

TABLE 3

HDTV CONSTRUCTION COSTS
PER STATION
BY STATION SIZE AND
BROADCAST FUNCTIONALITY
(MILLIONS OF 1990 DOLLARS)

	<u>NETWORK PASS-THROUGH</u>	<u>LOC. COMMERCIAL INSERTION</u>	<u>NON-NET PROGRAM</u>	<u>LOCAL ORIGINATION</u>	<u>FINAL CONVERSION</u>	<u>TOTAL COST</u>
GROUP 1 (30 STNS)	1.5	1.7	1.1	3.3	4.1	11.6
GROUP 2 (40 STNS)	1.3	1.5	1.0	3.0	3.7	10.4
GROUP 3 (80 STNS)	1.2	1.3	.9	2.7	3.3	9.4
GROUP 4 (160 STNS)	1.1	1.2	.8	2.4	3.0	8.4
GROUP 5 (320 STNS)	1.0	1.1	.7	2.2	2.7	7.6
GROUP 6 (640 STNS)	.9	1.0	.6	2.0	2.4	6.9

NOTES:

(1) Data taken from CBS Study, Figure 4

(2) Sum of costs for all phases (Total Costs) may not conform to last column due to rounding.

will be temporary, they will adjust NTSC investment in anticipation of the "sunset". Thus, for example, if the conversion were expected to be in, say, five years, stations could begin immediately to target the means to phase out the capital base by a) maintaining rather than replacing aging plant, b) making do with technologically obsolete equipment rather than replacing it with state-of-the-art facilities, and/or c) permitting service levels and quality to diminish. By anticipating the expiration of the dual-channel requirement, stations would be able to free up cash from the NTSC capital program to fund the HDTV capability.

A complicating factor in this analysis is the possibility that technological developments will permit broadcasters to replace aging/obsolete NTSC plant and equipment with "fungible" facilities that can be used to serve both NTSC and HDTV audiences. It is also quite likely that some equipment and facilities obtained to create an HDTV capability can also be used, at least in part, to service the traditional NTSC channel. Either of these measures might be undertaken by stations even before HDTV construction permits are awarded. There will be an incentive for the development and construction of facilities that can be used in common to service both NTSC and HDTV requirements. In principle at least, stations may be able to enjoy significant economies from the use of "common" plant and equipment in the rendition of two different--HDTV and NTSC--services.

In the course of estimating costs of installing an HDTV capability, the CBS analysis made some assumptions regarding stations' likely behavior with respect to renewing and maintaining NTSC plant. Specifically, the CBS study provides a) estimates of the average annual NTSC investment expenditures on plant and equipment by stations of different sizes, and b) the amount by which those expenditures can be reduced over time, thereby freeing up cash for HDTV investment.

TABLE 4 is derived from the CBS study. It shows, for stations of different sizes, the results of their derivation of

TABLE 4

GROSS AND NET HDTV
CAPITAL REQUIREMENTS
(\$ MILLIONS)

	<u>GROSS HDTV INVESTMENT</u>	<u>NTSC PLANT DISINVESTMENT</u>	<u>NET HDTV INVESTMENT</u>
GROUP 1	11.6	2.7	8.9
GROUP 2	10.4	1.8	8.6
GROUP 3	9.4	1.9	7.5
GROUP 4	8.4	1.4	7.0
GROUP 5	7.5	1.0	6.6

SOURCE: CBS STUDY

net incremental capital costs of creating an HDTV capability. The result is derived by subtracting from the required outlays for HDTV plant and equipment, an amount that reflects the reduction of "normal" NTSC investment during the transition. Thus, the CBS analysis basically assumes that a "streamlined" NTSC capability can be maintained, while an HDTV capability developed, at less (NTSC) capital cost than would have been otherwise required.

These investment savings are substantial, particularly for the larger stations. For the 30 stations in GROUP 1, the cash saved by foregoing "normal" NTSC plant renewal is \$2.7 million. CBS derives that figure by subtracting (\$5 million) "normal" NTSC investment and adding back an amount (\$2.3 million) required for "maintaining some NTSC equipment during the conversion".

The \$2.7 million assumed by CBS to be "saved" by station disinvestment in NTSC is a substantial proportion (23.3 percent) of total required HDTV investment (\$11.6M). Inspection of TABLE 4 indicates that the contribution to HDTV capital costs of cash flow from foregone NTSC investment is important, but of declining relative significance, to smaller stations. Thus, the contribution for GROUP 2 stations is about 17 percent) for GROUP 3 stations the contribution is 20 percent; for GROUP 4 station the contribution is 17 percent; and for GROUP 5 stations, the contribution is 15 percent.

The CBS study does not address the timing of a possible conversion deadline or dual-channel "sunset." Whatever the appropriateness of the conversion period underlying the CBS study, in view of the uncertainty about the dual-channel requirement and the future development of both NTSC and HDTV services markets, there is reason to be cautious about reliance on NTSC plant disinvestment as a source of cash for financing HDTV transmissions. Stations will not be inclined to disinvest in a market (NTSC transmissions) where they have extremely high HH penetration and which generates all current earnings, in order to invest in a very uncertain business (HDTV transmissions) in which (the most optimistic projections suggest) HH penetration will be less than five percent in ten years. Thus, to the extent that the "savings" from lower NTSC investment will lead to deterioration of the NTSC service, such economies are likely to be more apparent than real for a substantial period of time. The critical factor, again, will be the extent to which stations can invest in fungible equipment which can service both their HDTV and NTSC facilities. And the net cost of this new equipment will be influenced by the extent to which stations are able, given market forces and regulatory requirements, to recover fully the cost of the equipment it replaces.

Summary--CBS Study

The reports of the ongoing CBS study contribute to our understanding of what is required to construct a national over-the-air HDTV capability and some of the potential implications of the pace and structure of the transformation to full HDTV capability.

As with any forecast or projection, the outcomes are highly sensitive to assumptions; and, more sensitive to some than to others. It may be worthwhile to summarize the assumptions that have the greatest leverage on the CBS results and indicate the sensitivity of the results to those, or alternative, assumptions.

The critical assumptions of the CBS study are as follows:

- Stations in the larger markets will begin the transition to HDTV first;
- The transition will take place in phases, with larger stations taking five years from the beginning of construction and smaller ones nine years, to complete the process;
- Substantial manufacturing economies will be reflected in dramatically falling equipment prices over time, thereby permitting stations beginning the process later in the technology diffusion cycle to enjoy substantially lower costs. Specifically, the study assumes that each doubling of equipment sales will result in across-the-board equipment price reductions of 10 percent;
- The FCC will adopt an all-digital standard, which will negate the need for stations to acquire additional land, or construct a new tower, or incur substantial tower-related costs; and,
- Existing audio equipment will be reused and need not be replaced.

We have indicated above the basis of some reservations about these assumptions. These reservations are in some respects derivative from different assumptions about the likely nature and outcome of future regulatory processes and market forces, the most obvious being the fact that the FCC has now adopted construction deadlines which may permit the phase-in periods or staggered implementation contemplated by CBS.

Thus, for example, both the commencement and pace of HDTV-related construction will depend on a variety of FCC regulatory factors. The technical standards that will govern important equipment manufacturing parameters -- price, performance, availability -- will have significant impacts on the evolution of HDTV, but they still remain to be determined. Similarly, key features associated with the issuance of construction permits and the requirements attached with thereto are unknown, but will have an impact on the outer boundaries of the beginning, location and speed of the development of a national HDTV capability. As noted earlier, the Commission has adopted a maximum two-year period in which broadcast licensees would apply for HDTV channels (but possibly much earlier in markets without universal agreements among licensees as to channel assignments), and a three-year construction period.

Conclusion: Capital Costs of Implementing Broadcast HDTV

The costs of creating HDTV broadcast capability will vary from market to market and station to station within a given market. The cost variability is attributable to differences in several dimensions. These dimensions include the pace or timing of the transition; whether existing capabilities/facilities are fully or partially converted to HDTV capability; the extent to which existing facilities may be modified or must be completely replicated; the extent to which facilities which must be replaced can be fully amortized; the size or coverage of the station; and, a variety of unique circumstances associated with the operating environment of particular stations.

The cost for a network affiliate to upgrade plant to permit a pass through of the network signal is likely to be about a million and a half dollars for a large station and about half that for the very smallest, assuming it is allowed to implement HDTV at a significantly later date. It now appears that a full HDTV capability installed over a five-to-nine year period will cost less than \$12 million for a station in one of the top ten markets and about half that for the very smallest station. Net investment may be less, depending on: a) the ability of current and new station plant and equipment to service both an HDTV and NTSC signal; and b) the timing of the NTSC service "sunset."

III. THE FINANCIAL BURDEN OF BROADCAST STATION PROVISION OF HDTV

The additional investment and operating costs required to permit stations to simulcast are one indication of the financial burden facing station owners, but only in an absolute sense. To convey a relative or qualitative sense of the burden requires additional information and analysis. The financial burden of building HDTV plant depends on both investment requirements and financial capacity.

In this section, we will take a preliminary look at the economic "difficulty", or financial burden, occasioned by the fact that -- for example -- aggregate, incremental HDTV capital requirements for the industry could be almost \$10 billion, or that the cost to one of the smaller stations to build a network signal pass-through could be in the neighborhood of one million dollars. In doing so, it is helpful to consider the previously discussed capital cost estimates in the context of the financial resources available to stations and the general market environment within which the technology will be implemented. We also will examine the investment burden in the context of market and station size.

Station Income, Expenses and Cash Flow

TABLE 5 has been assembled for purposes of understanding better the financial capacity of stations in the broadcast industry relative to HDTV financial requirements. The table represents an attempt to dovetail data from different sources. It associates the dollar magnitude of selected categories of funds flow for broadcast stations (grouped according to the definitions used in the CBS study) with 1989 funds flow data reported in the 1990 Television Financial Report published by NAB.

The concordance between the CBS categories and the NAB data is imperfect. Unlike the CBS categories, the NAB cash flow data were classified according to ADI market categories (1-10, 11-20....131-150, 151-175, etc.), which categories are quite different from the categorizations of the network affiliates in the CBS study. Further, the cash flow data reported by NAB were very sparse for the 640 small stations that make up GROUP 6 in the CBS study. Thus, several adjustments and assumptions must be made to fit the NAB data to the CBS GROUPS.

The thirty largest stations in the CBS analysis would be comparable to the CBS, NBC, and ABC O&O's or affiliates in the top ten markets. The next forty may be taken to include other large stations in the top ten markets plus (most of) the network affiliates in markets 10 through 30. Similarly, the eighty stations in GROUP 3 would be comparable to the stations in ADI markets 30 through 60, while the 160 stations in GROUP 4 are roughly comparable to stations in ADI markets 60 through 100, and so on.

These and other "subjective" adjustments to the NAB data have been made to make those numbers fit the CBS categories. Accordingly, the table should be regarded as illustrative of the financial flows of stations in various groups. The assumptions

TABLE 5

SELECTED INCOME STATEMENT DATA
BROADCAST STATIONS BY SIZE
(\$MILLION--1989)

	<u>REVENUE</u>	<u>PRE-TAX PROFIT</u>	<u>DEPREC. & AMORT.</u>	<u>INTEREST</u>	<u>CASH FLOW</u>
GROUP 1 (30 STNS)	56	16	2.3	1.5	19
GROUP 2 (40 STNS)	24	3.2	1.8	1.7	6.2
GROUP 3 (80 STNS)	9	.5	1.0	1.4	3.0
GROUP 4 (160 STNS)	4	-.5	.9	.9	1.3
GROUP 5 (320 STNS)	2	-.1	.6	.3	.8
GROUP 6 (640 STNS)	1	--	--	--	--

NOTES:

- (1) Source: 1990 Television Financial Report, NAB.
- (2) Totals may be off due to rounding.
- (3) Data for small stations in CBS GROUP 6 not available.
- (4) Cash flow is as defined in NAB Report--pre-tax profit plus depreciation & amortization plus interest

necessary to make the NAB data conform to the CBS categories place substantial limitations on their use for other purposes.

Despite the statistical shortcomings of these data for other purposes, they should be satisfactory for our limited purposes here -- which are merely to put in financial perspective the HDTV investment cost estimates discussed above. The data in TABLE 4 illustrate what the funds flow for a representative station in the CBS universe might have looked like in 1989. Note that the size of the stations, as measured by revenue in column 1, declines quite precipitously as we move from GROUP 1 through successively smaller stations to GROUP 6. The range between the revenue of the largest stations and that of the smallest is more than a hundredfold.

TABLE 5 also reports total cash flow and its component parts (pre-tax profit, depreciation & amortization, and interest) as defined in the NAB Television Financial Report. Despite their shortcomings for detailed financial analysis, we will treat revenue and cash flow as useful comparative indices of the financial ability of stations in different CBS GROUPs to invest in HDTV facilities.

The spread in each category of cash flow between the largest and the smallest stations is quite pronounced. It is also notable that average pre-tax profit in 1989 for the stations outside the top 100 markets (CBS GROUPs 4, 5, and 6) was negative.

The Burden of HDTV Capital Costs

Like revenue and cash flow, the cost for constructing a fully functional HDTV capability declines as the size of the station declines. However, construction cost declines at a much slower rate with respect to reductions in station size than do revenue and cash flow. This implies that the relative burden for smaller stations is greater than for larger ones. The comparisons in the table indicate, for example, that the total cost of constructing a full HDTV capability declines from \$11.6 million for the larger stations to \$6.9 million for the smaller ones -- less than a 50 percent reduction (and even this assumes that they are permitted to implement HDTV on a slower track than large stations) -- while revenue and cash flow fall much more dramatically over the domain between the largest and smallest stations.

It is possible to calculate crude indices of the financial burden of creating an HDTV capability by relating measures of station revenue or cash flow to measures of expected HDTV investment cost. In general, an index of financial burden calculated in this way can take several values, depending on the underlying assumptions. Thus, for example, the financial burden

will vary according to the size of the construction program and the amount of HDTV functionality desired; it will vary with the number of years over which the investment is to be amortized; and, it will vary by size of station. The least burdensome construction program would be that occasioned by construction of a limited HDTV capability by a station in a large market and amortized over several years. The most burdensome construction program (yielding the highest index of financial burden) would be for a small station constructing a fully functional HDTV capability with very short-term financing. Tables illustrating these differences have been constructed and are discussed below.

To illustrate more clearly the ability of stations to finance the necessary construction without resort to external sources, we have compiled TABLE 5. It reproduces the data for revenue and cash for stations in each CBS GROUP -- as in TABLE 5 -- and adds, for purposes of comparisons, the total HDTV investment cost from the CBS study from TABLE 3.

TABLE 6 conveys a harsh picture of potential demands on station financial resources. It does so by characterizing the relative "burden" of creating a fully functional HDTV capability and financing it out of a single year's operations. We will begin with this case, then serially change the key assumptions and thereby describe less onerous HDTV investment burdens.

Dividing both station revenue and cash flow by the cost of implementing a fully functional HDTV capability for stations in each of the six GROUPS yields a rough indication of the extent to which the costs of HDTV construction are "covered" by revenue and cash flow generated in a single year. For the largest stations in GROUP 1, revenue and cash flow in 1989 would have covered the required investment 4.8 and 1.6 times respectively. For medium sized stations in GROUP 3, the coverage declines to 1.0 and .32 respectively. And, for the smallest stations, the ratios approach zero.

We underscore again the sensitivity of the "burden" measures to the premises underlying them -- particularly the pace and extent of the HDTV construction program. It is unlikely that most stations would choose to "flashcut" to a full HDTV capability and to finance it out of current operations. Thus, the picture presented by the data in TABLE 6 can and should be softened somewhat by looking at the numbers in the light of some less restrictive, and probably more realistic assumptions. The "burden" measures in TABLE 6 reflect the cost of full implementation of all five phases of the CBS HDTV capital formation programs (See TABLE 3). However, stations that stop short initially of fully replicating their current NTSC capability and opt instead for partial HDTV functionality will require less investment and, therefore, less financial burden.

TABLE 6

CASH FLOW, HDTV COSTS, RELATIVE BURDEN
FOR BROADCAST STATIONS BY SIZE

	<u>REVENUE</u>	<u>CASH</u>	<u>FULL HD COST</u>	<u>REV/COST</u>	<u>CASH/COST</u>
GROUP 1 (30 STNS)	\$56 M	\$19 M	\$11.6 M	4.8	1.6
GROUP 2 (40 STNS)	24	6.2	10.4	2.3	.6
GROUP 3 (80 STNS)	9	3.0	9.4	1.0	.32
GROUP 4 (160 STNS)	4	1.3	8.4	.5	.16
GROUP 5 (320 STNS)	2	.8	7.6	.25	.11
GROUP 6 (640 STNS)	1	--	6.9	.15	--

NOTES:

- (1) Revenue and Cash figures taken from TABLE 4; Full HD Cost is the CBS estimated cost to a station of constructing a fully functional HDTV capability as reported above in TABLE 3.
- (2) Relative "Burden" in the last two columns is calculated by dividing Revenue and Cash, respectively, by the Full HD cost.

To illustrate, suppose stations decide temporarily to forego development of the capability to run syndicated non-network programming, to originate programs locally and to postpone final conversion to HDTV. (They would of course maintain the full functionality of current NTSC plant.) This means that they would need only to invest in the facilities required to pass through the network signal and to insert locally originated commercials. The investment required to attain this level of functionality, in the CBS scenarios, is only about 28 percent of the investment required for full HDTV functionality. The burden of this less ambitious HDTV investment program, aspiring only to create capacity to pass through a network signal to insert local commercials, would create less than a third of the burden of an investment program designed to achieve full HDTV functionality.

The ability of stations to "cover" a truncated HDTV investment program out of cash flow is indicated in TABLE 7. The table is derived from previous tables and indicates cash flow, HDTV cost for both a fully functional and partially functional station capability (pass through and local commercial insertion only), and the ratio of annual cash flow to each of those investment programs. Moreover, while a structured investment program may be a realistic scenario for the short run, the FCC has made clear that all stations must ultimately (15 years is the tentative cut-over deadline) convert to HDTV and turn in their NTSC channels.

The measures in TABLE 6 and TABLE 7 express the financial burden as if the HDTV related investment expenditures will be financed fully out of operational cash flow in a single year. That need not be the case. For simplicity, we are ignoring interest charges, the opportunity costs of capital and the ability of stations to take on more debt. Incorporating those would complicate the analysis, but not change the basic conclusion that, for most stations, the financial burden of HDTV investment may be lessened by spreading out the associated expenditures. The ratios in TABLES 6 and 7 might usefully be restated to reflect the theoretical ability of stations to phase both construction and expenditures over time. Since the (cash flow and/or revenue) coverage ratios measuring "burden" are proportional to the duration of the construction program, and more specifically, the number of years over which the cost will be amortized, we can simply multiply those numbers in the table by the number of years to completion of the HDTV construction program (or the number of years to full amortization of the investment cost).

Thus, if stations in GROUP 1 take five years to expend the amounts required for complete construction of a full HDTV capability, the resulting ratios of annual revenue and annual cash flow to full cost, respectively, are 24 (5 times 4.8) and 8

TABLE 7

CASH FLOW, HDTV FUNCTIONALITY, AND RELATIVE INVESTMENT
BURDEN OF PHASED HDTV IMPLEMENTATION

	<u>CASH</u>	<u>HD COST</u> <u>(FULL FUNCTION)</u>	<u>HD COST</u> <u>(PART. FUNCTION)</u>	<u>CASH/COST</u> <u>(FULL)</u>	<u>CASH/COST</u> <u>(PART)</u>
GROUP 1 (30 STNS)	\$19 M	\$11.6 M	\$3.2 M	1.6	5.9
GROUP 2 (40 STNS)	6.2	10.4	2.8	.6	2.2
GROUP 3 (80 STNS)	3.0	9.4	2.5	.32	1.2
GROUP 4 (160 STNS)	1.3	8.4	2.3	.16	.57
GROUP 5 (320 STNS)	.8	7.6	2.1	.11	.38
GROUP 6 (640 STNS)	--	6.9	1.9	--	

NOTES:

- (1) Cash Flow taken from TABLE 4; Full and Partial HD Cost are the CBS estimates. Full Cost applies to a fully functional HDTV capability and Partial Cost applies to pass through and local commercial insertion only--both as reported above in TABLE 3.
- (2) Relative "Burden" (or investment coverage) in the last two columns is calculated by dividing Cash Flow by the Full and Partial HD cost, respectively.

(5 times 1.6). These numbers indicate substantially greater ability of stations to "cover" HDTV investment costs with the proceeds of current operations. Similarly for stations in GROUP 2, the ratios of annual revenue and annual cash flow to full cost spread over five years become 11.5 (5 times 2.3) and 3.0 (5 times .6), respectively. While we have not done so, the ratios can easily be recalculated to take into consideration that net HDTV investment may be lessened by HDTV-NTSC synergies or NTSC disinvestment, as discussed above.

IV. BROADCAST STATION HDTV IMPLEMENTATION--RISKS AND MARKET INCENTIVES

The incentive of a station to invest in HDTV is embodied in the future stream of earnings that such investment is expected to generate. The risk of investing in HDTV is related to the possibility that earnings will be modest or negative. This will happen if revenues derived from the HDTV conversion are not sufficient to cover associated capital and operating costs. Although HDTV investment costs and burdens provide the necessary foundation for addressing the incentives of station owners and managers to invest in HDTV technology, it is necessary to look beyond construction costs standing alone.

The analysis above indicated that many stations will have the financial wherewithal to invest in HDTV facilities. But the risks and incentives for doing so raise different questions all together.

Earnings will depend on both costs and revenue. While there is a fairly detailed record on the expected capital costs of HDTV stations, there is very little analysis in the record of likely incremental operating costs and revenues--two very important components underlying the determination of earnings.

The costs of operating an HDTV station, once it has been constructed, may not be substantially different from the costs of operating the current NTSC station. Additional costs will result from stations operating in both HDTV and NTSC modes during the "transition" period envisioned by the FCC. There are likely to be "economies of scope" in the joint operation of a new HDTV station and the current NTSC station, but there are good reasons to believe that stations will incur some incremental costs associated with engineering, marketing, sales, advertising and promotion, and general administration. The size of the increment will depend in large part, of course, on how the two channels are programmed and marketed, e.g., 100% simulcast or two separate programming services.

Because of this potential for diverse strategies, programming costs for the HDTV channel are particularly difficult to estimate. Programming and program production costs constitute by far the largest single expense component for an NTSC station. And programming is the largest single determinant of station revenue. Different stations will, as they do today, pursue different programming strategies based on valuations at the margin of the effect of programming strategies on costs, revenues and earnings.

Our analysis of HDTV program supply indicates considerable uncertainty about the terms and conditions under which HDTV programming will be available to broadcast stations. Inasmuch as programming in an NTSC environment is a substantial portion of station expenses, the availability of HDTV programming will have a significant impact on station costs. Moreover, the quality, quantity, and timeliness of HDTV programming will have a significant impact on expected HDTV revenues. Thus, the development of HDTV programming and the conditions of its availability to stations will have an important effect on the incentive of stations to assume the risk of constructing an HDTV capability.

The revenue side of the equation is equally unclear. The critical question here is whether and to what extent stations will be able to generate net HDTV advertising revenues as opposed to merely diverting revenues from their NTSC service. Because the FCC now envisions an eventual conversion to a single-channel HDTV operation, over the long run all NTSC revenues will be captured by the HDTV operation. For HDTV to generate a net increase in revenues for the broadcasting industry as a whole requires that a) HDTV be perceived as a substantially more valuable advertising medium than NTSC and thereby increase video advertising's relative share of the entire advertising market and/or b) broadcast stations be able to implement HDTV on a timetable or in a manner which permits them to increase their relative share of the video advertising market. The first condition is essentially unknowable at this time, though considerable skepticism is surely warranted. The second condition seems doubtful since there is no indication of any technological impediment to the timely introduction of HDTV by any of broadcasters' current or potential competitors.

In the short run, during the "transition" period, revenues will also be significantly affected by a station's programming strategy. That strategy will in turn be influenced by whatever content regulations are adopted by the FCC (e.g., partial or complete "simulcasting" requirements). While there is considerable uncertainty on these issues, we do know that a station's choice of programming and programming strategy will be made in an HDTV market environment that is very different from today's NTSC environment. The principal difference will be in

the number of households that have access to a programmed HDTV signal. Over 98% of U.S. households have an NTSC television receiver. None of them have an HDTV receiver. Indeed, such receivers are not available in the marketplace and it is not clear when they will be, and, there is substantial uncertainty about the probable household "take-up" rate of HDTV receivers once they are available in the marketplace.

Any HDTV-related revenues accruing to broadcasters will vary, then, not only with respect to the programming strategy, but directly with the number of viewers (and HDTV households). Like NTSC revenue, HDTV revenue will accrue to stations in proportion to the willingness of advertisers to buy time for commercial messages. In an NTSC environment, station revenue has come mainly from advertisers and in amounts roughly proportional to the number of viewers. In an HDTV environment, the universe of potential viewers will be such smaller than in today's NTSC environment because there will be fewer HDTV receivers in place.

Since expected HDTV revenue should be roughly proportional to the number of HDTV households, we can get a very crude estimate of the growth path of HDTV station revenue by looking at the growth of HDTV households. We can estimate the growth of HDTV households by applying the percentage penetration rates projected for HDTV to expected population in a given market.

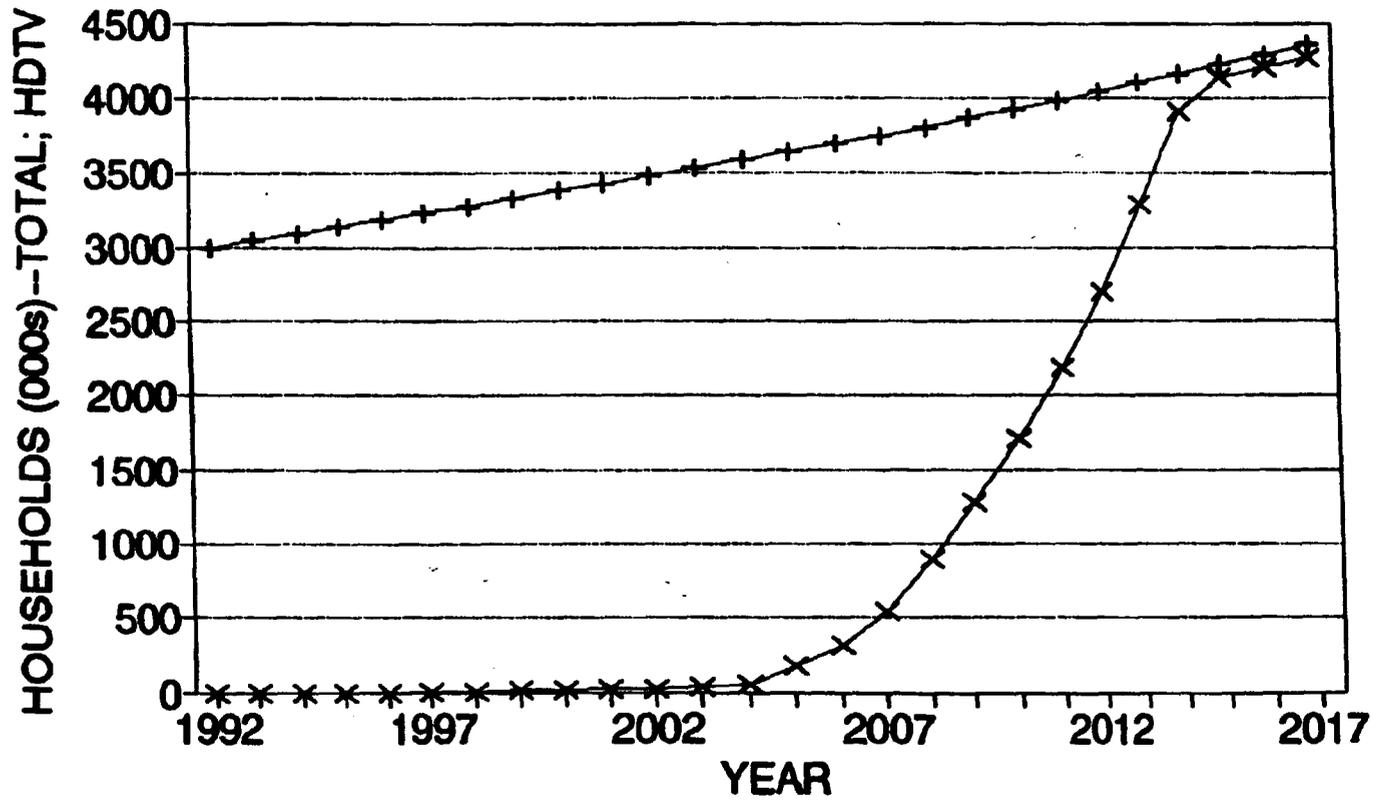
Chart 1 plots the number of households in a top ten television market, beginning with 3 million and growing at 15 percent per year. The number of HDTV households is derived by applying the HDTV HH penetration rates derived in the NTIA study. See, Appendix C, pp. 33-34. This HDTV diffusion scenario is a composite of the growth patterns of several successful consumer electronic product lines, including color television, home computers, VCRs, audio component systems, TVROs and projection TV. The HD household curve assumes that the FCC establishes a receiver standard in 1991; that it takes two years to "tool up" a production line and to fill the distribution pipeline so that HDTV receivers are widely available in retail outlets by the end of 1995; and that one percent household penetration is achieved by 2003. At the assumed rates of growth thereafter, 25% HH penetration is achieved in 2008 and 50% is achieved in 2011.

While admittedly imperfect as surrogates for station revenue, these estimates of HDTV receivers clearly indicate that, regardless of the nature of the HDTV programming, stations cannot expect substantial advertising revenue for several years after HDTV receivers are first introduced into the market place.

The HDTV diffusion pattern has some important implications for broadcaster incentives to make HDTV related investments. The diffusion path summarized in Chart 1 clearly implies that broadcasters who invest relatively "early" in HDTV transmission

CHART 1

HD PENETRATION--NTIA SCENARIO TOP TEN MARKET



+ HOUSEHOLDS x HD HOUSEHOLDS

facilities must expect very low levels of HDTV-related revenue for several years. Thus, for example, suppose that a broadcaster makes the investment in the same year as the Commission adopts a receiver standard. The HDTV diffusion rate sketched out here implies that this signal would be on the air for seven to eight years before it could be received by one percent of the households in that local market. The signal would be on the air for fifteen years before as many as 25% of local households would be able to receive the signal.

This simple exercise suggests that "early" broadcast HDTV investors may have to underwrite significant losses by investing before substantial numbers of HDTV receivers are in place.

Recent "studies" of HDTV receiver penetration are increasingly bold in their assumptions and aggressive in their forecasts. Unlike our study for NTIA (See Appendix C; "Economic Potential of Advanced Television Products", Darby Associates for National Telecommunications and Information Administration, April, 1988), these studies do not consider the possibility that the technology will not take off and follow the growth path of other successful consumer electronics technologies. For example, recent estimates of HDTV penetration coming out of the subcommittees of the Commission's ATV Advisory Committee are substantially more aggressive in forecasting HDTV diffusion rates and appear to have ignored all the cautionary flags raised in earlier works and by critics of those studies. Even if the authors of optimistic penetration studies do not call attention to the enormous uncertainties associated with their forecasts, potential investors in the technology, including broadcasters, must and do recognize the substantial possibility that such optimistic forecasts will not materialize as they decide the level and timing of their capital commitments to building the necessary parts of the infrastructure. Notwithstanding the numerous attempts to anticipate the rate of household adoption of HDTV products, the fact remains that all such efforts are necessarily conjectural. Despite the proliferation of increasingly optimistic views of the HDTV household diffusion rate, one sobering fact remains unchallenged. There is a significant possibility that this technology will not be as successful as other consumer electronic innovations and may indeed fail.

Under these circumstances, and responding to market forces alone, when would a broadcaster invest in the technology? Different stations would follow different strategies. Some would probably attempt to lead the market by constructing HDTV transmission capabilities and thereby attempting to stimulate the diffusion of HDTV receivers. These "risk-taking" stations might decide to build a station with "basic" functionality--i.e., the ability to pass through imported signals while adding local commercials--or even a fully functional station. Other "risk

averse" stations would wait and see how the market develops before putting funds at risk. Given basic market economics, stations in larger markets would be more likely to be aggressive and stations in smaller markets would be more likely to defer investment pending the development of better information about the likely payoff.

* * *

The preceding analysis was based on 1989 financial data, the most recent available at the time it was conducted. However, inspection of more recent financial data provides no basis for more optimistic predictions. Indeed, recent trends suggest a more difficult environment for local stations in the future because of the radical transformation of the technological and commercial milieu within which the U.S. broadcast industry operates. (See, OPP Report on Broadcast Television in a Multichannel Marketplace, June, 1991.) Each market in which the industry participates is undergoing tremendous pressure for change. No important aspect of the traditional broadcast business falls outside the reach of this transformation. New technologies continue to compete for viewers, advertisers are finding new alternatives and sharpening their requirements for traditional media, program supply conditions are changing, and the regulatory rules of the game continue to evolve in directions that create both new opportunities and new constraints. Both the ability and incentive of stations to adopt the new HDTV technology will be conditioned by the continuing transformation of the market environment in which they operate.

V. OTHER STAKEHOLDERS IN THE DEVELOPMENT OF HDTV

Video systems in the United States are made up of three distinct subsystems: a) program production, b) program delivery, and c) program display. These subsystems can be considered as necessary links in a chain that will make HDTV programming available for household viewing. The main business of the traditional over-the-air broadcasting industry has been to engage in two of these activities -- program production and program delivery through electronic signal transmission.

For HDTV to become a successful medium in the U.S., there must be more or less simultaneous development of HDTV program material; one or more HDTV program distribution systems; and the proliferation of consumer HDTV video display devices. Strong complementarities in the demand for different HDTV related products and services give rise to interdependencies in consumer valuations. That is, the value of an HDTV receiver or VCR in the home depends critically on the characteristics -- type, number, quality -- of programs available for viewing in the HDTV format. Program availability, of course, depends on the presence of both

HDTV compatible programs and the means for transmitting or distributing that programming to the home. Similarly, the value to producers/distributors of HDTV programs and/or transmitters of HDTV-programmed signals is very closely related to the number of households with the ability to receive such programs and programmed signals, i.e., the household penetration of HDTV receivers.

Several industries and numerous firms will have a significant stake in the growth and development of HDTV services. The primary stakeholders considered in the following stakeholder analysis are the current participants in NTSC markets for programming, audiences, and equipment. We have also considered, but will not discuss here, the potential role of other possible stakeholders, including the telephone companies, newspaper publishers, and the computer industry. Each will arguably have a significant potential stake in the development of HDTV, but the nature of their participation is not critical to the purposes of this paper, which focus on causes and effects of broadcast station HDTV related investment decisions. Thus, these industries and their leading firms do not appear to have the incentive or the ability to participate in HDTV development in ways that will help or otherwise have a substantial impact on broadcasters in the near term.

We will discuss the primary HDTV stakeholders and the nature of their stake in the following order: program supply interests; signal distribution interests (non-broadcast media outlets); and equipment manufacturing interests.

The Entertainment Business--Program Production and Supply

The broadcasting industry is a major customer of the entertainment programming industry. The Office of Plans and Policy of the FCC estimates the three networks alone were responsible for over \$6.1 billion dollars in programming expenditures in 1990; and, that expected growth of over five percent, compounded annually, would bring program sales to the three networks to almost \$8 billion by 1995. Another view of the enormous contribution of broadcasting to the programming industry is indicated by a recent Morgan Stanley estimate, based on MPAA data, that television accounts for the largest share of all outlets of total domestic film revenue. In 1989, television accounted for 42 percent, or about \$4.5 billion of that total. Moreover, sales of the U.S. film industry to U.S. broadcasters are growing at a compounded annual growth rate of almost 16 percent according to Morgan estimates.

Another view is provided by Robert W. Crandall in a companion analysis to the submissions of the three networks in the Fin/Syn proceeding. There, Crandall shows that in 1989 about \$5.3 billion was paid the program production industry for network

programs and first-run syndication. To repeat, the broadcasting industry is a major customer of the entertainment programming industry.

The interests of the program supply industry in the development of HDTV are further illustrated by the fact that construction of HDTV broadcast outlets with access to large numbers of HDTV households may add substantial value to existing inventories of programmed material. Suitable material could be converted to an HDTV format for distribution by newly constructed HDTV broadcast transmission plants. In this regard, it is instructive that Columbia Pictures, for example, has a library of 2,700 feature films and over 25,000 episodes of 240 series made for television, in addition to its capacity to produce 30 or 40 new films a year in its Tri-Star studio. MCA/Universal Studios has a library of more than 2,200 movies and 12,500 television episodes, while Warner owns about 1500 film titles and more than 100 television program series.

There are substantial program holdings in other film inventories as well; and, recent changes in their ownership suggests the strategic value of integrating program supplies with video distribution outlets. Turner Broadcasting purchased in 1985 the old MGM film library of hundreds of feature films. In the same year, News Corp. integrated the substantial library of Twentieth Century Fox with six independent television stations and affiliations with independently-owned broadcast stations. Other acquisitions of programming interests include -- Warner by Time, Inc.; Warner's combination with Lorimar; Thames Television's acquisition of Reeves; and, of course, the integration upstream by cable systems by acquiring interests in cable programming.

The potential for exploiting synergies among different elements of complete video networks is not limited to integration of program supply with video distribution outlets. The integration phenomenon reaches as well to acquisition and merger of hardware manufacturing interests with program supply assets. The most notable examples, of course, are the expansion of Sony into entertainment software through its acquisition first of CBS Records, but more importantly in the present context, its purchase of Columbia Pictures and the services of two very successful program producers (Guber-Peters Entertainment Company). Other indications of hardware/software integration include a) Matsushita's formation of Largo Entertainment; b) JVC's \$100 million movie production joint venture; c) Toshiba's joint venture with Time Warner; and d) Philips purchase of a substantial stake in Blockbuster Entertainment.

The Major Program Supply Players. The industry (producers as opposed to holders of program inventory discussed above) is dominated by a few large Hollywood based studios that both

produce product and act as its distributors. These firms are increasingly vertically integrated either as a result of being acquired by firms downstream in the entertainment chain (cable and broadcast related interests, equipment suppliers, cable networks, etc.) or as a result of studio acquisition of such firms. These companies include Columbia Pictures, Disney, MCA, MGM/UA, Newscorp (Twentieth Century-Fox), Paramount and Time-Warner.

The second tier of the production side of the industry is made up of numerous "independent" producers and production companies, some of whom have affiliated with the majors as a means of cutting costs and gaining substantially improved access to markets by using the marketing muscle and distribution channels of the majors. They do so by releasing films through the majors under long-term distribution contracts, thereby reducing their own risk and post-production costs.

Summary. The program supply industry has a substantial stake in the development of an HDTV capability by broadcasters. The programming industry will gain by the addition of markets for new productions and by the opportunity to upconvert existing film stocks to HDTV and market them to program transmission interests.

Other Distribution Media--The Cable Television Industry

Unlike groups of HDTV stakeholders who provide goods and services (programming services/products and receiving equipment) that are complementary to broadcast transmission of programmed signals over-the-air, the cable television industry is directly and pervasively competitive with broadcast stations. However, the introduction of HDTV by broadcast stations will influence the market dynamic of cable and broadcasting. It is worthwhile to explore the nature of the incentives and opportunities facing the cable television industry in an HDTV environment, if only because of the influence of cable's response to HDTV on the potential rate of HH diffusion of receivers -- a matter of considerable interest to broadcasters.

The cable television industry is comprised of three main economic or functional components: a video delivery function; program production and supply; and, a networking function that involves intermediation between local cable operators and both advertisers and program suppliers. These correspond roughly to similar functions found in the over-the-air broadcast industry.

The largest companies in the industry are both vertically and horizontally integrated. They own and operate cable systems in different geographical markets, as well as having equity interests in both program supply and "thematic" or other networks.

The industry has experienced enormous expansion over the past decade and now passes about 90 percent of all U.S. homes. Almost 60 percent of U.S. television households now subscribe to cable television services. Total industry revenues are now running at more than \$17 billion per year and growing in the 12-15 percent range annually. Major catalysts in the growth of the industry include ambitious construction programs that have made service available to increasing numbers of households and the proliferation of cable-only thematic programming networks that have raised consumer valuations and demand for cable services.

Most analysts expect the industry to continue to grow in each of its several size dimensions -- homes passed, subscribers, average number of channels per subscriber, revenue, earnings, and cash flow. The rather substantial growth and profitability prospects of the industry are summed up in the healthy acquisition premiums paid in recent years.

Cable and HDTV. Regulatory imperatives aside, in many respects the cable industry faces a dilemma similar to broadcasters in deciding whether and to what extent they should undertake HDTV-related construction programs. While the growth prospects for the cable industry are generally regarded more positively than for the broadcast industry, there is substantial debate in the industry over whether or not cable systems should risk investing in an HDTV capability. Moreover, the cable industry has a variety of alternative demands on its capital budgets that are not present in the broadcast industry.

We should distinguish at the outset the interests of cable programmers from those of system operators. Programmers will exploit any opportunity presented by the construction of cable system HDTV capability and the diffusion of HDTV household receivers. They probably will not, however, drive either process.

Creation of an HDTV capability by local system operators will result in greater investment and higher expenses, without, in the short term at least, much prospect for substantially increasing revenue. From the point of view of a cable operator (not integrated with networks or program production), the revenue effect of introducing an HDTV signal will be positive if, and only if: a) it increases the number of subscribers; b) it induces subscribers to increase the number of service "tiers" purchased; c) it permits charging a higher rate to existing subscribers; d) it increases the willingness of advertisers to pay; and/or e) it increases the demand for pay-per-view programming.

As a defensive measure, an operator might have an incentive to create an HDTV capability if failure to do so would result in negative effects on the foregoing revenue-related variables.

That would be the case, of course, if other HDTV programming were made available by competitive distribution media -- broadcasters, DBS, preprogrammed cassettes, etc.

The main requirement of a cable system, if it is to transmit HDTV signals, is for channel capacity. The availability of adequate channel capacity, when it is needed, depends on the capacity of the current system, the rate of utilization, and the system's position in the upgrade/rebuild cycle. There are also a variety of technical considerations that will influence the ability of a system to upgrade existing electronics to handle HDTV. Additional expenditures -- many of the same kind required of broadcasters -- will be required to create an HDTV pass through capability at the cable head.

Like those facing the broadcast industry, the incentives of the cable industry to innovate with HDTV technology are correlated strongly with the number of receivers in place. The precise nature of the bond between the installed base of HDTV compatible receivers and a given media's incentive to make available HDTV programming has not been determined. Nevertheless, it is clear that some threshold level of HDTV receiver penetration must either be achieved, or reasonably assured in the near term, before cable operators will have any incentive -- defensive or otherwise -- to innovate the technology.

Despite the uncertainty, the cable industry may opt to invest in HDTV-related plant conversions if broadcasters construct an HDTV simulcast capability and provide the impetus for increased household penetration of HDTV receivers. Thus, broadcast investment in HDTV transmission capability may provide a dual incentive for cable operators: it may increase broadcaster competition for viewers and increase the number of HDTV receivers in place, thereby increasing the expected value of cable investment in HDTV distribution capability.

One possible strategy for cable operators involves incremental entry into HDTV services -- beginning with retransmission of available HDTV broadcast signals. Subscription and pay-per-view in HDTV formats may subsequently be introduced by some systems in the larger markets with modest household receiver penetration, but basic and locally originated services are not likely to be offered until receiver penetration is quite substantial, perhaps 10-15 years out.

Thus, the initial entry of cable into HDTV services may well be both a defensive reaction to broadcast entry and exploitation of the opportunity to create an early HDTV tier utilizing the broadcast HDTV signal and the growing base of HDTV receivers given impetus by early broadcast HDTV transmissions.

The large MSOs that serve the bulk of cable households enjoy a variety of opportunities for expanding, growing, diversifying and otherwise creating value for shareholders. Investing in plant conversions to permit cable delivery of HDTV signals must compete in a cable company's internal capital budgeting processes with numerous alternative investment opportunities. These include those associated with increasing the subscriber and facilities base through acquisition of other cable companies; responding to the threat of telco competition by incorporating switching or initiating a PCN capability; continuing recent trends by investing more in programming; increasing marketing expenditures to take advantage of substantial operating leverage; or hedging their market advantages by taking positions in alternative delivery systems.

In summary, there are a variety of constraints on the incentive and ability of the cable industry to implement an HDTV capability. As it will be for the broadcast industry, construction of such a capability will be a fairly costly undertaking. Further, HDTV related investments must compete (for cash flow and expensive external capital) with other investment opportunities available to cable companies. Many of those alternative investments may appear to generate more value in the short term by increasing revenues or reducing costs than investment in HDTV.

Other Distribution Systems--The Home Video Industry

Consumer VCRs and video disk players of pre-recorded HDTV program material will probably be available to users at about the same time receivers come into the market. Home video equipment will no doubt be compatible with the simulcast broadcast HDTV signal and could be used either for "time shifting" the broadcast signal (as with the NTSC signal) and/or viewing commercially pre-recorded materials.

The historic growth of the home video market in an NTSC environment may hold clues as to how it might develop in an HDTV world. The growth of home video has been driven by the rapid diffusion of VCRs. The machines were first introduced in 1975 and by 1990 over 70 percent of U.S. households (about 65 percent of U.S. television households) had at least one VCR. The Electronics Industry Association estimates that in 1990 over 10 million VCRs, worth almost \$2.5 billion at the factory, were sold in the United States. In 1989 consumers spent \$4.6 billion to buy videocassettes and \$5.0 billion to rent them. The dramatic growth and substantial current impact of the home video market on the entertainment industry is apparent from the fact that, by 1989, video revenues accounted for 38.3 percent of filmed entertainment revenues -- up from 10.2 percent in 1983.

In contrast to cable and broadcast electronic networks, video stores are parts of a hard-copy distribution chain that includes program producers and distributors upstream and a VCR machine downstream in the home. Film from old stock or new releases is converted to programmed videocassettes (now almost exclusively in a VHS format) and physically transported to local distribution centers. Consumers themselves provide for the physical movement of the program material from local video stores to households. Thus, "homes passed" by this physical distribution system are reckoned by considering the number that are conveniently near a video store.

Several important changes to this videocassette network are required if consumers are to use it to access HDTV compatible programming:

- Conversion of existing 35mm feature films into an HDTV format and/or production of new material in a compatible format;
- Willingness of local video stores to stock HDTV videocassettes; and,
- Investment by households in HDTV compatible VCRs and receivers.

The first requirement, that titles in current libraries of 35mm film be converted to HD, is a process that is, apparently, both technologically and economically feasible. Kodak has recently announced a new telecine that it claims will perform this conversion at low cost, while preserving high technical quality in the converted material. The extent to which new productions might be recorded in HDTV rather than film is still being debated in the production community, but will be driven by evolving economic opportunities offered by adoption of the technology. Since the industry has invested substantially in 35 mm cameras and related production equipment, it is not likely to strand that investment all at once to convert to an HD production mode. A more likely scenario is that the industry will complement its existing capacity over time with a selective HD capability. There are studios now that specialize in recording visual materials in an HD mode and these will be expanded and joined in time by others as the market develops.

The extent to which video store owners are willing to stock HD cassettes is more problematic. Video store owners are confronted by the same "chicken and egg" dilemma faced by broadcasters and cable operators. Until the installed base of technology in the home reaches some critical mass, there is little economic incentive for the store owner to sacrifice valuable shelf space and to incur the inventory costs associated with stocking HD videocassettes.