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Direct Broadcast Satellite Radio

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INTRODUCTION

Radio broadcasting has entered a new era. Only two decades after Direct Broadcast Satellite (DBS) television home dish antennas (50 cm/18") first appeared on the market, one company has started broadcasting DBS radio to listeners in Africa and the Middle East. Within the next few years, two other companies plan to begin broadcasting to listeners in the United States.

To the average user, these systems will look very similar to conventional AM/FM radio systems, whether they are used in the home, office, or on the road. However, the real difference is in what the listener won't see. Rather than receiving a signal from a tower antenna of a local radio station, these new radios will receive signals from a set of satellites in geosynchronous orbit. Programming will be uplinked from ground stations to the satellites and then broadcast back to large geographic areas (e.g., the entire contiguous United States). An example system is shown in Figure 1.

AFRISTAR

WorldSpace Corporation, headquartered in Washington, DC, has started broadcasting DBS radio programs to listeners in Africa and the Middle East using their AfriStar satellite, which was launched by an Ariane 4 rocket on October 28, 1998. AfriStar has three spot beams covering Southern Africa, Western Africa (including Spain, France, and Italy), and the Middle East and Northeastern Africa (including Turkey), respectively (see Figure 2). Each spot beam can cover approximately 14 million square kilometers (5 million square miles). Unlike planned U.S. services, WorldSpace charges no monthly subscription fee and revenue is generated by advertisements on the audio channels.

AfriStar is positioned in a 21° East geosynchronous orbit and is controlled by the WorldSpace Operations Center located in Washington, DC. The prime contractor for the satellite is Alcatel Space Industries, and the EuroStar 2000+ satellite bus was built by Matra Marconi Space. The uplink frequencies are 7.025–7.075 GHz, and the downlink



Figure 1. Example of a Satellite Radio System

frequencies are 1.452–1.492 GHz. Each AfriStar downlink spot beam has capacity for ninety-six 16 kbit/s mono-AM-quality signals that can be combined for fewer channels of higher audio quality. The downlink signals in each spot beam are combined into two Time Division Multiple Access (TDMA) carriers. Uplink signals can be accepted as TDMA signals from control stations or, individually, as Frequency Division Multiple Access (FDMA) signals from originating program locations.

WorldSpace also launched AsiaStar in March 2000, a DBS radio satellite that currently covers Asia (105° East orbit). In late 2000, WorldSpace plans to launch AmeriStar (95° West orbit) to cover Latin America.

XM SATELLITE RADIO AND SIRIUS SATELLITE RADIO

In the United States, two companies plan to offer Satellite Digital Radio Service (SDARS). In October 1997, XM Satellite Radio and Sirius Satellite Radio were granted Satellite Digital Audio Radio Service (SDARS) licenses by the Federal Communications Commission (FCC) for U.S. DBS radio systems. Within the next few years, these companies plan to launch systems similar to the WorldSpace systems, with up to 100 audio channels. They expect to charge a \$9.95 monthly subscription fee for largely commercial-free programming.

In February 2000, the two companies announced plans to develop a unified standard

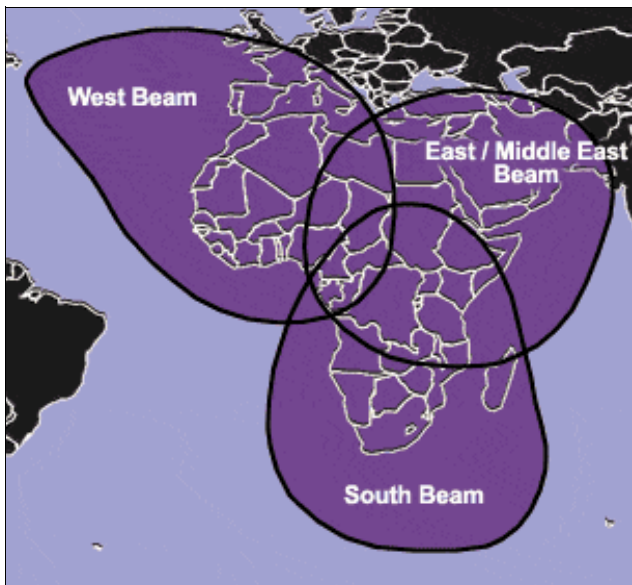


Figure 2. AfriStar Spot Beam Coverage

so that a common radio can receive both XM and Sirius programming. However, prior to this announcement, each company had already started independent product development. It remains to be seen if the two companies will start service with separate, incompatible receivers or delay introduction of their products until a standard U.S. DBS radio receiver has been developed.

A major thrust of both companies' business plans are to develop alliances with the major automobile manufacturers to build DBS-capable radios into new automobiles. XM



Figure 3. XM Car and Portable Radios

Satellite Radio has an agreement in place with General Motors (GM), and Sirius Satellite Radio has agreements in place with Ford and Daimler-Chrysler. Both companies also have agreements in place with major radio manufacturers. One of XM's slogans is "first there was AM, then FM, and soon XM Satellite Radio" (to be known as AM/FM/XM radio). Subject to a possible delay due to the redesign to meet a common U.S. standard, automobile manufacturers are planning to introduce DBS radios as an option in year 2001 automobiles. Figure 3 shows examples of both an XM car radio and portable radio.

To support these services, XM Satellite Radio plans to launch two HS702 15 kW geostationary satellites built by Hughes Space and Communications, which will contain Alcatel Space Industries' payloads. Launch services will be provided by Sea Launch (see Figure 4), which is 40 percent owned by Boeing. Sea Launch uses Russian and Ukrainian rocket stages launched from a floating platform that is sailed from Long Beach, California, to the Equator for each launch.

XM plans to position the two satellites at 85° West and 115° West, and the downlink will



Figure 4. Sea Launch Platform

be in the 2.33–2.34 GHz frequency range. A spare satellite will be kept on the ground for emergencies. Sirius Satellite Radio has similar plans, except it plans to launch three satellites to achieve U.S. coverage. Both companies plan to employ terrestrial repeaters in major cities where buildings would block satellite reception.

CONCLUSIONS

DBS radio has already been fielded in Africa and the Middle East, and will likely be available in the United States in 2 years. The cost of DBS radios will probably be \$100 to \$200 more than existing AM/FM radios, and subscriptions to largely commercial-free services are expected to be \$9.95 per month. The utility of DBS radio as a National Security and Emergency Preparedness (NS/EP) resource depends on the degree of market penetration. XM Satellite Radio and Sirius Satellite Radio view the 110 million automobile commuters in the United States as a primary market. That large a number of automobile radios could provide an effective capability for National emergency audio broadcasting.

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