infancy: Thus, pricing and terminal specs are difficult to determine, making business plans uncertain. Ground stations and terminals have not been standardized, which will keep costs artificially high in the near-term. Terminals are likely to cost close to $1000 per user, but cable modems and xDSL devices are on a declining cost curve, already dropping far below that price point.

- Latency: Utilizing satellites, particularly GEO satellites due to their distance from the Earth, for communications purposes introduces the problem of latency, or delay in transmission. While not a major concern with certain data transmissions, highly interactive voice and video applications are hampered by any delay in signal transmission. Latency is also a major problem for transmitting TCP/IP traffic over satellites.

- Cost: As the demand for high-speed satellite communications increases, the cost, complexity and size of satellites increases as well. New Ka-band technology requires satellites to become more powerful and carry more

technology onboard in order to simultaneously process voice, data and video transmissions. With the future proliferation of extensive LEO broadband constellations and high-powered GEO satellites, satellite operators will be forced to secure large amounts of funding in order to commence operation.

- Capacity: Whereas the fiber optic industry is just scratching the surface in optimizing capacity through multiplexing and other solutions, the limits of satellite capacity are evident. Despite new advances in Ka-band, V-band, and Q-band technology, satellites still lag behind fiber in transmission capacity.

- Demand: It is no secret that the demand for broadband services will continue to rise in the next decade. Based on fierce competition in the fiber optic market, costs are down and demand is up for fiber optic capacity and service. Satellite broadband operators should be able to initially carve out a small niche market for their services, but growth will only occur if costs are kept down and service is comparable to fiber optic cable in areas where both satellites and fiber are present.

- Price of Service: It is unclear how competitive satellite broadband data service providers will be in the long run relative to their fiber counterparts. Pricing will be crucial to the satellite systems, especially as they attempt to compete in areas where fiber, DSL and other broadband networks are already established. Even with the proposed bandwidth on demand and "pay-as-you-use" pricing principles of the proposed systems, it is likely that the cost of service will initially be high for consumers and businesses. However as more competitors enter the market, the price is likely to fall as satellite broadband access providers are forced to cut costs and become more competitive.

- Frequency Issues: The demand for broadband services has necessitated the invention of new frequencies to replace crowded frequency levels at lower bandwidths. However, higher frequencies are more susceptible to noise and interference, thus potentially negating any gain that placement of broadband services on satellites may provide. However, by using high-powered amplifiers to "blast" through the interference, researchers have seen preliminary success in solving this problem in the Ka-band and above.

- Investment: The recent failures of a few high profile systems to gain necessary investment highlights a general skepticism among investors with interests in the satellite market. The high levels of investment needed for future broadband satellite networks may mean that more satellite systems fail in securing the necessary funding for successful operation.

E-2 Global Commercial Satellite Industry Overview

The commercial space industry in total, which includes satellite manufacturing, launch equipment and services, satellite services and ground equipment manufacturing represented a $65.9 billion dollar market in 1998, with $17.6 billion in satellite manufacturing, $7 billion in launch services, $26.2 billion in traditional fixed/mobile/broadcast satellite services and $15.2 billion in ground equipment manufacturing.

The market for satellite services has grown dramatically mainly due to the emergence of DBS as the dominant revenue source. In fact, total DBS revenue represented $8.2 billion in 1998, with US DBS generating the lion's share at $5.2 billion. In 1998, commercial satellite services totaled roughly $26.2 billion, driven by growth in direct-to-home satellite services and increases in the use of fixed satellite services for international Internet backbone capacity.

In 1999, the commercial satellite industry is at a major point of transition in which the advances in digital communications that have driven the deployment of advanced terrestrial networks over the past decade are now being found in space. Satellites for telecommunications services were historically the property of international telecommunications operators and video programmers. Satellites in geosynchronous orbit provided transponder capacity for broadcast and "bent-pipe" communications services that served global telecommunications and video distribution markets. Today, however, improvements in satellite design and technology, coupled with an increasingly competitive global telecommunications market, has opened substantial new markets for satellite players, including digital audio, digital imaging, mobile satellite services, direct-to-home (DTH), Little LEO messaging and broadband multimedia satellite services.

Direct Broadcast Satellite Services

The Direct Broadcast Satellite (DBS) segment of the commercial satellite industry has achieved impressive growth rates since its inception, averaging a 50 percent annual growth rate in subscribers. The U.S. DBS sector performed well in 1998, generating $5.3 billion in revenue from a subscriber base of 10 million households. Hughes and Echostar are the two largest DBS players in the U.S. International DBS operators generated $3 billion in revenue in 1998. DBS services will continue to drive the consumer market over the next five years, thus creating the essential relationships between satellite operators and consumers necessary to grow the satellite data market.

Because the DBS sector has demonstrated such impressive growth, there now exists an opportunity for broadband satellite systems to tap into this large pool of subscribers. By choosing DBS, both businesses and consumers have shown their willingness to accept satellites as the delivery means for their programming and/or data needs. With a base of 10 million DBS households identified in the U.S. alone, broadband satellite operators in the U.S. already have a large target group of potential users to target. Consolidating DVB and data onto one VSAT

may be part of this strategy; voice is also capable of consolidation. The DBS sector will therefore be responsible for making satellite services via small aperture terminals attractive and viable in the consumer market. This responsibility may prove essential to the success of the broadband satellite market in the next decade.

Fixed Multimedia Satellite Services

Fixed multimedia satellite services are just beginning to take hold on the world market. 1998 combined revenue of fixed and broadband multimedia satellite services reached close to $6.7 billion in 1998, a significant increase over the previous year. Mainly provided through a VSAT and a PC/set-top box, fixed multimedia applications mainly include Internet access, telephony, cable and video transmission, private business networks, telemedicine, teleeducation and video conferencing. The Internet has made its presence felt in the fixed satellite services market over the past three years as international operators such as PanAmSat, Intelsat and Loral Orion are providing capacity leases to carriers interconnecting foreign nations to the U.S. Internet backbone. Though these arrangements constitute a traditional leased transponder arrangement, the ability of satellites to support Internet access is setting the stage for future Ka-Band broadband satellites. In 1998, Loral launched its CyberStar service, which uses existing Ku-Band transponder capacity to provide multimedia services directly to subscribers. Hughes has already launched its SkyMedia service, as well as DirecPC and DirecDuo in the U.S. and Europe for consumers and businesses to access its Ku-Band satellites for high-speed Internet downloads. These services require a telephone line return path, making them highly asymmetric, yet they have established an early market entry for mass-market satellite multimedia. The DirecDuo service is particularly important because it establishes the market potential for current DBS providers to market interactive multimedia directly to their existing customers over a similar infrastructure and an already established customer relationship.

Expected consolidations in the multimedia satellite field have taken place, with Motorola announcing full participation in Teledesic. In the new arrangement, Motorola and its partner Matra Marconi will contribute technology and market power in exchange for equity in the Teledesic system. Loral announced it will co-market Alcatel's SkyBridge satellite LEO service with its CyberStar GEO satellite service. Other major players, such as Hughes, SES Astra and Lockheed Martin have made important steps towards gathering the requisite financing for their systems, in spite of troubled economic markets worldwide and wariness among financing markets for satellite systems in recent months.

Multimedia satellite business plans are becoming more viable in 1999. Where systems such as Teledesic were roundly dismissed in early presentations, the global demand for Internet access and multimedia services has made the unique characteristics of broadband satellites much more attractive to investors and potential users. The development of the Internet has helped as well. GEO satellites' inherent broadcast architecture make the application of Internet caching

and multicasting highly attractive to service providers, which are presently dealing with the bottlenecks and growing pains associated with rapid and uneven Internet growth. Satellites relieve congestion throughout internetworks by providing a low-cost means of selectively distributing content to sites closer to end-users. This multicasting capability may emerge as the GEO satellites' "killer application" in the coming decade. For LEO satellite systems such as Teledesic, the challenge is to support and complement terrestrial broadband infrastructure while creating a unique niche for direct user-to-satellite applications and services.

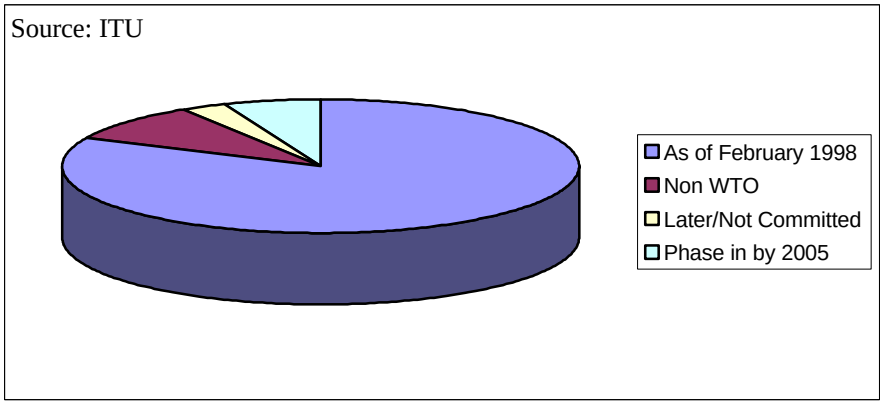
VSAT Networks

Due to the rise of broadband applications, many VSAT companies have shifted their focus from traditional narrowband applications to extensive broadband networks utilizing 2-way VSAT technology. VSATs, which once supported data rates up to 2 Mbps, are being redesigned to support 155 Mbps and above once broadband satellite networks are online. In the process, VSATs are now able to support a wide range of broadband applications, including IP multicasting, LAN/WAN interconnection, voice telephony and videoconferencing. As large broadband satellite systems such as Skybridge, Astrolink and Teledesic commence operation, the need for small terminals will enable VSAT manufacturers to enjoy profits due to increasing demand for terminals. Mass market production of 2-way VSATs will therefore push down costs for end users, enabling more demand for terminals.

Satellite Deregulation Efforts

The proliferation of global broadband satellite services has created the need for wide scale deregulation of the satellite sector. If broadband satellite operators and service providers are to succeed in their endeavors, deregulation efforts must be made in both national and international arenas. Significant progress has already been achieved in the U.S. and in such international bodies as the WTO and ITU. However, the global regulatory landscape for the satellite sector remains vastly uneven and in need of a uniform approach to continued deregulation.

World Telecom Revenue Covered by Members with Commitments to Full Competition



Source: ITU

E-3 Opportunities in the Broadband Satellite Market

Satellites are poised to provide connectivity to the Internet market, particularly the international Internet market, where traffic flows at a severe imbalance. Today over 75% of Internet content resides in North America (this may be changing however with more Internet content being stored outside the U.S.). In a typical Web surfing session, a small-bandwidth request is sent to a content server, followed by a high-bandwidth response. This type of communication is creating the imbalances found in the Internet, in which very little traffic flows into the U.S., yet a substantial amount flows outward. When ISPs or private network operators seek to purchase international capacity to provide access to the U.S., a significant amount of the capacity goes unused on typical leased lines because of the asymmetric nature of Internet traffic flow. Broadband satellite systems, because of their bandwidth-on-demand capabilities, are well-suited to international Internet applications because they can provide capacity on a pay-as-you-use basis, rather than paying upfront for symmetric capacity as is the case with T1/E1 services.

Internet Access Services

The demand for Internet access is one of the driving forces behind the new broadband era of telecommunications. The Internet is growing at such a rapid rate that the existing telecommunications infrastructure has found it difficult to keep pace with Internet bandwidth and access needs. Despite the widespread deployment of terrestrial and wireless broadband capacity, there is still a need for Internet access services in many parts of the world, especially in areas of low subscriber density. Internet access service is defined in this report as delivering the Internet direct to the end user. Given the inherent qualities of satellites (ubiquity, rapid deployment and large coverage areas), the opportunity exists for many satellite operators and service providers to focus on providing Internet access.

Worldwide Internet Host Computers

Region	Jan-1994	Jan-1995	Jan-1996	Jan-1997	Jan-1998	Jan-1999	CAGR 1994-1998	Change 1997-1998
Africa	11,639	29,042	53,175	109,929	144,379	182,901	73.5%	26.7%
Americas	1,467,062	3,080,753	5,913,686	9,918,654	19,394,554	28,522,639	81.0%	47.1%
Asia	87,009	193,440	473,678	1,149,020	2,032,630	3,167,004	105.2%	55.8%
Europe	614,721	1,195,352	2,569,217	4,238,025	7,213,688	10,570,691	76.6%	46.5%
Oceania	99,024	201,319	382,863	632,757	915,355	1,055,767	60.5%	15.3%
WORLD	2,283,978	4,711,226	9,417,531	16,135,992	29,802,017	43,498,699	80.3%	46.0%

Source: ITU, Network Wizards, RIPE, OECD

Web access is already being provided on a small scale to residential users and business users by a number of satellite operators and service providers through mainly Ku-band capacity, including Hughes/DirecPC, Europe Online, Loral/Cyberstar and many others. The future broadband satellite market offers the potential to expand on this initial market entry service to offer a less

expensive, higher-bandwidth solution, capable of data rates higher than current cable modem and ADSL implementations, from 1.5 Mbps to 45 Mbps.

Internet Backbone Services

The Internet today can be characterized as U.S.-centric, with the majority of Web content residing on U.S. servers. More than 90 percent of all Internet traffic originates, terminates or passes through the United States, primarily because many of the major Internet backbone providers are located in the U.S. In terms of Web content accessed, recent figures published by the ITU state that 94 of the 100 most visited web sites are located in the U.S. Even though the share of U.S. Internet hosts is predicted to fall relative to the rest of the world, global ISPs are increasingly demanding access to the U.S. Internet backbone via whatever links may be available, including satellite capacity. Today, less than 1 percent of capacity that ISPs lease comes from satellites. Satellite operators are hoping to increase this percentage in the future. Although satellites currently offer an effective means for the establishment of backbone links, the future remains unclear for satellites in this sector. With the proliferation and decreasing costs of submarine cable capacity, it is unclear at this time how satellites will fare in the long run. Due to rapid buildout and major technical advances in multiplexing, submarine cable will continue to be the most cost-effective and highest capacity solution for long haul routes, including the provision of Internet backbone services. A possible future application for Internet backbone services via satellite may be Intra-regional backbone services, especially over large landmasses. The rise in announced regional GEO satellite systems point to this trend in backbone connectivity.

Caching

Caching may be one of the most important applications for the growth of Internet traffic over satellite. In fact, satellites will rely on caching to solve the latency problems that have plagued the industry. Caching involves the transmission of the most popular Internet content to local servers. Today, only 1,000 Web sites represent over 80 percent of the most frequently accessed content on the Internet. These Web pages would be transmitted at regular intervals to designated server destinations. Content is then stored in the servers for local users to access. Navigating the Internet through cached content relieves the need to retrieve Internet data from the source, thus reducing delays and congestion inherent with accessing popular Internet content. Intelsat and Skycache are two leaders in this growing market.

IP Multicasting

Closely related to caching described above, IP multicasting has become an extremely popular topic in the Internet community because it addresses both the emerging “push” applications popular on the Internet and the congestion they cause. Multicasting, simply put, is the process by which one file is transmitted simultaneously to multiple locations. According to recent estimates, approximately 30 percent of all Internet traffic is multicast, which includes

applications such as Usenet, distribution lists, software and database updates, "push" applications like PointCast and groupware applications. Service providers engaged in this market include SkyStream, Ibeam, NetSat Express and the Fantastic Corporation.

LAN/WAN Interconnection

Many proposed satellite systems such as Teledesic and Astrolink see corporate LAN/WAN applications as one of the most lucrative areas for operation. As corporations expand into regions of the world where the telecommunications infrastructure is inadequate for broadband applications, the need for high-speed reliable connectivity between the regional and central offices becomes evident. Satellites, due to their ability to offer global coverage, are poised to gain a foothold in this market. The business/corporate market has traditionally been the more lucrative of the access markets (versus residential), so the expectation of significant revenues in this market segment is well founded for satellite operators that offer competitive corporate networking services.

E-4 Broadband Satellite Advantages over Terrestrial Networks

A common misperception regarding the future of broadband satellite services is that existing terrestrial-based solutions will dominate the market and leave very little market share to broadband satellites. While it is true that a host of terrestrial technologies, including LMDS, ADSL, cable modems and dedicated fiber, will challenge broadband satellite networks for market share in the broadband sector, satellites are poised to claim a meaningful portion of the total broadband market due to a number of advantages satellites hold over terrestrial technologies. The benefits include the following:

- Ubiquitous coverage. All areas within a satellites beam receive the same level of service, making it highly attractive in rough terrain or underdeveloped regions. Global satellite networks such as Skybridge will therefore offer one level of service to virtually all (over 99 percent) of the global population.

- Simplicity. Satellite systems bypass the complex web of landline networks, multiple carriers, pricing schemes and billing procedures. Network management of global networks is often more elegant in comparison to terrestrial networks.

- Bandwidth on demand. Satellites can easily be configured to provide capacity on demand to users within their coverage area. In the era of multimedia communications, this capability will allow users to "pay-as-they-use," which will be an attractive option to many private line terrestrial alternatives, which are virtually incapable of providing asymmetrical access.

- Support of mobile communications. Not all satellite data systems will support true mobility, but fixed solutions can be relocated within the systems' coverage area quickly and easily, simplifying service provision and management. Inmarsat and others have already made progress in the development of mobile ground stations.

- Uniformity. Corporate customers can consolidate multiple applications over a single satellite network, and provide the same level of service over the same technology to each site on the network, regardless of location.

- Asymmetry. Satellites are more cost effective than many terrestrial leased-line solutions in providing asymmetric transmission services. With over 75 percent of Internet content residing in the United States, satellites are poised to provide asymmetric links between the U.S. and foreign ISPs.

- Low Cost Global Coverage. Depending on the system architecture, an investment of $2-5 billion can fund a truly global broadband satellite system available to virtually every potential user. Terrestrial fiber and wireless solutions are significantly more expensive to deploy to the same global population.

- Rapid Deployment. In order to offer truly global services, satellites can be deployed much more rapidly than fiber optic cable and other terrestrial solutions. A period of 3-5 years from development to global or regional operation for all potential users is an essential factor for satellite success.

E-5 Advances in Satellite Technology

Technological advances are improving the price/performance ratio of satellite communications systems. Breakthroughs in performance, design and construction have all taken place in the commercial satellite industry as advances in terrestrial network infrastructure have spread to the space sector. Due to these technological advances, satellites are poised to provide efficient, cost-effective service for the broadband market. Advances include:

- New satellite designs, including LEOs and MEOs
- The incorporation of new frequency bands in satellite design, including Ka-, Q/V-bands
- Introduction of digital intersatellite link technology
- Use of Multiple spot beams for frequency reuse
- On-board switching capabilities
- Incorporation of advanced link access methods
- Higher onboard power

E-6 Broadband Satellite Ground Segment

As the design of broadband satellite systems progresses, the need for low-cost, high capacity terminals becomes apparent. Today, there are over 300,000 VSATs in place worldwide, and with the proliferation of broadband satellite systems, this number is predicted to skyrocket. Within every broadband satellite business plan is the requirement for design, testing, manufacture and servicing of ground terminals. A large number of manufacturers now exist that plan to offer terminals for use with broadband satellite systems of the future. However, the satellite ground terminal market is still in its early stages with much progress to be made on both technology and cost.

VSATs are increasingly becoming PC-based, IP-based, and DVB compliant. Set-top boxes are still a viable option for access due to low pricing and wide availability of suppliers. Another trend in the industry is the increasing demand for VSATs that offer both broadband multimedia (Internet access, video streams, etc.) and DTH video broadcasting. Echostar and DirecTV will blaze the trail for broadband terminals by offering their own solutions for accessing both DVB content and data/Internet applications over the same system.

Key factors driving the broadband terminal market include: terminal cost, terminal power, terminal size, terminal capacity, two-way versus receive-only terminals, terminal integration with existing and future networks, terminal certification, terminal distribution and service channels, and differences between GEO and LEO terminals.

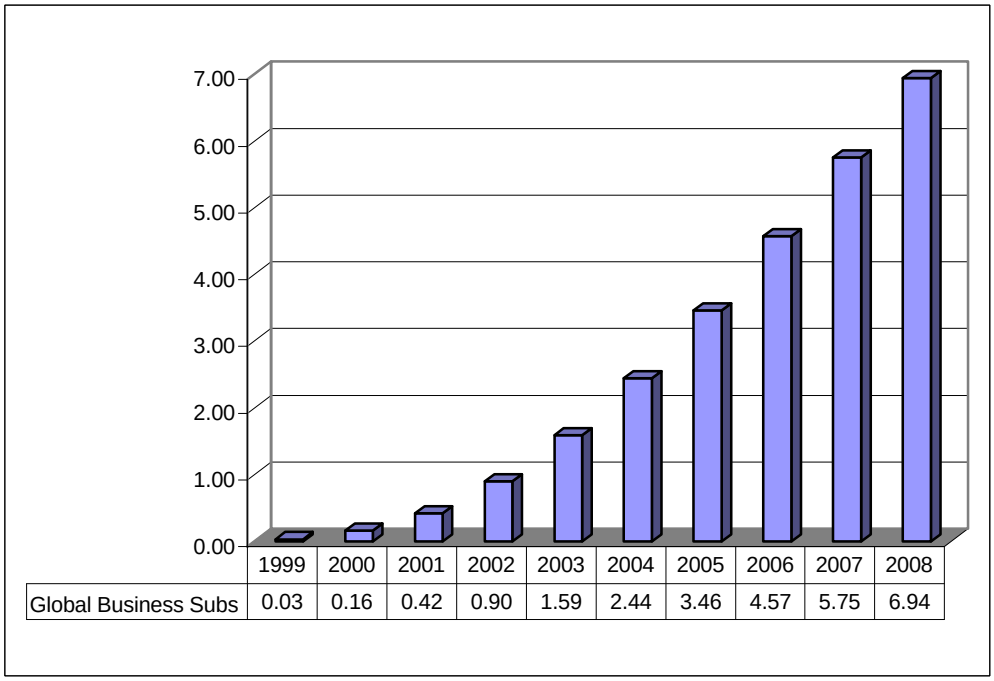
E-7 The Broadband Satellite Market, 1999-2008

Based on the market opportunities and advantages described above, the future for broadband satellite services through the next decade seems quite strong, especially after the launch of two-way, high bandwidth services in the Ka-band. Pioneer's projections for global business and residential subscribers are presented on page E-17. The global business subscriber base for broadband satellite services will increase from 30,000 businesses in 1999 to almost 7 million in 2008. Global residential access also shows the same trends; global residential subscribers will increase from close to 100,000 in 1999 to over 39 million in 2008. Both charts show the slow growth for satellite access services over the next 2-3 years. After the launch of the Ka-band however, subscriber totals increase dramatically.

The largest geographic area for both business and residential broadband satellite subscribers is North America. However, Europe also will experience significant subscriber growth as the popularity of European DBS TV services is leveraged and the convergence of DVB and IP data becomes more widespread. The Asia-Pacific region is forecast to become the third largest market in terms of

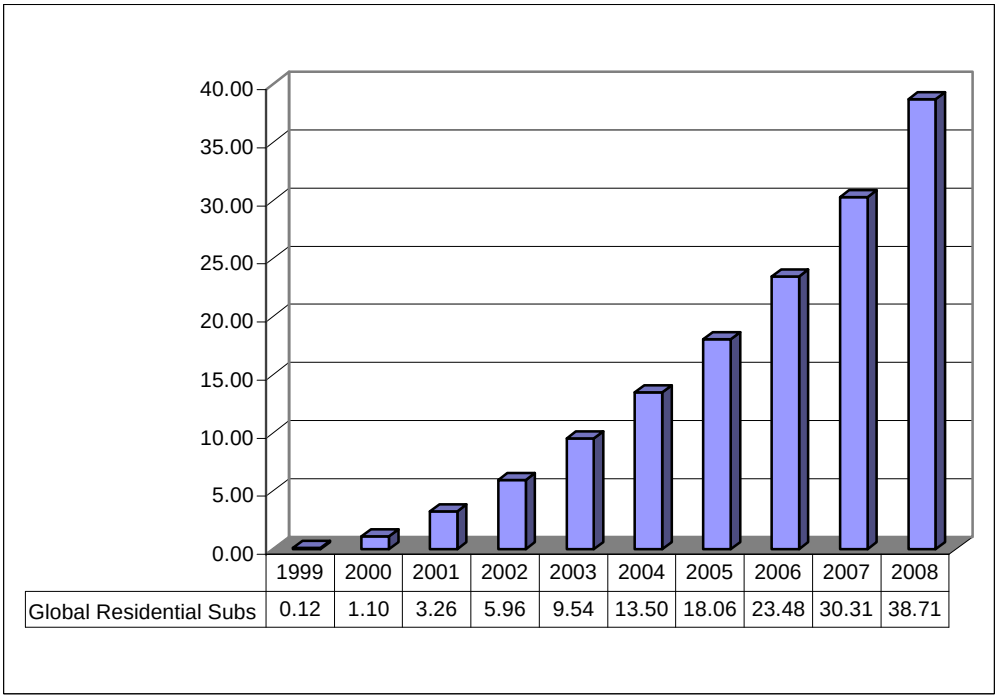
subscribers, but significant growth will most likely hold off until the end of the forecast period.

Global Satellite Business Subscriber Forecast: 1999-2008 (millions)



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Global Business Subs	0.03	0.16	0.42	0.90	1.59	2.44	3.46	4.57	5.75	6.94

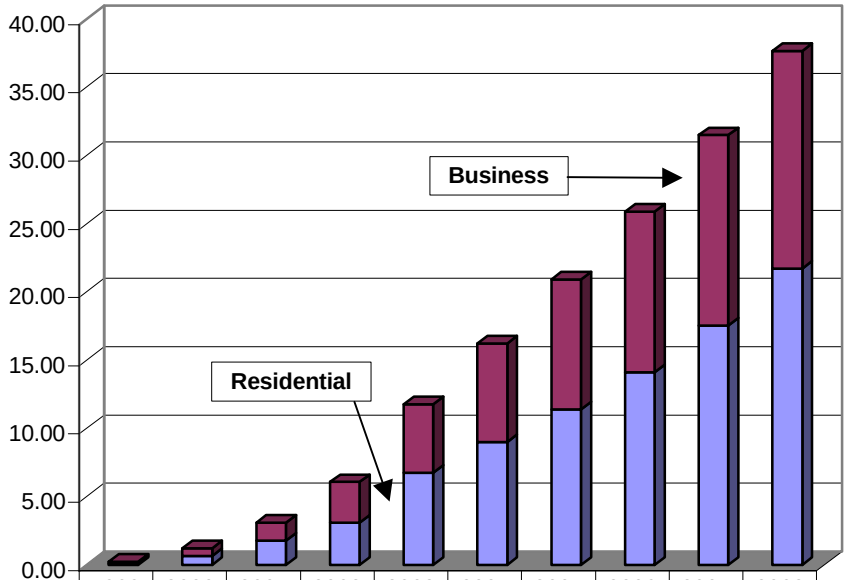
Global Satellite Residential Subscriber Forecast: 1999-2008 (millions)



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Global Residential Subs	0.12	1.10	3.26	5.96	9.54	13.50	18.06	23.48	30.31	38.71

Revenue projections closely follow the forecasts for subscribers given above. Total global satellite revenue will increase from close to $200 million in 1999 to $37 billion in 2008. Within the total revenue, residential service will represent the majority, with almost $22 billion of revenue in 2008. Geographic revenue trends differ slightly from the geographic trends for subscriber growth. The North American market will be the largest for broadband service revenue, due to the strong desire for higher bandwidth by residential users and the willingness of business users to try new access technologies. Asia, however, will be second in revenue at the end of the forecast period due to the predicted popularity of residential broadband satellite access. Even though Europe is forecast for a third place ranking in terms of revenue, the European will post large numbers for service revenue.

Global Satellite Service Revenue: 1999-2008 ($billions)



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Business Revenue	0.15	0.56	1.30	2.96	5.01	7.21	9.52	11.77	13.96	15.96
Total Residential Rev	0.08	0.63	1.77	3.10	6.75	9.00	11.38	14.11	17.52	21.70

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