

The **comsys** VSAT Report

10th edition

Hughes Profile & Summary

This report has
been prepared for:

HUGHES



The **comsys**

VSAT Report

10th edition

Version 3.0s

Profile & Summary

HUGHES™

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1. Summary

Hughes' presence casts a shadow over almost every player in the market. Its dominance of the enterprise VSAT industry is remarkable in the fact that the company has been able to sustain its lead for over twenty years and that it has rolled with the punches and constantly responded with new developments which has kept it at the forefront of an intensely competitive market. Customers purchase HNS VSAT systems because it is the market leader, but also because there is a confidence that the company will always overcome any problems and the system will work reliably. HNS has managed to walk the tightrope between innovation and proven reliability which service providers in the enterprise business require to the exclusion of almost anything else. The company's delivery of DVB-S2 ACM on its platform more than a year ahead of anyone else is a case in point and there are examples of operators who have gained a critical advantage in the markets as a result.

Hughes is traditionally a very conservative company giving the impression that it simply plods along, but to believe this would be a mistake. It is finely in tune with the market and misses little. Looking back, its product releases either catch the wave or begin it in the first place and the engineering machine which lies at the core of the company is continually advancing the platform and introducing new features. It doesn't like to abandon a product line and is committed to maintaining its customers' investment in its infrastructure through backwards compatibility. The market leader is always easy to knock, but to believe that Hughes has lost its focus is either a competitor's dream or a failure to understand that the company simply is VSAT. Hughes is the only company which has been able to demonstrate sustained leadership in technology, market share and financial results in the VSAT business. Hughes has consolidated its early lead in the satellite broadband Internet access market through its HughesNet system with 350,000 consumer subscribers in North America. Together with its enterprise business the company has now manufactured more than a million HughesNet terminals and, combined with the PES system, almost 1.5 million units have been produced. This market is one which feeds on volume and, once again, Hughes stands head and shoulders above its rivals.



2. Market Statistics

2.1. Data Sources & Methodology

The information in this Executive Briefing was compiled from the latest 10th Edition of the COMSYS VSAT Report, unless expressly indicated. Apart from information and product data already held in our library, direct contact was made with almost all of the organisations in the report to gather up-to-date information. Visits have been made to a large number of existing and potential suppliers and service providers in Europe, Asia/Pacific, Latin America and North America. COMSYS maintains extensive databases on both the interactive star and mesh DAMA VSAT markets and tracks a wide variety of information for all individual networks. These databases form the basis of most of the statistical analysis in this report.

2.2. Hughes Grows to Service Almost 60 per cent of VSATs Worldwide

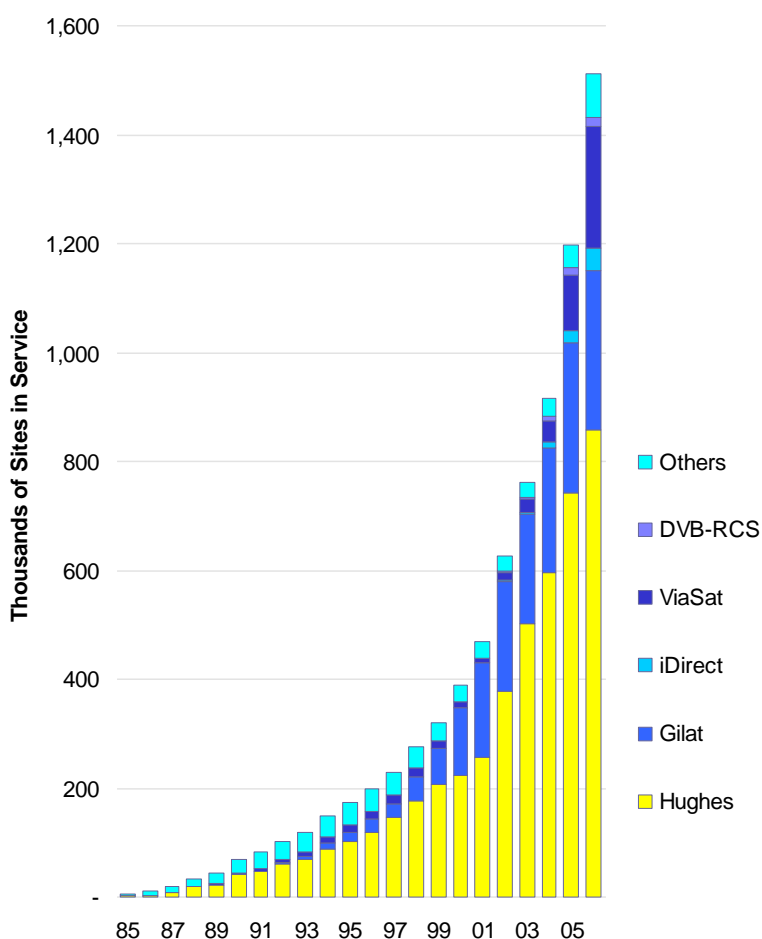


Figure 1 - Global VSAT Sites in Service

bookings and shipments in North America saw it grow to over 70 per cent of total sales in the region in 2006. The HughesNet US consumer business drove a 40 per cent share of that market even as WildBlue gained its own momentum. Hughes added around 10,000 subscribers a month to its service during 2005 and 2006, opening a new transponder every three to four weeks and substantially contributing to the Ku-band capacity crunch operators are seeing in the US.

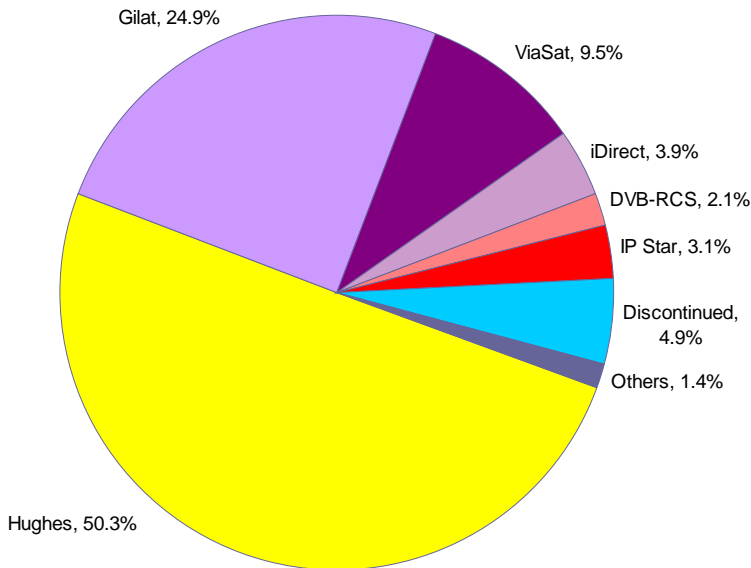
This, and the company's strong US enterprise business, sets the scene for Spaceway. Probably the most advanced spacecraft of its type with on-board processing and configurable spot beams,

HNS has stayed with the pace, generally making the right judgements and reading the market's demand better than its competitors. The past two years have seen Hughes retain its position once more as the leader of the industry in terms of both shipments and orders. Hughes systems now account for almost 60 per cent of all the VSAT sites in service worldwide through a combination of its own services and via its partners. The company is the largest provider of shared hub VSAT services in the world with leading positions in the consumer and enterprise segments in the United States, in Europe through HNS Europe, in Latin America and Brazil through Hughes do Brasil and in Asia through its Hughes Communications India joint venture in India.

The company provides platforms to almost every major VSAT service provider and its systems are favoured in many of the fastest growing enterprise and broadband markets. As an example, increased



Hughes' very own Spaceway-3 satellite was successfully launched in August 2007. The satellite will enter commercial service in the first part of 2008 and is expected to be used for both consumer and enterprise services. Commercial VSAT service on the new satellite could be groundbreaking. In the consumer market, lower cost bandwidth is almost the be all and end all, but COMSYS is eager to see what the system can bring to the enterprise business in the United States.

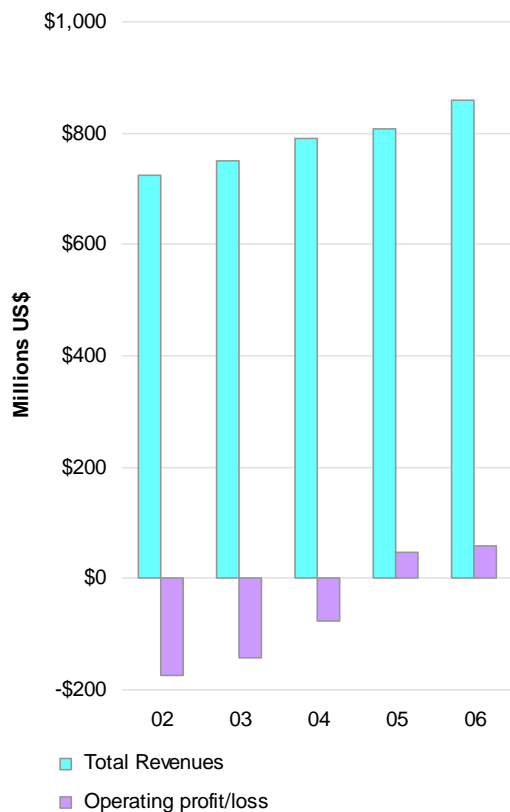


It is no coincidence that operators of Hughes hubs have on average many more billing VSATs on their systems than their competitors or that the company's ship to service ratio is the highest of any of the major vendors. The company is the only vendor with both a strong hardware business and a large service operation with strength at all levels - technical, operational, sales and financial - to make a real difference in the VSAT and the satellite marketplace. Market dominance of this magnitude does not come from doing things wrong.

Figure 2 - Interactive VSATs - Vendor Historical Enterprise Shipped Market Share



2.3. Hughes Posts Strong Revenue Growth & Increased Profitability



Since its listing on the NASDAQ in September 2006, Hughes has focused on VSAT design, manufacture and service recording strong revenue growth, achieving \$858 million in 2006, and increased profitability. Prior to the sale of the company, little was known about Hughes' financial performance due to the fact that they were buried deep within GM's results. However, it is clear that being a separate business has been a good move for Hughes.

Up until the end of 2002, Hughes had won over half of all the contracts greater than 1,000 sites and accounted for eight of the ten largest corporate networks in service. The past two years have seen the company win 37 of the 86 largest corporate networking deals amounting to almost 70,000 sites. The company has built a momentum in the corporate networking sector which is hard to challenge and in certain areas, such as the gas/convenience store business, it almost monopolises the segment. This helps it build specialisation and recognition in a particular industry, gives it an advantage when bidding for that same company's business abroad and gives it a great reference list which inspires confidence in other potential customers. The best example of this is one of the earliest – Wal-Mart – which deployed a network from Hughes across all of its stores in 1985.

Figure 3 - HNS Annual Revenues and P&L, 2002-6

The edge that this gave the business was recognised by others in the US retail segment and over the following few years most of the major US chain store retailers also installed VSAT networks. Wal-Mart's innovative decision and the importance of Hughes' VSAT solution in the company's massive growth was recognised in 2005 by Fortune Magazine as one of the 20 key business decisions that made history.

The company continues to exhibit its trademark attributes - aggressive pricing, strong sales, continuous product development and high levels of software and hardware engineering - and this makes Hughes both impressive to the customer and scary to the competitors. The competitive environment has changed a great deal in the past few years. It was not that long ago that DVB-RCS and the rise of ViaSat's LinkStar product looked like they might have the potential to mount a real threat. However, DVB-RCS has largely blown itself out, only managing to establish any form of strong market position within the US defence establishment. ViaSat has also struggled to grow its LinkStar business significantly after it lost the major advantage of its high inbound channel as both Hughes and Gilat upgraded their systems and some of its primary accounts serving the broadband access market experienced slower growth. In the mainstream enterprise market, Gilat has stepped up its game and has recovered from its earlier problems. In the specialised small networking segment both Comtech and iDirect have grown strongly, but this was not an area in which Hughes traditionally had a strong value proposition, and the two companies have tended to create more opportunities than they have taken away share from Hughes. In any case, Hughes now has the HX focused on this requirement and is known to have already displaced some competing platforms in some accounts.

We continue to hold the opinion that Hughes has the edge on its competitors because of its organisation, depth of market presence, experience, vertical integration and the fact that if it is ever behind with product features it is never far behind. For the potential purchaser, the fact



that buying Hughes is rarely a mistake counts for a great deal. The HN is one of the cutting edge systems available in the market today and as technology advances are introduced by the industry it provides an excellent platform on which to build. The HX offers more capabilities in segments which have never really been in Hughes' sweet spot before and also offers the allure some very attractive features in the future. Given all of this, there is every reason to suppose that Hughes' strength in depth, greater developed services business and increased responsiveness to the market will be enough to maintain its lead in the near term.

On top of this there is Spaceway. With a Hughes-owned Spaceway finally in orbit we await its release into commercial service which is expected early in 2008. The company believes that a combination of its High Availability DSL/VSAT service offering using Spaceway to extend and enhance a terrestrial network plus the use of its Ku-band HughesNet service where required, will meet the redundancy needs of most enterprise customers. We believe that Spaceway will be a major key to the company's future success because its design is both revolutionary and visionary and could potentially re-write the VSAT enterprise map entirely.

HNS is all the things that we have described it as - conservative, methodical, cautious, stable - but it is not above taking calculated risks and has managed to pull rabbits out of the hat to many people's surprise a number of times. The potential for more rabbits remains with the company as long as it retains its current structure. We commented in 1996 that Hughes Network Systems had managed its VSAT business almost faultlessly since the purchase from M/A-COM. We still believe this to be the case and believe that the separation of the business from GM, painful as the process itself was, has been cathartic for the company and it is stronger today as a standalone entity than it was wrapped up in a huge corporation. With so many recent achievements on the technical, product and market fronts there is now a spring in the step of staff at Hughes and a sense, internally and externally, that the stars are aligning for the business.



3. Product Breadth

3.1. The HN System

The HN7000S is a powerful platform which combines the functionality of greater processing power with high inbound speeds and yet manages to retain the price points which have made HNS's platforms such as compelling value proposition for so many operators and networks across the world. The HN7000 is now available in three packages – the base HN7000 which has a single Ethernet port, the HN7700 enterprise version and the HN7740 VOIP version all of which differ as shown in the table. The terminal introduced several important new features including inbound transmit rates up to 1.6 Mbps, turbo coding on the inroute and DVB-S2 with ACM on the outbound channel as well as expanding the capability to support C, extended C, extended Ku and Ka-band in addition to Ku-band. It also incorporated more processing power and greater memory, so more concurrent advanced and data intensive applications can be run through the terminal. The HN7700S raises the bar one step above the immediate competition with its integral support for serial protocols which supports both high speed IP and asynchronous traffic in a single, low cost package. With such a competitively positioned product and a reputation for delivering advanced features on time and providing a high level of support, Hughes has indeed proved it is very hard to beat.

Bandwidth Efficiency: Bandwidth efficiency has also become a key element in new systems. HNS has committed major R&D efforts in this area working towards substantially improving the operational cost of owning its system as well as further enhancing its efficiencies. DVB-S2 particularly was key to the release, especially because it incorporated adaptive coding and modulation (ACM) and LDPC (Low Density Parity Check) technologies. Hughes had been instrumental in the LDPC design and, as such, had a considerable advantage over its competitors in this area. Not only was it the first company to release DVB-S2 on its system, but Hughes produced its own ASIC whilst others had to wait for the semi-conductor industry to catch up. DVB-S2 alone is able to bring increased outbound channel efficiency of between 30 and 40 per cent over conventional DVB-S carriers, ACM (under certain bandwidth limited and high rainfall conditions) can add another 45 per cent or more on top of this and, in interviews with some of the first operators of the HN7000S, we are told that theory is actually working out in practice.

The past two years have seen Hughes continually adding new features to the HN system. It brought in integrated encryption of traffic over both the inbound as well as outbound channels and AIS – Adaptive Inroute Selection. In effect AIS is a form of ACM for the inbound channel. Hughes' design incorporates dynamic inbound FEC selection, automatic alternate symbol rate changes, by frequency hopping the remote to a different inbound channel, and dynamic uplink power control. The last of these has also allowed the company to decrease the minimum required spacing between the return channels. Hughes informs us that with this closed loop control between the hub and remote, the system continually and automatically seeks out the most efficient transmission based on the link between each individual remote and the hub. Further bandwidth efficiency improvements are planned with the addition of 8PSK modulation on the inbound channel.

Another important feature which HNS released at the end of 2004, and which was commercially deployed with a large carrier in 2005, is a hub outbound carrier cancellation scheme. This allows multiple inbound channels to be overlaid on the same bandwidth as the outbound channel, thus considerably increasing the efficiency of the system. In this scheme, the power and size of the outbound channel more than compensates for the noise the inbound channels add to what the remote terminals see, so there is no need to modify anything at the receive side in the field. At the hub, the system cancels out its own signal leaving behind the inbound channels. This feature is backwards compatible with systems already in operation because it only relies on a separate component to be installed at the hub.



Backwards Compatibility: The HN7000 is fully backwards compatible with all the products since the 4000 series and requires only a software upgrade to the NOC. Maintaining the value of a customer's infrastructure has always been an important issue for Hughes and it managed to maintain backwards compatibility on its original legacy ISBN/PES system for 15 years before the trend towards IP finally forced it to break away with a completely new design in what is now the HN system. This entire branch of Hughes' VSAT family tree - the 4000, 4010, 4020, 6000 and 7000 - operate on the same hub equipment, network management system and back office (OSS and BSS) software.

Efficient Scaleable Internet Access: The HN architecture employs a high speed DVB-S2 outbound carrier which incorporates Hughes' own encryption system and which is scaleable from 1 to a maximum 121 Mbps, depending on the transponder and the link budget. The inbound channels consist of a series of receive channel demodulators (RCDs), as in the other TDMA platforms, but the access scheme supports dynamic load levelling which provides optimised utilisation for Internet access. In addition, the HughesNet inbound architecture provides for a variety of Inbound Quality of Service (IQOS) features including guaranteed minimum bandwidth for a remote or group of remotes. The IQOS features were developed to address particular QoS requirements in the large scale consumer and enterprise markets. More recently, as Hughes has begun to target smaller, specialised vertical segment network opportunities and the operators who focus on these areas, it has released the HX system which has been designed with more granular, but less scaleable QoS features. HNS believes that its method of supporting Internet access services is more efficient than its competitors. In the first instance, the fact that the terminal is inactive when not used for a long period of time means that the system overhead is low in comparison with systems which require the transmission of regular timing bursts. Also, whilst the immediate move to a reservation-based mode leads to a slight delay in the first traffic a user sends, Hughes believes that this is more than made up for by the overall bandwidth efficiency of the system. The company claims efficiencies in excess of 90 per cent - in contrast to the theoretical maximum loading of 36 per cent and practical limit of 20 per cent for a contentious access TDMA slotted Aloha scheme. It believes that systems which use a mix of contentious access and reservation modes cannot reach its level of bandwidth efficiency.

The back office systems behind the platform are sophisticated and have the ability automatically to provision a customer from the last click of an order on the web. With the receipt of a valid request, an account is set up, a VSAT is provisioned and shipped through the distribution partner to the installer and the work order to install is issued. The service is authorised and bandwidth and class of service is established at the hub. Essentially this is the system that Hughes itself uses in its HughesNet consumer service in the United States that now supports over 385,000 subscribers and which has been adding between 10,000 and 15,000 subscribers a month over two years. Of course a system on consumer scales is not cheap, but in the enterprise market cost reduction of the hub has been an area of focus for the company for some years. 2005 saw it launch an entry-level hub product, known as the CX, to complement the full scale LX. In the CX configuration the system can support approximately 500 remote sites, but it is upgradeable and can easily be scaled to support service businesses and large networks which the LX is designed to address. The HX system adds a further layer of product options.

Additionally, as the IP functionality of the HN7000S VSAT has increased, it has become possible for the system to provide monitoring and reporting beyond the VSAT itself and into the local LAN environment. With malware of all sorts becoming more of a threat and virus infections increasingly the cause of massive increases in a customer's bandwidth use, operators have a real need to be able to identify a problem in the user's LAN in order to be proactive with troubleshooting and assisting the user in the event of a problem. Finally, Hughes is keen to point out that all of its terminals are RoHS¹ compliant, now an essential requirement for many markets. All of these advances have made the HN system a great deal more bandwidth efficient as well as cost competitive and, during 2006, established the platform as arguably the most advanced on offer in the market.

¹ EC Directive on the Restriction of Hazardous Substances (RoHS).



3.2. The HX System

The HX system was officially released in June 2006 as a platform designed specifically for smaller networks with a high quality of service requirement. Hughes took the basic structure of the larger HN system – including the DVB-S2 ACM outbound, inbound access schemes and the management system – as the core of the HX. For this reason, observers can be forgiven for initially thinking the HX is little more than a cost reduced version of its larger brother, but this is not the case.

Quality of Service: The ability to delivery high levels of guaranteed service in a much more granular way that large scale enterprise systems need, or can even cope with, is one key feature and this was possibly the largest task that Hughes set out to deliver in its HX system. As a consequence, despite the fact that the company had a great deal of technology which could simply be lifted out of the HN system, most if not all of the QoS software systems, including the algorithms, needed to be completely re-designed. The company also wanted to raise the maximum transmit rate of the remote terminal and to design an architecture that was both low cost and yet scaleable. Traditionally, Hughes has been highly focused on maintaining backwards compatibility in its systems, but as the HX system was targeted at new markets it was released from this constraint and had a clean slate on which to start.

Low Cost with High Functionality: As a consequence, the HX offers an almost unique combination made up from the advantages of highly scaleable, efficient, low cost technology taken from a proven and successful product coupled with a hub systems and IP architecture designed from the ground up. Hughes has long term plans for the system, but in the present version there are several major differences between the HX and the HN:

- Quality of Service capabilities are significantly expanded with the ability to set service guarantees by individual remote terminal and specific application. These include:
 - ▶ Constant bit rate providing a uniform transmission rate to avoid jitter in applications such as voice and video.
 - ▶ Minimum committed information rate (CIR), guaranteeing the throughput of a connection, with fixed steps to a maximum limited rate.
 - ▶ Minimum CIR with best effort to a maximum limited rate
 - ▶ Best efforts services - weighted fair queuing
 - ▶ Class-based weighted prioritisation

QoS is also tied to an operator-defined priority queue which sets four levels of IP traffic and allows the system to prioritise and rate limit the least critical traffic in an ordered fashion.

- Inbound transmission speeds have been raised from the maximum of 1.6 Mbps on the HN7000S terminals to 3.2 Mbps on the HX terminals.
- Optional 128 bit AES encryption.

Service for Demanding Customers: Hughes is targeting the HX system at operators focused in highly defined market segments such as the booming maritime stabilised business, oil & gas, embassy network and multi-national corporate segments. It has also firmly targeted the demand for high speed satellite backhaul circuits from the GSM operators and the highly military's need for highly customised mobile terminals capable of supporting multi-megabit mission critical applications. The combination of a low entry point and a DVB-S2 ACM outbound channel, especially in a market struggling with rising prices across the world and a real lack of satellite capacity in some regions, has proven to be an attractive one. Additionally, the system offers many of the advantages of the HN in that the HX50 terminal is priced similarly to the HN7700 due to the fact that it comes from a heritage of huge manufacturing scale. The HN system is also very efficient in its use of compression, Hughes' performance enhancing proxy (PEP) and adaptive inbound selection (AIS) as well as its ability to reduce a non-active remote terminal's bandwidth requirement to zero.



Provision of Greater Flexibility: In the longer term, the HX will become much more distinguishable from the HN. Whilst both systems will see increases to the inbound transmission rates, new FEC rates and more efficiency driven out of improved acceleration and compression technologies, the HX be upgraded to be able to support mesh connectivity. Mesh is a generic term which can imply many things, but specifically we expect to see full terminal-to-terminal connectivity on demand and a multi-gateway capability. This is likely to allow an operator to terminate traffic from an HX VSAT at different gateway locations depending on the performance and cost available at that site. So, for example, an operator in West Africa could (satellite coverage permitting) operate a local gateway in Africa supporting corporate intranet traffic, a gateway at the AIX for internet and a gateway in New York for voice termination.

Operators who have bought the system, several as a replacement or service platform upgrade to competing products Hughes has targeted, tell us the HX's capabilities are impressive and it delivers exactly the kind of service that it was designed for. What is more, many operators are looking for some kind of technical differentiation and, as a new product with a strong heritage, the HX offers this as well as the security of stability. Hughes is a bankable name in this business and its engineering capabilities are well known and respected, giving the customers we have interviewed a sense of assurance with respect to the future of the platform and the support from its manufacturer.



3.3. Spaceway

The Spaceway system is not a hardware product offering by Hughes, but an integrated service platform. In the past, there were plans to develop services on the Spaceway platform in regions other than North America and Hughes is known to have had quite advanced discussions with potential partners in other regions of the world. For the moment however, a service is only planned for North America, although this might change as Hughes' service develops.

Technology Integrated with Service: Spaceway cannot be described individually as either a ground or a space platform, it is a converged solution with the satellite and terminals integrated in a single design. It provides full CONUS coverage through 100 uplink cells coupled with coverage of Hawaii, Alaska and seven Latin American cities through a further 12 cells each of which is approximately 200 miles across. The satellite can be configured with a capacity plan allowing between zero and eight 50 Mbps of capacity for each uplink cell to optimise the spread of its available bandwidth across the system coverage. Each uplink cell has seven downlink micro-cells – 784 in all – which the satellite sweeps constantly to deliver up to 440 Mbps. When there is no data destined for a cell, the satellite bypasses it, thus automatically delivering the downlink bandwidth where required. All user terminals are able to communicate directly in mesh configuration with traffic being switched and routed on-board the satellite. The system also incorporates a broadcast beam with CONUS coverage, but it is likely that any widespread broadcast requirements will be provided via a hybrid Ku-band service.

Flexible and Scaleable Capacity: Spaceway incorporates onboard processing in its satellite design – essentially a fast packet switch – that allows traffic to be dynamically switched between spot beams. This is important because it enables a user terminal in one spot beam to communicate directly with another user terminal in another spot beam without using a double hop. Other, bent pipe designs constrain connectivity because a user terminal in a spot beam is only able to communicate with a specific regional gateway set up to serve a defined group of spot beams. One Spaceway satellite has 10 Gbps of capacity which, according to Hughes, means that the cost per bit on the system is approximately one third that of a typical Ku-band system. Coupled with Spaceway's connectivity capabilities, this makes for a powerful business proposition.

Spaceway marks a revolution in the functionality of satellite communications. The system's full mesh architecture and lower cost per bit represent a step function increase in the current generation of C/Ku-band VSAT platforms. When described as "full mesh", the true impact of this connectivity can be lost in a generalisation. Spaceway enables the interconnection of any terminal or group of terminals with another site or group of sites. Networks will be able to take the form of a mesh, star, multi-star or even simple point-to-point links, but by virtue of the fact that they are part of the Spaceway system, any point in the network may be reconfigured and adapted, the private network of a manufacturer can be interconnected with a supplier's network for example, access privileges can be added or changed all on a single platform. Deployment of intranets, extranets and VPNs will almost be a standard feature of the system making new application introductions in and between companies faster, smoother and less costly. Hughes describes the service as "Broadband Dialtone".

Gateway to a Private Network: Hughes has completed construction of its network operations centre in Germantown, and the terminal design is finalised. The service will support three types of terminal - two of which are defined as user terminals. All of the versions are capable of receiving 440 Mbps of which up to 30 Mbps can be processed by the two HN user terminals. The HG900 is essentially a large gateway which can be scaled to uplink several 16 Mbps carriers and will be the terminal used by HNS for the connection of user traffic to the Internet backbone. Individual users and operators will also use the HG900 as private or shared gateways at corporate headquarters or teleports to support specific networks or services. The largest antenna required for the system - even the major gateways - is 3.5 metres, although coupled



with a 100 watt RF system these will be capable of transmitting at rates of up to 100 Mbps and will require tracking.

A New Era in Consumer Broadband: The typical HN9000 consumer terminal will be provided with an antenna of 74 centimetres and an RF system of 1 Watt. The enterprise HN9500 will use a standard antenna of 98 centimetres with a 2 watt RF and have options for antennas 1.2 and 1.8 metres, depending on the location. The terminal design, which we have seen, supports dual feed LNBs which will allow a combination of broadcast satellite and Spaceway service from a single antenna in much the same way that HughesNet already does with DirecDuo. This configuration will also allow enterprise customers to deploy business television networks on any Ku-band satellite over a 20° arc from Spaceway's 95° West orbital position. The company has been working at the hardware level on appliance devices to extend the capabilities of the terminal to support high quality VoIP links and, at a service level, has a "Broadband Alliance" programme which encourages and assists application and technology developers to build products which take advantage - and are enabled by - the Spaceway platform. These include applications from the basic transport level through to value added services and content delivery which will form a suite of additional features as options on the platform.

Hughes has yet to officially announce prices for the terminals, but informs us that it expects the consumer and enterprise terminals to be priced at similar levels to its current HN7000S and HN7700S Ku-band VSATs. This would suggest that the launch price for an installed enterprise terminal will be between \$1,500 and \$2,000 and at subsidised consumer levels for the HN9000. Spaceway will integrate space segment with ground services in the same way as DirecTV and EchoStar use their satellite assets. In effect, Spaceway cuts out the middle-man and brings the margin which is currently handed over to the satellite operator to the basic business of providing service to the end customer. Coupled with its intrinsic lower cost of bandwidth, Spaceway is therefore designed to meet price points with margins which HNS and its VSAT service competitors in the traditional business have only dreamt about.

