Executive Comment December/January 2005

Two-Way Interactive Satellite Communications Services

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Executive Comment
For
AIAA Space Japan Review
January 11, 2005

Dr. Richard T. Gedney has spent 25 years in satellite communications. As NASA Project Manager for the Advanced Communications Technology Satellite he helped pioneer spot-beam systems and adaptive links. Currently he supports Efficient Channel Coding in Cleveland, Ohio in developing bandwidth efficient satellite systems. He is now contributing development work of Japanese WINDS Project

As is well known, many of the most successful uses of satellite communications have been broadcast services for the TV distribution to cable head ends, direct satellite TV to small home receivers and direct radio to automobiles. Such broadcasts services are extremely effective because the transmission cost per subscriber is very low and in the case satellite TV and satellite radio, the user equipment is very affordable. Two-way interactive satellite services have been much less successful primarily because of the high transmission and user equipment cost compared to terrestrial alternatives such as DSL and cable modem. Interactive VSAT systems have had success for two-way services such as point-of-sale but they have been more niche markets. The question is will two-way interactive satellite communications services for residents and small businesses ever really become substantial or just be a niche?

To date such systems as DirecWay by Hughes Network Systems, StarBand by Gilat and SatLynx in Europe have only been able to develop a modest amount of subscribers. Northern Sky Research reports that the total Global Consumer and SOHO Broadband Satellite Service revenue in 2004 was approximately $300M USD which probably equates to 300,000 to 400,000 subscribers. In the USA, these systems typically charge $600 for the user terminal and a $60 to $70 dollars monthly service fee. This significantly exceeds the pricing for DSL and Cable Modem services in the USA and is the principle reason limiting the subscriber growth.

The prime reason for the high service cost is the amount of expensive satellite bandwidth that must be allocated per user. These systems which use standard Ku-band satellites have fixed satellite links that are too bandwidth inefficient. Two major steps that are being taken to lower the bandwidth costs are to go to spot-beam satellites and adaptive links with advanced forward error correction (FEC). Spot-beam satellites allow a very high degree of frequency reuse so that a single satellite in orbit can have a large communications throughput which lowers the bandwidth costs.

Adaptive links involves managing each user terminal separately and having each one use as high a level modulation in combination with as high a code rate as the instantaneous link conditions allow. As link conditions fade for each individual terminal, the modulation level and code rate is changed to maintain BER requirements. Since only a low percentage of user terminals in a beam will encounter large rain attenuation at any time this technique significantly increases average information throughput per unit bandwidth. This increase is on the order of 300 to 400 percent for Ka-band geostationary satellite systems. The exact increase depends upon the rain rate region for the service location and the satellite configuration. In addition to these increases in capacity, the technique may lower satellite and user terminal EIRP requirements.

The Advanced Communications Technology Satellite (ACTS) developed in the late 1980s and launch in 1993 by NASA was a Ka-band, spot-beam satellite with adaptive links. The adaptive links on ACTS were simple in that they were only a two step process whereby the link for a specific terminal was changed from none to a half rate code and from full symbol rate to half symbol rate once a significant rain fade occurred. Although crude by today's standards it proved out the ability of adaptive links to provide reliable service.

Two satellite, iPSTAR and WildBlue have recently been developed which will attain unprecedented cost effectiveness for satellite-based broadband services. Both these spot-beam systems incorporate adaptive links. The iPSTAR satellite which is a hybrid Ku-Ka band system being developed by Shin Satellite Public Company of Thailand along with its technology partners Andrew, CodeSpace, Efficient Channel Coding and Space System Loral in the USA and Nera in Norway is scheduled for launch in the Spring of 2005. Using some 84 user spot-beams and adaptive links with Turbo codes, this satellite will be capable of 40 Gbps total throughput to provide services throughout ASIA.

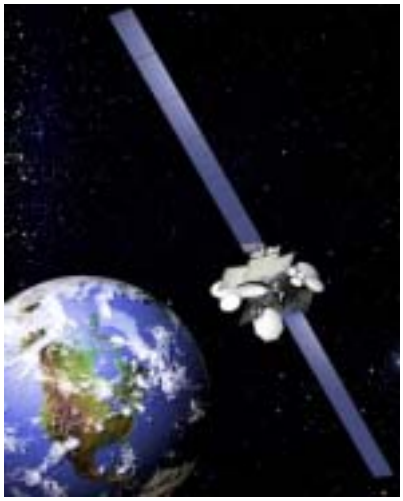
The IPSTAR satellite during CATR testing.
(Courtsey of Space Systems/Loral & Shin Satellite Plc.)

WildBlue Communications will use the ANIK-F2 satellite by Telesat of Canada to introduce interactive service in the USA this Spring. ANIK-F2 has Ka spot-beams covering CONUS

and will incorporate adaptive links developed by ViaSat. WildBlue has developed a dual Ku/Ka band user antennal that permits them to bundle two-way interactive services with receiving satellite TV using a single dish. WildBlue has reached an agreement with DirecTV on this bundling. This should significantly help them in marketing their service.

These two systems have solved one part of the competitive problem, that being the lowering of satellite bandwidth costs. The other equally important cost factor is the subscriber equipment. Without the ability to offer terminal equipment in the $150 to $200 USD range they will be at a very big disadvantage with their terrestrial competitors. To reach this price range for the combined indoor/outdoor terminal will not be achievable even with ASIC integration unless there are very high equipment volumes. Therefore, the service providers will need to subsidize the terminal equipment in order to appreciably grow the number of subscribers. This is the challenge for these service providers who will need financing to do so. It is not unlike the satellite TV business where even today it takes approximately $500 to $600 USD to acquire each subscriber. Included in that cost is, in most cases, giving away the terminal equipment.

Some people imply that WildBlue and iPSTAR can charge more in those areas where there is no terrestrial alternative. I for one do not subscribe to that since the average potential customer who is in an underserved area doesn't want to pay more than the urbanites.



ANIK-F2 (Courtsey of Telesat)

It has been a very long process of significant technology advances that have gotten satellites in the position to have a chance to successfully compete in the two-way interactive market place. Hopefully iPSTAR and WildBlue will be able to grow the number of subscribers fast enough to reap the benefits.