The NAB Convention provides an annual forum for discussion on a wide range of research, legal and policy issues, technology trends and management techniques for broadcasting and related industries, including the Internet and multi-media. This is the first report by Bob Greeney, ABA Director, Technology on the major issues reported at the meetings of the NAB'99 Convention held from 17–22 April 1999, in Las Vegas. His second report will be in July *ABA Update*.

Broadcasting technology developments

The National Association of Broadcasters (NAB) is the US broadcasting industry forum which, as well as being the industry forum for exchange of ideas, advises the US Government on issues of importance to the broadcasting industry in the USA.

NAB also sponsors an equipment exposition during the convention. This year the emphasis on production to transmission equipment for digital television and radio services and interactive multi-media services.

Digital radio Three US companies described progress with their proposed In-Band-on-Channel (IBOC) FM digital radio systems. All IBOC systems claim to achieve 'near CD quality' sound with a data rate of about 128 kilobits per second.

- *Lucent Technologies*: proposes a proprietary coding system called Perceptual Audio Coding to provide a 96 kbps data stream. Lucent is confident that they have developed the best system for IBOC digital radio system.
- *USA Digital Radio*: uses a multi carrier modulation (MCM) technique similar to the OFDM system used by Eureka-147 (the European digital radio system). USADR indicated that their system is in test and should be proven by the end of 1999.
- *Digital Radio Express*: also uses a multi carrier modulation system and claims to be ready for selection as the IBOC system of choice by broadcasters by the end of 1999.

The Federal Communications Commission's National Radio Standards Committee (NRSC) met at NAB'99 and determined that the three IBOC proponents are to provide tests results, by 15 December 1999, that show that their proposed IBOC systems gives better sound quality than the AM and FM services. The NRSC expects to complete assessment of the IBOC test results by March 2000. Beyond 1999, it is not clear whether or how the FCC will choose one of a combination of the proposed IBOC systems to provide the USA with a single digital radio standard for adoption by broadcasters. The concern is that, unless a single standard is agreed, digital radio broadcasting in the USA may struggle to survive in the same way that AM stereo faltered, because broadcasters and consumers were confused by the multiplicity of similar but incompatible standards.

Eureka-147: This digital radio system provides data rates of around 256 kbps per service and delivers CD quality sound. It is being implemented in many European countries as well as Canada, China, Singapore and other countries.

Canada has legislation supporting Eureka-147 and is well advanced in implementing its digital radio network in the new L-Band (1500 MHz). Eureka-147 services are now available in Montreal, Ottawa, Toronto and Vancouver. Mexico has decided that Eureka-147 is suitable for their purposes and intends to start implementation in 1999, also in the L-Band. (Mexico assisted Britain with the satellite transmissions of Eureka-147 in 1996, just after Australia conducted the first satellite trials of the system). Mexico has also said that their administration has not closed the door on any of the FM IBOC systems. Mexico believes that if IBOC becomes successful, it can be introduced in the FM bands as well as operating Eureka-147 digital radio services in the L-Band.

Digital Radio Mondiale. DRM is a consortium of 40 companies from Europe, the USA and Japan that is developing a digital radio system to replace AM radio.

The DRM system delivers a robust digital and better quality sound replacing short-wave and long-wave overseas AM broadcasting services. It is a proven, reliable system that operates satisfactorily within a 10 kHz bandwidth with a data rate up to 19 kbps. Because of its limited bandwidth and lower data rate, compared to other digital technologies, DRM does not claim to deliver CD quality sound.

Unlike the proposed FM IBOC systems, the DRM is a conversion technology, requiring a vacant AM channel for its implementation. Therefore the DRM technology cannot be fully exploited until existing AM analog services are switched off. It appears to have application in Australia as AM broadcasters look to digital broadcasting for their future.

- *Integrated Services Digital Broadcasting—Terrestrial*. Japan has announced its own developments in digital radio broadcasting. The ISDB- ▷

Innovations

T proposal uses part of the band segmented digital television modulation system to provide a rugged and reliable digital radio service for portable and mobile receivers. This ISDB system is similar in many aspects to both the European DVB-T digital television and the Eureka-147 COFDM digital radio systems and provides flexibility in data rate according to requirements of the broadcasters. The narrow band ISDB-T digital radio system is expected to receive approval in Japan later this year, for domestic implementation.

FCC developments During his keynote speech, FCC Chairman William Kennard made many references to future use of the spectrum and how it can be auctioned to the user who values particular spectrum the most.

Of particular significance to IBOC developments are proposals for low power FM radio services, known in the USA as microstations. These LPFM services will operate in the spaces between existing high power FM broadcasting services at powers of 10 watts, 100 watts and up to 1000 watts. Once these services are established it will be much more difficult for FM IBOC systems to operate in the FM band without causing interference to the LPFM services.

Digital satellite radio: Two new digital satellite radio systems were unveiled at NAB'99. Japan is developing a satellite digital broadcasting service for domestic use, operating at 2.6 GHz . It is intended to provide reliable service in the presence of multipath reflections—in circumstances where FM suffers from severely impaired reception. Still in development, the system is expected to be approved in Japan by the end of 1999. It provides for satellite delivery and for gap filler terrestrial transmitters in the 2.6 GHz band (S-band).

The service uses different frequencies within the band, for wide-area and small-area transmitters, to ensure reception by all domestic receivers within the service area. Wide area gap filler transmitters receive their signals from the satellite at Ku band (12 GHz) and retransmit them in the 2.6 GHz band (overcoming interference problems within the coverage area), while small area terrestrial retransmission re-use the same 2.6 GHz frequencies received from the satellite to provide localised extension of coverage in small pockets of poor reception for the 2.6 GHz satellite signals due to shadowing by buildings.

Three satellite digital radio services companies also reported:

• *WorldSpace* proposes to use three satellites to cover remote and regional parts of the world, serving Africa, Asia and the Americas. To date it has launched one satellite, AfriSpace, which passed acceptance tests on 14 April 1999 and commercial service will begin soon. It uses single carrier modulation with a maximum data rate of around 1.6 Mbps. Intended as a replacement for short-wave services, it provides reliable high-speed interactive multi-media services to areas not adequately served by other media.

• *XM Satellite Radio* is a US development which provides direct-to-home satellite radio services for subscription broadcasters. XM radio is delivered as part of a bouquet of services including digital television services but its radio services are aimed at niche markets.

• *CD Radio* is another US satellite digital radio service using multi carrier modulation to provide subscriber radio services by satellite, operating now.

Datacasting and multi-media Discussions on datacasting and multi-media broadcasting attracted a number of high profile speakers from Microsoft, WebTV, Sun Micro-systems, and Larry Ellison of Oracle Systems. Broadcasters and content providers consider that multi-media services are the major new business opportunities: many want to provide interactive multi-media services. Two datacasting models are:

• *carousel model*: broadcasters transmit the same material on a cyclic basis and viewers receive and store the data as it is transmitted for later recovery and viewing; and

• *continuous transmission model*: (or streaming media data transmissions) data is continually transmitted and can be received by any authorised user for recording or immediate use.

In each case, interactive capability is a critical factor. The return path is either a telephone line or a GSM digital telephone implying that the return data rate need not be great, typically of the order of 14 kbps or less for GSM, or 56 kbps using a telephone line. The forward delivery capacity of data and multi-media services is seen as the major issue, requiring a minimum of around 300 kbps (compared with the Internet over the telephone currently providing 56 kbps).

One speaker indicated that he sees each digital television receiver becoming a home server for HDTV with 10 Gbit hard drives to become available next year, becoming a multi-media home platform (as described in the DVB standards adopted for Australian digital television). According to a speaker from Japan indicated that storage devices for HDTV will need about 46 Mbps data handling capacity for replay while recording (the advent of a digital VCR). We will need new disk storage technology to handle the very high data rates required for storage and simultaneous replay of HDTV.