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FCC Advisory Committee on Advanced Television Service

Contribution to the Fifth Interim Report

of the Implementation Subcommittee

from

Working Party 2 on Transition Scenarios

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Table of Contents

Executive Summary	iii
Introduction	1
Objectives of IS/WP-2	1
Efforts undertaken	2
Transition Scenarios	3
Method	3
Inputs From Proponents	4
Surveys	5
Group Owners	5
Chief Engineers	6
Local Area Groups	6
Implementation Issues	7
Availability of specific channel assignments	7
Dissemination of technical information	7
Impact of assumptions on implementation time	8
Preference for time phased station implementation	10
Need for delay in applying	11
Availability of Consumer Product	12
Future Activities	12
Proponent Meetings	12
Survey Of Equipment Manufacturers	13
Survey Of Video Software Providers	13
Consumer Electronics Manufacturers Survey	13
Group Owners Repeat Survey	14
The Final Analysis	14
Conclusions	14
Technical Information	15
Critical Path Tasks	15
Broadcaster Interests in Staged Implementation	16
Availability of Consumer Receivers	16
Availability of Professional Equipment	16

Appendix A — Survey of TV Station Group Owners 18
Summary 18
Methodology/Administration 18
Response Rate 18
Statistical Significance 18
Questionnaire Design 19
Analysis of Responses 19
Implementation Timing 19
Resource Availability 20

Appendix B — Survey of TV Station Chief Engineers 22
Summary 22
Sample Design 22
Methodology/Administration 22
Response Rate 22
Questionnaire Design 23
Data Reduction 23
Statistical Significance 24

Appendix C — Report of IS/WP-2: Study Results and Preliminary Conclusions

Appendix D — Survey of Consumer Electronics Manufacturers

Appendix E — Materials Package Provided to Proponents
(PERT Charts/Gantt Charts/Assumptions Lists/Questions, etc.)

Executive Summary

IS/WP-2 has responsibility for developing "Transition Scenarios" for the change to an Advanced Television Service in the United States. In this interim report are described a number of significant and possibly surprising results of the work of IS/WP-2 that may influence thinking about the implementation of HDTV.

A survey of television station group owners conducted by IS/WP-2 revealed that they tend to favor a phased approach to the transition to Advanced Television, in which the largest markets make the transition to HDTV first. The proposed implementation schedule recently put forward by the FCC in its Notice of Proposed Rule Making is not consistent with such a staggered implementation and could easily lead to a difficult position for many broadcasters regarding the timing of their applications for an ATV channel assignment. Broadcasters would face the dilemma of applying early and possibly running out of time to implement or applying later and possibly receiving a less favorable channel assignment or other facilities. This leads IS/WP-2 to recommend possible solutions for this dichotomy.

IS/WP-2 has constructed implementation charts for different industry segments and for different sets of assumptions. These have revealed that certain tasks in the transition process are the most critical and require early and effective attention. The degree to which government regulatory processes, at various levels, will control the speed of implementation of HDTV is also highlighted by these charts.

It has become clear that a most crucial element in the whole implementation process is the availability of sufficient technical information on the selected system. The certification documents produced by the proponents thus far are not nearly sufficient in this respect. The task of putting this information together is considerable and likely will not be undertaken by a proponent before it knows that its system has been selected. IS/WP-2 points out the significance of this documentation to all parts of the transition process and to all parties concerned: manufacturers of professional equipment and consumer products, broadcasters, and the cable community.

The body of this document gives full treatment to these and a series of other significant implementation concerns, spelling out in detail where the critical points will be in bringing Advanced Television to the United States.

I. Introduction

This Fifth Interim Report of Implementation Subcommittee Working Party Two on Transition Scenarios represents the first extensive treatment of the concerted work of the members of the Working Party over a four year period. In particular, this document is the result of the tireless efforts of the following individuals, supported by their respective employers, constituted as a report-writing committee for IS/WP-2:

Arthur Allison	EMC^2 Consulting
Larry Cochran	Thomson Consumer Electronics
Caaj Greebe	Philips Laboratories
Charles Heuer	Zenith Electronics Corporation
Roger Pience	National Cable Television Association
Kenneth Skinner	Philips Laboratories
S. Merrill Weiss	Consultant

A. Objectives of IS/WP-2

In carrying out its charter, as provided by the FCC in establishing the Advisory Committee, Implementation Subcommittee Working Party 2 on Transition Scenarios has three principal objectives. These are:

(1) Development of transition scenarios for the industry segments involved in implementation of an Advanced Television (ATV) service. The transition scenarios developed are to be based upon an understanding of the tasks required for implementation by the industry segments and estimates of the time and, for the broadcast industry, personnel resources required to complete the tasks.

(2) Identification of differences in implementation between the proposed systems that may be relevant to the selection process and the forwarding of that information to the appropriate entities within the Advisory Committee. Any differences found are to be used to tailor transition scenarios to specific systems should that be necessary.

(3) Identification of potential problems surrounding the implementation of Advanced Television, so that these can be brought to the attention of others within the Advisory Committee and to the FCC. When possible, solutions to the problems raised are to be developed so that action can be taken in advance of the actual authorization of ATV service.

It should be noted that, in examining the various aspects of the transition to Advanced Television, IS/WP-2 has given no consideration to the financial resources required by the participants to carry out their respective implementations. Such matters are the responsibility of other groups within

the Advisory Committee structure. Rather, it has been assumed that each of the implementers has the financial wherewithal to make the necessary changes and additions to its facilities.

B. Efforts undertaken

A major part of the work undertaken by IS/WP-2 has been development of a series of charts of the implementation process for the various industry segments showing the tasks they must undertake, the relationships of those tasks, and the times likely to be taken in completing the tasks. Experts from each of the industry segments participated in the construction of the charts for their segments.

IS/WP-2 has surveyed the owners of all major television station groups to determine their expectations for the implementation of ATV transmission. It has also surveyed the Chief Engineers of a sample of stations to determine the personnel resources each has and might make available to carry out the implementation. (It should be noted that these surveys were conducted prior to the Notice of Proposed Rulemaking issued by the FCC on November 8, 1991. The potential impact of the regulatory incentive proposed in the Notice on the results of the surveys is discussed below.) In addition, IS/WP-2 has instigated discussions among the TV stations in some of the larger markets in order to understand the problems they may face and to give them a head start in addressing them.

In order to differentiate between implementation requirements and capabilities of the proposed systems, it is necessary to review IS/WP-2 implementation charts with the system proponents. To this end, a pair of meetings with the proponents has been planned, and this process is under way. The meetings are to first inform the proponents of the work of IS/WP-2 and then to get their inputs and their responses to questions posed by the Working Party regarding the implementations of their respective systems.

Because the IS/WP-2 timing estimates for the receiver design and manufacturing process suggest consumer receivers may not be generally available until 2½-3 years after the Report and Order establishing the HDTV service, IS/WP-2 is seeking additional expert input on the matter. A wider survey of TV receiver manufacturers is being conducted. A questionnaire (see Appendix D) will obtain their comments on the IS/WP-2 PERT and Gantt charts and the underlying assumptions for the consumer electronics industry. The questionnaire also solicits inputs on applicability of the development schedule to the design and manufacture of VCR's.

The Working Party issued a preliminary report, "Report of IS/WP-2: Study Results and Preliminary Conclusions," which was presented to the Implementation Subcommittee on November 19, 1991, and is attached as

Appendix C. The report contains an overview of the work undertaken by IS/WP-2 and some initial conclusions resulting from that work. This current Interim Report will provide more detail on the findings outlined in the preliminary report.

II. Transition Scenarios

In order eventually to arrive at an all-encompassing set of scenarios for the transition of the television industry to Advanced Television (ATV), IS/WP-2 has from the beginning broken down the industry into a number of segments for which individual scenarios or groups of scenarios could be created. These scenarios have been developed using similar structures that will allow their integration into a whole at the end of the process.

A. Method

The mechanisms chosen for depicting the various transition scenarios are PERT and Gantt charts. In a PERT chart, the tasks required to complete a project are arranged in a network in which the tasks are interconnected by virtue of their dependencies upon one another. The Gantt chart, on the other hand, shows the sequencing of activities in calendar time. A critical path, displayed on either chart, locates activities critical to controlling the overall time of the implementation. With the participation of experts from each industry segment, the time required for completion of each of the tasks was estimated.

From these inputs, plus a list of assumptions made for the many activities, a series of generic (not system-specific) PERT and Gantt charts was created for each industry segment. Some industry segments are represented by one scenario, while some required as many as three scenarios. The PERT/Gantt charts and their underlying assumptions as currently constituted and provided to the system proponents can be found in Appendix E.

Industry segments included in these examinations are:

Production/Postproduction
Networks
Local Stations
Transmitters
Satellite Distribution
Common Carrier Distribution
Cable
Consumer Products

One significant unknown among the tasks in the transition scenarios for some of the industry segments is the time that will be required for the availability of

professional equipment necessary to support the selected system. Early in its work effort, IS/WP-2 conducted a rudimentary survey of professional equipment manufacturers to ascertain their estimates on the availability of equipment. The response was too small to be statistically significant, and it became apparent that some of the responses were provided in an effort to influence the outcome of the study. Consequently the study was discounted as premature in further work of the committee. But the study did demonstrate in a qualitative way that the manufacturers would require considerably more information about the proposed systems before they could answer objectively about future equipment availability.

As a result of the lack of real information on professional equipment availability, IS/WP-2 has had to make certain assumptions about its appearance in the marketplace. In general, where no other data existed, the required items have been assumed to be available in sufficient quantity to meet the demand one year following finalization of the FCC's decision on a system. For transition scenarios based on assumptions that are considered to be realistic for the durations of other tasks, this assumption about equipment availability has little impact because of the much longer times taken by the entire process, thereby keeping the equipment well off the critical path. When other, much shorter assumptions are made about the durations of the other tasks, however, the availability of professional equipment moves into the critical path.

The potential impact of the availability of equipment, combined with its dependence on the availability of technical information (discussed later) and the strong possibility that one year is overly optimistic, leads to a need to retry the survey of manufacturers. This will be one of the upcoming activities of IS/WP-2, as discussed later in this report.

B. Inputs From Proponents

Meetings with the proponents are being held to gain their inputs on the implementation process. A joint meeting with all proponents was held on January 13, 1992, to familiarize them with the working party's work to date. The PERT charts, Gantt charts, assumptions lists, and lists of issues were presented for each of the industry segments. An opportunity was provided for questions from the proponents. Separate follow-up meetings with each of the proponents will be held to explore system-specific differences in the PERT/Gantt/Assumptions as well as system-specific implementation issues. These meetings will also provide an opportunity for questions from IS/WP-2.

III. Surveys

An important instrument for the collection of data by IS/WP-2 has been the survey. A number of surveys have been conducted covering different target groups and different aspects of the transition. Some have been recorded in earlier Interim Reports, for example the survey of television stations regarding the availability of space for additional antennas on existing towers. The remaining, heretofore unreported surveys, either completed, under way, or contemplated, are reported in this section and the later one on future activities.

A. Group Owners

A survey of TV station group owners, administered by mail, was conducted during the summer of 1991 to gather information on current human and financial resources plus estimates of manpower that could be made available to supplement that currently available at their stations for a major design/construction project. In addition, information was sought on when the owners intended to implement HDTV at their stations. A copy of the questionnaire can be found in Appendix A. An analysis was then conducted on the aggregate data and the results are detailed in the Appendix.

The salient points revealed by the analysis are:

- The group owners desire to time phase the start of HDTV implementation at their stations. 66 per cent of the stations covered are expected by their owners to start implementation in the first five years following the FCC decision. 58 per cent of the stations are expected to achieve pass-through operation in the first five years.

- The group owners' estimate of the interval from implementation start to pass-through yields an average time between one and two years.

- 31 per cent of the responding groups have no personnel within their groups to apply to station implementation efforts. For the 69 per cent that do have personnel available, the impact will depend strongly on the timing of station implementations. For example, only one-half person per station could be provided to support simultaneous transmitter conversions. Two people per station would be available if starts were phased as forecast by the groups.

- Due to the nature of the selection of the samples for the survey, the results cannot be extrapolated to cover all TV stations.

It is recognized that the potentially strong regulatory incentive for speedy implementation proposed in the FCC Notice of Proposed Rulemaking issued November 8, 1991, may cause group owners to take a somewhat different view of the timing of the implementation of Advanced Television at their

stations. IS/WP-2 has under consideration the taking of another survey of group owners to examine the effects of the Commission's proposal on the owners' expectations for implementation at their stations. This is discussed below in V. Future Activities.

B. Chief Engineers

A telephone survey was conducted of a random sample of television station chief engineers to obtain information about their stations' capabilities and the resources they have for design of both a new production facility and a new transmitter facility. (A copy of the questionnaire can be found in Appendix B along with a compilation of the data from 93 respondents and an analysis of the significant survey results.)

In analyzing the survey data, the Working Party attempted to correlate the capabilities and resources with a station size factor based upon the number of studios. No such correlation was found; stations of all sizes yielded about the same results. Efforts to find other correlated indicators were also unsuccessful. On average, there is one person per station capable of and available to do new production facility design and slightly less than this for new transmitter facility design.

Only about 5 per cent of the stations sampled currently receive design help from their group, their owner, or from co-owned stations. Correspondingly, in contemplating the construction of significant new studio facilities, chief engineers at 95 per cent of stations anticipated no outside help. Their expectations for support of the design of new transmitter facilities was of a similar order.

To pursue a concern that stations might not have the personnel resources to accomplish the implementation of Advanced Television, the chief engineers were asked about their current use of consultants and the potential for consultant participation in a major project. Outside consultants are currently engaged by stations for an average of 2.4 man-days per year. 39 per cent of the stations gave the names of consultants they would use for a major design project.

C. Local Area Groups

A matter of particular concern first raised by a member of the FCC staff is the availability of space on existing towers for new antennas for simulcast transmission. An early study by IS/WP-2 showed that a large percentage of stations would require new towers, even for "low power" transmission systems. The potential problem was thought to be particularly acute in some of the largest cities, where multiple-station tower facilities are often necessary.

To address the issue, IS/WP-2 established Local Area Groups as something of a prolonged survey in five large cities. The Local Area Groups are comprised of the chief engineers of all the television stations in each metropolitan area. Their purpose is two-fold: to help IS/WP-2 identify and understand impediments to implementation that will be peculiar to the largest cities, and to pro-actively instigate action by the stations in those areas to begin to deal with the difficulties they may face.

Among the five cities selected (Boston, New York, Chicago, San Francisco, and Los Angeles), only one group (Los Angeles) indicated that it expected little difficulty in the installation of new transmission systems. This results from the particular transmission site used by nearly all broadcasters in the market. In each of the other cases, there is a decided lack of available antenna capacity (weight and wind loading) on existing towers, whether individual (Boston) or multi-station (New York, Chicago, San Francisco).

Explorations of innovative ways to accommodate new antennas have begun in each of the latter cities, and it is too early to tell yet whether means can be found to utilize existing facilities or whether new towers will have to be constructed. The answers to these questions will be heavily dependent upon the transmitted power levels required for the new systems. IS/WP-2 has obtained information on anticipated power levels from the proponents at its recent meeting with them. It is now preparing new instructions for the Local Area Groups to help them utilize the new data and provide further feedback to IS/WP-2 about their particular situations.

IV. Implementation Issues

During the period since the last interim report, IS/WP-2 has discovered several new issues relevant to HDTV implementation, most of which it has previously brought to the attention of the Implementation Subcommittee. Some are discussed here for the first time.

A. Availability of specific channel assignments

In estimating the timing of the start of broadcast HDTV service, it is anticipated that the FCC will make channel assignments during the process of establishing the rules for the service. If the channel assignments are made later than the Report and Order establishing the HDTV service, this will add directly to the implementation time.

B. Dissemination of technical information

Equipment manufacturers on both the studio/transmitter side and the receiver side of the ATV system cannot begin design of their products until adequate technical information is available from the proponent whose system ultimately

is selected. Similarly the setting of standards, both in the Rules and in industry documentation, requires a high level of information transfer. The level of information provided by the proponents through SS/WP-1 is inadequate for either product design or standards-setting and is sufficient only for deciding on certification and the required testing.

In its analyses of the transition scenarios and estimates of the implementation timing of the various industry segments, IS/WP-2 has made the assumption that the required technical information will be published no later than the issuance of the NPRM proposing the system selection. Any later promulgation of the required data will add directly to the estimated time for completion of the many tasks each industry segment faces. A head start on the development and release of this information could alleviate such an impact on the implementation process.

Timely availability of all system-specific equipment will depend on quality documentation becoming accessible quickly to those needing it. A significant effort by the selected proponent, the FCC staff, and the appropriate industry standards-setting bodies will be required if the information is to be accurately and rapidly disseminated. Technical support of others by the selected proponent probably also will be needed. The tasks will require a significant commitment by the selected proponent. It is likely that the same personnel developing the system designs and the demonstration hardware will subsequently be needed to prepare the documentation required of the proponent. Another consideration is that the required level of documentation very likely involves the release of proprietary information. All proponents may not be equally qualified for these tasks.

Because of the potential impact of the timing of the release of the technical information, IS/WP-2 has called this matter to the attention of the Implementation Subcommittee and has itself begun examination of possible mechanisms for facilitating early dissemination of the data.

C. Impact of assumptions on implementation time

The impact of assumptions on implementation time is demonstrated by the particular case of the transmitter facility, critical to the timing of the beginning of broadcast service, for which two different sets of assumptions and charts were generated: one for a "typical" implementation scenario, and one for a "minimum" time to completion. Assumptions previously made about tasks for the ATV transition of broadcasters resulted in implementation times considered "typical" by IS/WP-2. Station channel assignment was assumed to occur later than the final Report and Order. Times estimated for completion of tasks such as litigation (based on prior experience), local government approvals (at typical processing times), Federal government approvals (at anticipated processing times), and land acquisition (at typical time) were used

in creating example PERT & Gantt charts for the transmitter implementation under two scenarios (existing tower and new tower).

A second set of assumptions has been developed leading to minimum implementation times, wherein station channel assignment is assumed coincident with the Report and Order establishing the HDTV service, no time is allowed for litigation, local government approvals are accelerated (90 days), Federal government approvals are accelerated (90 days), and land acquisition time is reduced.

The IS/WP-2 implementation studies under the two sets of assumptions discussed above show implementation times for a broadcaster as in the following table, in months. These examples present a range of possible implementation scenarios and point out that different activities can end up on the critical path when different underlying assumptions are made. For instance, in the case of a station using an existing tower, the "minimum" implementation time scenario shows that the encoder and exciter development are on the critical path. For the "typical" implementation time, these are not on the critical path.

Table 1

	New Tower Not Required	New Tower Required
Start to On-Air [1]	(Time in months)	
Minimum Time	16½	22½
Typical Time [5]	25½	42½
CP to On-Air [2]	(Time in months)	
Minimum Time	10½ [3]	8½
Typical Time [5]	16½ [4]	12½

[1] Start to On-Air time is from the station beginning the implementation process to the station being on the air with programming

[2] CP to On-Air time is from issuance of the FCC Construction Permit to the station being on the air with programming

[3] Equipment availability is on the critical path

[4] Local approvals are on the critical path

[5] Unlike the "Typical" PERT and Gantt charts, the "Typical Time" values given here do not include time for station assignment or litigation

The studies thus confirm that the 3 year/2 year proposal contained in the NPRM released 11/8/91 is reasonable in the abstract: a typical station committing to do so can be expected to be on the air within a five year cycle, including construction within a 2 year window from construction permit to on-air. In practice, however, this study and other work of IS/WP-2 suggest several additional observations:

1. No station can be expected to complete normal construction to on-air operation within the first year, few in the second.

2. A significant number of stations will require new antenna towers and sites.[1] This includes some stations in major markets, as evidenced by the Local Area Groups discussed above.

3. Few, if any, stations will achieve the minimum time. Not all stations will achieve even the typical time. Some will encounter significant uncontrollable delays. The Commission's Rules to administer the HDTV implementation should recognize and deal with this circumstance.

4. The proposed time limits would represent a significant truncation of the time interval over which stations are expected to implement, as compared to the broadcaster expectations of that time. Through survey questions posed to group owners and a sample of individual stations, IS/WP-2 has examined technical staffing and the manpower which could be made available for HDTV implementation. IS/WP-2 has concluded that the manpower that is forecasted to be available would support industry implementation to pass-through capability if the station starts are time-phased over the intervals suggested by CBS and the group owners. No such assertion can be made for the shorter schedule proposed by the Commission. (The personnel requirements are far more acute for the implementation for local origination than for the studio and transmitter pass-through. Local origination requires a much greater change and expenditure, and is likely to take considerably longer.)

D. Preference for time phased station implementation

Inputs to IS/WP-2 from its survey of station group owners show that it is in broadcasters' interests to time-phase the start of HDTV station implementation (and also to time-phase the degree of implementation accomplished, initially providing pass-through capability). A similar approach,

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[1] IS/WP-2 Second Interim Report to Implementation Subcommittee.

A survey of television stations suggests that 45 per cent may need a new tower (and some a new site), even for a "low-power" ATV implementation.

in which increasing numbers of stations started the transition process in succeeding years, was adopted in the CBS study. As in the CBS study, the owners plan to start with their largest markets first, moving later to the smaller markets. The staggering of implementations anticipated by both CBS and the group owners surveyed (even with what some see as their optimistic views about implementation time) results in approximately 50% of the stations reaching pass-through after 5 years.

The time restrictions proposed in the NPRM released 11/8/91 would preclude much of the time-phasing of station conversions desired by the broadcasters surveyed and suggested by CBS. Truncation of the implementation cycle will lead to the loss of some important benefits that would accrue from the staged approach. Specifically, it will:

- increase capital demands on groups, due to simultaneous construction;
- negate some of the equipment cost reductions forecasted by CBS and SS/WP-3, since design refinement and productivity increase require both time and work, not merely higher volume; and
- exaggerate the problem of financing the on-air operations of some stations, since the earlier the start, the smaller the audience.

E. Need for delay in applying

IS/WP-2 studies suggest that implementation realities and early filing by broadcasters for a construction permit (CP) for HDTV operation are in serious conflict. Many stations will find it necessary to delay application for an HDTV assignment so that they can accomplish as much as possible before issuance of a CP. This will guard against the erosion of the proposed two-year construction window by events that are either uncontrollable or which can be undertaken before a CP is issued. Examples of potentially uncontrollable events include site acquisition, various governmental approvals, and equipment procurement. The need to delay filing is obvious for (but not limited to) those stations requiring a new antenna tower. Study of the estimated times for implementation shows that 1-2 year delays should be expected.

If the method of channel assignment is first-come, first-served (Paragraph 19 of the NPRM), a broadcaster can be in an untenable position — it can elect to apply and risk being unable to build or elect to delay and risk receiving an "inferior" channel. In addition, there would be de facto discrimination against those that require a new tower compared to those that do not.

IS/WP-2 suggests that one way to further the Commission's desire for an early showing of support for HDTV implementation while at the same time easing the broadcaster's dilemma would be to encourage early filing by granting to early applicants an extension of the time they have to build.

F. Availability of Consumer Product

The implementation study on the consumer products segment - HDTV receivers - projects general market availability 3½ years after the release of full technical information (assumed to be coincident with the NPRM proposing a system selection) and 2½-3 years after the Report and Order authorizing the HDTV broadcast service. While it has been suggested that a proponent/manufacturer could have a 6-9 month advantage over this development time, it is generally agreed that consumer acceptance and significant market growth will be contingent upon product availability from a broad representation of the industry.

The development cycle is thought to be representative of a major new technological product involving several iterations of large scale, custom integrated circuit (IC) development. A manufacturer choosing to purchase, rather than develop, the semiconductor content would not have a significant time advantage. The ICs would still have to be developed. The prospective purchaser would still lack the application experience and head start gained by a receiver manufacturer/developer through several iterations of design.

The implementation cycle for consumer products is of equal importance to that for getting broadcast transmitters on the air and can affect the work and conclusions of the Commission and of other Working Parties of the Advisory Committee. Some have projected that HDTV receiver penetration will be seeded by demand for receivers stimulated by other media, before availability of terrestrial HDTV broadcasting. The scenario developed to date by IS/WP-2 for availability of technical information and standards and subsequent development of receivers does not support such a projection.

Because of the importance of receiver availability in the implementation process, IS/WP-2 has asked all consumer products manufacturers (EIA list) for comment on the receiver development charts and assumptions. Because of the importance of the consumer VCR in the marketplace, IS/WP-2 has also asked for comment on applicability to VCR development.

V. Future Activities

The Working Party has planned its expected activities through the end of the Advisory Committee process and the preparation of its final report. The major known items are summarized here. Others that may arise in the future will be considered as they occur.

A. Proponent Meetings

Follow-up meetings are planned in mid-March with the proponents for their response to IS/WP-2's questions and their comments on the information

presented to them at the meeting previously held. They have been asked to identify system-specific aspects of the implementations of their systems and to address various issues relevant to the implementation process. They have been asked to answer a specific list of questions and to discuss the materials prepared by IS/WP-2 as they relate to their respective systems.

B. Survey Of Equipment Manufacturers

As mentioned above, the availability of professional equipment will be critical to the implementation of Advanced Television and may lie on the critical path to achievement of that milestone. The information obtained previously from manufacturers of such equipment, although helpful, was less than adequate. As a result, IS/WP-2 plans a new survey of the manufacturers in the near future.

In addition to manufacturers' expectations about the availability of equipment for each of the proposed systems or its required input infrastructure, IS/WP-2 will be seeking a greater depth of understanding of the interrelationship of such availability to other aspects of the transition process. In particular, manufacturers' inputs will be sought on the impact on their design & manufacturing schedules of their access to the detailed technical information required to support design. They will be asked about their plans for providing initial equipment built to the system selected by the FCC. Included in the inquiry will both their schedules and their expectations on the form initial equipment will take. This will have a significant impact on its availability in production quantities and on its cost. They will also be asked about their plans for more mature equipment designs, at what quantities reduced pricing comes into play, and in what time frame such mature equipment is expected to be marketed.

C. Survey Of Video Software Providers

Since program source material is an important and integral part of an HDTV system, IS/WP-2 has been asked to survey video software providers to solicit their plans for supporting the implementation of HDTV. As a preliminary to any such potential work, IS/WP-2 will contact some key individuals within the industry to learn whether the problem is sufficiently worrisome to require a full survey, with all that it entails. Should there be indications of a significant issue for implementation of HDTV, IS/WP-2 will then develop a survey designed to learn how and when software is expected to become available.

D. Consumer Electronics Manufacturers Survey

The timing of the general availability of consumer equipment (receivers and VCRs) in the marketplace is crucial to the projection of the timing of most other aspects of the transition to Advanced Television including, most

importantly, consumer penetration itself. The experts from the consumer electronics industry participating in IS/WP-2 have made certain projections that recently have brought this item into focus.

Because of its significance, IS/WP-2 is currently validating its work with a wider group of experts than just those who participate in the Working Party. A survey has been sent to the members of the committee of the Electronics Industries Association responsible for television receiver issues. They have been asked to examine the IS/WP-2 work and comment on the tasks, the assumptions behind them, and the durations they are likely to take. Analysis of the responses will be an important part of IS/WP-2's future efforts.

E. Group Owners Repeat Survey

The proposal in the FCC Notice of Proposed Rulemaking released November 8, 1991, to require stations to "use or lose" their channel assignments has cast some doubt over the usefulness of some of the data collected by IS/WP-2 in its survey of station group owners. Consequently, IS/WP-2 is currently examining the possibility of conducting a repeat survey. The survey would seek owners' expectations for implementation under a regime such as that proposed in the Notice. It will explore the effect of such "regulatory incentives" on the expected speed of implementation by group-owned stations.

F. The Final Analysis

Once it has gathered all the relevant data with respect to each of the industry segments that time will allow, IS/WP-2 will undertake to integrate the information obtained into a unified picture of the eventual transition to Advanced Television. This cross-industry overview will be important to make apparent the many linkages that will exist between the various industry segments and the inter-dependencies of the tasks they will be performing. It will help to highlight the remaining issues and the things that might be done to help the transition proceed more smoothly and more rapidly.

VI. Conclusions

The work of IS/WP-2 is sufficiently advanced, covering a broad enough range in adequate depth, that a number of conclusions can be at least preliminarily drawn. While any of these results technically are modifiable until the final report of the Working Party is released, the evidence for these conclusions is strong enough that the Working Party feels they should be stated publicly at this time.

A. Technical Information

The availability of technical information is crucial to the implementation of Advanced Television. If adequate attention is not paid to this issue, Advanced Television cannot be implemented on the aggressive schedule the Commission seems to be favoring. After the system selection decision itself, this one item has the greatest potential to delay the implementation of Advanced Television among the tasks that must be carried out.

The structure for the necessary documentation and the responsibility for its generation should be established well in advance of a system selection. The system selection should be announced as soon as it has been made, if possible before other formalities are completed, so that the documentation process can start at the earliest possible moment. It is assumed that a proponent will not be willing to invest in this documentation effort until it knows that its system has been selected.

B. Critical Path Tasks

Each transition scenario for each industry segment has a number of tasks which effectively control the period of time required to complete the transition. These tasks are critical tasks because when they grow longer so does the total implementation time. Some of the critical tasks, however, will have a much greater influence on the overall implementation of Advanced Television than do nearly all of the others. Often they are the same tasks applied to several industry segments. These are pointed out here for the special attention they deserve.

Technical Information Available — This is the same issue discussed in A. above. It is repeated here because of the significance it has for every one of the transition scenarios. It is on the critical path, directly or indirectly, of every scenario. The timely availability of this information is a major assumption for all of the scenarios and is particularly critical to the broadcast, professional equipment, consumer electronics, and cable scenarios.

IC Design — Integrated circuits to implement the selected system form the basis for the design and manufacture of equipment of all kinds in each of the industry segments. ICs will be particular critical to the consumer electronics and cable industry segments because of the very large quantities involved. Any delays in their development will have an unusual impact on the overall length of the scenarios they impact. This is because, where most tasks stretch out a day at a time, IC development can increment a month or more at a time when initial designs do not work and must be modified and tried again.

Equipment Availability — System-specific professional equipment is required for most of the industry segments, including broadcast, network,

production/post production, cable, and satellite. Availability of the professional equipment, in turn, will be dependent upon a combination of the availability of the requisite technical information for its design and the difficulty of implementing the particular system selected in hardware. Assumptions have been made about the availability of the equipment. To the extent those assumptions are incorrect, the length of implementation for each of the industry segments will be similarly impacted.

Satellite Space Segment Availability — Availability of satellite transponders has been assumed in the satellite transition scenario and indirectly in all of the other scenarios that depend on satellite distribution of signals. These include the local station, network, and cable scenarios. Lack of a space segment for any program distribution dependent on satellite delivery will preclude that service from implementation. To the extent that HDTV requires additional transponder channels, this could be a seriously limiting factor. Systems that can reuse or share existing transponder space can ameliorate this situation.

C. Broadcaster Interests in Staged Implementation

The FCC proposal for a tight time schedule for implementation based upon "regulatory incentive" does not comport well with broadcaster infrastructure and their interests in a staged implementation of HDTV. IS/WP-2 has found that adequate design personnel resources are available for the staged implementation to the pass-through milestone sought by broadcasters and documented by CBS. No such findings have been made regarding the faster implementation desired by the Commission. In fact, there is very strong evidence that in a large number of cases, especially in larger cities, broadcasters will not be able to achieve the Commission's timetable, at least for full facilities, no matter how hard they try and no matter what resources they apply.

D. Availability of Consumer Receivers

Consumer HDTV receivers may very well not be generally available in the marketplace as quickly as has been predicted in some quarters. Detailed study by receiver manufacturers shows that it will take some 2½-3 years following the FCC decision on a system to begin delivery of consumer receivers into the distribution channels. This is very likely to be a gating item in HDTV implementation. It is of such significance that a wider range of inputs is being sought from consumer electronics manufacturers.

E. Availability of Professional Equipment

Professional equipment must be available to a wide range of participants in the production and delivery of programming before HDTV can regularly be produced and delivered to viewers. Certain assumptions have been made in

developing the transition scenarios that depend heavily on professional equipment being available. Reality may not match the assumptions, and this may become a gating item in the implementation of HDTV. Because of the importance of this item, a survey of manufacturers will be taken again to try to gain a better understanding of the timing of the availability of professional equipment.

Appendix A

Survey of TV Station Group Owners

Summary

The resources available for conversion to HDTV can affect the implementation schedule. The Implementation Subcommittee asked IS/WP-2 to supplement its survey of individual stations with an inquiry into additional resources which may be available. It was decided to gather relevant information from TV station group owners. The survey objectives were: 1) to obtain estimates for current human and financial resources and for the manpower which could be made available to supplement that already available at their stations for a major design and construction project, and 2) to elicit the HDTV implementation intentions of group owners.

Methodology/Administration

Station group owners were chosen as the target for the survey because they represented a means to gather information relating to a large number of stations with a smaller survey contact list. All groups listed in the TV Fact Book with three or more stations plus some well-known groups with two stations were selected. The survey was executed on a "pro bono" basis by members of the Working Party. The survey was administered via mail with responses coded for privacy. A second mailing was undertaken to encourage cooperation of non-respondents. The survey was conducted in the summer of 1991. Note that this was before the Notice of Proposed Rulemaking by the FCC on November 8, 1991. No conclusions can be drawn regarding the results that might have been obtained had the proposal for "regulatory incentive" contained in the Notice been known to the respondents.

Response Rate

Questionnaires were sent to 107 groups. Responses were received from 62 groups for a 58 per cent response rate. There were a total of 265 stations covered by the responses.

Statistical Significance

No analysis of the response distribution was undertaken. Given the nature of the selection of the sample, no projection to all TV stations is reasonable. Given the sensitivity of the issues involved, there may be significant non-response bias, and the results should be used with caution. Non-response may have been for reasons of privacy, inertia, or disinterest. Some groups may not have envisioned implementing HDTV in the six year period covered by the questionnaire.

Questionnaire Design

The questionnaire had three major sections. The first section was designed to gather information about the engineering resource on staff and available for a major project. Questions were also asked about the group operation so that responses potentially could be correlated with those of the Chief Engineer survey. The next section was designed to determine the size of the past annual capital budget for the five largest stations in the group. The third section was designed to obtain an estimate of when the group owners thought they would implement HDTV at these five stations. See the attached questionnaire for the specific questions.

Analysis of Responses

The survey yielded helpful information about the implementation expectations of group owners and the amount of engineering manpower available.

1. Implementation Timing

Addressing the implementation timing first, the respondents were asked in which years following FCC adoption of a system they expected to start construction and to complete pass-through facilities for HDTV. The survey respondents' estimate of the interval from start to pass-through, as compiled by IS/WP-2, had the distribution in Table 1 below. The average of these durations is between 1 and 2 years.

Table 1

#	Duration in Years — Station Start to Pass-Through
24	< 1
123	1-2
22	2-3
7	3-4

is the Number of Stations projected to achieve Pass-Through operation in the duration (from starting implementation to reaching pass-through) shown in the right-hand column.

The expectations of the respondents with regard to the years following an FCC decision in which they think they will start implementation and achieve pass-through operation are indicated in Table 2 below. The percentages are based upon all stations in the groups that responded. The results cannot be extrapolated to all stations in the U.S. because of the sample design.

Considering the groups themselves, there were 43 groups of the 62 responding that expected to start implementation at their first station within the first three years after a final FCC decision on a system. 66 per cent of the stations represented were expected to start implementation in the first five years following the FCC decision on a system. 58 per cent of the stations covered were expected to achieve pass-through in the first five years.

Table 2

	Implementation Start			Achieve Pass-Through			Percent
Year	Number	Percent	Cum %	Number	Percent	Cum %	Active
1	47	18%	18%	8	3%	3%	17%
2	33	12%	30%	37	14%	17%	30%
3	48	18%	48%	34	13%	30%	46%
4	25	9%	57%	39	15%	45%	54%
5	23	9%	66%	35	13%	58%	58%
6	20	8%	74%	24	9%	67%	56%
6+	30	11%	85%	24	9%	76%	59%

The table also shows the percentage of these groups' stations that are active in construction during each year. Percent active is the number of stations that have started but not completed full implementation of HDTV. Because the end period given in the study is 6+ years and because of the large number of entries in that period, the data does not support an analysis of the average duration to full implementation of HDTV. The overall conclusion can be drawn from the data, however, that most large group stations are not expected to complete full implementation of HDTV by the end of the first six years.

In addition to the stations covered in the preceding table, there were 37 stations included in the responses for which the group owners either did not provide any starting information or said the stations would not convert to HDTV.

2. Resource Availability

The data on personnel resource available to support implementation is best used in the aggregate. The number of sample points decreases to too low a level for confidence with more than a single division. Various analyses with high vs. low capital spending do not show better correlations than the total data. The data does show that about 31% of the groups have no group level or sister station personnel resource to apply to station implementation efforts.

The resource available from the remaining 69% of the groups is very limited. For transmitter implementation, the groups could provide about 1/2 person per station assuming all stations were active at the same time. Those groups with more than 5 stations would have even less. The situation improves significantly to over 2 persons per station if stations are time phased. The loaning of resource between sister stations is a significant contributor to this increase.

The table below shows the average resource available based upon the groups' forecast of implementation timing.

Table 3

Pass-Through Implementation — Transmitter Design								
Year [1]	1	2	3	4	5	6	6+	Sample Size
All Groups [2]	1	2	1.7	1.5	1.4	1.2	1.3	62
w/Resource [3]	1.7	3.6	2.7	2.3	2.1	1.8	2	42

1 "Year" is the year number following an FCC Report and Order establishing an HDTV service.

2 "All Groups" represents the number of personnel per station that could be made available to supplement station personnel when the available supplemental personnel are averaged over all the groups responding.

3 "w/Resource" represents the number of personnel per station that could be made available to supplement station personnel when the available supplemental personnel are averaged only over those stations owned by groups that indicated they have personnel to support their station, either from the groups or from sister stations.

Studio implementation resource data is similar to the transmitter implementation data shown above. It was apparent from the questionnaires that many respondents assumed that the studio and transmitter implementations would be sequential; so the total resource is less than the sum of transmitter and studio estimates. Nevertheless, the data appears reasonably in agreement with the small station Chief Engineers' expectations of 1.7 man-days per week of support from their groups.

It was anticipated that the capital expenditure responses would be useful in segmenting the responses in order to better correlate the Group Owners survey with the Chief Engineers survey. This did not turn out to be the case.