

Broadband Access Marketspace, Ltd.

*China's New Broadband Requirements:
"Putting Trillions of Megabits of Information To Work"*

**IMPLICATIONS FOR STRATEGIC INVESTMENT IN CHINA'S BROADBAND
WIRELESS TELECOMMUNICATIONS INDUSTRY**

by Mr. Douglas C. MacLellan
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OVERVIEW

Imagine a world with three underdeveloped Taiwans aggressively seeking economic growth and trade on a global scale, with all the immutable tenacity and caution of China. This is the reality of China's current economic expansion with GDP anticipated to be over US\$1 trillion in 2001. One of the requirements to sustaining this immense growth is significant advances in China's telecommunications industry. Yet, industry regulators have been cautious in their licensing policy related to new technologies and foreign investment.

China's rules on foreign investment in its telecommunications industry have been submitted to the country's State Council for approval and will be released prior to China's entry into the World Trade Organization. China stands at the brink of becoming a market of tens of millions of wired and wireless broadband subscribers in the next three to five years. Three key wireless broadband technologies have entered China's broadband connection race: Local Multipoint Distribution Service ("LMDS"), Multichannel Multipoint Distribution Service ("MMDS") and Very Small Aperture Terminal ("VSAT"). It is anticipated that China's State Radio Regulation Bureau will release to multiple operators the frequency of 3.5 GHz for MMDS by perhaps the fourth quarter of 2001, followed by 26 GHz LMDS in mid-to-late 2002. Currently, there are at least 15 various VSAT operators with over 100,000 existing VSAT customers and additional operators anticipated to enter the VSAT market in 2001. These wireless broadband services have the ability to provide China with key tools required for it to reach its national goals in a cost effective manner that keeps pace with North American and European social and economic developments.

2001 is also anticipated to be a significant licensing year for Chinese broadband wireless operators. The later half of 2001 these new license holders will focus on technology selection, construction, financing and initial system build out. It is recommended that strategic investors interested in this segment of the Chinese telecom industry should consider the following investment opportunities:

1. Invest in publicly traded broadband telecommunications equipment suppliers;
2. Invest in small emerging telecommunications operators;
3. Seek cooperative relationships with prospective license winners prior to the granting of any licenses;
4. Create strategic or corporate partnerships with one or more prospective license holders.

Mr. Douglas MacLellan holds significant expertise in developing and financing businesses in emerging markets, particularly in the telecommunications, software and media industries. Over the past fourteen years, Mr. MacLellan has helped to develop and finance business in Bulgaria, Cambodia, Canada, Chile, China, Hungary, India, Korea, Madagascar, Russia and the United States. Mr. MacLellan was a co-founder and a significant stakeholder in two China based cellular and PSTN telecommunications businesses that had joint ventures with China Unicom. These joint ventures had operations in Chongqing City, Chengdu, Ningbo and the provinces of Yunnan, Inner Mongolia and Ningxia. Mr. MacLellan has been doing business in China since 1982. Mr. MacLellan was also a co-founder of the predecessor to AT&T Latin America.

THE CHINESE TELECOMMUNICATIONS INDUSTRY

The Chinese telecommunications industry has several factors that are driving its strong growth. Clearly, China's continued economic expansion coupled with multiple positive changes in the regulatory environment and new telecom technologies are fueling this growth. The continued low penetration of basic and enhanced telecommunications services makes China a significant world market for equipment vendors and ultimately telecom investors. China looks particularly attractive to the many U.S. and European broadband wireless vendors given the current weak demand in North America and

Europe. China's broadband wireless market niche is anticipated to grow significantly over the next three years.

TELECOM REGULATIONS IN CHINA

China's regulatory environment continues to improve. The Ministry of Information Industry ("MII"), China's telecom regulatory agency has a goal to facilitate orderly competition, wherein the government appears to favor some of the new operators such as China Unicom, Netcom and Railcom. Last year the Chinese government issued regulations that ensure interconnection with incumbent carriers, and once China is admitted to the WTO, these and other new regulations are anticipated to facilitate an orderly market entry for foreign operators and investors.

UNIQUE WIRELESS BROADBAND APPLICATIONS

LMDS, MMDS and VSAT technologies offers small, medium and large scale businesses located in rural and urban markets the ability to have high quality state of the art real-time business and stock market data, internet services, voice and video content delivery. The most impressive aspect of these technologies is that they provide an easy to use high quality solution for video conferencing, distance learning and medical diagnosis. These services provide significant interactive multimedia communications that are critical for the hospitals, schools and universities and government ministries seeking to communicate with their counterparts on a national level. These wireless broadband services have the ability to provide China with key tools required for it to reach it's national goals in a cost effective manner that keeps pace with North American and European social and economic developments.

WIRELESS BROADBAND TECHNOLOGY

The "Last Mile" is still a major bottleneck in enterprise networks as service providers struggle to meet rapidly increasing bandwidth demands. Fortunately, the airwaves can now be used as a high-bandwidth, rapid-deployment alternative to wire-based services. Broadband fixed wireless solutions use high-frequency radio connections between two or more fixed sites to send and receive data, voice, and video in a similar way that hard-wired solutions deliver these services. Unlike mobile wireless solutions, the endpoints in fixed wireless solutions are stationary and therefore less susceptible to the bandwidth and quality limitations associated with mobile wireless networks. Fixed-wireless networks can deliver up to 155 Mbps of capacity to bandwidth-starved businesses, remote offices, and telecommuters. Moreover, telecom operating companies and other service providers can deploy such networks in a fraction of the time that it would take to build traditional wired infrastructures. The benefit to customers is that fixed-wireless operators can fulfill their bandwidth demands faster, especially in areas in which wireline infrastructures need to be established or upgraded.

Multiple spectrums can be used to provide fixed-wireless solutions. However, there are two strategic spectra that have been licensed to operators who are deploying services

in North America, Europe and Austral-Asia: 2.5 – 3.5 GHz and 26 - 28 GHz. These frequencies support LMDS and MMDS services. Allocation and licensing of spectrum in other geographies has only just begun. Together, LMDS and MMDS can be used to deliver fixed-wireless broadband access to almost any type of business location, from city centers to rural outposts. With both LMDS and MMDS and even VSAT technologies, an antenna and radio are installed on the roof of a customer's building site and connected by a coaxial cable to customer premises equipment ("CPE") in the wiring closet. Building owners can then use in-building wiring to distribute broadband services to multiple tenants in the same structure.

WTO AND FOREIGN INVESTMENT IN TELECOM

China's rules on foreign investment in its telecommunications industry have been submitted to the country's State Council for approval and will be released prior to China's entry into the World Trade Organization ("WTO"), according to Mr. Wu Jichuan, the Minister of the MII. As part of the terms for its accession to the WTO, China agreed to let foreign entities own stakes in telecommunications ventures, with the allowed percentage increasing in stages. Such ownership in the past has been illegal. In advance of the rule changes, no pilot joint ventures have been allowed, other than the one already in place between Shanghai Post & Telecommunication Administration and AT&T Corp. China has agreed to a phased liberalization of its telecom sector, as described in its Schedule of Specific Commitment relating to the World Trade Organization Basic Telecommunications Agreement. China has adopted a deregulation scheme which is defined by type of telecommunications service and by geographic area, involving separate percentage caps on foreign investment. The following schedule assumes China's accession in late 2001.

Value-Added and Paging Services

- Upon accession: Up to 30% foreign ownership in Beijing, Guangzhou and Shanghai (and operations connecting these cities);
- 2002: Up to 49% foreign ownership in Beijing, Guangzhou and Shanghai and the 14 cities listed below (and operations connecting these cities);
- 2003: Up to 50% foreign ownership with no geographic restrictions;
- Foreign service suppliers will be able to provide the following services: electronic mail, voice mail, on-line information and data base retrieval, electronic data interchange, enhanced/value-added facsimile services (including store and forward, store and retrieve), code and protocol conversion, on-line information and data processing (including transaction processing), and paging services; and
- Foreign service suppliers may provide services to Beijing, Shanghai, and Guangzhou upon accession, to Chengdu, Chongqing, Dalian, Fuzhou, Hangzhou, Nanjing, Ningbo, Qingdao, Shenyang, Shenzhen, Xiamen, Xian, Taiyuan and Wuhan after one year, and nationwide after two years.

Mobile Services

- Upon accession: Up to 25% foreign ownership in Beijing, Guangzhou and Shanghai (and operations connecting these cities);
- 2002: Up to 35% foreign ownership in Beijing, Guangzhou and Shanghai and the 14 cities listed below (and operations connecting these cities);
- 2004: Up to 49% foreign ownership with no geographic restrictions;
- Foreign service suppliers will be able to provide all analogue/digital cellular services and personal communications services; and
- Foreign service suppliers may provide services to Beijing, Shanghai, and Guangzhou one year after accession, to Chengdu, Chongqing, Dalian, Fuzhou, Hangzhou, Nanjing, Ningbo, Qingdao, Shenyang, Shenzhen, Xiamen, Xian, Taiyuan and Wuhan after three years, and nationwide after five years.

Fixed Wireline Services

- 2004: Up to 25% foreign ownership in Beijing, Guangzhou and Shanghai (and operations connecting these cities);
- 2006: Up to 35% foreign ownership in Beijing, Guangzhou and Shanghai and the 14 cities listed below (and operations connecting these cities);
- 2007: Up to 49% foreign ownership with no geographic restrictions;
- Foreign service suppliers will be able to provide domestic and international voice, packet-switched data transmission services, circuit-switched data transmission services, and facsimile services. International closed user groups voice and data services are also included; and
- Foreign service suppliers may provide services to Beijing, Shanghai, and Guangzhou after three years, Chengdu, Chongqing, Dalian, Fuzhou, Hangzhou, Nanjing, Ningbo, Qingdao, Shenyang, Shenzhen, Xiamen, Xian, Taiyuan and Wuhan after five years, and nationwide after six years.

Internet and Satellite Services

- Internet and satellite services are included, but not explicitly scheduled, following the scheduling convention of most WTO members, including the United States;
- Internet services are subsumed under value-added services; and
- For satellite services, China has attached to its services schedule and signed the “Notes for Scheduling Basic Telecom Services” (S/GBT/W/REV.1). This means unless explicitly excluded in China’s sectoral column, any basic service may be provided through any means of technology (e.g. cable, wireless, satellites).

Access to International Services

- All international telecommunications services suppliers shall be licensed by the MII, which will act as an independent regulatory authority. The decisions and procedures used by regulators shall be impartial with respect to all market participants.

CHINA'S LMDS AND MMDS LICENSING PROCESS

The licensing activities in China are anticipated to be a bidding process rather than an auction. The key wireless broadband applications that have entered the broadband connection race are LMDS and MMDS. It is anticipated that China's State Radio Regulation Bureau will release 3.5 GHz as the frequency for MMDS by perhaps the fourth quarter of 2001 for second and third tier cities to perhaps three separate operators. LMDS at the 26 GHz frequency is not anticipated to be licensed until 2002. Operating licenses for first tier cities for LMDS and MMDS are not anticipated to be released until perhaps late 2003 or early 2004. The companies that are attempting to be license winners include: China Telecom, China Mobile, China Unicom, China Railroad Telecom ("RailCom"), Huaneng Telecom, Jitong Communications Company ("Jitong"), China Network Communications Corporation ("NetCom"), China Education and Research Network ("Cernet") and the State Power Corporation ("SPC"). These new licenses are anticipated to fall under the Value Added segment of the new Chinese telecom regulations.

CHINA'S BROADBAND MARKET

China stands at the brink of becoming a market of tens of millions of wired and wireless broadband subscribers in the next three years. Up to the end of last 2000, China had 144.4 million fixed-line phone subscribers, 70.9 million mobile-phone subscribers, 22.5 million Internet subscribers and 90 million cable T.V. subscribers. It is anticipated that Ethernet, VSAT, DSL, coax cable, MMDS and LMDS will become the six leading broadband access technologies for China over the next five years. China's wired broadband market is currently relatively small. China Telecom has approximately 100,000 ADSL users among its 144 million fixed line customers and in 2001 anticipates adding another 300,000 ADSL customers. A slew of new operators are taking aim at China Telecom's dominance in providing telecom services. China Telecom's full service rival China Unicom, along with China Mobile, Jitong, Huaneng Telecom, Cernet, Netcom, Railcom and SPC are all looking at deploying broadband wireless solutions to compete with the former monopoly. The lure is that, like all monopoly markets, margins are still fat: China Telecom currently charges customers approximately US\$4,000.00 a month for an E1 circuit. Although each of the below noted broadband solutions has its advantages, broadband fixed wireless solutions or LMDS, MMDS and VSAT technologies appear to bridge several of the short comings of the other various broadband solutions and in most cases provides unique commercial advantages. These three technologies provide reasonably inexpensive symmetrical, fiber quality and high data rate services for a variety of telecom situations. The use of LMDS, MMDS and VSAT technologies enables the use of unobtrusive roof top antennas replacing the need for the trenching requirements in cable and fiber solutions. This makes them perfect alternatives when high-speed, high quality and quick time to market is critical to commercial success.

China's Various Broadband Solutions

Platform	Current	Maximum Data	Symmetrical or	Market Niche
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	Availability	Rate	Asymmetrical	
LMDS	Low	51 to 155 Mbps downstream 154Mbps upstream	Symmetrical	Medium and large sized businesses and institutions.
MMDS	Low	8.9Mbps downstream 2.0Mbps upstream	Symmetrical	Small and Medium sized businesses and institutions.
Very Small Aperture Terminal (VSAT)	Low	Up to 8 Mbps	Symmetrical	Small and Medium sized businesses and institutions.
Twisted Pair Copper	Medium	56 Kbps	Symmetrical	Total market
Enhanced Copper (DSL)	Low	1.5 Mbps downstream 64Kbps upstream	Asymmetrical	Small and medium sized businesses and institutions.
Fiber-in-the-loop	Low	2.5 Gbps	Symmetrical	Large scale businesses and institutions.
Hybrid Fiber Coax (HFC)	Low	30 Mbps downstream 10Mbps upstream	Asymmetrical	Large scale residential.
Broadband Satellite	Low	400 Kbps downstream Phone line upstream	Asymmetrical	Large scale businesses and institutions.

LMDS AND MMDS TECHNOLOGY TRAILS

Currently, numerous Chinese telecom operators are conducting LMDS and MMDS technologies trials in the 3.5, 5.0, 24-26 and 38 GHz ranges with equipment from various European and North American equipment manufacturers in different Chinese cities. Trials are underway in 10 cities, according to the MII. Nokia is testing its CityHopper solution with Guangdong Telecom and Netcom. P-Com has four trials in place, including one with China Telecom in Shanghai. China Mobile is conducting its tests in Chongqing, Hangzhou and Wuhan; China Netcom in Beijing; Jitong in Qingdao and Dalian; and China Unicom in Guangzhou. The commercial deployment holdup is spectrum allocation. The Ministry of Information Industry (MII) is not anticipated to decide on initial spectrum allocations until late 2001. Mr. Ruming Chen, deputy director general of MII's radio regulatory department, has stated that, "To date only one LMDS trial has been completed and it concluded that the issue was "complicated". "It's not just for operators, but ISP's as well," he added that the government hadn't yet decided how to allocate the licenses. Mr. Chen also has stated that, "for wireless broadband access

network carried on high frequency band, China only considers, at present, the use of LMDS technology”. It is assumed that when Mr. Chen has spoken of LMDS, he is including MMDS in his views on wireless broadband technologies. Mr. Chen has encouraged Chinese operators to cooperate closely with equipment vendors in order to speed up the testing of LMDS/MMDS technology. Cost effectiveness, easy installation and flexibility in organizing a network make LMDS/MMDS an important supplementary network for fiber optical access network.

Initial LMDS and MMDS Trial Participants

Foreign Technology Provider	Chinese Partners	Technology Focus and Trial Location
<u>Aspac Communications, Inc.</u> USA (OTC: ACMN) and VYYO, Inc. (NASDAQ: VYYO)	Beijing YeeYoo Network Information Technology, Cernet and Sinotech.	1 to 3.5 GHz MMDS Beijing
<u>Floware/Breeze.com</u> Isreal (NASDAQ: FLRE)	Datong Telecom, Technology Co., Ltd. formally China Academy of Telecommunications Technology.	3.5 GHz MMDS 26 GHz LMDS
<u>Adaptive Broadband Corp</u> USA (NASDAQ: ADAPE)	Casil Telecommunications Holdings Ltd., a subsidiary of China Aerospace Industry Corp. and China Unicom.	5GHz MMDS and in the future 3.5 GHz MMDS Guangzhou
<u>P-Com Corporation</u> USA (NASDAQ: PCOM)	PIIC Information Industry Corporation formally part of China Telecom and Guangdong Broadband Network Corporation.	26 GHz LMDS Guangdong Province
<u>Alcatel</u> France (NYSE: ALA)	TBA	3.5 GHz MMDS and 26 GHz LMDS
<u>Ericsson</u> Sweden (NASDAQ: ERICY)	TBA	3.5 GHz MMDS and 26 GHz LMDS
<u>Siemens AG</u> Germany (NYSE: SI)	TBA	3.5 GHz MMDS and 26 GHz LMDS
<u>Nokia Corporation</u> Finland (NYSE: NOK)	Guangdong Telecom and NetCom	3.5 GHz MMDS and 26 GHz LMDS

MMDS, LMDS AND VSAT BACKGROUND

MMDS and LMDS define two licensed, spectrum frequencies, though the terms are often used casually to refer to worldwide spectra below the 10 GHz frequency range (“MMDS”) and above 10 GHz (“LMDS”). Each frequency range has different bandwidth potential. In addition, each has different distance limitations between CPE and base station. These traits make each frequency suitable for different customer markets. In general it costs approximately US\$20,000 to build a hub for a broadband fixed wireless network compared to US\$250,000 for a fiber last mile network, making LMDS, MMDS and VSAT natural low cost solutions for serving fiber-less government, business and household customers.

MMDS: MMDS specifies a 6 MHz bandwidth of the 2.5 GHz frequency range in the U.S. and Canada and generally 3.5 GHz worldwide. MMDS tends to be less expensive to deploy than LMDS, because a single base station can serve up to a 35-mile radius. Frequency bands below 10 GHz have long propagation distances and are only mildly affected by climatic changes such as rain. MMDS is typically deployed in second and third tier sized markets. Also the typical North American monthly customer charge for MMDS services has been approximately US\$50.00.

LMDS: LMDS comprises spectrum in the 26 to 30 GHz range, for example the U.S. service specified in the 28 GHz band. LMDS offers generous capacity; in current practice, it is usually deployed at DS3 or approximately 45 Mbps in speeds. The tradeoff is that, compared with its MMDS counterpart, the distance it supports between customer transceiver and network base station is fairly short – under five miles. In addition, LMDS equipment is currently more expensive, as it requires greater amplification capabilities. Because of the high speeds and user capacity, corresponding monthly subscriber service fees of approximately US\$1,000.00 to US\$1,500.00 are typical. A minimum of 25 customers per site is typically necessary in order for an operator to deploy LMDS services to a commercial or residential building. LMDS service roll-outs are usually in first tier urban environments and are used by customers with high-bit-rate bandwidth requirements. It is common for LMDS networks to connect to fiber-optic landline networks at the back end.

VSAT: VSAT is a device known as an earth station that is user to receive and send satellite transmissions. The “very small” component of the VSAT acronym refers to the size of the VSAT dish antenna, which is typically 3 to 6 feet in diameter and is mounted on a roof, wall or on the ground. This antenna, along with the attached low noise blocker or (“LNB”) which receives the inbound signal and the signal uplink devise or transmitter, make up a typical outdoor VSAT application. Additionally, there is an indoor desk top box or PC that contains the receiver and transmitter circuit boards and interfaces to attach to any LAN’s, servers, PC’s, TV’s or telephones. VSAT operating speeds typically operate at approximately 8Mbps. The average VSAT unit in China will cost the end user approximately US\$4,500.00 to purchase and have installed, with an average monthly service charge of US\$ 50.00.

INVESTMENT CONCLUSIONS

2001 is anticipated to be a significant licensing year for Chinese broadband wireless operators. The later half of 2001 new MMDS license holders will focus on technology selection and system build-out and financing that will include working capital requirements. 2002 should be the period of initial system deployment and the commencement of commercial services. Currently, any direct private investment in China’s telecom industry prior to WTO acceptance is prohibited other than vendor debt financing. Yet, strategic partnerships made ahead of China’s WTO acceptance appear to be a reasonable path to secure an early interest in broadband operators. The

following are the various investment strategies available when considering an investment opportunities in China's wireless broadband market.

1. Invest in publicly traded LMDS/MMDS broadband telecommunications equipment suppliers such as VYYO, Inc. (NASDAQ: VYYO), Floware/Breeze.com (NASDAQ: FLRE), Adaptive Broadband Corporation (NASDAQ: ADAPE), P-Com Corporation (NASDAQ: PCOM), Alcatel (NYSE: ALA), Ericsson (NASDAQ: ERICY), Semens AG (NYSE: SI) and or Nokia Corporation (NYSE: NOK).
2. Invest in small emerging market LMDS/MMDS telecommunications operators such as Aspac Communications, Inc. ("ASPAC") (OTC: ACMN). Although, ASPAC is a small cap company, if they have chosen the right in-country partners, and they are able to convert their corporate partnership into an equity interest, the revenue and earning opportunities due to their early entrance into the China marketplace could be truly compelling. Obviously, investing in smaller capitalization firms, if successful in China, will likely provide for the largest gain from China broadband developments as a greater percentage of their respective gross revenues and prospective earnings come from this large single market.
3. Seek cooperative relationships with prospective LMDS/MMDS license winners prior to the granting of the licenses. This cooperation would come in the form of one or more private debt advances and or an alternative financial arrangement that would in the end be in-hole or in-part converted into a direct equity interest in the targeted broadband subsidiary of the firms that are currently attempting to be license winners including: China Telecom, China Mobile, China Unicom, China Railroad Telecom, Huaneng Telecom, Jitong Communications Company, China Network Communications Corporation, China Education and Research Network and the State Power Corporation.
4. Create a broad based strategic or corporate partnership with one or more prospective LMDS/MMDS license holders that encompasses an initial round of debt financing followed by raising follow-on financings and providing various other technical and financial advice, including equipment vendor advice, corporate partnership advice, venture capital and investment banking advice and western business practices advice. This corporate partnership process would also likely include seeking unique Chinese government approvals to perform technology partnerships and or technology trials with key government organizations in order to create a base-line value of selected broadband wireless technology. If this process were successful then the chosen technology would be recommended for provincial level development by various government ministries. Lastly, this partnership process would also seek unique relationships with one or more broadband wireless technology vendors such as Nokia, Adaptive Broadband Corp., Alcatel SA and or Ericsson, etc. in order to maximize

the accelerated build-out of the targeted wireless broadband networks and to seek to manufacture some or all of any selected technologies under license in China.

5. Lastly, at least 15 existing VSAT operators are in business today in China with additional operators anticipated this year. This segment of the wireless broadband industry has developed a small but growing market niche, ahead of LMDS and MMDS spectrum allocation. Thus, various VSAT technology and equipment financing corporate partnerships may also become valuable investment and business opportunities. Companies such as SSE Telecom, Inc. (NASDAQ: SSET) and Gilat Satellite Networks (NASDAQ: GILTF) both technology suppliers and system operators appear strongly grounded in China. One of Gilat's affiliates, KSAT Satellite Networks (VSE: KSA), a small China based VSAT supply company also may garner significant market share. Also, StarBrand Communications, Inc. a privately held US company which is also an affiliate of Gilat also appears to have unique technology and operating relationships in China to build a strong customer base. There are also likely to be several new Chinese owned VSAT operators that emerge during 2001, which will be likely candidates for debt and equity financings after China's entry into WTO in late 2001.

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