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Chairman

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FCC ADVISORY COMMITTEE ON ADVANCED TELEVISION SERVICE

SYSTEMS SUBCOMMITTEE

FOURTH INTERIM REPORT

FINAL VERSION - 3/8/91

Irwin Dorros

Chairman, Systems Subcommittee

FCC ADVISORY COMMITTEE ON ADVANCED TELEVISION SERVICE

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SYSTEMS SUBCOMMITTEE

FOURTH INTERIM REPORT

1.0. Introduction

1.1. Charter and Organization

In the Charter of the Advisory Committee on Advanced Television Service, the FCC assigned the Systems Subcommittee (SS) the objective to specify the transmission/reception facilities appropriate for providing advanced television (ATV) service in the United States. The scope of this function, as specified on page 2 of the Charter, includes the following activities:

"(a) Evaluate, on technical and economic bases, advanced television systems now under development for the purpose of determining feasibility for implementation in the United States;

"(b) Recommend advanced television system(s) now under development as candidate(s) for implementation, or specify the design of an appropriate system.

"(c) Advise on the appropriate transmission/reception technical standards and spectrum requirements for the recommended system(s)."

In brief, the Systems Subcommittee is to apply the guidance of the Planning Subcommittee (PS) to the technical analysis, testing, and economic analysis of various ATV system proposals, and develop a recommendation for the optimal ATV standard(s) for the United States. The recommendations of the Systems Subcommittee will be used both by the full Advisory Committee in its advice to the FCC, and by the Implementation Subcommittee (IS) in its identification of regulatory and policy issues and the development of a transition scenario to introduce a terrestrial broadcast ATV service.

The Subcommittee's organization includes Irwin Dorros (Bellcore) as Chair, and John Abel (National Association of Broadcasters) and Tyrone Brown (Steptoe and Johnson) as Vice Chairs. The Chair and Vice-Chairs of the Subcommittee, along with the Chairs and Vice-Chairs of its Working Parties, are collectively referred to as the Officers.

The substantive work of the Subcommittee has been divided into four Working Parties: (1) Systems Analysis; (2) System Evaluation and Testing; (3) Economic Assessment; and (4) System Standards. The Systems Subcommittee organization chart is included as Attachment A, which provides the names and affiliations of each of the officers. Attachment B is a listing of the Subcommittee meetings.

The functions of each Working Party (WP) are briefly described below, and summaries of their progress are provided in later sections of this Report. Detailed reports from each of the Working Parties are included as Attachments D through G. The *Test Sequence & Calendar* issued by the Advisory Committee, in cooperation with the Advanced Television Test Center (ATTC), the Cable Television Laboratories (CableLabs), and the Advanced Television Evaluation Laboratory (ATEL) of Canada, is Attachment H.

Each Working Party has a Chair and three Vice Chairs, selected for their expertise as well as to provide balanced industry representation. Membership in the Working Parties is open to the public. All Subcommittee and full Working Party meetings are conducted in open fora.

SS/WP1 (Systems Analysis) is charged with collecting information from ATV proponents, analyzing the technical content of that information, and recommending which systems should proceed to the stage of testing by SS/WP2. Analysis of ATV systems is to be done in accordance with the guidance provided by the Planning Subcommittee, in particular, PS/WP1 (ATV Attributes).

SS/WP2 (System Evaluation and Testing) is charged with carrying out the appropriate objective and subjective testing of systems that have passed through the SS/WP1 screening program. Technical and procedural guidance are provided by several Working Parties in the Planning Subcommittee, particularly PS/WP2 (Testing and Evaluation Specifications) whose output is expected to incorporate the decisions of PS/WP1 (ATV Attributes), PS/WP4 (Alternative Media), and PS/WP6 (Subjective Assessment). The results of the SS/WP2 testing program will be key inputs to the SS/WP4 work on recommending the optimal ATV standard(s), and PS/WP3 as it considers spectrum utilization issues.

SS/WP3 (Economic Assessment) is charged with estimating the costs associated with each of the ATV systems. Guidance is to be provided by PS/WP5 (Economic Factors and Market Penetration) and IS/WP2 (Transition Scenarios). The economic analyses produced by SS/WP3 will be key contributions to the deliberations of SS/WP4 as it evaluates the various systems.

SS/WP4 (System Standards) is charged with recommending the ATV transmission standard(s) for the United States. As indicated above, key inputs will come from the other three SS Working Parties. In addition, SS/WP4 will consider the guidance and information provided by the Planning Subcommittee's Working Parties, as well as its Advisory Groups on Creative Issues and Consumer/Trade Issues. The recommendations of SS/WP4 will be used by the Advisory Committee in its advice to the FCC and by the Implementation Subcommittee in developing a plan for introducing a terrestrial ATV service in the United States.

1.2. The Decision-Making Process

A discussion of the decision-making process was first introduced in the Second Interim Report, issued April 1989. It bears repeating, since it provides both the backbone and the context for the work of the Systems Subcommittee.

The decision-making approach used by the Systems Subcommittee and its Working Parties, consistent with the guidance of the Advisory Committee Chair, is to work toward group consensus. We realize that some issues may be contested and consensus may be difficult to reach at times. Voting has been suggested as an alternative to resolve difficult issues. It is important, however, that the Subcommittee's recommendations have the overall support of the industry, and the best way to achieve that result is to forge a consensus.

Clearly, there may be issues on which a minority view (or views) may persist. The Subcommittee has decided to handle those issues in the following manner: the officers of a particular group (Subcommittee or any of its WPs) will make a determination of the general consensus on each issue, and reflect that in their draft report; then, members of the group will be provided with an opportunity to review the report, the group's officers will respond to the comments, and those members with residual minority views may submit their views, in writing, to be appended to the group's final report.

Some participants may view the development of a recommended standard as a "horse race" among the various proponents' systems, with a single winner and the rest losers. The Subcommittee does not share that view. Our objective is to examine the technical and economic characteristics of the various ATV system proposals and achieve industry consensus on the optimal ATV standard for the United States -- one that could be in use for the next forty years.

Recognizing the importance of the recommended standard, and the importance that the terrestrial broadcast standard will have on the industry infrastructure as a whole, the Subcommittee sees a need to conduct extensive objective and subjective tests of the proposed systems, as well as field tests, before a recommendation is reached. We will also place a high priority on examining how well the proposed system or systems can be interfaced with alternative delivery media, especially cable systems and consumer VCRs. Performance on a cable system will be part of both the laboratory and field test procedures. While the Systems Subcommittee will not be asking proponents to provide video recording equipment for testing, it does plan to determine that proposed systems will not adversely affect the cost and complexity of this popular consumer item.

We also recognize, however, a need to reach a timely decision in order for the FCC and the industry to move forward with ATV implementation. Thus, we are exploring means to expedite the testing process without sacrificing any of the depth necessary to make an informed decision.

The ATV transmission standard to be recommended by the Subcommittee may relate entirely to one of the system proposals submitted, or it may be some synthesis of the best features of several proposals. Such a synthesis may result from the deliberations of SS/WP4 or, ideally, from the proponents themselves. Industry agreement on a standard, prior to the Advisory Committee's recommendation to the FCC, will speed the eventual introduction of an ATV service in the United States.

1.3. Flow of Information

In an undertaking as complex as the Advisory Committee's work, with its many constituent parts, a road map is essential to understand how the pieces fit together into a cohesive whole. The drawing reproduced in Appendix 1 of this Report, entitled *Information Flow in the Advisory Committee*, was created by SS/WP4. It is a useful guide to structure the flow of information, and to understand that structure.

As the body responsible for administering the test program, SS/WP2 is shown as the group managing the test results from the three laboratories. It serves as the single point of contact for the laboratories, and is then responsible for distributing the test data to other groups which need them in a timely fashion. The procedures for distribution are detailed in the Test Management Plan (document SS/WP2-0124).

The Systems Subcommittee generally believes that the best way to get useful information is for the user of the information to specify its needs. Therefore, each group in the Systems Subcommittee which requires information from another group (in the form of a report) will write an outline for the report. The outline will specify both the information needed, and the desired form of that information. As shown in Appendix 1, SS/WP2 will stipulate the form of the report it expects from each of the laboratories, and SS/WP4 will specify the form of the report it expects from SS/WP2. SS/WP4 will also specify the form of the reports it expects from other entities in the Advisory Committee, such as the Working Parties in the Planning Subcommittee, and we strongly urge those entities to do the same for the information they need.

1.4. Key Issues

1.4.1. Time Available for Field Testing

The Systems Subcommittee is committed to the schedule required by the FCC. We plan to make every effort to conclude our work in sufficient time to allow the Advisory Committee to release its final report on 30 September 1992. Everyone concerned with the process realizes that the timetable is challenging. Given that the laboratory tests have been delayed several times, many knowledgeable people feel that the deadline is now *too* challenging, that too little time will be available to do an adequate job of testing the systems under actual working conditions in the field. Jules Cohen, a noted expert in this area and Chair of SS/WP2's Field Test Task

Force (the group responsible for writing the Field Test Procedures Plan), articulated this concern in a letter to Mark Richer, Chair of SS/WP2. His letter states, in part:

> *"The procedure provided (in the Field Test Plan) is far from the ideal for field testing of what we hope will be the North American standard for terrestrial broadcasting of an Advanced Television System --- a standard as enduring as the NTSC that it replaces. What we have done in the Task Force is develop a procedure consistent with the time restraints (and likely cost restraints) of the schedule decreed by the Commission and the Advisory Committee. A more logical procedure, from an engineering viewpoint, is to extend the field testing for a period likely to spread over two years. During that time, several experimental transmissions would be initiated and prototype receivers placed in a relatively large number of receiving locations. The system would be given a real "shakedown" and modifications made to correct weaknesses found.*
>
> *"Adherence to the present schedule may not even afford the time needed to carry out this limited test procedure provided. If ATTC testing of the last system is to be completed in April, 1992, followed by subjective testing in Canada, an analysis by PS/WP-3 to determine permissible power level and accommodation characteristics for the systems, analysis by SS/WP-4 of both test data and spectrum studies, followed by selection of the system (or systems) for field test, how much time can be available prior to mid-August for the test procedure? Since the Advisory Committee deadline for a report to the Commission is September 30, 1992, SS/WP-4 will surely have to have in hand by mid-August all relevant data so that its draft report can meet the schedule."*

The possibility of recommending a system to the FCC without field testing, without having verified its operation under actual field conditions, has been discussed several times and found to be unacceptable. However, the time available for field testing is bounded by two dates: the conclusion of the laboratory testing, and 30 September 1992, the date of the Advisory Committee's final report to the FCC. Since the start of laboratory testing has been delayed, to April 1991, the conclusion of laboratory testing will also be delayed. If all goes according to the schedule, the subjective assessment tests will conclude in June 1992, leaving less than four months to conduct the field tests, evaluate the data, and write a report. In the opinion of many experts, this is clearly inadequate. We raise the issue again to encourage a thorough discussion and realistic consideration of options by the Advisory Committee.

1.4.2. Consumer Acceptance of ATV

In the course of its discussions with Planning Subcommittee Working Part 5, SS/WP3 uncovered what it calls "a serious void" in the work of the Advisory Committee as a whole. The Working Party considers it critically important to

understand what the American consumer will consider to be a dramatic enhancement of the overall television viewing experience. In other words, how high must the quality of an ATV image be to motivate the successful adoption of a new television service? The conviction that a major omission had been discovered gained momentum at almost the same time that Planning Subcommittee Working Party 7 on Audience Research reported its inability to implement a program to begin to answer these very questions.

There are a variety of implications linked to this issue. First, the final design compromises inherent in any system development effort would be helped considerably by the knowing what the consumer would judge to be an enhanced viewing experience. The knowledge of what screen size is required to adequately portray the new images is crucial to ATV receiver manufacturers. SS/WP3 has already identified screen size as the most critical cost element within the receiver. Finally, a better understanding of the ATV picture criteria in the home of the consumer would allow better compromises to be made in the studio origination equipment, compromises to help ensure that the received signal quality is maximized in a cost-effective way for the broadcaster.

SS/WP3 believes that a lack of information on consumer reactions to ATV is a fundamental flaw in the entire process, and urges the Advisory Committee to expeditiously address this issue.

1.4.3. Delivery of Format Converters

One of the key pacing items for the entire testing process is the digital format converter, a device designed by the Advanced Television Test Center (ATTC) staff to permit recording and playing back several video formats for which the Sony digital VTRs were not specifically designed. It is this device which allows the ATTC and the Canadian Advanced Television Evaluation Laboratory (ATEL) to provide source material in formats required by some of the systems. It is a vital component of both the objective and subjective tests. In a real sense, it makes the testing program possible.

Under terms of its contract with the ATTC, Tektronix, the manufacturer of the format converter, has made them available for purchase by the system proponents. Several companies have placed orders for one or more of the machines to assist in their development efforts. Neither the Advisory Committee, nor the ATTC have been part of these negotiations.

The Systems Subcommittee is aware that the devices have not yet been delivered. While the purchase of these machines is a private matter between the system developers and Tektronix, and the testing program will not be delayed to accommodate a late delivery of the format converters, we do wish to acknowledge for the record that some of the proponents feel they have been disadvantaged by not having them available. We urge the principles to quickly resolve the situation.

We are, however, directly concerned with another aspect of the matter. The ATEL has also purchased a format converter for use in subjective assessments of the ATV systems. It is a vital element of the test program. If delivery of that particular device is delayed, the entire testing program will be delayed, as there is no slack time in the schedule to recover from a late start. Delivery of the format converter for ATEL is a main line, critical path item for the entire testing process.

1.4.4. Testing of Digital Systems

The testing program has taken on a new dimension with the submission of three more digital systems. If certified by SS/WP1, that will bring the number of digital systems to four, out of a total of six to be tested. Since the existing test procedures were written for analog systems, and the new digital systems are fundamentally different, some new tests will have to be developed, and some new procedures will have to be written to exercise them.

The time needed to perform these new tests is a grave concern. Since the total test program cannot be extended, some existing tests may have to be eliminated to make time available for the digital tests. SS/WP2's Task Force on Prioritization, along with the test laboratories, is closely reexaming the time needed for the total test program. Based upon the results of that study, SS/WP2 may elect not to perform some of the tests. This work is planned to be finished prior to the start of testing on the first system.

2.0. Systems Analysis - Working Party 1

2.1. Charter and Organization

Systems Subcommittee Working Party 1 (SS/WP1) has the responsibility to analyze the various systems proposed for the distribution of ATV, determine the technical viability of each, and if appropriate, certify them for testing by Systems Subcommittee Working Party 2. SS/WP1 is guided in its work by the attributes developed by the Planning Subcommittee.

The Chair of SS/WP1 is Mr. Birney Dayton of NVision. He is assisted by three Vice-Chairs: Mr. Carl Eilers of Zenith, Dr. David Kettler of BellSouth Services, and Mr. John Swanson of Cox Broadcasting. The Secretary for the group is Mr. Bill Gaylord of BellSouth Services.

2.2. Summary of Progress to Date

At the meeting on 22 June 1990, an Analysis Task Force was formed, Chaired by Bob Keeler of AT&T, to develop a detailed technical assessment of each system as part of the final certification procedure. This work is discussed further in Section 2.2.2., below.

2.2.1. Status of Proponents and Systems

The pace of system development has continued to accelerate in the year since the Third Interim Report was issued. At that time, seven proponents had reserved a total of nine access periods or test "slots" on the *Sequence & Pro Forma Calendar* jointly developed by Advisory Committee, the Advanced Television Test Center (ATTC), and the proponents themselves. The seven entities were: Faroudja Laboratories, Production Services, the David Sarnoff Research Center, NHK, MIT, Zenith, and the Advanced Television Research Consortium (ATRC), an organization consisting of North American Philips Consumer Electronics Company, NBC, Thomson Consumer Electronics, and the David Sarnoff Research Center.

Subsequently, Faroudja and Production Services withdrew their systems from consideration, and General Instruments submitted a system called DigiCipher. Because it is an all digital system, DigiCipher was different from the other proposals at that time. Other companies, however, were also known to be considering the development of a digital system throughout the fall of 1990.

On 14 November 1990, Mr. Wiley wrote to the companies which had reserved test slots and asked them to declare their intentions by year's end. Two proponents, Zenith (in conjunction with AT&T as a co-developer) and the ATRC, replied that they did indeed intend to submit digital systems. On 29 January 1990, General Instruments and MIT announced the formation of the American Television Alliance, created for the purpose of jointly developing all digital, simulcast HDTV systems.

The current test schedule in Attachment H (*Test Sequence & Calendar*) shows six slots reserved by six proponents. The six are: the David Sarnoff Research Center (ACTV), NHK (Narrow MUSE), General Instruments (DigiCipher), Zenith/AT&T (SC-HDTV), North American Philips Consumer Electronics Company (Analog Simulcast HDTV), and MIT (Channel Compatible HDTV). It appears that the changes are not over yet. According to declarations by the proponents, the last three submissions will soon be replaced. Zenith/AT&T intend to submit an all digital system, Digital Spectrum Compatible HDTV, in place of SC-HDTV, the Advanced Television Research Consortium (ATRC) intends to submit an all digital system, Advanced Digital Television, in place of North American Philips' Analog Simulcast HDTV, and the American Television Alliance (ATA) intends to submit an all digital system, ATVA Progressive System, in place of MIT's Channel Compatible HDTV system. Being new submissions, these three systems are subject to "re-pre-certification" by WP1, as described in Section 2.2.2. below.

2.2.2. Certification of Systems

SS/WP1 is responsible by its charter for certifying systems for testing by SS/WP2. The criteria to be used for, and the timing of, this certification was the subject of lively debate in both Working Party 1 and the Systems Subcommittee.

The Advisory Committee and the Advanced Television Test Center wanted the systems to be certified as early as possible, to facilitate planning and to be sure that the correct equipment is being purchased by the laboratory. On the other hand, these systems are still in the prototype stage of development. Most are changing so rapidly that the proponents can only give the Committee a vague idea of the final technical details.

As a compromise, certification was agreed to be accomplished in two stages. The systems would be reviewed as quickly as possible and, if warranted, given preliminary certification based on the limited technical detail provided. No judgement of the technical merits of the systems would be made during this preliminary certification period. The review would consist of an overview analysis to be sure the system seems technically reasonable, combined with a judgment by SS/WP1 that the proponent will have the resources available to actually develop hardware for testing.

A proponent is obliged to reveal the full technical details of its system design ninety (90) days before that system is scheduled to move into the ATTC for testing. WP1's Analysis Task Force will then undertake a technical analysis of the system and complete it sixty (60) days before the system is scheduled to move into the ATTC. At that point, a second, rigorous review will take place at which time all the salient details of the system operation will presumably be known. Based upon this second review, WP1 will grant the system final certification for testing, if appropriate.

The Systems Subcommittee recognizes that development is continuing, and major changes may be made to a system in the period of time between preliminary and final certification. As noted above, three proponents have stated their intention to deliver essentially new systems for testing. In the event that a system has changed in a major way, it must be pre-certified a second time (re-pre-certified) to be eligible for testing. As part of its work, the Analysis Task Force has been given the authority to determine if system changes are significant enough to warrant consideration of re-pre-certification by the full Working Party.

All the systems on the current schedule in Attachment H have been pre-certified for testing, and ACTV, the first system to be tested, has been granted final certification. As new entries, Digital SC-HDTV, Advanced Digital Television, and the ATVA Progressive System will have to be re-pre-certified. New system descriptions, required for pre-certification, were delivered to WP1 by 28 February 1991, the deadline established by Mr. Wiley. Pre-certification for these systems,as well as final certification for NHK's Narrow MUSE system, will be considered at a three day meeting to be held on 20-22 March 1991.

2.3. Future Work

Based on the Attachment H version of the *Test Sequence & Calendar*, WP1 has developed a schedule for its analysis work throughout the remainder of 1991. The schedule may be found in Appendix 2 of this Report.

As is noted in Appendix 2, a three-day meeting will be held on 20-22 March 1991 in Washington. At the meeting, the members will consider preliminary certification for the three new digital systems, and final certification for NHK's Narrow MUSE.

3.0. System Evaluation and Testing - Working Party 2

3.1. Charter and Organization

Systems Subcommittee Working Party 2 (SS/WP2) was established to conduct tests of proposed ATV systems based upon test procedures designed by the Planning Subcommittee and provide information from those tests to Systems Subcommittee Working Party 4 to aid in its recommendation.

After guiding the work of SS/WP2 for more than three years, Mr. Ben Crutchfield of the Advanced Television Test Center stepped down as Chair in April 1990. The System Subcommittee would like to acknowledge Mr. Crutchfield's many accomplishments and express its gratitude for his leadership.

Mr. Mark Richer of PBS graciously agreed to take over the Chair of SS/WP2 after Mr. Crutchfield's resignation. He is assisted by three Vice-Chairs: Dr. Walt Ciciora of American Television and Communications, Mr. Joel Engel of Ameritech, and Mr. George Hanover of the Electronic Industries Association (EIA). The Chair and Vice-Chairs are collectively referred to as the Officers of the Working Party. The Secretary for the group is Mr. Alan Godber of NBC.

3.2. Summary of Progress to Date

SS/WP2 has held a total of 24 meetings to date, all in the Washington, DC area. Average attendance at a meeting is 30 persons.

Since the Third Interim Report, several new Task Forces have been formed:

Task Force	*Chair*
Test Prioritization	Lynn Claudy
Audio Test Procedures	Don Lockett
Field Test Procedures	Jules Cohen
System Specific Testing	John Watson

The Task Force on Test Prioritization, Chaired by Mr. Lynn Claudy of the National Association of Broadcasters, reviewed and optimized the test procedures with the goal of minimizing the time needed for testing each system. The Task Force on Audio Test Procedures, Chaired by Mr. Don Lockett of National Public Radio, developed both the objective and subjective audio test procedures plans. The Task Force on Field Test Procedures, Chaired by Mr. Jules Cohen, has developed and written the Field Test Procedures Plan, and the Task Force on System Specific Testing, Chaired by Mr. John Watson of Group W, is developing specific test procedures for each system to address the areas of concern developed by SS/WP1's Analysis Task Force.

3.2.1. Test Management and Test Procedures Plans

Most of the substantive work of SS/WP2 is contained in the Test Management Plan and the various Test Procedures Plans. The Test Management Plan (document SS/WP2-0124), that was first approved by the Advisory Committee at its 19 July 1989 meeting, has been modified and updated as necessary since that time. The latest version incorporates changes which require proponents to submit complete ATV systems, including audio subsystems, for testing. It has been amended to include an outline of the certification process, and an option for system specific testing. The revisions also clarify the actions necessary by the test laboratories in the event a major anomaly is encountered while executing the test procedures. The Advisory Committee is requested to approve all changes to date.

A total of five documents make up the Test Procedures Plans. They are:

Test Procedures Plan	*Document Number*
Objective and Transmission Tests	SS/WP2-0189
Cable Television Transmission Tests	SS/WP2-0357
Video Subjective Tests	SS/WP2-0390
Audio Subjective Tests	SS/WP2-0533
Field Test Procedures	SS/WP2-0601

The first three documents were approved last year as part of the Third Interim Report. Since then, some modifications have been made to each of them.

In the Objective and Transmission Test Plan, all references to testing augmentation systems have been removed, and test procedures for both static and dynamic resolution have been completed. Audio objective test procedures and specific procedures for RF power metrology are included. In addition, tests were added and procedures developed to evaluate potential degradation to the vertical blanking interval of NTSC services such as closed captioning, and procedures have been added for evaluating interference to BTSC audio in NTSC systems. Another change was the addition of procedures to evaluate compatibility of enhanced NTSC systems with consumer NTSC VCRs.

The Cable Television Test Plan now includes testing through optical fiber systems. Tests with microreflections present have also been added.

Major changes were made to the Video Subjective Test Plan, based upon input from the SS/WP2 Task Force on Prioritization, to ensure efficient testing of the systems.

The Audio Subjective Tests and the Field Tests are new documents, presented to the full Committee for the first time with this Report.

3.2.2. Test Facilities and Equipment

3.2.2.1. The Advanced Television Test Center (ATTC)

The Advanced Television Test Center is in the final stages of its preparation for laboratory testing of the ATV systems. Construction of the laboratory has been completed at its Alexandria, Virginia facility, and all required equipment has been received, installed or scheduled for timely completion. ATTC and CableLabs staff are in the process of meeting with representatives of each proponent to review the technical interface, test and operating procedures, and administrative matters. The first of six systems on the test schedule, ACTV, is expected to be delivered to the facility on or about 1 April 1991.

A prototype model of the Format Convertor has passed acceptance tests at the factory, and has been delivered to the ATTC. It is currently on loan to Planning Subcommittee Working Party 6 (PS/WP6) for use in creating the motion test sequences needed for subjective assessment of the ATV system performance.

3.2.2.2. The Cable Television Laboratories (CableLabs)

The test bed for performing the cable portion of the ATV test procedures was built by Jerrold Communications and delivered to the Advanced Television Test Center in October 1990. It has undergone extensive testing and been accepted by CableLabs for performance of the tests called for in the Cable Television Test Plan. The software necessary to control the test bed is under development and progressing well. Interconnection of the test bed with the remainder of the facility is scheduled for completion by the end of February, in time for a dry run of the entire system.

3.2.2.3. The Advanced Television Evaluation Laboratory (ATEL)

The Advanced Television Evaluation Laboratory (ATEL), located near Ottawa, is an off- premises laboratory of the Communications Research Centre, Department of Communications of Canada. The ATEL was developed to provide the special environment and facilities needed to conduct video subjective assessments of the ATV systems. The tests will be carried out under rigorously controlled conditions, ensuring valid and repeatable results.

The ATEL's activities are supported by a consortium of interests from government

and industry in Canada. The members of this consortium are the Canadian Broadcasting Corporation (CBC), the Communications Research Centre (CRC) of Canada, the Department of Communications (DOC) of Canada, Leitch Video International (Canada), Rodgers Engineering (Canada), Tektronix (Canada), and Telesat Canada.

Trial runs to demonstrate the effectiveness of the facility and to verify the test procedures are scheduled to begin in February 1991. Subjective tests of the terrestrial ATV systems are scheduled to begin in May 1991. As detailed in Section 1.4.3., the format converter necessary to carry out the subjective assessment tests has not yet been delivered to the ATEL. If delivery is late, causing the start of testing to be delayed, this delay will reflect directly to the conclusion of testing. No slack time is available between tests to recover from a late start. Thus, delivery of the format converter for ATEL is a critical path item for the entire testing process.

3.2.3. Test Schedule

With the leadership and participation of Chairman Wiley, a *Test Sequence & Calendar* has been jointly developed by the Advisory Committee, the ATV system proponents, and the laboratories. The present schedule, included with this Report as Attachment H, allows six test slots for testing ATV systems in the period between April 1991 and April 1992. The six proponents currently holding reservations for slots are: the David Sarnoff Research Center, NHK, General Instruments, Zenith, North American Philips Consumer Electronics Company, and MIT. As noted in Section 2.2.1., above, both the systems and the proponents may change somewhat in the coming months.

During a test slot at the ATTC, a system will be subjected to the procedures contained in the Objective Test Procedures Plan and the Cable Test Procedures Plan. The tests in the Video Subjective Test Procedures Plan will be conducted at the ATEL, lagging the ATTC/Cable Labs tests by about six weeks. No time has yet been identified to conduct the audio subjective tests, and, based on the current schedule required by the FCC, very little time is available to conduct the field tests. In fact, many knowledgeable people are concerned that the time allocated for field testing is inadequate. This issue was discussed in more detail in Section 1.4.1., Time Available for Field Testing.

3.3. Future Work

While much has been accomplished by SS/WP2, much remains to be done. As testing begins, the Working Party will continue to play a critical role. The Working Party has a number of important tasks ahead of it in the coming months, including:

(1) *Development of Test Procedures for Digital Systems.* The entry of several digital systems presents some new challenges to WP2. Modifications to the existing test

procedures, and some new test procedures specifically for digital systems, have been suggested. In addition, two new attributes which relate primarily to digital systems have been developed by Planning Subcommittee Working Party 1. SS/WP2 will modify the test procedure documents as necessary to accommodate these changes.

(2) *Development of System Specific Tests.* As part of the certification process, SS/WP1's Analysis Task Force will develop "areas of concern", that is, possible weaknesses in the design of each system which may not be adequately exercised by the existing test procedures. Using that information, WP2 will develop specific tests for each system to address those areas of concern.

(3) *Development of Laboratory Management Plans.* The Test Management Plan requires that each of the three laboratories submit a plan to WP2 detailing how they will execute the Test Procedures Plans. Formulating the plans is the responsibility of the laboratories, but SS/WP2 will work with the test facilities to help expedite their completion. These plans are especially important because laboratory testing cannot begin until the plans are on file with SS/WP2.

(4) *Identification of Resources.* Two of the Test Procedure Plans, the Audio Subjective Test Procedures Plan and the Field Test Procedures Plan, are new documents. As such, no resources have yet been identified to execute them. The field tests in particular, because of the scope of the resources needed, are a source of concern. A first meeting was held on 30 January 1991 between the Field Test Task Force, equipment manufacturers and the proponents to begin to address the resource issues. WP2 will continue to work with the Advisory Committee, equipment manufacturers, the laboratories, and the system proponents to resolve this matter as quickly as possible.

(5) *Management and Oversight of the Laboratory Tests.* Throughout the testing process, SS/WP2 will be the body to oversee the conduct of the laboratory tests, receive the test data, and disseminate them to other bodies in the Advisory Committee as necessary.

The Test Procedures Plans and the Test Management Plan are helping SS/WP2 and the laboratories navigate uncharted territory. The Working Party anticipates that the plans, even after approval by the Advisory Committee, will have to be modified and updated occasionally throughout the testing process as new information becomes available, and it will have to have some flexibility in this regard. The Advisory Committee recognized this fact when it authorized Chairman Wiley, at the 19 July 1989 meeting, to make minor modifications and amendments to the plans without full Committee review and approval.

4.0. Economic Assessment - Working Party 3

4.1. Charter and Organization

The charter of Systems Subcommittee Working Party 3 (SS/WP3), calls for the establishment of costs associated with the distribution of advanced television and for an assessment of the economic and technological feasibility of each of the systems proposed for transmission of an ATV service.

The Chair of SS/WP3 is Mr. Larry Thorpe of Sony Advanced Systems. He is assisted by three Vice-Chairs: Ms. Shellie Rosser of Anixter Corporation, Mr. Bill Loveless of the Bonneville International Corporation and Mr. Richard Grefe of the National Association of Public Television Stations. The secretary for the group is Rupert Stow.

4.2. Summary of Progress to Date

The Working Party has held a total of twenty-two meetings to date, five since the Third Interim Report. Of the five, four were joint meetings with either PS/WP5 or IS/WP2.

Since the time of the Third Interim Report, SS/WP3 has undertaken a comprehensive study of the total ATV distribution infrastructure. Following the spirit of the Advisory Committee's charter, the Working Party has placed particular emphasis on the terrestrial broadcast network system. Other systems, such as the satellite feeder system and cable systems will be examined from the viewpoint of their interface with the broadcast system.

The Working Party has established six Specialist Groups, each responsible for examining a different industry segment: Terrestrial Broadcast, Cable, Satellite, Telco, Receiver/VCR, and Production. The receiver and VCR studies are being conducted by a specialist panel within EIA. This panel has been asked to consider the impact of various systems on receiver design and complexity. The charge of each Specialist Group is to develop detailed block diagrams needed to assess the impact of three particular ATV transmission systems on that industry segment. The three systems, ACTV from the David Sarnoff Research Center, Narrow MUSE from NHK, and Spectrum Compatible HDTV from Zenith, were chosen, based upon recommendations from SS/WP1, because they represent major classes of solutions identified for the terrestrial transmission problem. Recently, another type of solution, digital systems, have been proposed. In the coming months, the block diagrams will be modified to consider this new class of systems.

The scope of SS/WP3's work has broadened considerably in the last year. In particular, the topic of transition scenarios for broadcasters occupied a good deal of time and effort. CBS and PBS each presented independent transition/cost studies which demonstrated how a network might implement an ATV service, and have that

service peacefully co-existing with incumbent NTSC equipment. A key element of both plans is the concept of a phased transition to ATV, a process which might take several years. The Terrestrial Broadcast Specialist Group modified the system block diagrams of future ATV broadcast infrastructures as a consequence of these, and other, developments. Cost issues attendant to these developments continue to be identified and addressed.

In addition to all the emphasis placed on the changing models for transition scenarios, WP3 simultaneously continues to grapple with defining a marketplace model for how ATV receivers will enter the U.S. home. Other studies include the likely ATV program delivery media and the sequence in which they might be implemented, possible sources of ATV programming, especially in the early years, the elapsed time to achieve a one percent market penetration, the shape of the growth curve following this critical penetration level, and the influence of parallel ATV growth scenarios in Europe and Japan.

4.3. Future Work

The future work of WP3 will be directed along two main paths: Refining the broadcasting system block diagrams, particularly to assess the impact of proposed all digital systems on the industry infrastructure, and refining the ATV receiver penetration models, and the underlying assumptions which led to the formulation of the models.

After more than three year's work, SS/WP3 confirms its earlier report that any attempt to analyze an ATV proponent's hardware in isolation has little meaning. The macro economics of an ATV service must be considered. Further, a grasp of the details of a future ATV total broadcast system is absolutely essential if any credible attempt is to be made to analyze the cost of conversion of a local television station - and the expected substantial cost of network conversion.

WP3 has tentatively decided that ATV receivers designed to the different systems proposed will inevitably differ in their manufacturing cost - but not by a great amount. The Working Party feels that acquiring some grasp of the absolute cost to be expected at the time of introduction is highly important. As market penetration rises and consumer dynamics attain normal dimensions, these costs will drop sharply - and any differences between systems will converge even more. Determining the shape of that falling curve - with the attendant information on time to achieve one percent market penetration, the cost of the receiver at that time to achieve 50% market penetration, and the associated receiver costs will be a key goal in the coming months.

5.0. System Standards - Working Party 4

5.1. Charter and Organization

Systems Subcommittee Working Party 4 (SS/WP4), the Working Party on System Standards, has the responsibility to examine all the available data gathered or developed by other Working Parties and Advisory Groups in the Advisory Committee and, based upon that information, recommend a standard or standards for the terrestrial transmission of advanced television service. Recommendations developed by SS/WP4 will be used by the full Advisory Committee as it develops its own recommendations and advice for the FCC, and by the Implementation Subcommittee, whose charter includes the development of a transition scenario for the introduction of advanced television service in the United States.

The Chair of SS/WP4 is Dr. Robert Hopkins, Executive Director of the Advanced Television Systems Committee. He is assisted by three Vice-Chairs: Mr. Hugo Gaggioni of Sony Advanced Systems, Mr. Bruce Sidran of Bell Communications Research, and Mr. Louis Williamson of American Television and Communications. Mr. Gerald Robinson of Scientific Atlanta serves as Secretary for the group. The Chair and three Vice-Chairs are collectively referred to as the Officers.

5.2. Summary of Progress to Date

The Working Party has held a total of nine meetings, most recently on 25 January 1991. There are currently 70 members.

Since the last Interim Report, three Task Forces have been formed to address the substantive issues facing WP4. The Task Force on Data Format, Chaired by Mr. Gaggioni, is responsible for determining what data will be needed by WP4 to make its recommendation, where that data will come from, what the form of the data shall be, what data reduction needs to be performed, and what group shall do any necessary reduction. The Task Force has been working with SS/WP2 and the test laboratories to review and refine the data reporting sheets which will form the bulk of the laboratory's report to the Advisory Committee. This work will continue until a complete set of sheets is available, and will be completed prior to testing.

While it was agreed in the 11 April 1989 meeting of SS/WP4 that its recommendations would be based only on consensus, at subsequent meetings concerns were expressed that it may not be possible to reach consensus on a recommended standard. Several members believed it was necessary to develop a process for making a recommendation in the absence of consensus. A Task Force, Chaired by Mr. Gnidziejko of NBC, was established to examine possible processes. After several meetings, it was determined that no alternatives to consensus were acceptable. Following that determination, at the 25 October 1990 meeting, the Working Party re-affirmed its position that the recommendation of a standard would be based only on consensus. With its work completed, the Task Force was

disbanded. The Systems Subcommittee would like to thank Mr. Gnidziejko and the other members of the Task Force for their contributions.

The Working Party has developed a process to write its final report, beginning with the outline. A Task Force on Report Drafting, Chaired by Mr. Sidran, has been empanelled to do this work. A copy of the outline as approved by WP4 is included with this Report as Appendix 3. An attachment to the outline, entitled *Philosophy for 1992 Final Report*, gives some additional background information and rationale for the creation of the report.

Chapters 4, 5 and 6 of the final report will consist of input contributions from other entities in the Advisory Committee. In other words, their final reports to SS/WP4. Guidance will be given to these groups by providing details on the information needed by WP4 in these sections. Chapters 7 through 9 will contain an examination of the issues which must be considered in making a recommendation for an ATV standard, an analysis of each system tested, and the recommendations of the Working Party. Work is underway to write Chapter 7 which examines the issues and establishes the format which will be used to analyze the tested systems. The remainder of the report will contain conclusions and information regarding work - related to the recommendation - which must be done in the future.

SS/WP4 has defined a process for recommending an ATV system. A copy of the flowchart for the process may be found in Appendix 4 of this Report. The "critical objectives" are viewed as desirable features of an ATV service and are expected to exceed some minimum requirements. This information will be contained in Chapter 7 of the final report. Each proposed system will be measured against the critical objectives. Systems which survive this process will be compared against each other by examining the differences and determining which system or systems could offer superior service. The process has provisions for review and refinement as new information becomes available.

5.3. Future Work

The Working Party has much to do to complete its final report for inclusion in the 30 September 1992 final report of the Advisory Committee.

(1) *Completion of the Data Reporting Sheets.* Over the next several months WP4 will continue to work with SS/WP2 and the testing laboratories to refine and complete the set of data reporting sheets. This work will be finished before testing begins.

(2) *Development of Certification Criteria for Field Testing.* At the 21 June 1990 Systems Subcommittee meeting, SS/WP4 was designated as the body to certify systems for field testing by SS/WP2 in much the same way that SS/WP1 is empowered to certify systems for laboratory testing. A set of certification criteria will be developed for this purpose.

(3) *Refinement of the Final Report.* Information will be given to other Working Parties throughout 1991 to serve as guidance on the material needed by SS/WP4. The outline will be refined and the individual sections will be written as information becomes available. Work is underway to write Chapter 7 and the sections of Chapter 8 will be completed as the testing of each system is completed. The recommendation and conclusions cannot be completed, of course, until all systems have been tested, and all data is reduced and analyzed.

6.0. Acknowledgements

The Systems Subcommittee would like to recognize the tremendous progress, and the tremendous contributions, made since the Third Interim Report by the individuals in the Working Parties. This work is done by dedicated professionals donating their time, despite hectic schedules, for the public good. We deeply appreciate their continuing participation and their sacrifices.

We would also like to recognize and thank the ATV system proponents. They are the real heroes in this endeavor, investing time, energy, and money to help develop an American ATV service second to none.

Information Flow

In the Advisory Committee