

APPENDIX A

Towers for Simulcast Advanced Television Systems

The following is a memorandum submitted by Jules Cohen and Associates, PC., to Specialist Group 10 of the Planning Subcommittee's Working Party 3, dated June 19, 1990.

"In estimates of the cost of initiating an Advanced Television System (ATV), a major item often included is a new tower. A survey of technical directors of television stations yielded the conclusion that, in the judgment of the technical directors, a substantial number of stations would require new towers to accommodate an additional antenna for ATV. For the reasons given below, new tower requirements are believed to have been exaggerated.

The ATV system adopted for terrestrial transmission will have to be of such nature that it can be located at 100 to 120 miles from a co-channel NTSC broadcast station without causing interference to reception of the NTSC station to a degree any greater than co-channel NTSC stations now cause to each other when spaced in the order of 180 miles. Inherent in that requirement is the need for the ATV station to provide satisfactory service to a substantial area while using less effective radiated power (ERP) than the equivalent NTSC station. Lower ERP can mean not only smaller transmitters, but also smaller antennas and smaller diameter coaxial cable than its NTSC counterpart.

Smaller antennas and cables reduce the weight required to be hung on a tower, but even more important, the smaller antennas and cables reduce the wind load. A tower not capable of carrying double its present load may very well be capable of accepting a lesser load without excessive derating.

Prior to adding anything other than a trivial load to a tower, a stress analysis is necessary. Such analyses are likely to cost in the range of six to fifteen thousand dollars. Upon completion of the stress analysis, the tower owner is advised of what members, if any, in the tower would be over stressed if the new load is added. Substantial overloading of a large number of members will mean that the tower must be replaced. However, experience with similar situations indicates that

the excessive stress is more often than not confined to a relatively small number of members.

In the instance where the number of tower members needing attention is not excessive, the members can be replaced or reinforced. Sometimes the requirement is as simple as adding a second steel angle back-to-back with the steel angle already in place. Sometimes one or more guy levels must be supplied with larger diameter guys, or an additional group of guys provided at a new level, perhaps with other guys being repositioned.

Strengthening an existing tower is much less costly than building a new tower. Even a fairly extensive amount of work can be accomplished within a one hundred thousand dollar budget. Furthermore, that work can usually be accomplished without disrupting the station operation.

Quite obviously, all existing towers cannot be subjected to a stress analysis at this time to arrive at a more realistic cost figure for the ATV conversion. However, experience dictates a conclusion that relatively few stations would have to resort to tower replacement as a condition for adding a simulcast ATV channel."

ATTACHMENT C

HIGH DEFINITION TELEVISION

Member/PBS Transition Planning

Introduction

Each television station in America has a different station configuration and is in a unique competitive situation. Each station will have to examine its own situation in light of the many factors in order to decide what role it wants to play in the area of Advanced Television.

This document attempts to present some rudimentary and preliminary cost factors that will help stations to estimate the expense to add an ATV simulcast system. This is intended to be a shopping list with some basic groupings so that station general, financial, production and engineering managers can begin to develop long range strategies which would allow a manageable and graceful transition into ATV.

Much has been made in recent times about the high costs of advanced television. What has not been discussed is that these investments can be made over a many year period. Also not stated is that many of the high costs can be attributed to high research and development costs that must necessarily be absorbed through initial product sales. As time goes on, the technology of manufacturing and the equipment itself will improve and the costs will go down. Finally, costs generally refer to wide bandwidth major studio production equipment. As ATV develops, new more limited bandwidth equipment will need to be developed for local broadcast stations so that it can be produced at a lower cost. A few items of such equipment are already beginning to appear at HDTV trade shows. Others are now being discussed by equipment manufacturers and PBS is urging these manufacturers to complete the development of such products.

I. Tower Site/System

A. New Tower Site:

Land (50 acres)	\$500K
Site Development	\$100K
Access Road	\$900K
Soils and Survey	\$10K
Electric (substation and generator)	\$400K
Tower & Installation (1000')	\$500K

Total - \$2,410K

B. Existing Tower Site, New Tower:

Access road	\$150K
Soils and survey	\$10K
Electric (substation and generator)	\$400K
Tower & Installation (1000')	\$500K

Total \$1,060K

C. Existing Tower Site, Existing Tower:

Major modifications	\$100K
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D. Existing Tower Site, Existing Tower:

Minor modifications	\$10K
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II. Transmitter Building

A. New building(1500 sf)	\$113K
B. Existing building, additlon(500 sf)	\$38K
C. Existing building, minor modifications	\$10K

III. Legal Consultation

A. No dedicated action	\$5K
B. Complaints, no court action	\$50K
C. Complaints, court action	\$500K

IV. Engineering Services

A. Antenna systems design	\$36K
B. FAA & FCC Application/Followup	\$50K
C. Tower Application/Followup	\$8K

V. Transmission Plants**A. VHF Low Band Transmission Plant, 10KW ERP, with:**

Transmitter - 2 KW, Installed	\$150K
HDTV Encoder (or Format Converter/Modulator)	\$100K
Remote control system	\$30K
Antenna	\$250K
Transmission line (1000')	\$50K
Antenna/Line Installation Services	\$50K
Test Signal Inserter	\$26K
Test Equipment	\$65K
Precision Demodulator	\$22K
Demultiplexer	\$15K
HD Color Monitor 14"	\$11K
HD Precision Waveform Monitor	\$12K
HD Signal Monitor	\$20K
Audio Processing	\$6K
Audio Monitoring	\$10K
Total	\$817K

B. VHF High Band Transmission Plant, 30 KW ERP, with:

Transmitter - 5 KW	\$200K
HDTV Encoder (or Format Converter/Modulator)	\$100K
Remote Control System	\$30K
Antenna	\$250K
Transmission line (1000')	\$50K
Antenna/Line Installation Services	\$50K
Test Signal Inserter	\$26K
Test Equipment	\$65K
Precision Demodulator	\$22K
Demultiplexer	\$15K
HD Color Monitor 14"	\$11K
Precision WM	\$12K
HD Signal Monitor	\$20K
Audio Processing	\$6K
Audio Monitoring	\$10K
Total	\$867K

Figure 12 shows, for example, that when Group 2 has reached Phase D of the transition in the sixth year, 53% of television households will have HDTV service available, while in the eighth year, when the 160 stations in Group 3 have achieved Phase D, 83% or 76 million households will have HDTV service available.

The last Phase (F) of conversion to high definition electronic news gathering is not shown, because many stations may defer this phase for some years, as discussed previously.

C. UHF Transmission Plant, 150 KW ERP, with:

Transmitter - 20 KW	\$300K
HDTV Encoder (or Format Converter/Modulator)	\$100K
Remote Control System	\$30K
Antenna	\$250K
Transmission line (1000')	\$80K
Antenna/Line Installation Services	\$50K
Test Signal Inserter	\$26K
Test Equipment	\$65K
Precision Demodulator	\$22K
Demultiplexer	\$15K
HD Color Monitor 14"	\$11K
HD Precision Waveform Monitor	\$12K
HD Signal Monitor	\$20K
Audio Processing	\$6K
Audio Monitoring	\$10K
Total	\$997K

Sample Transmission Package 1**10 KW ERP VHF, (Low Band) (best case)****Existing tower site**

Existing Tower, minor modification	\$10K
Existing building, minor modifications	\$10K
Legal fees, no complaints	\$5K
Engineering/antenna	\$36K
Engineering/FAA&FCC	\$50K
Engineering/tower	\$8K
Transmission Plant	\$817K

Total	\$936K
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Sample Transmission Package 2**10 KW ERP VHF, (Low Band) (worst case)**

New tower site & tower	\$2,410K
New building	\$113K
Legal fees	\$50K
Engineering/antenna system	\$36K
Engineering/FAA&FCC	\$50K
Engineering/tower	\$8K
Transmission Plant	\$817K

Total	\$3,484K
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Sample Transmission Package 3

30 KW ERP VHF, (High Band) (best case)

Existing tower site

Existing Tower, minor modification	\$10K
Existing building, minor modifications	\$10K
Legal fees, no complaints	\$5K
Engineering/antenna	\$36K
Engineering/FAA&FCC	\$50K
Engineering/tower	\$8K
Transmission Plant	\$867K

Total **\$986K**

Sample Transmission Package 4

30 KW ERP VHF, (High Band) (worst case)

New tower site & tower	\$2,410K
New building	\$113K
Legal fees	\$50K
Engineering/antenna system	\$36K
Engineering/FAA&FCC	\$50K
Engineering/tower	\$8K
Transmission Plant	\$867K

Total **\$3,534K**

Sample Transmission Package 5

150 KW ERP UHF (best case)

Existing tower site

Existing tower, minor modification	\$10K
Existing building, minor modification	\$10K
Legal fees, no complaints	\$5K
Engineering/antenna system	\$36K
Engineering/FAA & FCC	\$50K
Engineering/tower	\$8K
Transmission Plant	\$997K
Total	\$1,116K

Sample Transmission Package 6

150 KW ERP UHF (worst case)

New tower site & tower	\$2,410K
New building	\$113K
Legal fees	\$50K
Engineering/antenna system	\$36K
Engineering/FAA&FCC	\$50K
Engineering/tower	\$8K
Transmission Plant	\$997K
Total	\$3,664K

VI. Broadcast Origination/Studio Plant

MODEL #1 HDTV - PASS-THROUGH NETWORK PROGRAMMING**HDTV Broadcast Operations**

1	Broadcast/routing switcher	\$80K/each	\$80K
4	HD color monitors 4 - 18"	\$11K/each	\$44K
	Video signal processing/distribution		\$35K
1	Upconverter	\$50K/each	\$50K
1	Downconverter	\$50K/each	\$50K
2	HD Precision WM	\$12K/each	\$24K
2	HD Precision Signal Monitors	\$20K/each	\$40K
12	HD B&W monitors (8")	\$2K/each	\$24K
	Audio monitoring (4 ch.)	\$10K/each	\$10K
	HD Studio Test Equipment		\$75K
	WB Oscilloscope	\$15K	
	HD Test Generator	\$26K	
	Bit Error Rate Analyzer	\$12K	
	Tools	\$15K	
	Misc	\$7K	
1	Precision Demodulators	\$22K/each	\$22K
1	Demultiplexers	\$15K/each	\$15K

MODEL #1 HDTV - continued

HDTV PBS Feeds

1	HD satellite receiver	\$10K/each	\$10K
1	HD character generator	\$60K/each	\$60K
1	HD still store	\$70K/each	\$70K
1	HD sync generator/pulse distribution	\$25K/lot	\$25K
1	HD Frame Synchronizer	\$38K/each	\$38K

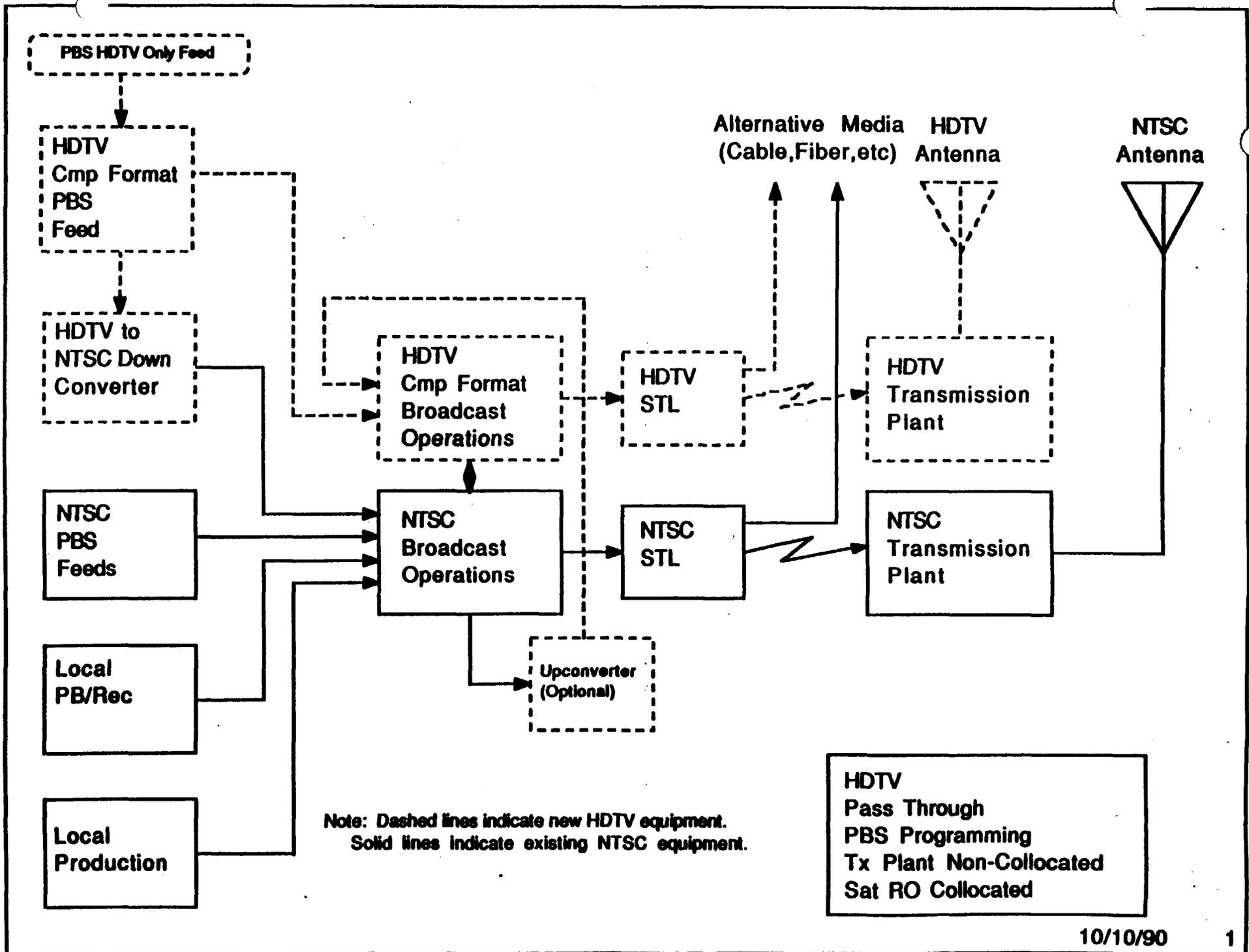
HDTV Studio to Transmitter Links

1	HD STL	\$48K/each	\$48K
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Subtotal	\$720K
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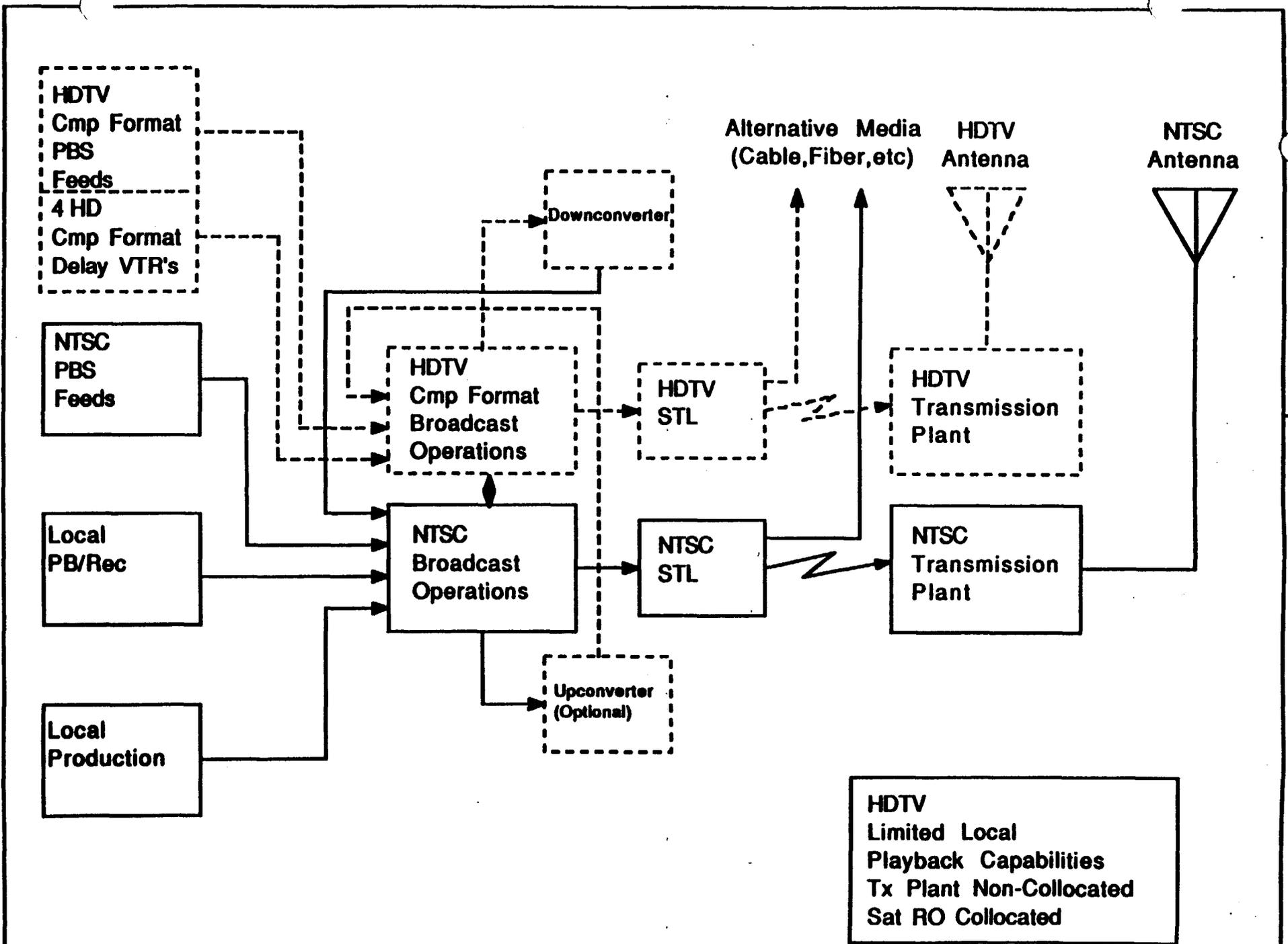
Installation Materials (7%)	\$50K
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Total for Model 1	\$770K
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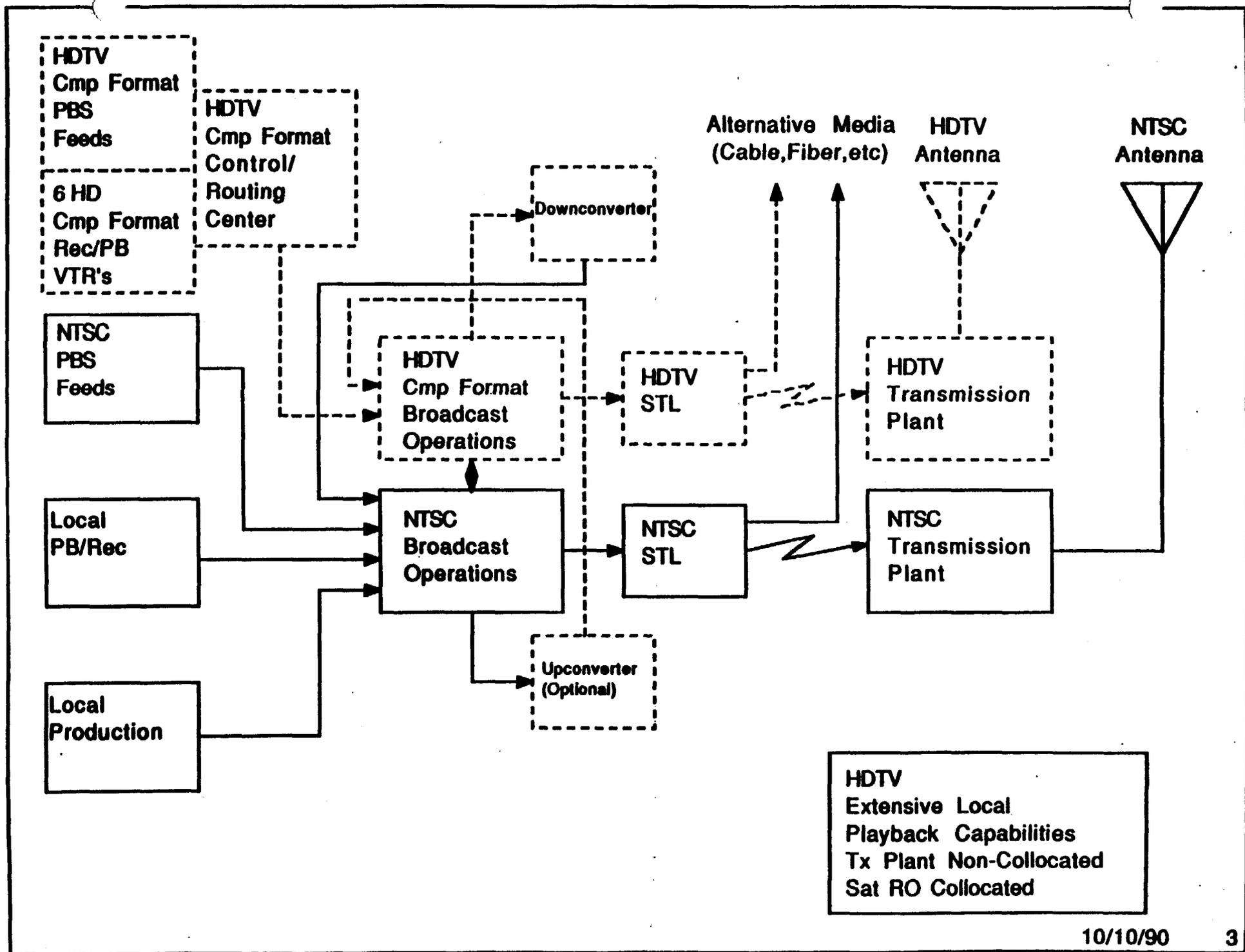
MODEL #2 HDTV - LIMITED LOCAL PLAYBACK CAPABILITIES

4	HD compressed format VTR's	\$80K/each	\$320K
	Router Expansion for HD VTR's		\$80K
8	HD B&W Monitors (8")	\$2K/each	\$16K
2	HD 14" color monitors	\$11K/each	\$22K
2	HD Utility WM	\$6K/each	\$12K
1	HD Precision WM	\$12K/each	\$12K
1	HD Precision Signal Monitor	\$20K/each	\$20K
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		Subtotal	\$482K
		Installation Materials (5%)	\$24K
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		Model 2 Total	\$506K
		Total for Models 1 & 2	\$1,276K



MODEL #3 HDTV - EXTENSIVE LOCAL PLAYBACK CAPABILITIES

2	HD compressed format VTR's	\$80K/each	\$160K
1	HD compressed format video cart machine	\$800/each	\$800K
	HD router expansion		\$40K
8	HD B&W monitors (8")	\$2K/each	\$16K
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		Subtotal	\$1,016K
	Installation Materials (5%)		\$51K
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		Model 3 Total	\$1,067K
		Total for Models 1, 2 and 3	\$2,343K



MODEL #4 HDTV - PRODUCTION/POST/REMOTE CAPABILITIES

Broadcast Format Equipment (Compressed Format)

2	HD compressed format VTR's	\$80K/each	\$160K
	HD router expansion		\$40K
4	HD B&W Monitors (8" Dual)	\$2K/each	\$8K
1	HD STL (Add Redundancy)	\$48K/each	\$48K
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	Distribution Subtotal		\$256K

MODEL #4 HDTV - continued**Production Format Equipment (Wideband Format)
(all of the following operates in a full bandwidth format)****Studio Production Equipment**

3	HD VTR's	\$320K/each	\$960K
1	HD routing switcher	\$160K/each	\$160K
3	HD cameras	\$375K/each	\$1125K
1	HD switcher	\$400K/each	\$400K
	HD signal distribution/processing		\$35K
1	HD DVE	\$250K/each	\$250K
	HD signal distribution		\$75K
1	HD compressed/Full Band Format Converter	\$50K/each	\$50K
1	HD character generator	\$120K/each	\$120K
	HD sync system/distribution		\$75K

MODEL #4 HDTV - continued

2	HD Color Monitors (28")	\$25K/each	\$50K
4	HD Color Monitors (18")	\$11K/each	\$44K
13	HD B&W Monitors (14")	\$3.7K/each	\$48K
8	HD B&W Monitors (8")	\$2K/each	\$16K
8	HD Utility WM's	\$6K/each	\$48K
1	HD Frame Synchronizer	\$38K/each	\$38K
	HD Test Equipment		\$100K
1	HD Precision WM	\$12K/each	\$12K
1	HD Precision Signal Monitor	\$20K/each	\$20K

Field Production

1	HD field camera	\$375K/each	\$375K
1	HD field VTR	\$320K/each	\$320K

MODEL #4 HDTV - continued

Post Production

1	HD editing system	\$50K/each	\$50K
1	HD editing switcher/signal processing		\$350K
1	HD DVE	\$250K/each	\$250K
1	HD paint system	\$500K/each	\$500K
1	HD character generator	\$120K/each	\$120K
4	HD color monitors (18")	\$11K/each	\$44K
8	HD B&W monitors	\$2K/each	\$16K
2	HD utility WM	\$6K/each	\$12K
1	HD Signal Monitor	\$20K/each	\$20K

Production Subtotal \$5,683K

Installation Materials/Spares (5%) 284K

Production Total \$5,967K

Model 4 Total \$6,223K

Total for Models 1, 2, 3, & 4 \$8,566K