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Re: Teledesic's Comments on IDA's Proposed Approach to Fixed-Wireless Broadband Network Deployment and Service Provisioning in Singapore

Dear Ms. Ng:

Thank you for inviting industry to comment on the Info-communications Development Authority's (IDA) proposed approach to fixed-wireless broadband network deployment and service provisioning in Singapore. Teledesic is very pleased that IDA is fully liberalizing its licensing regime and we are looking forward to working with IDA to ensure that Teledesic's satellite based broadband services are available in Singapore.

Teledesic is very pleased to offer its comments on the the issues raised by IDA:

(a) the potential of and benefits arising from the deployment of fixed-wireless broadband network, the likely services/applications to be deployed and the potential demand from business and consumers.

Teledesic's non-geostationary fixed satellite service (NGSO FSS) will offer global, broadband "Internet-in-the-Sky" services. Using a constellation of satellites, Teledesic and its partners will create the world's first network to provide affordable, worldwide, "fiber optic-like" access to telecommunications services such as broadband Internet access, videoconferencing, high-quality voice and other digital data needs. On Day One of service, Teledesic will enable broadband telecommunications access for businesses, schools and individuals in

Singapore and everywhere else on the planet. Teledesic terminals will offer consumers data rates of up to 311 Mbps (3+ Gbps).

Teledesic's principal investor is its Chairman, Craig McCaw, the visionary behind cellular communications in the US and the majority owner of both Nextel, one of the US's largest cellular networks and Nextlink, a LMDS based system that offers high-quality local broadband services in urban areas. Other investors are Bill Gates, Chairman of Microsoft, Motorola, Boeing, AT&T, Kingdom Holdings Company and other investors from around the globe. Billions of dollars have been raised to fund the Teledesic system.

The Teledesic service will be an important complement to services offered by existing and future telecommunications operators. Within Singapore, Teledesic will provide fiber-like broadband access to any location, urban or rural, passed or not by fiber. Outside Singapore, Teledesic will extend the reach nationally, regionally or globally of any domestic wireline or wireless, private or public network. Broadband NGSO networks like Teledesic can seamlessly extend the existing terrestrial FS and fiber-based infrastructure to provide advanced information services anywhere on Earth. In effect, NGSO FSS systems such as Teledesic will be critical access technologies for international e-commerce.

This unparalleled reach also has important implications for economic development and social policy in Singapore and beyond. No location will be without access to broadband telecommunications services. The technological challenges of linking individuals, government agencies, schools, hospitals and public services can be a thing of the past. Whenever and wherever institutions and individuals want access to fiber-like telecommunications services they will have it.

Because these NGSO satellite systems are inherently global in architecture, they also stand to radically transform the economics of the world's telecommunications infrastructure through their ability to provide *the same quality and quantity of service to all areas of the world*, including those places to which it would be uneconomical to extend traditional wireline service. For example, Singapore's proposed approach to the issue recognizes that one of the key hurdles in providing these services is overcoming the so-called "last mile" problem. These hurdles are spectacular: NTT in Japan estimated that it would cost US $600 billion to wire every home in Japan with fiber optics.

As advanced communications technologies continue to revolutionize the ways people exchange and process information, NGSO satellite systems can play an important role by helping those areas with the most urgent development needs leapfrog stages of telecommunications development and gain immediate access to the most advanced telecommunications capabilities.

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There is no doubt of the explosive demand for broadband telecommunications services. Innumerable data confirm this increasing need for bandwidth:

Globally --

- In 2004, 500 million PCs will be connected to the Internet (Merrill Lynch)
- In 2002, electronic commerce will be a $350 billion business (Forrester Research)
- Web traffic is growing at 200% CAGR (IDC).

The satellite broadband market opportunity is also dramatic –

Revenue projections:

- Bain & Company: US$40B by 2002
- Merrill Lynch: US$52B by 2007
- Pioneer Consulting: US$108B by 2010
- AT Kearney: US$230B by 2012

Number of Broadband Satellite Sites:

- Pioneer Consulting: 18M sites by 2005
- Booz Allen & Company: 100M sites by 2010

Telecommunications needs of residential users and enterprises are being driven by the bandwidth requirements of the content, services and applications being carried over the network(s). Whether leisure content for residential consumers or data-hungry applications for SMEs, demand for bandwidth is growing at an unprecedented rate. Consumer expectations are also on the rise: No matter whether they are residential or SME, consumers will expect constraint-free, high-quality bandwidth on demand.

The means by which the consumer accesses broadband services are also growing in number and diversity. The technologies for providing wireless broadband access such as Fixed Wireless Access - the subject of this consultation - and satellite (specifically low Earth orbit, non-geostationary fixed satellite service such as Teledesic) are proving themselves to be viable future alternatives to existing cable and fiber. Wireless technologies will also complement wireline-based networks by extending their reach to non-wired users in many areas. Additionally, wireless broadband access for residential and enterprise consumers may well change the economics of access given the inherent flexibility of the access infrastructure.

As the current connection problems are solved and the number of users that demand broadband applications expands, value-added services will be offered which have barely been considered today. In addition, every day applications and usage patterns are demanding ever increasing capacity. Where current applications range from e-mail, data transfer, and internet browsing, in the next few years users will demand access to ever increasing high speed connections

and will be using high capacity applications such as video-conferencing, software distribution, e-mail with video and multimedia, and internet browsing that will require high-speed connections.

Wireless technologies hold the potential to solve that problem and to bring the benefits of broadband services to the widest set of consumers in the least disruptive manner. Wireless technologies do not require the replacement or upgrading of physical infrastructure that would be disruptive to urban areas. Wireless technologies also would speed the connection of areas that are not currently connected because of physical location.

(b) ***The possible uses for the fixed-wireless broadband technology, and how the competing demands for the spectrum should be managed, including the allocation process, the timing of the process and criteria to be used. IDA also seeks comments on whether there are interconnection and access issues that may pose problems to achieving IDA's objective of transparent and seamless inter-connection and open access; and how these may be practically and realistically addressed. IDA further seeks comments on the type and level of QOS standards, including both network and customer QOS standards, that would be appropriate to benchmark the quality of the network and services deployed.***

Under Section (a) above, we discussed many of the uses for satellite based fixed-wireless broadband technology. The best way to summarize is to note that most any application that can be done with fiber optics can be done with Teledesic. Teledesic can also be used by:

- service providers for seamless and transparent: routing, trunking, cellular backhaul, instant rural infrastructure, upgrading existing infrastructure, as backup infrastructure, and many other uses;
- multi-national corporations to create global virtual private networks. While countries like Singapore have excellent telecommunications infrastructures, many locations where multi-nationals have offices do not. For instance, Singapore Airlines has offices in many countries that have basic telecommunications infrastructures; by using a satellite based broadband global network, all of Singapore Airlines' offices around the world could communicate at the same level and utilize broadband applications to enhance their corporate communications.

We also note that Teledesic's system architecture will provide fiber-optic like quality of service standards, with 99.9% availability.

In terms of satellite based systems, Teledesic agrees with IDA's policy to give preference to operators who deploy the spectrum for nationwide fixed-wireless networks rather than for localized applications. Given the time and expense associated with building operating and maintaining satellite based systems, and the nationwide benefit that such systems will provide, IDA should give a policy preference to national, rather than localized applications.

(c) ***The amount of spectrum that should be made available for terrestrial fixed-wireless broadband and satellite services, including the timing for review of spectrum reservation and allocation, where appropriate.***

We were extremely pleased to find that IDA has set aside the 28.6-29.1 GHz bands for NGSO FSS, and we hope that the IDA will also allocate the 18.8-19.3 GHz bands to NGSO FSS on a primary basis.

At the International Telecommunication Union's World Radio Conference in 1995 (WRC-95), over 180 administrations supported an international spectrum designation for NGSO FSS to operate on a primary basis in the frequencies 18.8-19.3 GHz and 28.6-29.1 GHz. The decision was made to make 400 MHz available immediately and freeze 100 MHz for consideration at WRC-97. At WRC-97, the remaining 100 MHz was made available, thereby internationally designating the full 2 x 500 MHz FSS satellite systems. Teledesic agrees with IDA's view that regarding spectrum for satellite services and with the need for international cooperation in coordinating specific frequencies for global satellite services such as nongeostationary systems.

In the US, the FCC took several years to develop a frequency band plan that would allow all the competing services to develop. Specifically, it was determined that the terrestrial FS and the satellite FSS could not share the same frequencies. It therefore developed a band plan with separate spectrum for terrestrial LMDS, NGSO FSS and GSO FSS. By setting aside separate spectrum for each service, each service will be able to grow to its full potential.

Many countries with liberalize licensing regimes, such as Australia and New Zealand, do not review licensee's use (or non-use, as the case may be) of their spectrum licenses, with the assumption that licensees have paid for the licenses and therefore will use the spectrum in an appropriate manner. Some countries also impose roll-out obligations (or milestones) which must be met in order for a provisional license to be considered final. Roll-out obligations/milestones should be reasonable, take into account the timeframe within which the operator can realistically deploy the service, and should be developed with industry input. This, obviously, will also depend on the complexity of the type of service.

(d) ***The optimal amount of spectrum to be allocated to each operator, including the detailed assumptions/basis/calculations used to derive the proposed spectrum bandwidth, and the timing of allocation where appropriate. IDA also seeks comments on the optimal number of operators that can be licensed, bearing in mind the growth of the broadband market in Singapore.***

Teledesic is designing a satellite based system that will operate in the spectrum allocated by the ITU to its type of service, non-geostationary fixed satellite

service (NGSO FSS), the 18.8-19.3 GHz and 28.6-29.1 GHz bands. Teledesic's system is designed to utilize these frequency bands in their entirety. We note that ITU studies[1] have found that between 3 to five NGSO FSS systems can share these frequency bands. Note that sharing between the NGSO FSS and fixed services (FS) is problematic and will not allow full deployment of either type of service when they are forced to share. We were very, very pleased to see that IDA has set aside the 28.6-29.1 GHz bands to NGSO FSS.

(e) The most appropriate licensing and spectrum allocation approach to adopt. Views are also sought on whether spectrum should be assigned in a phased manner or allocated fully to the operator at the grant of licence. Should there be a separate component for licence fees payable in addition to spectrum fees payable?

Teledesic supports the idea that licenses should be open to any qualified applicant. However, Teledesic strongly believes that satellite systems should not be subjected to a public bidding process. It has been the experience of Teledesic and other space segment operators that auctions, while useful and efficient when applied to terrestrial services, have decisive disadvantages where global satellite services are concerned.

Perhaps the most significant disadvantage is that public bidding procedures do not lead to the same economic efficiencies in satellite licensing that such procedures produce in the terrestrial context. This is because global landing rights must be acquired sequentially, on a country-by-country basis, rather than just locally, and yet the value of landing rights in any one country is directly related to the number of other countries to which the satellite network extends. Since there is no way to know what the outcome will be in other countries, there is no reliable way to assign a value to any one license. To our knowledge, no country has ever auctioned spectrum for global satellite services, and the International Telecommunications Union (ITU) has recognized that sequential auctions are not an economically efficient means for assigning spectrum for satellite services.

Indeed, an ITU Report on the "Economic Aspects of Spectrum Management" concluded, "auctions may be inefficient or impractical for certain services or situations."[2] In particular, auctions will not work well for global or regional satellite services. As the ITU Report concluded:

[1] Teledesic would be pleased to offer further information on the ITU's NGSO FSS sharing studies upon request.

[2] Report ITU-R SM.2012, "Economic Aspects of Spectrum Management," 1997 SM Series, at 18 (1997).

> if auctions to license global or regional satellite systems were held in multiple countries, potential service providers would likely have to expend significant resources simply to participate in each auction, and such a cumbersome process could lead to delays in implementing new and innovative services. In addition, sequential auctions would create significant uncertainty for potential service providers because such providers would be unsure that they would win auctions in all countries in which they wish to provide service. If this uncertainty were sufficiently severe, it could deter entry and impede provision of service and the development of new international satellite services under current ITU regulations.[3]

Furthermore, public bidding in the context of capital-intensive satellite systems simply creates regulatory uncertainty and discourages new entrants. It is difficult to comprehend expending large sums of capital in an effort to construct a satellite system, only to lose the rights to proceed in any given country. Nongeostationary satellite systems, by their nature, are global enterprises. As such, a spectrum bidding process introduces the possibility of speculators creating so-called "paper" satellite systems which are then sold to legitimate operators at a price premium that harms the legitimate operator, and forces higher prices on consumers. For these reasons, Teledesic respectfully submits that no public bidding requirements should be instituted for satellite systems.

Teledesic agrees that application fees and annual regulatory fees are beneficial to ensuring the smooth operation of the regulatory system in Singapore. However, care must be taken to avoid crippling the growth of broadband services in Singapore by applying licensing fees that fixed-wireless operators cannot afford.

Teledesic cautions that IDA should not discourage the expansion and further deployment of broadband services in Singapore by structuring spectrum fees on the basis of use by current narrowband systems. Accordingly, IDA should not calculate spectrum fees based only on the amount of spectrum used. Teledesic submits that if annual spectrum fees are imposed, they should be nominal, and should be based on a small fraction of a licensee's annual earnings before interest, taxes, depreciation, and amortization.

In conclusion, Teledesic stresses that excessive fees may prevent the introduction of fixed-wireless services, terrestrial and satellite based, into Singapore.

(f) ***Whether the proposed spectrum band in para 2.4.1 should be reserved primarily for IBBMM services or whether they should be assigned for broadcasters' usage.***

[3] *Id*.

IDA's current policy approach relates to IBBMM service and the spectrum needed to provide such services. If broadcasters are interested in providing two-way services, which could be considered interactive under the definition of IBBMM, such broadcasters could submit applications to IDA. However, if the interactive function of such service is merely a separate component of a broadcaster's primary activity, then that primary activity –streaming data to subscribers- should be kept separate from true IBBMM services. Broadcasters could be allowed to operate the interactive portion of their service within the IBBMM spectrum.

(g) *The appropriate licence duration for the provision of fixed-wireless broadband services.*

Teledesic agrees with IDA's approach that license duration should be suitably long for operators to rollout their networks, recoup their investment and earn reasonable rates of return as well as a sufficient degree of business security to encourage investment in Singapore. Even by today's mega-project standards, satellite systems are extremely expensive to design, develop, and operate. To attract the investment needed to roll-out such systems and to recoup that investment, license duration needs to be extended for a period that is longer than terrestrial based counterparts. Teledesic submits that for broadband satellite systems, ten to fifteen years would be a reasonable duration.

(h) The timeframe for award of licence as well as the time needed by the operators to roll-out their networks and offer commercial services to the public.

Awarding licenses as soon as possible will allow companies to begin to develop value-added services and provide those services to consumers in Singapore. The proposal to award licenses by the 3rd quarter of 2000 is reasonable. The earlier a company has obtained its license, the more secure it will be in attracting the capital necessary to rollout its service.

Once a license has been granted, it may take some time for a satellite service to rollout commercial services to the public. As in the case against a bidding process for satellite spectrum, the resources involved in developing a global service require that a longer than ordinary rollout period be established. Without a good indication that a satellite system will be licensed globally, the needed investment cannot be attracted. Those assurances come in the form of licenses from individual countries.

Allowing an extended period between grant of a license and the commercial rollout of a satellite service does not mean that applicants should be granted licenses and then have no accountability as to when consumers can expect service. Applicants should be required to demonstrate that they are capable,

both technically and financially, of rolling out service by an agreed-upon date. Requiring a set of milestones that the licensee must meet on a regular basis, prior to commercial rollout, will provide IDA with assurance that the licensee is not a speculative venture and that the operator will be providing service to the public in Singapore as promised.

(i) How the issues of rain attenuation and compliance with QOS standards would be addressed.

Teledesic's system architecture addresses rain attenuation problems by having a higher satellite elevation angle and by having multiple antennas on each terminal. In addition, our system architecture allows for fiber-optic like quality of service.

We believe, however, that IDA should give operators the freedom to build their systems to meet consumers' needs, so long as health and safety standards are met. As IDA stated in its paper, its goal is to "give operators maximum flexibility in running and optimising their networks and ensure that they will continue to innovate and respond competitively to meet the needs of users and help Singapore position itself as a key info-communications hub." This will best be accomplished by allowing operators to develop innovative, advanced systems. However, IDA may want to provide operators with guidelines on minimum allowable QOS standards. Such standards should be developed with industry input in order to ensure that they are reasonable and realistic.

(j) ***How operators plan to install their own internal wiring, the potential difficulties faced and the cost of doing so. IDA also seeks comments on how these difficulties can be practically and realistically addressed by potential operators and how IDA can facilitate the installation.***

Local installation of our network will be done on a customer-by-customer basis and will require little, if any, difficulties. As a satellite based broadband system, users will purchase Teledesic's user equipment terminals and technicians will install our fixed satellite terminals on a rooftop or other unobstructed area in a few hours. Teledesic's user equipment will consist of small satellite dishes to large "aggregator" terminals that a large user, such as a service provider, can use for more advanced applications. All users will be sited and will need to be enabled before the system is operational.

The only potential issue we foresee is interconnection and siting related challenges. IDA may wish to act as an arbitrator only when industry cannot reach equitable solutions to any problems that may arise.

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Once again, I would like to emphasize how thrilled Teledesic is that IDA is liberalizing its licensing environment so fully and thoughtfully. I certainly hope that our comments will be helpful, and it would be my pleasure to discuss any of these issues with you in greater detail at any time. Please also let me know if you have any questions or comments on our thoughts expressed in this paper. Best wishes.

Very truly yours,

Sallye Clark
Director, International and Government Affairs

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