David Sarnoff Research Center

Video Quality

- **ADTV has the highest resolution (1440 x 960) of any proposed system**
- **Only ADTV offers both progressive and interlaced scanning**
- **The combination of best compression and highest bit rate produces superior HDTV picture quality**

	ADTV	Zenith/AT&T Digital Spectrum Compatible	General Instr. DigiCipher	MIT/GI ATA-Progressive
Resolution	1440 x 960	1280 x 720	1408 x 960	1280 x 720
Video data rate	17.73 Mbps	8.46 - 16.92 (12.69 average)	17.47 Mbps	17.47 Mbps
bits/pixel	.43	.23	.43	.32
Bi-Directional Motion Comp	✔	No	No	No

David
Sarnoff
Research Center

Video and Audio Quality

- **Only ADTV uses MPEG compression**
  - Bi-directional motion compensation is a fundamental advantage offered only by MPEG. It allows more bits to be used for fine picture detail, rather than to correct prediction errors that result from poor motion compensation
  - MPEG compression represents the best techniques from a worldwide committee of compression experts

- **ADTV has the highest data rate of any proposed HDTV system -- 24 Mbps**

- **The combination of best compression and highest bit rate produces superior HDTV picture quality**

David
Sarnoff
Research Center

Coverage Area

This topic is total spaghetti

- **Only ADTV's signal is designed to *avoid* NTSC interference**
- **Only ADTV's signal is designed to gain interference rejection from NTSC receivers' Nyquist filter => more power for ADTV for equivalent interfence as other systems**
- **More power and less interference = better coverage**

David Sarnoff Research Center

Coverage Area & Accommodation

ADTV-NTSC Co-Channel Spacing	Accommodation Percentage	Coverage Range
99 miles (160 km)	**99.7 %**	**50.7 miles**
112 miles (180 km)	**98.4 %**	**54.5 miles**
124 miles (200 km)	**95.8 %**	**58.6 miles**
136 miles (220 km)	**91.3 %**	**62.5 miles**

- A noise-limited range of **55.5 miles** (the same as NTSC) can be provided with a co-channel spacing of 115 miles. This will *accommodate **97.5%** of the broadcasters with a simulcast channel*. (By comparison, NTSC provides a range of 55.5 miles at 155 miles co-channel spacing).
- Broadcasters in especially difficult co-channel situations can reduce their coverage area, or they can slightly reduce their picture quality and select ADTV's 16-QAM option. ADTV (16-QAM) provides a noise-limited range of **55.5 miles** with a co-channel spacing of 105.6 miles, *increasing accommodation percentage to **98.8%***.
- For co-channel ADTV-NTSC co-channel separation larger than about 112 miles, essentially none of the ADTV coverage area is lost as a result of NTSC interference.
- ADTV provides coverage area that is *superior* to NTSC in situations where co-channel constraints are not present.

David Sarnoff Research Center

Transmission Robustness

- **Only ADTV has the combination of two-tier transmission a fixed signal structure that has no data dependencies**

	ADTV	Zenith/AT&T Digital Spectrum Compatible	General Instr. DigiCipher	MIT/GI ATA-Progressive
Reed-Solomon Error Correction	✔	✔	✔	✔
CRC Error Detection	✔	No	No	No
Decoder Reentry	✔	✔	No	No
Two-tier transmission	✔	✔	No	No
Data-independent tiers	✔	No	N/A	N/A
Clock recovery from high-power signal	✔	No	No	No
Receiver Error Concealment	✔	No	No	No

David Sarnoff Research Center

Scope of Features and Services

- **Only ADTV provides flexible delivery of video, audio and data - the mix can even vary dynamically**

- **The benefits are:**
  - service that can be individually tailored to market needs
  - new service opportunities, such as the capability to deliver innovative new interactive programming to "smart receivers"
  - the ability to evolve and stay competitive

	ADTV	Zenith/AT&T Digital Spectrum Compatible	General Instr. DigiCipher	MIT/GI ATA-Progressive
Number of stereo audio channels	up to 72	2	2	2
AUX Data rate	256 kbps nominal (up to 18.5 Mbps)	412.86 kbps	126 kbps	126 kbps
Flexible mix of video, audio and data	✔	No	No	No
Burst-Mode AUX Data Capability	✔	No	No	No

David Sarnoff Research Center

Interoperability

- **ADTV is interoperable with HDTV production and delivery needs in every aspect: Production, transmission and display**
  - 1050/2:1/59.94 HDTV; 1050/1:1/24 film 1050/1:1/29.97 "mixed"

- **ADTV is interoperable with computer multimedia and data networks in every aspect: production, compression, transmission and display**

	ADTV	**Zenith/AT&T** Digital Spectrum Compatible	**General Instr.** DigiCipher	**MIT/GI** ATA-Progressive
Cable & Satellite Transmission	✔	✔	✔	✔
VCR	**MPEG compression is designed for digital storage**	not designed for VCR	not designed for VCR	not designed for VCR
Data Networks	**Most compatible with B-ISDN**	not designed for data networks	not designed for data networks	not designed for data networks
Multimedia Computer & CDI (MPEG Video format)	✔	Not MPEG compatible	Not MPEG compatible	Not MPEG compatible

David
Sarnoff
Research Center

Computer Display (Progressive Scan & Square Pixels)	✔	✔	No	No

David
Sarnoff
Research Center

Extensibility

- **ADTV is completely extensible**
  - new service types can be added easily
  - unrecognized service types are disregarded by receivers
  - the result is extensibility - with no backward compatibility constraints

David Sarnoff Research Center

Cost to Broadcasters & Alternate Media

- **HDTV production equipment is readily available and cost-effective for ADTV. ADTV also offers cost and performance advantages in the cost of NTSC conversion.**

	ADTV	Zenith/AT&T Digital Spectrum Compatible	General Instr. DigiCipher	MIT/GI ATA-Progressive
Camera sensitivity with associated production standard	Acceptable	Poor	Acceptable	Poor
Approx. data rate of associated 4:2:2 production DVTR	663 Mbps	884 Mbps	649 Mbps	884 Mbps
Production Equipment readily available	✔	No	✔	No

Vertical relationship to NTSC, D1 & D2	**2:1**	**3:2**	**2:1**	**3:2**
Horizontal relationship to D1	**2:1**	**4:3**	**88:45**	**4:3**
Cost and quality of HDTV<-> D1 transcoding	**Excellent**	**Good**	**Poor**	**Good**

David Sarnoff Research Center

Cost to Consumers

- **ADTV provides economies for the consumer by using a *single, standard decompression decoder* for all compressed video applications - broadcast, cable, satellite, VCR, and CD-I disks**

- **Only ADTV offers a common compressed video standard for both HDTV and personal computers**

	ADTV	Zenith/AT&T Digital Spectrum Compatible	General Instr. DigiCipher	MIT/GI ATA-Progressive
Terrestrial HDTV	MPEG++	Proprietary DCT	Proprietary DCT	Proprietary SBC
Cable & Satellite HDTV	MPEG++	Proprietary VQ	Proprietary DCT	Proprietary SBC
HD-DVCR	MPEG++	Proprietary DCT	?	?
Cable & Satellite SDTV	MPEG	?	Proprietary DCT	?
SD-DVCR	MPEG	?	?	?
Consumer Multimedia (CD-I)	MPEG			
Computer Multimedia	MPEG & JPEG			

David
Sarnoff
Research Center

David Sarnoff Research Center

Other Consumer Cost Factors

- **Memory speed and its impact on memory organization and cost**
- **Display scanning rates**

	ADTV	Zenith/AT&T Digital Spectrum Compatible	General Instr. DigiCipher	MIT/GI ATA-Progressive
Pixels/frame	2.073 MP	1.382 MP	2.027	1.921 MP
DRAM memory for 1 frame	16 Mbit	16 Mbit	16 Mbit	16 Mbit
Memory access time	16 ns	12 ns	16.4 ns	12 ns
Memory Cost	Low	High	Low	High
Scanning rate	2H	3H	2H	3H