EESOR 483
Final Report
Astrolink

June 6, 1997

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Objective

Our goal is to help Lockheed Martin determine how it can enter and strategically position itself in the broadband telecommunications market through the Astrolink project. They need to determine the market segments they want to capture with Astrolink and find the optimal launching strategy for its nine satellites to accomplish that.

Introduction

Lockheed Martin Commercial Space & Missiles

Up to the 1980's, Lockheed Martin was the dominant supplier of space and missile systems for the US government. They focused on serving large system operators such as NASA and the US military. As their revenue depended mostly on government spending, Lockheed Martin was not primarily concerned with cost efficiency or competitiveness. However, due to several political events in the 1990's such as the dismantling of the Berlin Wall and the collapse of the USSR, US defense budgets were significantly reduced. This forced Lockheed Martin to reexamine its business practices to adapt to market changes, which include switching their target market from military to commercial space and telecommunication segment.

With the change of situation, Lockheed Martin can no longer enjoy the advantages of designing custom products using the bottoms up costing approach; instead it has to design standard products which meet cost constraints in order to remain competitive. In addition, Lockheed has to adapt to the competitive market for commercial space and telecommunications for survival. Their new approach to business can be summarized by their mission statement: "[to be] The global leader of system and technology solutions for the commercial and government space and strategic missile marketplace".

Astrolink

The Astrolink venture is an initiative of Lockheed Martin Telecommunications. It is an independent company jointly owned by Lockheed Martin and international network operators. The intent of Astrolink is to develop a global broadband satellite communications network. The Astrolink system consists of a constellation of nine geostationary (GEO) satellites that will provide a broad array of digital communication services ranging from voice and data to multimedia transmissions globally. Astrolink satellites will use spot beams for more focused data transmission. Bandwidth on demand capability will allow Astrolink satellites to flexibly change bandwidths based on demand needed. Astrolink aims at providing a GEO satellite-based broadband global communication network that offer bandwidth on demand capability with seamless connectivity. It plans to operate by the year 2000 with multimedia and Internet access as its main applications, serving both FSS[1] and DTH[2] markets. For background information on satellite telecommunications please refer to Appendix A.

Market Overview

The satellite communications market includes three segments: fixed satellite services (FSS), mobile satellite services (MSS), and direct-to-home (DTH). Each segment targets its instant infrastructure capability to different users. FSS provides service to broadcasters, Fortune 500 companies, and telephone companies. The highest growth area in this market is the rapidly developing high-speed multimedia services and Internet access. MSS covers the transmission of voice and/or data to and from mobile terminals. The current applications are telephony to ships and aircraft; however, the highest-growth segments in the future will be providing services to land-based users, such as dual-mode cellular/satellite phones, mobile data terminals, and fixed

[1] Fixed Satellite Services
[2] Direct To Home

application, such as remote locations and village phones. DTH refers broadly to the broadcasting of television, radio, and multimedia entertainment services directly to viewers and listeners. The number of customers subscribing to the service drives the growth in this segment.

Astrolink's market can be segmented in two ways: regionally and application wise. Regionally, there are three continental regions that should be of particular interest to Astrolink: North America, Asia, and Europe. Application wise, the market can be segmented into small and medium businesses, telecommuters/workers, telemedicine and Internet/home market. Other potential market segments include remote manufacturing and teleteaching, but their size can be considered insignificant.

Table 1: Astrolink's Application Areas

Telecommuting	Electronic Commerce	Telemedicine	Home Use
High Speed Internet Access	Corporate Training	Medical Imaging (MRI, USG)	High Speed Internet Access
Desktop Video Conferencing	Video Conferencing	Training and Disaster Recovery	Electronic Product Distribution
Groupwork: Collaborative "Whiteboard"	Virtual Private Network	Remote Health Care	Home Banking
	Remote Manufacturing	Cross Medical Records and Billings	Distance Learning
	Software Distribution / Update		World Wide Interactive Gaming
	High Speed Data: LAN to LAN		

A study of 502 companies done by the Business Research Group (BRG) showed the need to improve efficiency, accessibility, and service drives most vertical telecommunication markets to wireless data communications. Bear Stearns projects an excess demand growth of 20% per year through year 2000 in the global data communication market, including both satellite- and land-based services. Many major companies rely upon mission-critical data networks. As these

companies expand into the emerging market regions where telecommunication infrastructures are inadequate, they are likely to seek end-to-end providers to tie these sites to their corporate network. Moreover, many corporations increasingly call for "bandwidth-on-demand" applications, such as videoconferencing, which is experiencing high rates of growth and represents a significant source of demand for satellite services. As satellite services can tie locations that do not have access to advanced land-based communications facilities, the ability to link Internet Service Providers (ISPs) to web access points, coupled with Internet access, is a value-added service that corporate networking customers are demanding. After 2000, the growth in the FSS market is expected to accelerate with the development of new Ka-band satellite systems. Next generation Ka-band services such as Astrolink's will take high-speed Internet access to the next level by driving earth station cost below $1,000 and offering mass-market-oriented service pricing.

We found that the major initial markets for Astrolink will be heavily business and elite clienteles oriented. Applications such as remote manufacturing, high-speed data transfer (financial, marketing, home Internet, etc.), corporate networks, business applications (telecommuting) are the target. Since Astrolink will place one satellite at a time, the operation will initially be regional, becoming global only when the five satellites in the different positions have been launched. Furthermore, some market segments are in their nascent stage of development. This brings up the problem of determining growth and potential market size.

Regardless of the possible benefits it promises, even up until now broadband communication is a new technology venture that remains unknown in terms of how people would respond to it. Nevertheless, the opportunity of capturing the large global market and reaping huge amount of profit does exist. Hence, it is necessary for Astrolink to create demand and to be the first to capture the market. Demand prediction within identified market segments

both application-wise (business application, telecommuting, Internet/home market) and regionally (North America, Europe, Asia) is a crucial task.

In doing the analysis, we took into account the uncertainties. They include the issues of competition, market growth, market share, market size, regulations, product adoption/market penetration, technology evolution, launch failure, and financing difficulties. Intense competition can negatively affect pricing, and in turn, cash flows and margins. In addition, indirect competitors such as terrestrial network operators can pose threat as they extend their coverage to areas previously unserved and update capabilities of existing, older networks. Many of these competitors have deep pocket and communication expertise. Due to the nascent nature of the Ka band network, projection of market size and market growth is difficult to do, if not impossible. Consequently, it is less likely that an accurate projection of market share and product adoption (how customers will react to the product) can be obtained.

In terms of regulations, Astrolink needs to deal with extensive international, national, and local regulation. Specifically, they need to obtain orbital and frequency assignments, secure landing rights in each country of operation, interconnect with local networks on favorable economic terms, and comply with transmission content restrictions. The inability to receive required approvals could dramatically impair Astrolink's financial viability. Astrolink can either create their own local, land-based distribution and marketing channels or develop effective relationships with reliable service partners to perform the services to them. The FCC deregulation in telecommunication market adds another complexity into the problem as it allows for potentially more intense competition for Astrolink in the near future.

Astrolink must show their skill at creating platforms that can evolve with developments in technology, as well as respond to shifts in market demands due to technological obsolescence. The risk pertains to the entire network structure, from orbiting satellites to handheld receivers. Industry statistics reveal that about one in ten satellite launches fails due to launch vehicle

malfunction. While satellite providers such as Astrolink are usually insured against launch failure, construction and launch of replacement satellites can take a year or longer, resulting in revenue delays, potential foregone customer contracts, and potential weakening of competitive positioning. Finally, due to the large, often multistage financing requirements to achieve cash flow breakeven, financing difficulties at any stage of a company development may result in delay or cancellation of its projects.

To succeed in the mass market, Lockheed Martin must be able to leverage their traditional space technology prowess (the "Space Game") with down-to-earth marketing savvy (the "Ground Game") by building recognized service brands and capturing key distribution channels. Specifically, the Space Game refers to the attributes related to the launch and operation of satellites while the Ground Game refers to the ability to sell mass market services that will drive industry growth into the next century. However, since Astrolink does not have the experience of dealing with the end customers, to succeed in the Ground Game Astrolink should work through strategic alliances/partnerships with local entities. These local entities may be local telecommunication companies, satellite service providers, or mass market equipment manufacturers. There are several reasons why strategic alliance is important. First, Astrolink can tap into the partners' distribution and customer service functions in countries where they have an established presence. Second, local licensing takes political savvy or well-connected partners. As Astrolink needs to obtain a range of operating licenses for each country they intend to provide service, they can best handle this considerable administrative and logistical task of coordinating the licensing process by tapping the talents of well-connected local partners.

Regional Market Segments

Our analysis focuses on the major application areas that contribute to demand for broadband satellite services. For each market regions (North America, Europe and Asia), we analyzed factors contributing to demand for such services and gave their growth projections

We found that the following four areas make up the bulk of the demand. These major application areas are: Telecommuters, Telemedicine, Electronic Commerce and Home Use.

Telecommuters: The end users in this segment includes home businesses, full time and part time home workers, and after hour workers. Their needs range from interactive databases, teleconferencing capabilities and fax, to email and video mail.

Telemedicine: The potential users of telemedicine services include fixed location facilities such as hospitals, mobile facilities including ambulance and commercial liners, as well as for training and disaster recovery activities. Typical traffic will consist of computer tomography (CT) documents, different imaging results (MRI, USI, and NMI), X-rays, medical records, and billings. *Electronic Commerce:* This segment includes remote manufacturing. *Home users:* This segment includes internet data access, newsletters and other publication distributions, videophones, home education, interactive games, and telecommuting. Home use: Home users include high speed internet access, home banking, distant learning and world wide gaming.

The number of telecommuters in North America is projected to be 41.8 million in the year 2000. In Europe, it is about 38 million and in Asia, 19 million.

The number of telemedicine operators in North America is estimated at 5.5 million. In Europe and Asia, they are approximately 5 million each.

The number of companies involved in electronic commerce in North America and Asia by the year 2000 is projected to be 152,250. In Europe it is about 130,500.

By the year 2000 Home users in North America is approximately 38.28 million. The number is 16.5 million for Europe and 9.9 million for Asia.

Since the demand for broadband telecommunication services in North America is the highest, Astrolink should first establish a strong presence there. Realizing that the demand growth in Europe and Asia are relatively high compared to North America, Astrolink should also establish their presence in these regions soon.

The growth rate for the four application areas in the three regions is also important factors we looked at. Annual growth rate estimates are given in the table below:

Table 2: Projected Annual Growth Rate for the Four Main Application Areas

	N. Am	Europe	Asia
Telecommuters	5%	10%	15%
Telemedicine	4%	5%	8%
Electronic Commerce	10%	10%	15%
Home Use	10%	8%	12%

Source: Appendix C

Growth rate for Asia dominates all major application areas since these areas have the largest population in the world, and economic growth experienced is highest. Our projection shows that as a percent of US total demand, Asia is only13.1% in 2000 Q1 and by end of 2007, it is 67.69%. This tremendous growth trend is expected to continue.

Competitive Strategy Analysis

Competitive Strategy

Astrolink's entrance into the global satellite telecommunications market must be accompanied by an appropriate positioning within the industry that embodies the overall goals of Astrolink and allows it to compete effectively. One means to examine the positioning is via Michael Porter's five forces and competitive advantage analysis. While this is not the only mean by which we can proceed, the analysis will begin with an initial examination using Porter's theories. In determining positioning within an industry, one must examine competitive advantage, competitive scope, and positioning strategy.

Competitive Advantage

Astrolink's competitive advantage over current systems is its higher bandwidth. Current constellations operate either as DTH or MSS or FSS. Systems such as Iridium and Globalstar will have an established their position by the time Astrolink is ready and available. These constellations will have both a price advantage and a market distribution advantage over Astrolink. Furthermore, they do not have Astrolink's latency problems. It should be clear that it is the product differentiation (higher bandwidth transmission) that will make Astrolink attractive to potential customers. Thus Astrolink's niche is clearly to compete in a different market segment – one that is not currently served by existing systems.

There is no current system available for global broadband transmission. Broadband competition will come from terrestrial sources. Astrolink is competing against ground base systems on both lower costs and superior performance and ease of installation. Terrestrial networks such as fiber optic cable are expensive, such that the installation has been limited to areas with the most heavily used data "highways." Rural installation of high bandwidth cabling is negligible and would not be cost effective in the future. Studies have shown that the satellite infrastructure is one of the most cost-effective and time-efficient means of establishing networks.

With the launch of other systems such as Spaceway and Teledesic, other systems will have achieved a similar, if not better, rate of transmission. Astrolink's advantage over these systems is lower overall system costs. Spaceway is a more costly constellation with 20 satellites. There are also differences in its product in terms of the spot beams they use leading to a divergent market focus from that of Astrolink. Unlike Spaceway whose spot beams will be mostly focused on populated areas, Astrolink's ability to cover both rural and highly populated areas and its focus on business applications rather than the home entertainment industry will enable Astrolink to develop a niche whereby it offers a price advantage over Spaceways.

Teledesic's ambitious system will be expensive but it will offer real time communications link with less latency. Teledesic also provides uniform rural/urban coverage. As a result, Astrolink will need to find a niche where it is the cost leader over these two systems.

The bottom line is that since we expect a proliferation of broadband transponders in orbit, Astrolink will not be able to compete solely on the basis of a "better" product. Its product may be better for certain market segments but it is clear that if the other constellations are built, Astrolink will have to emphasize its costs per performance capability.

Competitive Scope

The basic decision is to choose between a broad scope and a narrow scope. Astrolink has the ability to compete in all currently foreseeable segments of the satellite telecommunications industry. However, it cannot be priced effectively vis a vis dedicated systems for DTH or narrowband communications. And so it should be clear that a narrow scope should be the emphasis of Astrolink – in particular focusing on those market segments where it has at least technological parity an a cost advantage. In terms of Porter's strategy, the preferred strategy is that of cost focus. Astrolink needs to be focused on a lower cost in its selected market segment.

Establishing/Maintaining Competitive Advantage

Inherent in establishing a competitive advantage is heterogeneity of products. Each of the current broadband satellite systems has a specific focus market segment, though each also has the ability to compete in most market segments. In order to establish an advantage, Astrolink's costs and overall value should be emphasized. In addition, establishing a value chain through strategic alliances can further enhance product advantages. Part of the value to customers may be the flexibility of the service. Services, distribution, marketing, and overall

infrastructure provided affiliated international network operators could also help increase the overall value of the system. Please refer to Appendix B for Astrolink's decision hierarchy.

The Space Cat Model

The objective of the Space Cat Model is to help Astrolink determine the optimal launching strategy. Each launching strategy is evaluated by the discounted profit predicted over seven years. We projected the profit per quarter because as Astrolink wants the whole system up within two years so there will be a satellite launched in every quarter. Profit per quarter is calculated as revenue minus cost.

Revenue Calculation

Let us first examine the revenue side. The formula we used to calculate the revenue in *$ M* is (Total Astrolink demand in which it can meet in TBits) x (price per MBit). The price Astrolink will charge per Mb is estimated to be 0.54 cents (Appendix C). To estimate Astrolinks's total demand we segmented the market into three regions and four application areas. We included only North America, Europe, and Asia in our analysis for these are the regions from which the satellite communication industry can extract most (approximately 93% according to Communications Center) of its revenue. In each of the regions we looked closely at four key markets: telecommuters, telemedicine, electronic commerce, and home use. In each of these market segments we found the total data transmission required in TBits. Multiplying that by Astrolink's market share in that segment gave us Astrolink's quarterly demand. Specifically, below are the formulas we used.

Table 3: Equation for Quarterly Demand of Each Segment

Astrolink's quarterly demand (inTBits) for the telecommuter segment = (# Telecommuters in million) x (# Mbits per Telecommuter per quarter) x (Penetration Rate) x (Market Share).
Astrolink's quarterly demand (inTBits) for the telemedicine segment = (# Operations per quarter in million) x (# Mbits per Operation) x (Penetration Rate) x (Market Share).
Astrolink's quarterly demand (in TBits) for the electronic commerce segment = (# Companies) x (# Mbits per Company per quarter) x (Penetration Rate) x (Market Share).
Astrolink's quarterly demand (in TBits) for the home use segment = (# Households with Computers in million) x (# Mbits per Household per quarter) x (Penetration Rate) x (Market Share).

Astrolink's total demand per quarter for a region is the sum of the above four values. Each satellite has a capacity of 19,678 Mbits/sec. This number takes into account the reduction of Astrolink data transfer volume due to peak hour overloading and header/maintenance information. The capacity is calculated from the number of spot beams per satellite (64) and the number of channels per beam. This is scaled down by a factor of 0.3 to account for fluctuating peak and off peak demand. The demand that Astrolink can meet per region depends on the number of satellites it has launched in that region and is therefore, the minimum of regional capacity and total demand. We will call this "Total Use". The sum of Total Use in each of the three regions times the price per Mbits gives us their revenue for that quarter.

For simplicity of the model we did not include the increase in demand to the Astrolink system resulting from global or multi-regional networking. Since the launches are only three months apart the additional revenue from synergy due to global networking is insignificant enough to be excluded from the model. Please refer to Appendix C for further details of the model.

Cost Calculation

The cost in each quarter can be broken up into building cost and operating/launching cost. Building of the first unit is approximated to be $ 128 million. Based on the Koelle Method the costs of building subsequent units reduce by 95% of the prior unit due to the learning curve. This reduction affects only the first four satellites built, after which the cost per satellite remains constant. The non-recurring cost of $ 144 million is added to the building cost of the first satellite. The building cost is estimated by Communications Center.

The operating/launching cost includes the costs of ground stations, operators and personnel, launching and insurance costs. This cost is projected by MIT Research to be $ 5.3 billion over the system life cycle. We approximated the life cycle to be 12 years. To calculate the yearly cost of operation we assumed an inflation rate of 3%. We found C, the operation cost in the first year, which satisfy the equation $C + (1.03)^1C + \ldots + (1.03)^1C = 5.3$ to be $ 337.65 million. We divided this number by 4 to get the quarterly operation cost for the first year. $(1.03)^{(k-1)}C$ is the operation cost for year k.

NPV Calculation

We calculated the risk adjusted expected net present value of the quarterly profit. We believe that Astrolink's market share is the most uncertain and the most influential of all the sources of uncertainties. With that in mind, we took all the uncertainties as deterministic and modeled how the randomness of the market share would affect Astrolink's cashflows and therefore their launching decision. For each launching alternative we looked at Astrolink's projected quarterly profits and discounted them back to the year 1997 to get the NPV. It is not enough to compare the NPV of the launching strategies because we need to incorporate the affect of the uncertainty in market share on Astrolink's decision. We used an exponential utility function to reflect on their risk tolerance. To model the uncertainty in market share we simulated

the market share using Crystal Ball. In each run we calculated the u-value of the NPV using the utility function U(x) = -exp(-x/rho) where x = NPV and rho = risk tolerance. From interviews with Lockheed Martin we assessed their risk tolerance to be $ 100 million. We ran 1000 simulation trials and found the expected value of the u-values by averaging the 1000 u-values generated. We converted it to the certain equivalent using the formula CE= rho*ln(-U). The CE is the risk adjusted expected NPV for that launching strategy. The launching strategy with the highest risk adjusted expected NPV is the optimal strategy.

The discount rate used in this model is 8% per annum. We are using a rate that is quite high for we would like to be conservative in our estimation. In calculating the Net Present Value we discounted the quarterly cashflows using the discount factor $\frac{1}{(1.02)^k}$ where *k* is the number if quarters since first quarter of 1997.

We made the assumption that market shares are normally distributed. We simulated Astrolink's yearly market share for each region and key application markets. The simulation was not done quarterly because the per quarter variation is not big enough to make a significant impact on the NPV. Astrolink's market share in general is highest in Asia due to fewer competitors. We believe that there is a correlation between the growth (or decrease) in market share across the regions and application areas. To reflect this we simulated a "base" market share for each year and set the market share for each region and application area to be a multiple of that. For example, Astrolink's market share in telemedicine sector is taken to be 1.25 times the "base" market share. This multiple is used for all seven years of projection. Each application area of each region has a different multiples based on the data we have gathered. In general, the market share in 2001 is lower than in 2000 because many new players such as Hughes' Spaceway and Loral's CyberStar are entering the Ka band market at that time. Since Astrolink is the first to enter the market and first to complete a global network, its market share

is expected to grow over the next three years. There is a drastic drop in their expected market share in the year 2005 with the birth Teledesic. We have assumed serial correlation except between the years 2004 and 2005 when Teledesic enters the market. The mean, standard deviation, and correlation are summarized in Appendix C.

Model Results

We ran four launching strategies through the Space Cat Model and the results are summarized in Appendix C. The optimal strategy is to launch in North America in 2000 Q1, Europe in 2000 Q2, Asia in 2000 Q3, North America in 2000 Q4, Europe in 2001 Q1, and Asia in 2001 Q2.

Interpreting the Model Results

We feel reasonably comfortable with our simulation results, and it can best be explained by 2 main factors: 1) Demand for broadband services in each region and 2) growth in demand for broadband services in the different regions.

Since we believe North America has the highest number of telecommuters and market penetration rate among three regions, our simulation results are in line with Lockheed Martin's desire to build a strong presence in the North America Satellite communications market early; and also to compete with Hugh's Spaceway System. Furthermore, our results show that if we launched in North America in 2000 Q3 instead of Q1, our risk adjusted expected NPV is the lowest among our four scenarios. Also, it is not optimal to launch the second satellite in North America since demand for the first 2 quarters in the year 2000 can be met with the presence of just one satellite.

We launch our second satellite in Europe instead of Asia, as demand for broadband services is higher in Europe than in Asia, at least in the first 2 quarters of year 2000. Growth in

demand is not high enough to justify launching the third satellite in Europe given that the second satellite is launched in Europe.

We recommend launching the fourth satellite in North America since want a back up unit in case our first satellite malfunctioned, and we may end up losing our biggest market. Another reason why we did not launch the fourth satellite in either the Atlantic region or the Oceania since our simplified model does not include these regions as potential markets in at least the first two years after the first launch.

We realize that we could have included launching our fourth satellite in the Atlantic region to generate additional revenues. However, due to the low demand in these regions, Astrolink should take a wait-and-see approach for at least another three quarters. Furthermore, if Astrolink launches the fourth satellite in one of these two regions, they may face the possibility of incurring unnecessary costs from satellite maintenance and other related operating costs when demand is still low.

With the optimal launching strategy, we project that Astrolink will break even in 4.5 years, which is in line with their requirement of between four to six years. This break-even point is possible only if our projected high capacity usage of our satellites is realized. Also, the accuracy of our assumption about penetration level, market share for Astrolink and demand for broadband services is necessary for this model to be valid.

Caveat

In our model, we did not account for the additional costs and revenues associated with the two proposed two launches in the Atlantic and from the one in Oceania. We did this for two main reasons: 1) revenues from these regions are much lower (estimated combined demand of 7%) compared to the other three regions, 2) it is hard to estimate demand and growth rates for broadband services in these 2 regions due to lack of data. We omit them to simplify our analysis.

We also did not account for the synergy from forming a global network earlier since we feel the synergy created, at least in the next two years following the first launch, would not have a significant effect on our projected profit. Due to our time constraint and lack of data, we were unable to do a sensitivity analysis on factors in our model.

A suggestion to improving our analysis could be doing sensitivity analysis on Lockheed's risk tolerance, rho. In doing a sensitivity analysis of the model on risk tolerance, we need to simulate a thousand runs for each level of risk tolerance over a wide enough range, and compute the associated risk adjusted expected NPV.

Scenario Analysis

One method to examine the industry and market is through scenario analysis. The key uncertainties that underly our expected revenue is the size of the market, the adoption rate (market penetration), the amount of competition, market entry (including launches, timing, etc.) and the general economic outlook. To keep matters simple, three or four scenarios will be examined.

Current Situation:

The FCC has recently approved filings for 73 GEO Ka Band satellites. Teledesic has contracted Boeing as its satellite manufacturer. The economic outlook for the United States in the next two years is still positive. This is important since the financing necessary for the satellite systems will come primarily from the United States. There is strong growth of consumer electronics, PC, and the Internet with little signs of slow down. The other economies of the world are relatively stable and with the deregulation of telecommunications prescribed by the EC, there will be more openness (and more competition) in the European telecommunications market. The first Iridium and Globalstar satellites have been launched and

the success of those systems will be a key barometer of future Ka satellite system development and success.

Scenario #1: Catastrophic Overload

Competition

Economic growth remains stable throughout much of the industrial nations. The narrowband voice satellite constellation (Iridium, etc.) receives enough revenue to justify their existence along with additional investments in Ka Band satellites. Thus most of the planned Ka band satellites received adequate financing and developmental support to go ahead with installation. The load puts significant pressure on satellite manufacturers to keep the supply chain moving promptly and on launch vehicles to launch the satellites on time. Launch failure thus can become a significant setback - delaying system implementation by at least 3 months.

Demand and Economic Climate

After the initial financing of the satellite system and continued slow economic growth, consumers and businesses (from industrial nations) become a little wary fearing a future downturn. They become more value conscience. Thus, the projected demand is not as great as anticipated, though in a thriving economy, the demand is not too significantly lower. Furthermore, demand is lower because a lower than expected growth rate of computer products, internet services, etc. due to disillusionment with the anticipated promise of such items.

Regulations

Entry into the Asian and European markets are hampered by regulations. The European Commission's Satellite Directive has stated that they would like to liberalize and harmonize satellite services in the future. However, that does not occur and problems obtaining licenses

and permission to use radio spectrum still exists. Astrolink has difficulties obtaining these licenses resulting in delays and a European market share that is lower than projected. In an attempt to protect their market and foster domestic and regional telecommunication providers, Japan issues new regulations limiting the number of foreign operators. In addition, China wants to regulate information coming in and out of the country making it difficult for a foreign company such as Astrolink to serve that area.

The Bottom Line

The market has a glut of telecommunications providers and channels and not enough demand from the consumer and business side to fulfill those requirements. Consumers are hesitant about engaging new unproven technology and they are also unsure about the merits of the technology.

Proposed Action

Astrolink would want to establish itself as having a competitive edge over other ventures in selected applications. These will be the "bread and butter" markets for Astrolink. It should focus on establishing itself as providing a cost-effective service in market segments where Astrolink's system characteristics provide it with an inherent advantage. This may include examining/developing new markets for Astrolink's services. Thus Astrolink can assuage consumer fears and foster growth of those markets thereby ensuring its economic survival and prosperity. One must remember that the market is not "poor", it is just uncertain that it should spend its resources on Astrolink's services. Thus, a better market focus and the establishment of a better more cost effective product can be tremendous in signing on reluctant customers.

Scenario #2: Economic Downturn

Competition

The economic growth in the Americas and Europe has resulted in an overheating of the economies. The consequence is a downturn in the economic cycle and a recession that has global impact. There is not enough capital to support all the proposed and existing global satellite networks and therefore many of them are cancelled or downsized. Only a few systems such as Spaceway, CyberStar, and Astrolink are being developed and Teledesic is being downscaled (with an accompanying push back in its operation date so as to catch the global economy when it rebounds). Therefore, there are fewer competitors.

Demand and Economic Climate

The recession however impacts demand. Consumers and business are increasingly unwilling to spend money on services that they consider to be "unnecessary" or perhaps "frivolous" and so the demand is considerably less than anticipated.

Regulations

Regulations and entry into foreign markets has become stricter due to a perceived need to foster home industries. The need stems from the desire of national governments to bring the local economy out of its current doldrums. Furthermore, partnerships are also more difficult to secure since few companies are willing to take the risks necessary to support the new technology and to market a product to a public which they perceive as having little interest in the service.

Bottom Line

Despite the fact that there is less competition than anticipated, Astrolink faces many difficulties in meeting its milestone for capacity usage, global market penetration, and revenue generation. This is due to lower demand, tremendous difficulties entering foreign markets, difficulties securing alliances, and a general perception of weakness in the market.

Proposed Actions

Economic downturn and decrease demand may merit either a delay or cancellation of launch.. Astrolink would thereby only focus on the most potentially profitable markets or wait for the demand to develop in those markets. Furthermore, it could engage in strategic alliances to mitigate the risks and to aid in marketing. Strategic alliances may help bring the service to the customers who desire it the most or it could augment the services provided by Astrolink (thereby making the product more attractive). Targeting the markets with the highest potential growth and profitability is important.

Scenario #3: The Middle Road

Competition

The current economic/financial climate cannot finance every single proposed Ka band satellite. In fact, competitors such as AT & T have already pulled out. Suppose the trend continues as is with only about half of the constellations being built. The most likely candidates are Hughes Spaceway, Loral CyberStar, LM's Astrolink, perhaps a few others. It is foreseen that Teledesic will be built, though it may not end up as ambitious a system as initially proposed. Teledesic will also become operational around 2005-6(even though their press release claims a service date of 2002); a few years after Astrolink is in place. There will be competition for major urban areas though each system will eventually develop their own niche in the broadband market.

Demand and Economic Climate

Economic growth proceeds at a steady pace with the Asian economies growing most rapidly. Consumers are encouraged by continued economic growth and low inflation (in industrial countries) and are able to stimulate growth in products such as PC, Internet services/equipment, etc. Because of increase commerce and increased access to the Internet, businesses are moving towards more electronic transactions both internal accounting and management and for external

commerce. The development and use of EDI (electronic Data Interchange) format helps businesses move towards making much of their transactions electronic.

Entry into foreign markets such as Indonesia is difficult but alliances with local partners can be secured to facilitate entry.

Scenario #4: High Throughput/Little Traffic

Competition

The market for global satellite telecommunication grows as expected or slightly better. Implementation of Astrolink's system went as planned. Well-financed systems such as Spaceway are also launched while more marginal systems are not developed. Teledesic, however, faces considerable technical, financial, and organizational problems. These problems lead to a considerably smaller version of the original system or a serious delay in implementation of its planned network. Therefore, Astrolink has a considerable lead in capturing the market and limited competition. Furthermore, Astrolink can establish their customer base and can basically guarantee further growth.

Demand and Economic Climate

The Pacific Rim booming economy has turn out to be even better than expected. The main reason for this is the growing commitment of the Chinese government to open and free trading. Implementation of AFTA (Asia Pacific Free Trade Agreement) encourages companies to continue their globalization effort at even a faster rate than the current one, on both sides of the Pacific. The East European nations experience a phenomenal economic growth, one like the Asia is experiencing right now and this growth enables West European economic to expand. Overall, the global economy is expanding. In addition, the bandwidth technologies are able to penetrate the market considerably, creating a considerable market and demand growth. Network security technologies have improved and have fueled electronic commercial activities.

Entry to Asian markets continues to be difficult, however a larger number of local companies are interested to establish alliances with industry expert such as Lockheed Martin.

Regulation

The boom in the Pacific Rim has stimulated desired deregulation. This is due to a lessening fear of foreign competition and increased interest in high technology. Furthermore, deregulation proscribed by the EC has made entry and alliance making into Europe much easier.

The Bottom Line

So there plenty of demand for Astrolink and entry into markets is not a serious problem. Astrolink has its choice of markets and must limit their obligations. Astrolink capacity is fully utilized. The question that faces Astrolink is how to meet the demand and prevent (eventual) competitors from chipping away at Astrolink's market.

Proposed Action

Astrolink has many alternatives. Clearly it is important to remain focused on its key markets. But furthermore, Astrolink could augment its satellite constellation with additional satellites at its FCC licensed locations or it can enter into an alliance with another satellite telecommunication company or buy out an existing licensed location from a system developer that lacks the capital to develop their system. The key here is to use Lockheed Martin's expertise in satellite building to quickly meet market demand and establish oneself as a leader in the satellite telecommunications industry.

Conclusion

In our analysis, we studied the market for broadband satellite telecommunications and focused on three geographical regions: North America, Europe, and Asia. For each of this region, we evaluate the demand in four application areas: telecommuting, telemedicine, electronic commerce, and home use.

We examined Astrolink's competitive positioning with respect to its competitors in the telecommunication market. We found that product differentiation is a key to Astrolink's success. This pertains to focusing its marketing effort to provide wide coverage for specific market segments. In particular, Astrolink's spot beams cover both rural and highly populated areas, allowing them to better serve the business applications.

The Space Cat Model that we developed aims at helping Astrolink determine its optimal launching strategy. We looked at four different launching strategies and ran simulations to pick the best alternative. Our simulation results indicate that the optimal launching strategy would be launching one satellite per quarter starting in the year 2000.

APPENDIX A

Technology Background

Narrowband vs. Broadband

Different kinds of information and media have distinct bandwidth requirements. Text has the lowest bandwidth requirement while high-resolution video has the highest. Many of the proposed satellite networks will use broadband technology. Broadband technology is defined as a networking technique for transmitting large amounts of voice, data, image, and multimedia digital signals over long distances at 45 Mbps (Mega-bits-per-second) or higher rate, as opposed to narrowband, which only transmits at 64 Kbps (Kilo-bits-per-second). Broadband technology also provide users with bandwidth on demand. This refers to a

Existing Frequency Bands

Band	Frequency (GHz)	Primary uses
Mobile	1.6-2.5	Handheld telephones (LEO)
C	4	Entertainment (CATV and yard)
		International telephone
Ku	12	Business and retailers (VSAT)[3]
Ka	20	Two way data to home and office PCs

[3] Very Small Aperture Terminals

Advantages and Disadvantages of Ka Band

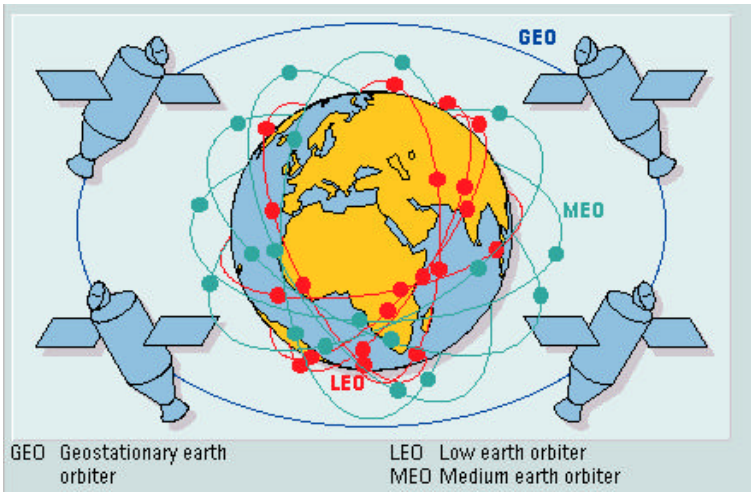
Advantages	Disadvantages
▪ Wide bandwidths	▪ Rain attenuation
▪ Higher bit rates possible	▪ Complex on-board processing
▪ Lower earth station costs and complexity	▪ Reliability unknown
▪ Intersatellite links possible	▪ Manufacturing complexity
▪ Bandwidth on demand	
▪ Smaller antenna which leads to lower power requirement	

transmission service that can provide varying amounts of transmission capacity on a dynamic basis. It is particularly suited for multimedia transmissions that involve a varying combination of these types of transmissions. Other advantages along with its disadvantages are summarized in the above table.

Types of Satellites

There are four types of satellite systems: geostationary-earth-orbit (GEO), highly elliptical orbit (HEO), medium-earth-orbit / intermediate-circular-orbit (MEO/ICO), and low-Earth-orbit (LEO). Geostationary satellite systems orbit at an altitude of 22,300 miles above the Equator, the only orbit that allows the satellite to maintain a fixed position in a relation to Earth. At this height, communications through a GEO entail a transmission latency of at least one-half second. Traditionally, all satellite services have been delivered by GEO satellites. Recently, a number of projects have proposed the use of LEO satellites that orbit less than a thousand miles above the earth. These satellites virtually have no signal delays and require lower power than that of GEO

satellites. However, LEO networks cost more than GEO because they have larger number of satellites. However, because LEOs are much closer to the Earth than GEOs, their frequency-reuse areas (coverage area) are much smaller. This in turn results in a much higher number of satellites required for LEO-based network system to cover the whole Earth as compared to the GEO satellite network. For example, Lockheed Martin's proposed constellation, Astrolink, consists of only nine GEO satellites, while Teledesic network uses a constellation of 288 inter-linked LEO satellites.



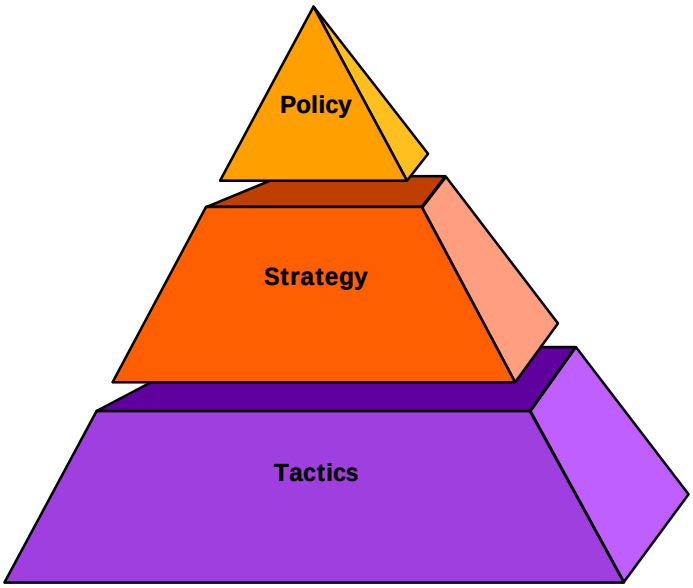
Currently, terrestrial network is still the dominant system in the telecommunication market. Terrestrial network consists of: telephone cable, TV cable, fiber optic, and wireless communications such as cellular and laser data transfer.

There are four key advantages of satellite networks over land-based fixed line systems: (1) the costs are independent of distance; (2) the signal is ubiquitous, traveling from one point to multiple points; (3) satellites offer easy access to remote areas, allowing an instant infrastructure; and (4) reception/transmission equipment may be transportable or mobile. The instant infrastructure theme focuses on the cost-efficiency and "first-to-market" advantages of satellite-based telecommunications services over terrestrial, or land-based, transmission media. Satellite providers such as Astrolink can offer ubiquitous, high quality coverage to entire continents virtually instantaneously with limited investment in ground-based facilities. They can also deliver services ranging from basic fixed and mobile telephony to broadband Internet access and 200-channel digital television more rapidly and less costly than terrestrial providers, which must

build or upgrade the infrastructure region by region. Satellite transmission costs do not vary with distance traveled or with the number of receiving terminals, making satellite the low-cost alternative for point-to-multipoint transmissions, such as the distribution of CNN cable television programming all over the world. Furthermore, it also provides the lowest cost for "thin route" communications over long distances, such as telephone and data communications for rural or remote locations. The combination of low fixed operating costs and large coverage areas ("footprints") gives them the potential to breakeven in cash flow with only modest penetration. Thus, unlike cellular telephony or cable television, a narrowly targeted service such as mobile satellite telephony in Asia can produce attractive returns, even while signing only a small fraction of potential subscribers. Bear Stearns reports that once satellite providers have achieved cash breakeven, they typically generate cash flow margins of 40% to 70% for retail and 60% to 90% for wholesale services.

APPENDIX B

Decision Hierarchy



Lockheed Martin Space & Missiles
FCC deregulation

Strategic alliance/partnership
Market focus
Optimal launching order

Anticipate competitors
Explore new technology

Appendix C

Determination of Values

The values used in the model were developed in various methods. Some data could not be arrived at directly. For example, market penetration of satellite telecommunications in the telecommuting, business transfer, home/personal use, and telemedicine markets are figures that are unavailable since the market is non-existent. Thus we had to develop a model based on our knowledge of wireless telecommunication (cellular) which had a 13% penetration rate by 1995. Since cellular has many other competitors while Astrolink's target market has fewer terrestrial competitors, one would expect the market penetration for Astrolink applications to have higher adoption rate. We could also use the Bass model:

$$F(0) = 0$$

$$F(t) = [1 - e^{-bt}]/[1 + ae^{-bt}]$$

$$where\ a = \frac{p}{q} \text{ and } b = p + q$$

F(t) is the penetration rate at time t

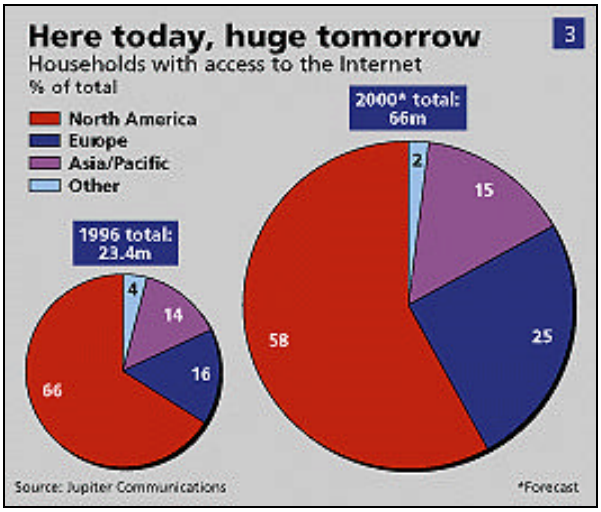
p = coefficient of innovation

q = coefficient of imitation

We can then guess a value for p and q based on our knowledge of current adoption rate of high technology devices such as the internet, cellular communications, etc. and factor in a scaling value that represents the degree of terrestrial competition for the market.

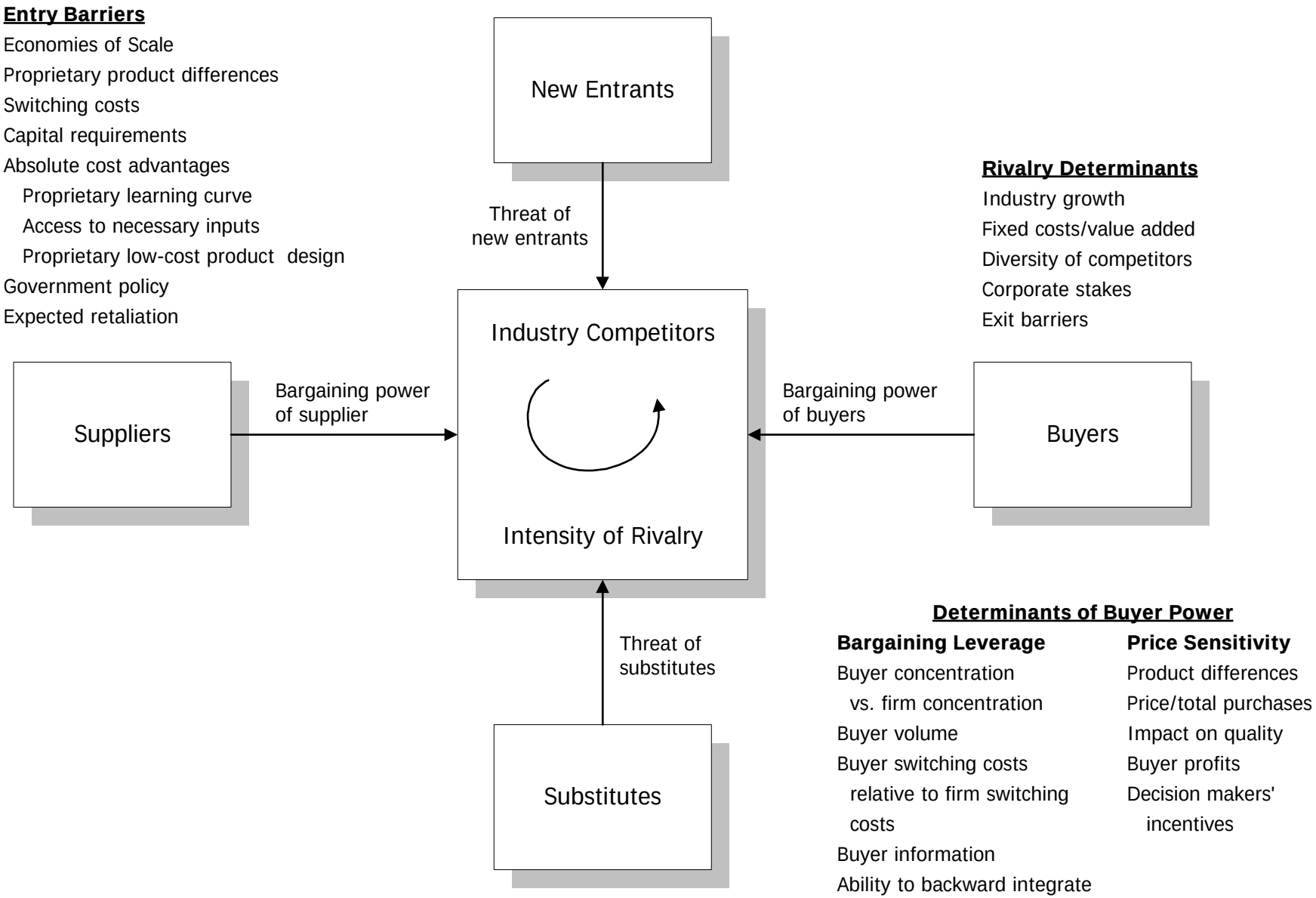
Market growth rates were determined from actual data when available. For example, we have data for the U.S. for the number of telecommuters in 1994 and 1996 along with a projection for the year 2000. We used those values to project forward in time. For telemedicine, we scaled up a projection of population growth. For home and business use we used values for growth of personal computers (with Internet connection) and the growth of businesses engaging in electronic data transfer.

Market size was estimated for projections and survey data. For example, data was available for the number of households with internet connections in 1996 and 2000 (projection). There was data for a number of worldwide businesses engaging in electronic interbusiness transactions. The number was divided up accordingly to the three regions we examined. We assumed that each business engaged in 1000 such transactions daily at a rate of 38.4 Kb/s



Price per Mbits

We decided on using bits and having Astrolink charge on a per bit basis. Astrolink would charge $.25 a minute for a 384 Kb/s connection. We then assumed that the connection was operating for the entire time and thus we arrived at a cost per bit In actuality we don't expect a per bit basis charge and this is just an estimate. The price per Mb is ($ 0.25/min)/(384*60 Kb/min)*1000*0.5 = 0.54 cents. The 0.5 term is due to our assumption that the revenue was divided in half - half to Astrolink and the rest to suppliers and distributors.


Entry Barriers
Economies of Scale
Proprietary product differences
Switching costs
Capital requirements
Absolute cost advantages
Proprietary learning curve
Access to necessary inputs
Proprietary low-cost product design
Government policy
Expected retaliation
New Entrants
Threat of new entrants
Rivalry Determinants
Industry growth
Fixed costs/value added
Diversity of competitors
Corporate stakes
Exit barriers
Suppliers
Bargaining power of supplier
Industry Competitors
Intensity of Rivalry
Bargaining power of buyers
Buyers
Threat of substitutes
Substitutes
Determinants of Buyer Power
Bargaining Leverage
Buyer concentration vs. firm concentration
Buyer volume
Buyer switching costs relative to firm switching costs
Buyer information
Ability to backward integrate
Subsitute products
Price Sensitivity
Product differences
Price/total purchases
Impact on quality
Buyer profits
Decision makers' incentives
Determinants of Substitution Threat
Relative price performance of substitutes
Switching costs
Buyer propensity to substitute

Teleworkers/Telecommuters

Application	Data Rate (kb/s)	Hours	Total Data Rate (Million bits)	Note 1 Mb = 1024 Kb
Audio Conferencing	16	5	288	
Video Telephony	192	1	691.2	<- very poor quality
Video Conferencing	4000	0.1667	2400	<- MPEG-2 Low
Data (10 MB/ day)	Various		409.6	
Fax (30 pages/ week)	96	0.02	5.76	<- 25.6 KBytes per page roughly
Other	128	1	460.8	
Total			**4255.36**	<- Mbits/week
			0.007035979	<- Mb/s
Total Telecommunters			3.80E+07	<- in 1996
			2.67E+05	<- Mb/s
			1.44378E+12	<- Mb per Quarter
			3.80E+04	<- Mb per Quarter per Telecommuter

Note - everything is in terms of Kb

Telemedicine

Resolution (2048x2048)	4194304	pixels
Bits/Pixel	10	
Compression (15:1)	0.0667	high quality JPEG does 10 to 20 :1
Subtotal	2796202.67	bits
Overhead data (10%)	3075822.93	
Bits per image	2.9333	
Price at $.25 per unit per min	$ 0.19	
Operations per year	20	
Assume 1% penetration	1%	
Scans per Operation	20	
Total Images	4	
Images sent per operation	2	average of 2 other locations
Bits per Image (above)	2.9333	
Total Bits per operation	23.4667	Million bits/year
Total Bits per operation	1.9556	Million bits/month
Total Bits per operation	**5.867**	

Electronic Commerce (Per Transaction)

Application	Data Rate (kb/s)	Seconds	Total Data Rate (Million bits)
Transaction	384	0.1	0.0384
Trans per day per company			1000
Total (Mb)			38.4
Total per quarter			**3504**

Home Requirement Budget

Per Houshold per week	Data Transfer per Week (MB)	Time Spent	Average bit rate (kbs)	Scale by 60
Adult use				
Work Related	1	3.5	0.6349	38.095
Personal	3	4	1.6667	100
Children use				
WWW	4	4	2.2222	133.333
Interactive Games	9	5	4	240
Class, research	1	4	0.5556	33.333
Total	18			

Mb/week/household	144	
Mb/quarter/household	**1877.1429**	
Households with PC (2001)		7.00E+07
PC with Data Connection	0.5	3.50E+07
Satellite Pentration	0.25	8.75E+06

Alternative 1

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
North America																			
	US Growth Rate			Telecommut	Telemedici	Ecommerc	HomeUse		NA Scale	Scale numbers from US to North America									
	Yearly			5%	4%	10%	10%		1.1										
	Quarterly			1.012	1.010	1.024	1.024												
(1) Telecommuters																			
# Telecommuters (Millions)		41.8	42.3	42.8	43.4	43.9	44.4	45.0	45.5	46.1	46.7	47.2	47.8	48.4	49.0	49.6	50.2	50.8	51.4
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.055	0.055	0.055	0.055	0.05	0.05	0.05	0.05	0.09	0.09	0.09	0.09	0.11	0.11	0.11	0.11	0.13	0.13
Astrolink Market Share		0.052392	0.052392	0.0523918	0.052392	0.039605	0.039605	0.039605	0.039605	0.064195	0.064195	0.064195	0.064195	0.06616	0.06616	0.06616	0.06616	0.077358	0.077358
Astrolink Demand (Tb/quarter)		4576	4633	4689	4747	3302	3343	3384	3425	10116	10240	10366	10493	13380	13544	13710	13878	19413	19652
(2) Telemedicine																			
# Operations/Quarter (Millions)		5.5	5.554194	5.6089215	5.664188	5.72	5.776361	5.833278	5.890756	5.9488	6.007416	6.066609	6.126386	6.186752	6.247713	6.309274	6.371442	6.434222	6.497621
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.08	0.08	0.11	0.11
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		0.042263	0.042679	0.0430997	0.043524	0.049839	0.05033	0.050826	0.051326	0.140024	0.141404	0.142797	0.144204	0.240132	0.242498	0.244887	0.2473	0.40151	0.405466
(3) Electronic Commerce (Intercompany)																			
# Company		152250	155921.3	159681.15	163531.6	167475	171513.4	175649.3	179884.8	184222.5	188664.8	193214.2	197873.3	202644.8	207531.3	212535.6	217660.6	222909.2	228284.4
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.025	0.025	0.025	0.025	0.08	0.1	0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.15	0.15
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		873.4435	894.5055	916.07531	938.1653	2324.134	2975.222	2437.573	2496.351	5179.865	5304.77	5432.688	5563.69	7046.701	7216.623	7390.642	7568.858	11329.21	11602.4
(4) Home Use																			
# Housholds w. Computers (Millions) w		38.28	39.20307	40.148403	41.11653	42.108	43.12338	44.16324	45.22818	46.3188	47.43572	48.57957	49.751	50.95068	52.17929	53.43752	54.7261	56.04575	57.39722
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.025	0.025	0.025	0.025	0.08	0.08	0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.15	0.15
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.031186
Astrolink Demand (Tb/quarter)		117.6475	120.4844	123.38974	126.3651	313.0466	320.5954	328.3261	336.2432	697.6961	714.5201	731.7498	749.395	949.1475	972.0349	995.4743	1019.479	1525.976	504.0105
(5) Total Demand (Tb)		**5567**	**5648**	**5729**	**5812**	**5939**	**6639**	**6150**	**6258**	**15994**	**16260**	**16531**	**16806**	**21376**	**21733**	**22097**	**22467**	**32269**	**31758**
Capacity (Tb)		**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**5567**	**5648**	**5729**	**5812**	**5939**	**6639**	**6150**	**6258**	**15994**	**16260**	**16531**	**16806**	**21376**	**21733**	**22097**	**22467**	**32269**	**31758**

Alternative 1

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
North America															
(1) Telecommuters															
# Telecommuters (Millions)		52.1	52.7	53.3	54.0	54.7	55.3	56.0	56.7	57.4	58.1	58.8	59.5	60.3	61.0
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.13	0.13	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17
Astrolink Market Share		0.077358	0.077358	0.024949	0.024949	0.024949	0.024949	0.029615	0.029615	0.029615	0.029615	0.019618	0.019618	0.019618	0.019618
Astrolink Demand (Tb/quarter)		19893	20137	7585	7679	7773	7868	10085	10208	10334	10460	7453	7544	7637	7731
(2) Telemedicine															
# Operations/Quarter (Millions)		6.561645	6.626299	6.691591	6.757526	6.824111	6.891351	6.959255	7.027827	7.097075	7.167005	7.237625	7.30894	7.380958	7.453686
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.11	0.11	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		0.409462	0.413496	0.159156	0.160725	0.162308	0.163908	0.211593	0.213678	0.215783	0.21791	0.145775	0.147211	0.148662	0.150126
(3) Electronic Commerce (Intercompany)															
# Company		233789.2	239426.7	245200.1	251112.8	257168.1	263369.4	269720.2	276224.1	282884.9	289706.3	296692.2	303846.5	311173.4	318676.9
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.15	0.15	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		11882.18	12168.7	4823.002	4939.303	5058.407	5180.384	6647.379	6807.672	6971.83	7139.947	5098.787	5221.738	5347.653	5476.605
(4) Home Use															
# Housholds w. Computers (Millions) w		58.78128	60.19871	61.65032	63.13694	64.6594	66.21858	67.81536	69.45063	71.12534	72.84044	74.59689	76.3957	78.23788	80.12448
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.15	0.15	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		1600.457	1639.05	649.6289	665.2938	681.3365	697.766	895.3613	916.9518	939.0629	961.7071	686.7754	703.3361	720.2961	737.6651
(5) Total Demand (Tb)		**33376**	**33945**	**13058**	**13283**	**13513**	**13746**	**17628**	**17933**	**18245**	**18562**	**13239**	**13470**	**13705**	**13945**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**33376**	**33945**	**13058**	**13283**	**13513**	**13746**	**17628**	**17933**	**18245**	**18562**	**13239**	**13470**	**13705**	**13945**

Alternative 1

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
Europe																			
	Europe Growth Rate			Telecommut	Telemedici	Ecommerc	Home Use												
	Yearly			10%	5%	10%	8%												
	Quarterly			1.024	1.012	1.024	1.019												
(1) Telecommuters																			
# Telecommuters (Millions)		38.0	38.9	39.9	40.8	41.8	42.8	43.8	44.9	46.0	47.1	48.2	49.4	50.6	51.8	53.0	54.3	55.6	57.0
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06	0.08	0.08	0.08	0.08	0.11	0.11
Astrolink Market Share		0.047153	0.047153	0.0471526	0.047153	0.035644	0.035644	0.035644	0.035644	0.057776	0.057776	0.057776	0.057776	0.059544	0.059544	0.059544	0.059544	0.069622	0.069622
Astrolink Demand (Tb/quarter)		2042	2092	2142	2194	1698	5638	1781	1824	1868	6202	6352	6505	9154	9375	9601	9832	16189	16579
(2) Telemedicine																			
# Operations/Quarter (Millions)		5	5.061361	5.1234754	5.186352	5.25	5.314429	5.379649	5.445669	5.5125	5.580151	5.648632	5.717953	5.788125	5.859158	5.931063	6.003851	6.077531	6.152116
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.057631	0.057631	0.057631	0.057631	0.043565	0.043565	0.043565	0.043565	0.070615	0.070615	0.070615	0.070615	0.072776	0.072776	0.072776	0.072776	0.085094	0.085094
Astrolink Demand (Tb/quarter)		0.016905	0.017113	0.0173226	0.017535	0.026836	0.027166	0.027499	0.027836	0.06851	0.069351	0.070202	0.071064	0.123563	0.125079	0.126614	0.128168	0.182041	0.184275
(3) Electronic Commerce (Intercompany)																			
# Company		130500	133646.8	136869.55	140170	143550	147011.5	150556.5	154187	157905	161712.7	165612.2	169605.7	173695.5	177883.9	182173.4	186566.2	191065.1	195672.3
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.08	0.08	0.08	0.08	0.12	0.12
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		598.9327	613.3752	628.16593	643.3133	498.0288	510.0381	522.337	534.9324	1775.954	1818.778	1862.636	1907.551	4026.686	4123.785	4223.224	4325.062	7768.604	7955.934
(4) Home Use																			
# Housholds w. Computers (Millions) w		16.5	16.82054	17.147303	17.48042	17.82	18.16618	18.51909	18.87885	19.2456	19.61948	20.00061	20.38916	20.78525	21.18903	21.60066	22.02029	22.44807	22.88416
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.08	0.08	0.11	0.11	0.11	0.11	0.14	0.14
Astrolink Market Share		0.047153	0.047153	0.0471526	0.047153	0.035644	0.035644	0.035644	0.035644	0.057776	0.057776	0.057776	0.057776	0.059544	0.059544	0.059544	0.059544	0.069622	0.069622
Astrolink Demand (Tb/quarter)		43.81355	44.6647	45.532377	46.41691	59.61625	60.77439	61.95502	63.1586	166.9794	170.2232	173.5301	176.9012	255.5541	260.5186	265.5796	270.7389	410.727	418.706
(5) Total Demand (Tb)		**2685**	**2750**	**2816**	**2883**	**2256**	**6209**	**2365**	**2422**	**3811**	**8191**	**8388**	**8589**	**13436**	**13759**	**14090**	**14428**	**24368**	**24954**
Capacity (Tb)		**0**	**0**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**0**	**0**	**2816**	**2883**	**2256**	**6209**	**2365**	**2422**	**3811**	**8191**	**8388**	**8589**	**13436**	**13759**	**14090**	**14428**	**24368**	**24954**

Alternative 1

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Europe															
(1) Telecommuters															
# Telecommuters (Millions)		58.4	59.8	61.2	62.7	64.2	65.7	67.3	68.9	70.6	72.3	74.1	75.8	77.7	79.5
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.11	0.11	0.13	0.13	0.13	0.13	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Astrolink Market Share		0.069622	0.069622	0.022454	0.022454	0.022454	0.022454	0.026653	0.026653	0.026653	0.026653	0.017656	0.017656	0.017656	0.017656
Astrolink Demand (Tb/quarter)		16979	17388	6787	6951	7119	7290	10226	10472	10725	10984	7451	7631	7815	8004
(2) Telemedicine															
# Operations/Quarter (Millions)		6.227616	6.304043	6.381408	6.459722	6.538997	6.619245	6.700478	6.782708	6.865947	6.950208	7.035502	7.121843	7.209244	7.297718
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.085094	0.085094	0.027444	0.027444	0.027444	0.027444	0.032576	0.032576	0.032576	0.032576	0.02158	0.02158	0.02158	0.02158
Astrolink Demand (Tb/quarter)		0.186536	0.188826	0.07192	0.072802	0.073696	0.0746	0.11525	0.116665	0.118096	0.119546	0.089071	0.090164	0.091271	0.092391
(3) Electronic Commerce (Intercompany)															
# Company		200390.7	205222.9	210171.6	215239.6	220429.8	225745.2	231188.7	236763.5	242472.8	248319.7	254307.6	260439.9	266720	273151.6
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.12	0.12	0.15	0.15	0.15	0.15	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		8147.781	8344.254	3445.002	3998.483	3613.148	3700.274	4498.227	5220.922	5346.817	5475.749	3933.35	4028.198	4125.332	4224.809
(4) Home Use															
# Housholds w. Computers (Millions) w		23.32872	23.78191	24.24391	24.71489	25.19501	25.68447	26.18343	26.69208	27.21061	27.73922	28.2781	28.82745	29.38746	29.95836
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.14	0.14	0.16	0.16	0.16	0.16	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19
Astrolink Market Share		0.069622	0.069622	0.022454	0.022454	0.022454	0.022454	0.026653	0.026653	0.026653	0.026653	0.017656	0.017656	0.017656	0.017656
Astrolink Demand (Tb/quarter)		426.84	435.132	163.4981	166.6743	169.9122	173.213	235.8024	240.3832	245.053	249.8135	178.0739	181.5333	185.0599	188.6549
(5) Total Demand (Tb)		**25554**	**26168**	**10396**	**11116**	**10902**	**11164**	**14960**	**15934**	**16317**	**16709**	**11563**	**11841**	**12126**	**12417**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**25554**	**26168**	**10396**	**11116**	**10902**	**11164**	**14960**	**15934**	**16317**	**16709**	**11563**	**11841**	**12126**	**12417**

Alternative 1

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
Asia																			
	Asia Growth Rate			Telecommut	Telemedici	Ecommerc	Home Use												
	Yearly			15%	8%	15%	12%												
	Quarterly			1.036	1.019	1.036	1.029												
(1) Telecommuters																			
# Telecommuters (Millions)		19.0	19.7	20.4	21.1	21.9	22.6	23.4	24.3	25.1	26.0	26.9	27.9	28.9	29.9	31.0	32.1	33.2	34.4
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.08	0.08
Astrolink Market Share		0.057631	0.057631	0.057631	0.057631	0.043565	0.043565	0.043565	0.043565	0.070615	0.070615	0.070615	0.070615	0.072776	0.072776	0.072776	0.072776	0.085094	0.085094
Astrolink Demand (Tb/quarter)		416	431	446	462	723	749	776	803	2697	2793	2892	2995	4794	4965	5141	5324	8595	8901
(2) Telemedicine																			
# Operations/Quarter (Millions)		5	5.097133	5.1961524	5.297096	5.4	5.504903	5.611845	5.720863	5.832	5.945296	6.060792	6.178532	6.29856	6.420919	6.545656	6.672815	6.802445	6.934593
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.055011	0.055011	0.0550114	0.055011	0.041585	0.041585	0.041585	0.041585	0.067405	0.067405	0.067405	0.067405	0.069468	0.069468	0.069468	0.069468	0.081226	0.081226
Astrolink Demand (Tb/quarter)		0.016137	0.01645	0.0167697	0.017096	0.026348	0.02686	0.027382	0.027914	0.069186	0.070531	0.071901	0.073297	0.128347	0.130841	0.133383	0.135974	0.194493	0.198271
(3) Electronic Commerce (Intercompany)																			
# Company		152250	157663.7	163269.94	169075.5	175087.5	181313.3	187760.4	194436.8	201350.6	208510.3	215924.5	223602.3	231553.2	239786.8	248313.2	257142.7	266286.2	275754.8
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.055011	0.055011	0.0550114	0.055011	0.041585	0.041585	0.041585	0.041585	0.067405	0.067405	0.067405	0.067405	0.069468	0.069468	0.069468	0.069468	0.081226	0.081226
Astrolink Demand (Tb/quarter)		293.477	303.9125	314.71905	325.9099	510.2531	528.3967	547.1855	566.6423	1426.689	1477.419	1529.953	1584.356	2818.184	2918.393	3022.166	3129.628	4547.364	4709.059
(4) Home Use																			
# Housholds w. Computers (Millions) w		9.9	10.1845	10.477175	10.77826	11.088	11.40664	11.73444	12.07165	12.41856	12.77544	13.14257	13.52025	13.90879	14.30849	14.71968	15.14268	15.57784	16.02551
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.017	0.017	0.017	0.017	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.09	0.09	0.09	0.09	0.12	0.12
Astrolink Market Share		0.06287	0.06287	0.0628702	0.06287	0.047526	0.047526	0.047526	0.047526	0.077034	0.077034	0.077034	0.077034	0.079392	0.079392	0.079392	0.079392	0.09283	0.09283
Astrolink Demand (Tb/quarter)		19.86214	20.43293	21.020116	21.62418	39.56753	40.70459	41.87433	43.07769	107.7464	110.8427	114.0281	117.3049	186.5544	191.9155	197.4306	203.1042	325.7418	335.1027
(5) Total Demand (Tb)		**729**	**755**	**782**	**810**	**1273**	**1318**	**1365**	**1413**	**4231**	**4381**	**4536**	**4696**	**7799**	**8075**	**8361**	**8657**	**13468**	**13945**
Capacity (Tb)		**0**	**0**	**0**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**0**	**0**	**0**	**810**	**1273**	**1318**	**1365**	**1413**	**4231**	**4381**	**4536**	**4696**	**7799**	**8075**	**8361**	**8657**	**13468**	**13945**

Alternative 1

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Asia															
(1) Telecommuters															
# Telecommuters (Millions)		35.6	36.9	38.2	39.6	41.0	42.4	43.9	45.5	47.1	48.8	50.5	52.3	54.2	56.1
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13
Astrolink Market Share		0.085094	0.085094	0.027444	0.027444	0.027444	0.027444	0.032576	0.032576	0.032576	0.032576	0.02158	0.02158	0.02158	0.02158
Astrolink Demand (Tb/quarter)		9217	9545	3985	4126	4273	4425	6527	6760	7000	7249	5387	5579	5777	5982
(2) Telemedicine															
# Operations/Quarter (Millions)		7.069308	7.20664	7.34664	7.48936	7.634853	7.783171	7.934372	8.088509	8.245641	8.405825	8.569121	8.73559	8.905292	9.078291
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.081226	0.081226	0.026196	0.026196	0.026196	0.026196	0.031096	0.031096	0.031096	0.031096	0.020599	0.020599	0.020599	0.020599
Astrolink Demand (Tb/quarter)		0.202123	0.206049	0.079035	0.08057	0.082135	0.083731	0.13027	0.132801	0.135381	0.138011	0.103556	0.105567	0.107618	0.109709
(3) Electronic Commerce (Intercompany)															
# Company		285560.1	295714.1	306229.1	317118.1	328394.2	340071.2	352163.5	364685.8	377653.3	391081.9	404988	419388.6	434301.3	449744.2
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.081226	0.081226	0.026196	0.026196	0.026196	0.026196	0.031096	0.031096	0.031096	0.031096	0.020599	0.020599	0.020599	0.020599
Astrolink Demand (Tb/quarter)		4876.504	5049.903	1967.651	2037.617	2110.071	2185.101	3453.422	3576.219	3703.382	3835.067	2923.158	3027.1	3134.737	3246.203
(4) Home Use															
# Housholds w. Computers (Millions) w		16.48604	16.9598	17.44718	17.94857	18.46436	18.99498	19.54084	20.1024	20.68009	21.27438	21.88575	22.51468	23.1617	23.8273
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.12	0.12	0.14	0.14	0.14	0.14	0.18	0.18	0.18	0.18	0.2	0.2	0.2	0.2
Astrolink Market Share		0.09283	0.09283	0.029939	0.029939	0.029939	0.029939	0.035538	0.035538	0.035538	0.035538	0.023542	0.023542	0.023542	0.023542
Astrolink Demand (Tb/quarter)		344.7327	354.6394	137.272	141.2169	145.2751	149.4499	234.6409	241.3839	248.3206	255.4567	193.4312	198.9899	204.7084	210.5911
(5) Total Demand (Tb)		**14439**	**14950**	**6090**	**6305**	**6529**	**6760**	**10216**	**10577**	**10952**	**11339**	**8504**	**8805**	**9117**	**9439**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**14439**	**14950**	**6090**	**6305**	**6529**	**6760**	**10216**	**10577**	**10952**	**11339**	**8504**	**8805**	**9117**	**9439**

Alternative 1

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4
Total World Use		**5567**	**5648**	**8545**	**9504**	**9469**	**14166**	**9880**	**10093**	**24036**	**28832**	**29454**	**30092**	**42611**	**43567**	**44547**	**45552**
Satellites in Orbit		**1**	**2**	**3**	**4**	**5**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Available Capacity		19678	39357	59035	78714	98392	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071
% Use		28%	14%	14%	12%	10%	12%	8%	9%	20%	24%	25%	25%	36%	37%	38%	39%
Launch Cost		272	121.6	115.52	110	110	110	0	0	0	0	0	0	0	0	0	0
Operating Cost		84.41315	84.41315	84.41315	84.41315	86.94554	86.94554	86.94554	86.94554	89.55391	89.55391	89.55391	89.55391	92.24053	92.24053	92.24053	92.24053
Revenue ($M)		30	31	46	52	51	77	54	55	130	156	160	163	231	236	242	247
Profit		-326	-175	-154	-143	-146	-120	-33	-32	41	67	70	74	139	144	149	155
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
NPV		-257.2124	-135.5692	-116.39108	-106.1382	-106.0438	-85.76474	-23.34575	-22.09396	27.49117	44.1179	45.43759	46.74108	86.3818	87.84896	89.30385	90.74697
Cumulative NPV		-257.2124	-392.7816	-509.17266	-615.3108	-721.3547	-807.1194	-830.4652	-852.5591	-825.0679	-780.95	-735.5125	-688.7714	-602.3896	-514.5406	-425.2368	-334.4898

	Year	2004.1	2004.2	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Total World Use		**70106**	**70658**	**73368**	**75063**	**29544**	**30705**	**30943**	**31670**	**42803**	**44444**	**45513**	**46611**	**33305**	**34115**	**34947**	**35802**
Satellites in Orbit		**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Available Capacity		118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071
% Use		59%	60%	62%	64%	25%	26%	26%	27%	36%	38%	39%	39%	28%	29%	30%	30%
Launch Cost																	
Operating Cost		95.00774	95.00774	95.007744	95.00774	97.85798	97.85798	97.85798	97.85798	100.7937	100.7937	100.7937	100.7937	103.8175	103.8175	103.8175	103.8175
Revenue ($M)		380	383	398	407	160	167	168	172	232	241	247	253	181	185	190	194
Profit		285	288	303	312	62	69	70	74	131	140	146	152	77	81	86	90
		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
NPV		163.8921	162.3644	167.29995	168.9954	33.12656	35.75381	35.71172	36.98381	64.42938	67.44534	68.85589	70.25666	34.81608	36.08468	37.34173	38.58764
Cumulative NPV		-170.5977	-8.233282	159.06667	328.062	361.1886	396.9424	432.6541	469.6379	534.0673	601.5127	670.3685	740.6252	775.4413	811.526	848.8677	887.4553

Total ($M)	**887.4553**
U value	**-0.00014**

	Mb/s	Spot beam	Channel/Be	Channel per	Reduction	Quarter
satellite capacity	19678	64	1	130	0.3	7.884
price ($/ Mb)	0.0054					

LAUNCHING STRATEGY	
USA 1	2000.1
USA 2	2000.2
EUR 1	2000.3
EUR 2	2001.1
ASIA 1	2000.4
ASIA 2	2001.2
Tot Cost	3841.6

Alternative 1

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
North America																			
	US Growth Rate			Telecommut	Telemedici	Ecommerc	HomeUse		NA Scale	Scale numbers from US to North America									
	Yearly			5%	4%	10%	10%		1.1										
	Quarterly			1.012	1.010	1.024	1.024												
(1) Telecommuters																			
# Telecommuters (Millions)		41.8	42.3	42.8	43.4	43.9	44.4	45.0	45.5	46.1	46.7	47.2	47.8	48.4	49.0	49.6	50.2	50.8	51.4
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.055	0.055	0.055	0.055	0.05	0.05	0.05	0.05	0.09	0.09	0.09	0.09	0.11	0.11	0.11	0.11	0.13	0.13
Astrolink Market Share		0.052392	0.052392	0.0523918	0.052392	0.039605	0.039605	0.039605	0.039605	0.064195	0.064195	0.064195	0.064195	0.06616	0.06616	0.06616	0.06616	0.077358	0.077358
Astrolink Demand (Tb/quarter)		4576	4633	4689	4747	3302	3343	3384	3425	10116	10240	10366	10493	13380	13544	13710	13878	19413	19652
(2) Telemedicine																			
# Operations/Quarter (Millions)		5.5	5.554194	5.6089215	5.664188	5.72	5.776361	5.833278	5.890756	5.9488	6.007416	6.066609	6.126386	6.186752	6.247713	6.309274	6.371442	6.434222	6.497621
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.08	0.08	0.11	0.11
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		0.042263	0.042679	0.0430997	0.043524	0.049839	0.05033	0.050826	0.051326	0.140024	0.141404	0.142797	0.144204	0.240132	0.242498	0.244887	0.2473	0.40151	0.405466
(3) Electronic Commerce (Intercompany)																			
# Company		152250	155921.3	159681.15	163531.6	167475	171513.4	175649.3	179884.8	184222.5	188664.8	193214.2	197873.3	202644.8	207531.3	212535.6	217660.6	222909.2	228284.4
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.025	0.025	0.025	0.025	0.08	0.1	0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.15	0.15
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		873.4435	894.5055	916.07531	938.1653	2324.134	2975.222	2437.573	2496.351	5179.865	5304.77	5432.688	5563.69	7046.701	7216.623	7390.642	7568.858	11329.21	11602.4
(4) Home Use																			
# Housholds w. Computers (Millions) w		38.28	39.20307	40.148403	41.11653	42.108	43.12338	44.16324	45.22818	46.3188	47.43572	48.57957	49.751	50.95068	52.17929	53.43752	54.7261	56.04575	57.39722
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.025	0.025	0.025	0.025	0.08	0.08	0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.15	0.15
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.031186
Astrolink Demand (Tb/quarter)		117.6475	120.4844	123.38974	126.3651	313.0466	320.5954	328.3261	336.2432	697.6961	714.5201	731.7498	749.395	949.1475	972.0349	995.4743	1019.479	1525.976	504.0105
(5) Total Demand (Tb)		**5567**	**5648**	**5729**	**5812**	**5939**	**6639**	**6150**	**6258**	**15994**	**16260**	**16531**	**16806**	**21376**	**21733**	**22097**	**22467**	**32269**	**31758**
Capacity (Tb)		**19678**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**5567**	**5648**	**5729**	**5812**	**5939**	**6639**	**6150**	**6258**	**15994**	**16260**	**16531**	**16806**	**21376**	**21733**	**22097**	**22467**	**32269**	**31758**

Alternative 1

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
North America															
(1) Telecommuters															
# Telecommuters (Millions)		52.1	52.7	53.3	54.0	54.7	55.3	56.0	56.7	57.4	58.1	58.8	59.5	60.3	61.0
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.13	0.13	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17
Astrolink Market Share		0.077358	0.077358	0.024949	0.024949	0.024949	0.024949	0.029615	0.029615	0.029615	0.029615	0.019618	0.019618	0.019618	0.019618
Astrolink Demand (Tb/quarter)		19893	20137	7585	7679	7773	7868	10085	10208	10334	10460	7453	7544	7637	7731
(2) Telemedicine															
# Operations/Quarter (Millions)		6.561645	6.626299	6.691591	6.757526	6.824111	6.891351	6.959255	7.027827	7.097075	7.167005	7.237625	7.30894	7.380958	7.453686
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.11	0.11	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		0.409462	0.413496	0.159156	0.160725	0.162308	0.163908	0.211593	0.213678	0.215783	0.21791	0.145775	0.147211	0.148662	0.150126
(3) Electronic Commerce (Intercompany)															
# Company		233789.2	239426.7	245200.1	251112.8	257168.1	263369.4	269720.2	276224.1	282884.9	289706.3	296692.2	303846.5	311173.4	318676.9
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.15	0.15	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		11882.18	12168.7	4823.002	4939.303	5058.407	5180.384	6647.379	6807.672	6971.83	7139.947	5098.787	5221.738	5347.653	5476.605
(4) Home Use															
# Housholds w. Computers (Millions) w		58.78128	60.19871	61.65032	63.13694	64.6594	66.21858	67.81536	69.45063	71.12534	72.84044	74.59689	76.3957	78.23788	80.12448
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.15	0.15	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		1600.457	1639.05	649.6289	665.2938	681.3365	697.766	895.3613	916.9518	939.0629	961.7071	686.7754	703.3361	720.2961	737.6651
(5) Total Demand (Tb)		**33376**	**33945**	**13058**	**13283**	**13513**	**13746**	**17628**	**17933**	**18245**	**18562**	**13239**	**13470**	**13705**	**13945**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**33376**	**33945**	**13058**	**13283**	**13513**	**13746**	**17628**	**17933**	**18245**	**18562**	**13239**	**13470**	**13705**	**13945**

Alternative 1

Aggregate Demand Projections

Europe

Europe Growth Rate	Telecommut	Telemedici	Ecommerc	Home Use
Yearly	10%	5%	10%	8%
Quarterly	1.024	1.012	1.024	1.019

	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
(1) Telecommuters																			
# Telecommuters (Millions)		38.0	38.9	39.9	40.8	41.8	42.8	43.8	44.9	46.0	47.1	48.2	49.4	50.6	51.8	53.0	54.3	55.6	57.0
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06	0.08	0.08	0.08	0.08	0.11	0.11
Astrolink Market Share		0.047153	0.047153	0.0471526	0.047153	0.035644	0.035644	0.035644	0.035644	0.057776	0.057776	0.057776	0.057776	0.059544	0.059544	0.059544	0.059544	0.069622	0.069622
Astrolink Demand (Tb/quarter)		2042	2092	2142	2194	1698	5638	1781	1824	1868	6202	6352	6505	9154	9375	9601	9832	16189	16579
(2) Telemedicine																			
# Operations/Quarter (Millions)		5	5.061361	5.1234754	5.186352	5.25	5.314429	5.379649	5.445669	5.5125	5.580151	5.648632	5.717953	5.788125	5.859158	5.931063	6.003851	6.077531	6.152116
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.057631	0.057631	0.057631	0.057631	0.043565	0.043565	0.043565	0.043565	0.070615	0.070615	0.070615	0.070615	0.072776	0.072776	0.072776	0.072776	0.085094	0.085094
Astrolink Demand (Tb/quarter)		0.016905	0.017113	0.0173226	0.017535	0.026836	0.027166	0.027499	0.027836	0.06851	0.069351	0.070202	0.071064	0.123563	0.125079	0.126614	0.128168	0.182041	0.184275
(3) Electronic Commerce (Intercompany)																			
# Company		130500	133646.8	136869.55	140170	143550	147011.5	150556.5	154187	157905	161712.7	165612.2	169605.7	173695.5	177883.9	182173.4	186566.2	191065.1	195672.3
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.08	0.08	0.08	0.08	0.12	0.12
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		598.9327	613.3752	628.16593	643.3133	498.0288	510.0381	522.337	534.9324	1775.954	1818.778	1862.636	1907.551	4026.686	4123.785	4223.224	4325.062	7768.604	7955.934
(4) Home Use																			
# Housholds w. Computers (Millions) w		16.5	16.82054	17.147303	17.48042	17.82	18.16618	18.51909	18.87885	19.2456	19.61948	20.00061	20.38916	20.78525	21.18903	21.60066	22.02029	22.44807	22.88416
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.08	0.08	0.11	0.11	0.11	0.11	0.14	0.14
Astrolink Market Share		0.047153	0.047153	0.0471526	0.047153	0.035644	0.035644	0.035644	0.035644	0.057776	0.057776	0.057776	0.057776	0.059544	0.059544	0.059544	0.059544	0.069622	0.069622
Astrolink Demand (Tb/quarter)		43.81355	44.6647	45.532377	46.41691	59.61625	60.77439	61.95502	63.1586	166.9794	170.2232	173.5301	176.9012	255.5541	260.5186	265.5796	270.7389	410.727	418.706
(5) Total Demand (Tb)		**2685**	**2750**	**2816**	**2883**	**2256**	**6209**	**2365**	**2422**	**3811**	**8191**	**8388**	**8589**	**13436**	**13759**	**14090**	**14428**	**24368**	**24954**
Capacity (Tb)		**0**	**19678**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**0**	**2750**	**2816**	**2883**	**2256**	**6209**	**2365**	**2422**	**3811**	**8191**	**8388**	**8589**	**13436**	**13759**	**14090**	**14428**	**24368**	**24954**

Alternative 1

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Europe															
(1) Telecommuters															
# Telecommuters (Millions)		58.4	59.8	61.2	62.7	64.2	65.7	67.3	68.9	70.6	72.3	74.1	75.8	77.7	79.5
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.11	0.11	0.13	0.13	0.13	0.13	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Astrolink Market Share		0.069622	0.069622	0.022454	0.022454	0.022454	0.022454	0.026653	0.026653	0.026653	0.026653	0.017656	0.017656	0.017656	0.017656
Astrolink Demand (Tb/quarter)		16979	17388	6787	6951	7119	7290	10226	10472	10725	10984	7451	7631	7815	8004
(2) Telemedicine															
# Operations/Quarter (Millions)		6.227616	6.304043	6.381408	6.459722	6.538997	6.619245	6.700478	6.782708	6.865947	6.950208	7.035502	7.121843	7.209244	7.297718
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.085094	0.085094	0.027444	0.027444	0.027444	0.027444	0.032576	0.032576	0.032576	0.032576	0.02158	0.02158	0.02158	0.02158
Astrolink Demand (Tb/quarter)		0.186536	0.188826	0.07192	0.072802	0.073696	0.0746	0.11525	0.116665	0.118096	0.119546	0.089071	0.090164	0.091271	0.092391
(3) Electronic Commerce (Intercompany)															
# Company		200390.7	205222.9	210171.6	215239.6	220429.8	225745.2	231188.7	236763.5	242472.8	248319.7	254307.6	260439.9	266720	273151.6
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.12	0.12	0.15	0.15	0.15	0.15	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		8147.781	8344.254	3445.002	3998.483	3613.148	3700.274	4498.227	5220.922	5346.817	5475.749	3933.35	4028.198	4125.332	4224.809
(4) Home Use															
# Housholds w. Computers (Millions) w		23.32872	23.78191	24.24391	24.71489	25.19501	25.68447	26.18343	26.69208	27.21061	27.73922	28.2781	28.82745	29.38746	29.95836
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.14	0.14	0.16	0.16	0.16	0.16	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19
Astrolink Market Share		0.069622	0.069622	0.022454	0.022454	0.022454	0.022454	0.026653	0.026653	0.026653	0.026653	0.017656	0.017656	0.017656	0.017656
Astrolink Demand (Tb/quarter)		426.84	435.132	163.4981	166.6743	169.9122	173.213	235.8024	240.3832	245.053	249.8135	178.0739	181.5333	185.0599	188.6549
(5) Total Demand (Tb)		**25554**	**26168**	**10396**	**11116**	**10902**	**11164**	**14960**	**15934**	**16317**	**16709**	**11563**	**11841**	**12126**	**12417**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**25554**	**26168**	**10396**	**11116**	**10902**	**11164**	**14960**	**15934**	**16317**	**16709**	**11563**	**11841**	**12126**	**12417**

Alternative 1

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
Asia																			
	Asia Growth Rate			Telecommut	Telemedici	Ecommerc	Home Use												
	Yearly			15%	8%	15%	12%												
	Quarterly			1.036	1.019	1.036	1.029												
(1) Telecommuters																			
# Telecommuters (Millions)		19.0	19.7	20.4	21.1	21.9	22.6	23.4	24.3	25.1	26.0	26.9	27.9	28.9	29.9	31.0	32.1	33.2	34.4
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.08	0.08
Astrolink Market Share		0.057631	0.057631	0.057631	0.057631	0.043565	0.043565	0.043565	0.043565	0.070615	0.070615	0.070615	0.070615	0.072776	0.072776	0.072776	0.072776	0.085094	0.085094
Astrolink Demand (Tb/quarter)		416	431	446	462	723	749	776	803	2697	2793	2892	2995	4794	4965	5141	5324	8595	8901
(2) Telemedicine																			
# Operations/Quarter (Millions)		5	5.097133	5.1961524	5.297096	5.4	5.504903	5.611845	5.720863	5.832	5.945296	6.060792	6.178532	6.29856	6.420919	6.545656	6.672815	6.802445	6.934593
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.055011	0.055011	0.0550114	0.055011	0.041585	0.041585	0.041585	0.041585	0.067405	0.067405	0.067405	0.067405	0.069468	0.069468	0.069468	0.069468	0.081226	0.081226
Astrolink Demand (Tb/quarter)		0.016137	0.01645	0.0167697	0.017096	0.026348	0.02686	0.027382	0.027914	0.069186	0.070531	0.071901	0.073297	0.128347	0.130841	0.133383	0.135974	0.194493	0.198271
(3) Electronic Commerce (Intercompany)																			
# Company		152250	157663.7	163269.94	169075.5	175087.5	181313.3	187760.4	194436.8	201350.6	208510.3	215924.5	223602.3	231553.2	239786.8	248313.2	257142.7	266286.2	275754.8
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.055011	0.055011	0.0550114	0.055011	0.041585	0.041585	0.041585	0.041585	0.067405	0.067405	0.067405	0.067405	0.069468	0.069468	0.069468	0.069468	0.081226	0.081226
Astrolink Demand (Tb/quarter)		293.477	303.9125	314.71905	325.9099	510.2531	528.3967	547.1855	566.6423	1426.689	1477.419	1529.953	1584.356	2818.184	2918.393	3022.166	3129.628	4547.364	4709.059
(4) Home Use																			
# Housholds w. Computers (Millions) w		9.9	10.1845	10.477175	10.77826	11.088	11.40664	11.73444	12.07165	12.41856	12.77544	13.14257	13.52025	13.90879	14.30849	14.71968	15.14268	15.57784	16.02551
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.017	0.017	0.017	0.017	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.09	0.09	0.09	0.09	0.12	0.12
Astrolink Market Share		0.06287	0.06287	0.0628702	0.06287	0.047526	0.047526	0.047526	0.047526	0.077034	0.077034	0.077034	0.077034	0.079392	0.079392	0.079392	0.079392	0.09283	0.09283
Astrolink Demand (Tb/quarter)		19.86214	20.43293	21.020116	21.62418	39.56753	40.70459	41.87433	43.07769	107.7464	110.8427	114.0281	117.3049	186.5544	191.9155	197.4306	203.1042	325.7418	335.1027
(5) Total Demand (Tb)		**729**	**755**	**782**	**810**	**1273**	**1318**	**1365**	**1413**	**4231**	**4381**	**4536**	**4696**	**7799**	**8075**	**8361**	**8657**	**13468**	**13945**
Capacity (Tb)		**0**	**0**	**19678**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**0**	**0**	**782**	**810**	**1273**	**1318**	**1365**	**1413**	**4231**	**4381**	**4536**	**4696**	**7799**	**8075**	**8361**	**8657**	**13468**	**13945**

Alternative 1

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Asia															
(1) Telecommuters															
# Telecommuters (Millions)		35.6	36.9	38.2	39.6	41.0	42.4	43.9	45.5	47.1	48.8	50.5	52.3	54.2	56.1
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13
Astrolink Market Share		0.085094	0.085094	0.027444	0.027444	0.027444	0.027444	0.032576	0.032576	0.032576	0.032576	0.02158	0.02158	0.02158	0.02158
Astrolink Demand (Tb/quarter)		9217	9545	3985	4126	4273	4425	6527	6760	7000	7249	5387	5579	5777	5982
(2) Telemedicine															
# Operations/Quarter (Millions)		7.069308	7.20664	7.34664	7.48936	7.634853	7.783171	7.934372	8.088509	8.245641	8.405825	8.569121	8.73559	8.905292	9.078291
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.081226	0.081226	0.026196	0.026196	0.026196	0.026196	0.031096	0.031096	0.031096	0.031096	0.020599	0.020599	0.020599	0.020599
Astrolink Demand (Tb/quarter)		0.202123	0.206049	0.079035	0.08057	0.082135	0.083731	0.13027	0.132801	0.135381	0.138011	0.103556	0.105567	0.107618	0.109709
(3) Electronic Commerce (Intercompany)															
# Company		285560.1	295714.1	306229.1	317118.1	328394.2	340071.2	352163.5	364685.8	377653.3	391081.9	404988	419388.6	434301.3	449744.2
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.081226	0.081226	0.026196	0.026196	0.026196	0.026196	0.031096	0.031096	0.031096	0.031096	0.020599	0.020599	0.020599	0.020599
Astrolink Demand (Tb/quarter)		4876.504	5049.903	1967.651	2037.617	2110.071	2185.101	3453.422	3576.219	3703.382	3835.067	2923.158	3027.1	3134.737	3246.203
(4) Home Use															
# Housholds w. Computers (Millions) w		16.48604	16.9598	17.44718	17.94857	18.46436	18.99498	19.54084	20.1024	20.68009	21.27438	21.88575	22.51468	23.1617	23.8273
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.12	0.12	0.14	0.14	0.14	0.14	0.18	0.18	0.18	0.18	0.2	0.2	0.2	0.2
Astrolink Market Share		0.09283	0.09283	0.029939	0.029939	0.029939	0.029939	0.035538	0.035538	0.035538	0.035538	0.023542	0.023542	0.023542	0.023542
Astrolink Demand (Tb/quarter)		344.7327	354.6394	137.272	141.2169	145.2751	149.4499	234.6409	241.3839	248.3206	255.4567	193.4312	198.9899	204.7084	210.5911
(5) Total Demand (Tb)		**14439**	**14950**	**6090**	**6305**	**6529**	**6760**	**10216**	**10577**	**10952**	**11339**	**8504**	**8805**	**9117**	**9439**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**14439**	**14950**	**6090**	**6305**	**6529**	**6760**	**10216**	**10577**	**10952**	**11339**	**8504**	**8805**	**9117**	**9439**

Alternative 2

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4
Total World Use		**5567**	**8397**	**9327**	**9504**	**9469**	**14166**	**9880**	**10093**	**24036**	**28832**	**29454**	**30092**	**42611**	**43567**	**44547**	**45552**
Satellites in Orbit		**1**	**2**	**3**	**4**	**5**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Available Capacity		19678	39357	59035	78714	98392	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071
% Use		28%	21%	16%	12%	10%	12%	8%	9%	20%	24%	25%	25%	36%	37%	38%	39%
Launch Cost		272	121.6	115.52	110	110	110	0	0	0	0	0	0	0	0	0	0
Operating Cost		84.41315	84.41315	84.41315	84.41315	86.94554	86.94554	86.94554	86.94554	89.55391	89.55391	89.55391	89.55391	92.24053	92.24053	92.24053	92.24053
Revenue ($M)		30	46	51	52	51	77	54	55	130	156	160	163	231	236	242	247
Profit		-326	-160	-149	-143	-146	-120	-33	-32	41	67	70	74	139	144	149	155
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
NPV		-257.2124	-124.0372	-113.1761	-106.1382	-106.0438	-85.76474	-23.34575	-22.09396	27.49117	44.1179	45.43759	46.74108	86.3818	87.84896	89.30385	90.74697
Cumulative NPV		-257.2124	-381.2496	-494.42574	-600.5639	-706.6077	-792.3725	-815.7182	-837.8122	-810.321	-766.2031	-720.7655	-674.0244	-587.6426	-499.7937	-410.4898	-319.7429

	Year	2004.1	2004.2	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Total World Use		**70106**	**70658**	**73368**	**75063**	**29544**	**30705**	**30943**	**31670**	**42803**	**44444**	**45513**	**46611**	**33305**	**34115**	**34947**	**35802**
Satellites in Orbit		**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Available Capacity		118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071
% Use		59%	60%	62%	64%	25%	26%	26%	27%	36%	38%	39%	39%	28%	29%	30%	30%
Launch Cost		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operating Cost		95.00774	95.00774	95.007744	95.00774	97.85798	97.85798	97.85798	97.85798	100.7937	100.7937	100.7937	100.7937	103.8175	103.8175	103.8175	103.8175
Revenue ($M)		380	383	398	407	160	167	168	172	232	241	247	253	181	185	190	194
Profit		285	288	303	312	62	69	70	74	131	140	146	152	77	81	86	90
		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
NPV		163.8921	162.3644	167.29995	168.9954	33.12656	35.75381	35.71172	36.98381	64.42938	67.44534	68.85589	70.25666	34.81608	36.08468	37.34173	38.58764
Cumulative NPV		-155.8508	6.513642	173.81359	342.809	375.9355	411.6893	447.4011	484.3849	548.8142	616.2596	685.1155	755.3721	790.1882	826.2729	863.6146	902.2023

Total ($M)	**902.2023**
U value	**-0.000121**

	Mb/s	Spot beam	Channel/Be	Channel per	Reduction	Quarter
satellite capacity	19678	64	1	130	0.3	7.884
price ($/ Mb)	0.0054					

LAUNCHING STRATEGY

USA 1	2000.1
USA 2	2000.4
EUR 1	2000.2
EUR 2	2001.1
ASIA 1	2000.3
ASIA 2	2001.2
Tot Cost	3841.6

Alternative 4

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
North America																			
	US Growth Rate			Telecommut	Telemedici	Ecommerc	HomeUse		NA Scale	Scale numbers from US to North America									
	Yearly			5%	4%	10%	10%		1.1										
	Quarterly			1.012	1.010	1.024	1.024												
(1) Telecommuters																			
# Telecommuters (Millions)		41.8	42.3	42.8	43.4	43.9	44.4	45.0	45.5	46.1	46.7	47.2	47.8	48.4	49.0	49.6	50.2	50.8	51.4
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.055	0.055	0.055	0.055	0.05	0.05	0.05	0.05	0.09	0.09	0.09	0.09	0.11	0.11	0.11	0.11	0.13	0.13
Astrolink Market Share		0.052392	0.052392	0.0523918	0.052392	0.039605	0.039605	0.039605	0.039605	0.064195	0.064195	0.064195	0.064195	0.06616	0.06616	0.06616	0.06616	0.077358	0.077358
Astrolink Demand (Tb/quarter)		4576	4633	4689	4747	3302	3343	3384	3425	10116	10240	10366	10493	13380	13544	13710	13878	19413	19652
(2) Telemedicine																			
# Operations/Quarter (Millions)		5.5	5.554194	5.6089215	5.664188	5.72	5.776361	5.833278	5.890756	5.9488	6.007416	6.066609	6.126386	6.186752	6.247713	6.309274	6.371442	6.434222	6.497621
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.08	0.08	0.11	0.11
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		0.042263	0.042679	0.0430997	0.043524	0.049839	0.05033	0.050826	0.051326	0.140024	0.141404	0.142797	0.144204	0.240132	0.242498	0.244887	0.2473	0.40151	0.405466
(3) Electronic Commerce (Intercompany)																			
# Company		152250	155921.3	159681.15	163531.6	167475	171513.4	175649.3	179884.8	184222.5	188664.8	193214.2	197873.3	202644.8	207531.3	212535.6	217660.6	222909.2	228284.4
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.025	0.025	0.025	0.025	0.08	0.1	0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.15	0.15
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		873.4435	894.5055	916.07531	938.1653	2324.134	2975.222	2437.573	2496.351	5179.865	5304.77	5432.688	5563.69	7046.701	7216.623	7390.642	7568.858	11329.21	11602.4
(4) Home Use																			
# Housholds w. Computers (Millions) w		38.28	39.20307	40.148403	41.11653	42.108	43.12338	44.16324	45.22818	46.3188	47.43572	48.57957	49.751	50.95068	52.17929	53.43752	54.7261	56.04575	57.39722
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.025	0.025	0.025	0.025	0.08	0.08	0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.15	0.15
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.031186
Astrolink Demand (Tb/quarter)		117.6475	120.4844	123.38974	126.3651	313.0466	320.5954	328.3261	336.2432	697.6961	714.5201	731.7498	749.395	949.1475	972.0349	995.4743	1019.479	1525.976	504.0105
(5) Total Demand (Tb)		**5567**	**5648**	**5729**	**5812**	**5939**	**6639**	**6150**	**6258**	**15994**	**16260**	**16531**	**16806**	**21376**	**21733**	**22097**	**22467**	**32269**	**31758**
Capacity (Tb)		**19678**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**5567**	**5648**	**5729**	**5812**	**5939**	**6639**	**6150**	**6258**	**15994**	**16260**	**16531**	**16806**	**21376**	**21733**	**22097**	**22467**	**32269**	**31758**

Alternative 4

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
North America															
(1) Telecommuters															
# Telecommuters (Millions)		52.1	52.7	53.3	54.0	54.7	55.3	56.0	56.7	57.4	58.1	58.8	59.5	60.3	61.0
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.13	0.13	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17
Astrolink Market Share		0.077358	0.077358	0.024949	0.024949	0.024949	0.024949	0.029615	0.029615	0.029615	0.029615	0.019618	0.019618	0.019618	0.019618
Astrolink Demand (Tb/quarter)		19893	20137	7585	7679	7773	7868	10085	10208	10334	10460	7453	7544	7637	7731
(2) Telemedicine															
# Operations/Quarter (Millions)		6.561645	6.626299	6.691591	6.757526	6.824111	6.891351	6.959255	7.027827	7.097075	7.167005	7.237625	7.30894	7.380958	7.453686
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.11	0.11	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		0.409462	0.413496	0.159156	0.160725	0.162308	0.163908	0.211593	0.213678	0.215783	0.21791	0.145775	0.147211	0.148662	0.150126
(3) Electronic Commerce (Intercompany)															
# Company		233789.2	239426.7	245200.1	251112.8	257168.1	263369.4	269720.2	276224.1	282884.9	289706.3	296692.2	303846.5	311173.4	318676.9
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.15	0.15	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		11882.18	12168.7	4823.002	4939.303	5058.407	5180.384	6647.379	6807.672	6971.83	7139.947	5098.787	5221.738	5347.653	5476.605
(4) Home Use															
# Housholds w. Computers (Millions) w		58.78128	60.19871	61.65032	63.13694	64.6594	66.21858	67.81536	69.45063	71.12534	72.84044	74.59689	76.3957	78.23788	80.12448
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.15	0.15	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		1600.457	1639.05	649.6289	665.2938	681.3365	697.766	895.3613	916.9518	939.0629	961.7071	686.7754	703.3361	720.2961	737.6651
(5) Total Demand (Tb)		**33376**	**33945**	**13058**	**13283**	**13513**	**13746**	**17628**	**17933**	**18245**	**18562**	**13239**	**13470**	**13705**	**13945**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**33376**	**33945**	**13058**	**13283**	**13513**	**13746**	**17628**	**17933**	**18245**	**18562**	**13239**	**13470**	**13705**	**13945**

Alternative 4

Aggregate Demand Projections

Europe

	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
Europe Growth Rate				Telecommut	Telemedici	Ecommerc	Home Use												
Yearly				10%	5%	10%	8%												
Quarterly				1.024	1.012	1.024	1.019												
(1) Telecommuters																			
# Telecommuters (Millions)		38.0	38.9	39.9	40.8	41.8	42.8	43.8	44.9	46.0	47.1	48.2	49.4	50.6	51.8	53.0	54.3	55.6	57.0
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06	0.08	0.08	0.08	0.08	0.11	0.11
Astrolink Market Share		0.047153	0.047153	0.0471526	0.047153	0.035644	0.035644	0.035644	0.035644	0.057776	0.057776	0.057776	0.057776	0.059544	0.059544	0.059544	0.059544	0.069622	0.069622
Astrolink Demand (Tb/quarter)		2042	2092	2142	2194	1698	5638	1781	1824	1868	6202	6352	6505	9154	9375	9601	9832	16189	16579
(2) Telemedicine																			
# Operations/Quarter (Millions)		5	5.061361	5.1234754	5.186352	5.25	5.314429	5.379649	5.445669	5.5125	5.580151	5.648632	5.717953	5.788125	5.859158	5.931063	6.003851	6.077531	6.152116
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.057631	0.057631	0.057631	0.057631	0.043565	0.043565	0.043565	0.043565	0.070615	0.070615	0.070615	0.070615	0.072776	0.072776	0.072776	0.072776	0.085094	0.085094
Astrolink Demand (Tb/quarter)		0.016905	0.017113	0.0173226	0.017535	0.026836	0.027166	0.027499	0.027836	0.06851	0.069351	0.070202	0.071064	0.123563	0.125079	0.126614	0.128168	0.182041	0.184275
(3) Electronic Commerce (Intercompany)																			
# Company		130500	133646.8	136869.55	140170	143550	147011.5	150556.5	154187	157905	161712.7	165612.2	169605.7	173695.5	177883.9	182173.4	186566.2	191065.1	195672.3
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.08	0.08	0.08	0.08	0.12	0.12
Astrolink Market Share		0.06549	0.06549	0.0654898	0.06549	0.049506	0.049506	0.049506	0.049506	0.080244	0.080244	0.080244	0.080244	0.0827	0.0827	0.0827	0.0827	0.096698	0.096698
Astrolink Demand (Tb/quarter)		598.9327	613.3752	628.16593	643.3133	498.0288	510.0381	522.337	534.9324	1775.954	1818.778	1862.636	1907.551	4026.686	4123.785	4223.224	4325.062	7768.604	7955.934
(4) Home Use																			
# Housholds w. Computers (Millions) w		16.5	16.82054	17.147303	17.48042	17.82	18.16618	18.51909	18.87885	19.2456	19.61948	20.00061	20.38916	20.78525	21.18903	21.60066	22.02029	22.44807	22.88416
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.08	0.08	0.11	0.11	0.11	0.11	0.14	0.14
Astrolink Market Share		0.047153	0.047153	0.0471526	0.047153	0.035644	0.035644	0.035644	0.035644	0.057776	0.057776	0.057776	0.057776	0.059544	0.059544	0.059544	0.059544	0.069622	0.069622
Astrolink Demand (Tb/quarter)		43.81355	44.6647	45.532377	46.41691	59.61625	60.77439	61.95502	63.1586	166.9794	170.2232	173.5301	176.9012	255.5541	260.5186	265.5796	270.7389	410.727	418.706
(5) Total Demand (Tb)		**2685**	**2750**	**2816**	**2883**	**2256**	**6209**	**2365**	**2422**	**3811**	**8191**	**8388**	**8589**	**13436**	**13759**	**14090**	**14428**	**24368**	**24954**
Capacity (Tb)		**0**	**0**	**19678**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**0**	**0**	**2816**	**2883**	**2256**	**6209**	**2365**	**2422**	**3811**	**8191**	**8388**	**8589**	**13436**	**13759**	**14090**	**14428**	**24368**	**24954**

Alternative 4

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Europe															
(1) Telecommuters															
# Telecommuters (Millions)		58.4	59.8	61.2	62.7	64.2	65.7	67.3	68.9	70.6	72.3	74.1	75.8	77.7	79.5
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.11	0.11	0.13	0.13	0.13	0.13	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Astrolink Market Share		0.069622	0.069622	0.022454	0.022454	0.022454	0.022454	0.026653	0.026653	0.026653	0.026653	0.017656	0.017656	0.017656	0.017656
Astrolink Demand (Tb/quarter)		16979	17388	6787	6951	7119	7290	10226	10472	10725	10984	7451	7631	7815	8004
(2) Telemedicine															
# Operations/Quarter (Millions)		6.227616	6.304043	6.381408	6.459722	6.538997	6.619245	6.700478	6.782708	6.865947	6.950208	7.035502	7.121843	7.209244	7.297718
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.085094	0.085094	0.027444	0.027444	0.027444	0.027444	0.032576	0.032576	0.032576	0.032576	0.02158	0.02158	0.02158	0.02158
Astrolink Demand (Tb/quarter)		0.186536	0.188826	0.07192	0.072802	0.073696	0.0746	0.11525	0.116665	0.118096	0.119546	0.089071	0.090164	0.091271	0.092391
(3) Electronic Commerce (Intercompany)															
# Company		200390.7	205222.9	210171.6	215239.6	220429.8	225745.2	231188.7	236763.5	242472.8	248319.7	254307.6	260439.9	266720	273151.6
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.12	0.12	0.15	0.15	0.15	0.15	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18
Astrolink Market Share		0.096698	0.096698	0.031186	0.031186	0.031186	0.031186	0.037019	0.037019	0.037019	0.037019	0.024523	0.024523	0.024523	0.024523
Astrolink Demand (Tb/quarter)		8147.781	8344.254	3445.002	3998.483	3613.148	3700.274	4498.227	5220.922	5346.817	5475.749	3933.35	4028.198	4125.332	4224.809
(4) Home Use															
# Housholds w. Computers (Millions) w		23.32872	23.78191	24.24391	24.71489	25.19501	25.68447	26.18343	26.69208	27.21061	27.73922	28.2781	28.82745	29.38746	29.95836
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.14	0.14	0.16	0.16	0.16	0.16	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19
Astrolink Market Share		0.069622	0.069622	0.022454	0.022454	0.022454	0.022454	0.026653	0.026653	0.026653	0.026653	0.017656	0.017656	0.017656	0.017656
Astrolink Demand (Tb/quarter)		426.84	435.132	163.4981	166.6743	169.9122	173.213	235.8024	240.3832	245.053	249.8135	178.0739	181.5333	185.0599	188.6549
(5) Total Demand (Tb)		**25554**	**26168**	**10396**	**11116**	**10902**	**11164**	**14960**	**15934**	**16317**	**16709**	**11563**	**11841**	**12126**	**12417**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**25554**	**26168**	**10396**	**11116**	**10902**	**11164**	**14960**	**15934**	**16317**	**16709**	**11563**	**11841**	**12126**	**12417**

Alternative 4

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4	2004.1	2004.2
Asia																			
	Asia Growth Rate			Telecommut	Telemedici	Ecommerc	Home Use												
	Yearly			15%	8%	15%	12%												
	Quarterly			1.036	1.019	1.036	1.029												
(1) Telecommuters																			
# Telecommuters (Millions)		19.0	19.7	20.4	21.1	21.9	22.6	23.4	24.3	25.1	26.0	26.9	27.9	28.9	29.9	31.0	32.1	33.2	34.4
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.286	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.08	0.08
Astrolink Market Share		0.057631	0.057631	0.057631	0.057631	0.043565	0.043565	0.043565	0.043565	0.070615	0.070615	0.070615	0.070615	0.072776	0.072776	0.072776	0.072776	0.085094	0.085094
Astrolink Demand (Tb/quarter)		416	431	446	462	723	749	776	803	2697	2793	2892	2995	4794	4965	5141	5324	8595	8901
(2) Telemedicine																			
# Operations/Quarter (Millions)		5	5.097133	5.1961524	5.297096	5.4	5.504903	5.611845	5.720863	5.832	5.945296	6.060792	6.178532	6.29856	6.420919	6.545656	6.672815	6.802445	6.934593
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.055011	0.055011	0.0550114	0.055011	0.041585	0.041585	0.041585	0.041585	0.067405	0.067405	0.067405	0.067405	0.069468	0.069468	0.069468	0.069468	0.081226	0.081226
Astrolink Demand (Tb/quarter)		0.016137	0.01645	0.0167697	0.017096	0.026348	0.02686	0.027382	0.027914	0.069186	0.070531	0.071901	0.073297	0.128347	0.130841	0.133383	0.135974	0.194493	0.198271
(3) Electronic Commerce (Intercompany)																			
# Company		152250	157663.7	163269.94	169075.5	175087.5	181313.3	187760.4	194436.8	201350.6	208510.3	215924.5	223602.3	231553.2	239786.8	248313.2	257142.7	266286.2	275754.8
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.06	0.06
Astrolink Market Share		0.055011	0.055011	0.0550114	0.055011	0.041585	0.041585	0.041585	0.041585	0.067405	0.067405	0.067405	0.067405	0.069468	0.069468	0.069468	0.069468	0.081226	0.081226
Astrolink Demand (Tb/quarter)		293.477	303.9125	314.71905	325.9099	510.2531	528.3967	547.1855	566.6423	1426.689	1477.419	1529.953	1584.356	2818.184	2918.393	3022.166	3129.628	4547.364	4709.059
(4) Home Use																			
# Housholds w. Computers (Millions) w		9.9	10.1845	10.477175	10.77826	11.088	11.40664	11.73444	12.07165	12.41856	12.77544	13.14257	13.52025	13.90879	14.30849	14.71968	15.14268	15.57784	16.02551
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.017	0.017	0.017	0.017	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.09	0.09	0.09	0.09	0.12	0.12
Astrolink Market Share		0.06287	0.06287	0.0628702	0.06287	0.047526	0.047526	0.047526	0.047526	0.077034	0.077034	0.077034	0.077034	0.079392	0.079392	0.079392	0.079392	0.09283	0.09283
Astrolink Demand (Tb/quarter)		19.86214	20.43293	21.020116	21.62418	39.56753	40.70459	41.87433	43.07769	107.7464	110.8427	114.0281	117.3049	186.5544	191.9155	197.4306	203.1042	325.7418	335.1027
(5) Total Demand (Tb)		**729**	**755**	**782**	**810**	**1273**	**1318**	**1365**	**1413**	**4231**	**4381**	**4536**	**4696**	**7799**	**8075**	**8361**	**8657**	**13468**	**13945**
Capacity (Tb)		**0**	**19678**	**19678**	**19678**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**0**	**755**	**782**	**810**	**1273**	**1318**	**1365**	**1413**	**4231**	**4381**	**4536**	**4696**	**7799**	**8075**	**8361**	**8657**	**13468**	**13945**

Alternative 4

Aggregate Demand Projections	Year	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Asia															
(1) Telecommuters															
# Telecommuters (Millions)		35.6	36.9	38.2	39.6	41.0	42.4	43.9	45.5	47.1	48.8	50.5	52.3	54.2	56.1
# MBits/ Telecommuter (per quart)		37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29	37994.29
Penetration		0.08	0.08	0.1	0.1	0.1	0.1	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13
Astrolink Market Share		0.085094	0.085094	0.027444	0.027444	0.027444	0.027444	0.032576	0.032576	0.032576	0.032576	0.02158	0.02158	0.02158	0.02158
Astrolink Demand (Tb/quarter)		9217	9545	3985	4126	4273	4425	6527	6760	7000	7249	5387	5579	5777	5982
(2) Telemedicine															
# Operations/Quarter (Millions)		7.069308	7.20664	7.34664	7.48936	7.634853	7.783171	7.934372	8.088509	8.245641	8.405825	8.569121	8.73559	8.905292	9.078291
# MBits/ Operation		5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.081226	0.081226	0.026196	0.026196	0.026196	0.026196	0.031096	0.031096	0.031096	0.031096	0.020599	0.020599	0.020599	0.020599
Astrolink Demand (Tb/quarter)		0.202123	0.206049	0.079035	0.08057	0.082135	0.083731	0.13027	0.132801	0.135381	0.138011	0.103556	0.105567	0.107618	0.109709
(3) Electronic Commerce (Intercompany)															
# Company		285560.1	295714.1	306229.1	317118.1	328394.2	340071.2	352163.5	364685.8	377653.3	391081.9	404988	419388.6	434301.3	449744.2
Mbits/ Company (per quarter)		3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504	3504
Penetration		0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.1	0.1	0.1	0.1
Astrolink Market Share		0.081226	0.081226	0.026196	0.026196	0.026196	0.026196	0.031096	0.031096	0.031096	0.031096	0.020599	0.020599	0.020599	0.020599
Astrolink Demand (Tb/quarter)		4876.504	5049.903	1967.651	2037.617	2110.071	2185.101	3453.422	3576.219	3703.382	3835.067	2923.158	3027.1	3134.737	3246.203
(4) Home Use															
# Housholds w. Computers (Millions) w		16.48604	16.9598	17.44718	17.94857	18.46436	18.99498	19.54084	20.1024	20.68009	21.27438	21.88575	22.51468	23.1617	23.8273
# MBits/ Household (per quart)		1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1	1877.1
Penetration		0.12	0.12	0.14	0.14	0.14	0.14	0.18	0.18	0.18	0.18	0.2	0.2	0.2	0.2
Astrolink Market Share		0.09283	0.09283	0.029939	0.029939	0.029939	0.029939	0.035538	0.035538	0.035538	0.035538	0.023542	0.023542	0.023542	0.023542
Astrolink Demand (Tb/quarter)		344.7327	354.6394	137.272	141.2169	145.2751	149.4499	234.6409	241.3839	248.3206	255.4567	193.4312	198.9899	204.7084	210.5911
(5) Total Demand (Tb)		**14439**	**14950**	**6090**	**6305**	**6529**	**6760**	**10216**	**10577**	**10952**	**11339**	**8504**	**8805**	**9117**	**9439**
Capacity (Tb)		**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**	**39357**
Total Use (Tb)		**14439**	**14950**	**6090**	**6305**	**6529**	**6760**	**10216**	**10577**	**10952**	**11339**	**8504**	**8805**	**9117**	**9439**

Alternative 4

Aggregate Demand Projections	Year	2000.1	2000.2	2000.3	2000.4	2001.1	2001.2	2001.3	2001.4	2002.1	2002.2	2002.3	2002.4	2003.1	2003.2	2003.3	2003.4
Total World Use		**5567**	**6403**	**9327**	**9504**	**9469**	**14166**	**9880**	**10093**	**24036**	**28832**	**29454**	**30092**	**42611**	**43567**	**44547**	**45552**
Satellites in Orbit		**1**	**2**	**3**	**4**	**5**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Available Capacity		19678	39357	59035	78714	98392	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071
% Use		28%	16%	16%	12%	10%	12%	8%	9%	20%	24%	25%	25%	36%	37%	38%	39%
Launch Cost		272	121.6	115.52	110	110	110	0	0	0	0	0	0	0	0	0	0
Operating Cost		84.41315	84.41315	84.41315	84.41315	86.94554	86.94554	86.94554	86.94554	89.55391	89.55391	89.55391	89.55391	92.24053	92.24053	92.24053	92.24053
Revenue ($M)		30	35	51	52	51	77	54	55	130	156	160	163	231	236	242	247
Profit		-326	-171	-149	-143	-146	-120	-33	-32	41	67	70	74	139	144	149	155
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
NPV		-257.2124	-132.4019	-113.1761	-106.1382	-106.0438	-85.76474	-23.34575	-22.09396	27.49117	44.1179	45.43759	46.74108	86.3818	87.84896	89.30385	90.74697
Cumulative NPV		-257.2124	-389.6143	-502.79045	-608.9286	-714.9725	-800.7372	-824.0829	-846.1769	-818.6857	-774.5678	-729.1302	-682.3892	-596.0074	-508.1584	-418.8545	-328.1076

	Year	2004.1	2004.2	2004.3	2004.4	2005.1	2005.2	2005.3	2005.4	2006.1	2006.2	2006.3	2006.4	2007.1	2007.2	2007.3	2007.4
Total World Use		**70106**	**70658**	**73368**	**75063**	**29544**	**30705**	**30943**	**31670**	**42803**	**44444**	**45513**	**46611**	**33305**	**34115**	**34947**	**35802**
Satellites in Orbit		**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Available Capacity		118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071	118071
% Use		59%	60%	62%	64%	25%	26%	26%	27%	36%	38%	39%	39%	28%	29%	30%	30%
Launch Cost																	
Operating Cost		95.00774	95.00774	95.007744	95.00774	97.85798	97.85798	97.85798	97.85798	100.7937	100.7937	100.7937	100.7937	103.8175	103.8175	103.8175	103.8175
Revenue ($M)		380	383	398	407	160	167	168	172	232	241	247	253	181	185	190	194
Profit		285	288	303	312	62	69	70	74	131	140	146	152	77	81	86	90
		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
NPV		163.8921	162.3644	167.29995	168.9954	33.12656	35.75381	35.71172	36.98381	64.42938	67.44534	68.85589	70.25666	34.81608	36.08468	37.34173	38.58764
Cumulative NPV		-164.2155	-1.851071	165.44888	334.4442	367.5708	403.3246	439.0363	476.0202	540.4495	607.8949	676.7508	747.0074	781.8235	817.9082	855.2499	893.8376

Total ($M)	**893.8376**
U value	**-0.000131**

	Mb/s	Spot beam	Channel/Be	Channel per	Reduction	Quarter
satellite capacity	19678	64	1	130	0.3	7.884
price ($/ Mb)	0.0054					

LAUNCHING STRATEGY	
USA 1	2000.1
USA 2	2000.4
EUR 1	2000.3
EUR 2	2001.2
ASIA 1	2000.2
ASIA 2	2001.1
Tot Cost	3841.6

Crystal Ball Report

Simulation started on Tue, May 27, 1997 at 4:25:42 PM

Simulation stopped on Tue, May 27, 1997 at 4:42:48 PM

Forecast: Total NPV (alt 4) **[MARKET 2.XLS]alt 4 - Cell: D128**

Summary:

Certainty Level is 99.20%

Certainty Range is from 0.00 to 8 $ Million

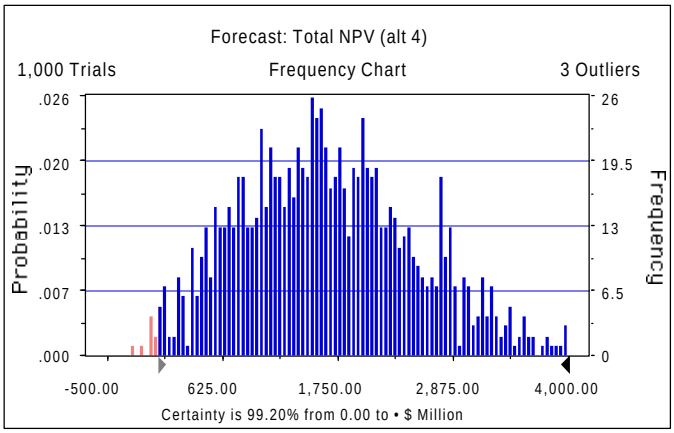
Display Range is from -500.00 to 4,000.00 $ Million

Entire Range is from -274.89 to 4,666.23 $ Million

After 1,000 Trials, the Std. Error of the Mean is 27.05

Statistics:	Value
Trials	1000
Mean	1,658.02
Median	1,595.52
Mode	---
Standard Deviation	855.54
Variance	731,947.11
Skewness	0.33
Kurtosis	2.71
Coeff. of Variability	0.52
Range Minimum	-274.89
Range Maximum	4,666.23
Range Width	4,941.13
Mean Std. Error	27.05

Forecast: Total NPV (alt 4) (cont'd) **[MARKET 2.XLS]alt 4 - Cell: D128**



End of Forecast

Forecast: U value (alt 4) **[MARKET 2.XLS]alt 4 - Cell: D129**

Summary:

Display Range is from -1.5000e+0 to 0.0000e+0 utils

Entire Range is from -1.5626e+1 to -5.4302e-21 utils

After 1,000 Trials, the Std. Error of the Mean is 1.6903e-2

Statistics:	Value
Trials	1000
Mean	-4.1972E-02
Median	-1.1770E-07
Mode	---
Standard Deviation	5.3452E-01
Variance	2.8571E-01
Skewness	-2.5519E+01
Kurtosis	7.2736E+02
Coeff. of Variability	-1.2735E+01
Range Minimum	-1.5626E+01
Range Maximum	-5.4302E-21
Range Width	1.5626E+01
Mean Std. Error	1.6903E-02

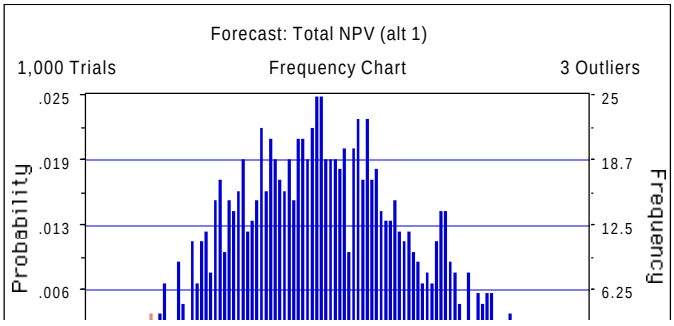
CE=	317.076

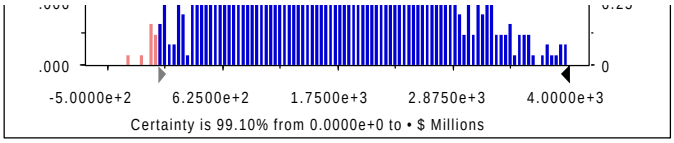
Forecast: Total NPV (alt 1) **[MARKET 2.XLS]alt 1 - Cell: D128**

Summary:

Certainty Level is 9.9100e+1%
Certainty Range is from 0.0000e+0 to 8 $ Millions
Display Range is from -5.0000e+2 to 4.0000e+3 $ Millions
Entire Range is from -2.8312e+2 to 4.6619e+3 $ Millions
After 1,000 Trials, the Std. Error of the Mean is 2.7045e+1

Statistics:	Value
Trials	1000
Mean	1.6519E+03
Median	1.5903E+03
Mode	---
Standard Deviation	8.5525E+02
Variance	7.3145E+05
Skewness	3.2913E-01
Kurtosis	2.7104E+00
Coeff. of Variability	5.1773E-01
Range Minimum	-2.8312E+02
Range Maximum	4.6619E+03
Range Width	4.9450E+03
Mean Std. Error	2.7045E+01





Forecast: Total NPV (alt 1) (cont'd) **[MARKET 2.XLS]alt 1 - Cell: D128**

End of Forecast

Forecast: U-value (alt 1) **[MARKET 2.XLS]alt 1 - Cell: D129**

Summary:
Display Range is from -1.7500e+0 to 0.0000e+0 utils
Entire Range is from -1.6966e+1 to -5.6726e-21 utils
After 1,000 Trials, the Std. Error of the Mean is 1.8297e-2

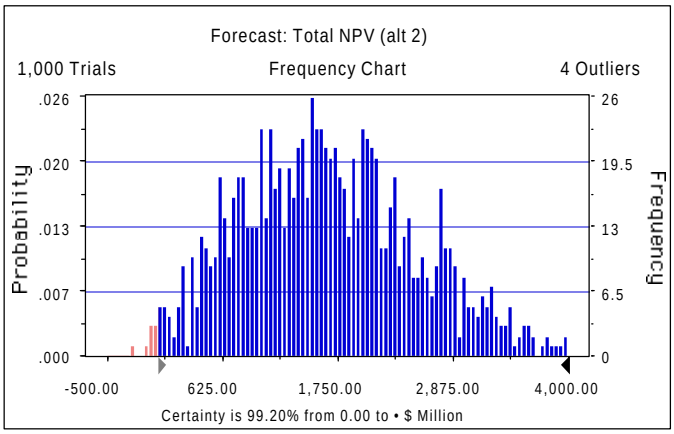
Statistics:	Value
Trials	1000
Mean	-4.4857E-02
Median	-1.2396E-07
Mode	---
Standard Deviation	5.7859E-01
Variance	3.3477E-01
Skewness	-2.5719E+01
Kurtosis	7.3612E+02
Coeff. of Variability	-1.2899E+01
Range Minimum	-1.6966E+01
Range Maximum	-5.6726E-21
Range Width	1.6966E+01
Mean Std. Error	1.8297E-02

CE= 310.427

Forecast: Total NPV (alt 2) **[MARKET 2.XLS]alt 2 - Cell: D128**

Summary:
Certainty Level is 99.20%
Certainty Range is from 0.00 to 8 $ Million
Display Range is from -500.00 to 4,000.00 $ Million
Entire Range is from -264.11 to 4,671.96 $ Million
After 1,000 Trials, the Std. Error of the Mean is 27.07

Statistics:	Value
Trials	1000
Mean	1,666.00
Median	1,602.81
Mode	---
Standard Deviation	855.92
Variance	732,604.55
Skewness	0.33
Kurtosis	2.71
Coeff. of Variability	0.51
Range Minimum	-264.11
Range Maximum	4,671.96
Range Width	4,936.07
Mean Std. Error	27.07



Summary:

Display Range is from -1.5000e+0 to 0.0000e+0 utils
Entire Range is from -1.4029e+1 to -5.1281e-21 utils
After 1,000 Trials, the Std. Error of the Mean is 1.5239e-2

Statistics:	Value
Trials	1000
Mean	-3.8484E-02
Median	-1.0942E-07
Mode	---
Standard Deviation	4.8191E-01
Variance	2.3224E-01
Skewness	-2.5247E+01
Kurtosis	7.1542E+02
Coeff. of Variability	-1.2522E+01
Range Minimum	-1.4029E+01
Range Maximum	-5.1281E-21
Range Width	1.4029E+01
Mean Std. Error	1.5239E-02

CE= 325.751

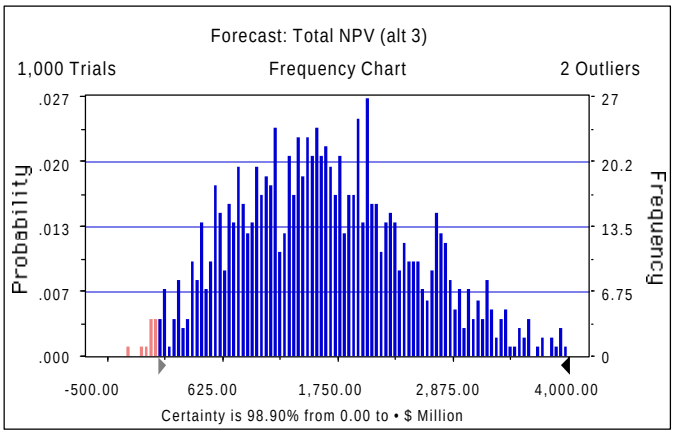
Forecast: Total NPV (alt 3) **[MARKET 2.XLS]alt 3 - Cell: D128**

Summary:

Certainty Level is 98.90%
Certainty Range is from 0.00 to 8 $ Million
Display Range is from -500.00 to 4,000.00 $ Million
Entire Range is from -306.46 to 4,649.48 $ Million
After 1,000 Trials, the Std. Error of the Mean is 27.02

Statistics:	Value
Trials	1000
Mean	1,634.67
Median	1,573.79
Mode	---
Standard Deviation	854.46
Variance	730,093.53
Skewness	0.33
Kurtosis	2.71
Coeff. of Variability	0.52

Range Minimum	-306.46
Range Maximum	4,649.48
Range Width	4,955.94
Mean Std. Error	27.02



Forecast: Total NPV (alt 3) (cont'd) **[MARKET 2.XLS]alt 3 - Cell: D128**

Summary:

Display Range is from -2.0000e+0 to 0.0000e+0 utils
Entire Range is from -2.1425e+1 to -6.4206e-21 utils
After 1,000 Trials, the Std. Error of the Mean is 2.2924e-2

Statistics:	Value
Trials	1000
Mean	-5.4238E-02
Median	-1.4627E-07
Mode	---
Standard Deviation	7.2492E-01
Variance	5.2550E-01
Skewness	-2.6248E+01
Kurtosis	7.5940E+02
Coeff. of Variability	-1.3365E+01
Range Minimum	-2.1425E+01
Range Maximum	-6.4206E-21
Range Width	2.1425E+01
Mean Std. Error	2.2924E-02
CE=	291.4367

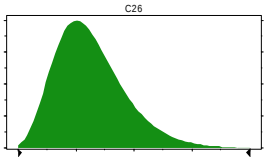
Assumptions

Assumption: C26 **Cell: C26**

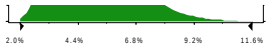
Lognormal distribution with parameters:

Mean	5.0%
Standard Dev.	1.5%

Selected range is from 0.0% to 19.5%



Mean value in simulation was 5.0%



Correlated with:

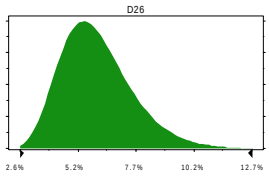
D26 (D26)	0.50

Assumption: D26 **Cell: D26**

Lognormal distribution with parameters:

Mean	6.0%
Standard Dev.	1.6%

Selected range is from 0.0% to 24.7%
Mean value in simulation was 6.1%



Correlated with:

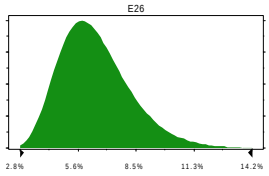
C26 (C26)	0.50
E26 (E26)	0.40

Assumption: E26 **Cell: E26**

Lognormal distribution with parameters:

Mean	6.5%
Standard Dev.	1.8%

Selected range is from 0.0% to 20.0%
Mean value in simulation was 6.6%



Correlated with:

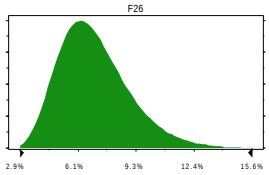
D26 (D26)	0.40
F26 (F26)	0.50

Assumption: F26 **Cell: F26**

Lognormal distribution with parameters:

Mean	7.0%
Standard Dev.	2.0%

Selected range is from 0.0% to 22.0%
Mean value in simulation was 7.0%



Correlated with:

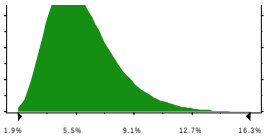
E26 (E26)	0.50
G26 (G26)	0.50

Assumption: G26 **Cell: G26**

Lognormal distribution with parameters:

Mean	6.0%

Standard Dev. 2.2%



Selected range is from 0.0% to 27.6%
Mean value in simulation was 6.0%

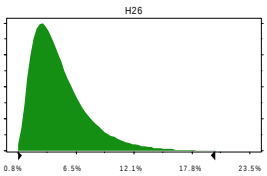
Correlated with:

F26 (F26)	0.50
H26 (H26)	0.20

Assumption: H26 **Cell: H26**

Lognormal distribution with parameters:

Mean	5.0%
Standard Dev.	3.1%



Selected range is from 0.0% to 20.0%
Mean value in simulation was 4.9%

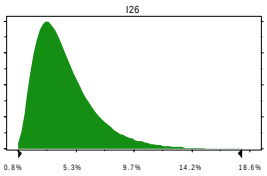
Correlated with:

G26 (G26)	0.20
I26 (I26)	0.60

Assumption: I26 **Cell: I26**

Lognormal distribution with parameters:

Mean	4.5%
Standard Dev.	2.5%



Selected range is from 0.0% to 18.0%
Mean value in simulation was 4.5%

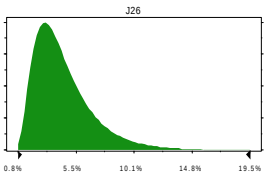
Correlated with:

H26 (H26)	0.60
J26 (J26)	0.40

Assumption: J26 **Cell: J26**

Lognormal distribution with parameters:

Mean	4.5%
Standard Dev.	2.6%



Selected range is from 0.0% to 20.0%
Mean value in simulation was 4.6%

Correlated with:

I26 (I26)	0.40

End of Assumptions

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