

(i) Perceived Value

The perceived incremental value to the consumer of ATV service over the present NTSC service may be the same as the perceived incremental value of color TV over monochrome television thirty years ago. The assumptions made will include the views that the value is the same, and that it is considerably less than for the transition to color.

(ii) Price of Consumer Equipment

Detailed price estimates for consumer equipment are not yet available, but manufacturers' estimates have provided a useful starting point. A range of assumptions will be made for the introductory prices, possibly affected by forward pricing policies of the manufacturers. In any event, prices are assumed to fall rapidly from economies of scale and when improved design is effected, most notably by the introduction of LSI circuitry.

(iii) Television Station Conversion Costs

The ability of stations to convert to ATV service in a timely manner will clearly influence the rate of penetration of service in the consumer market. In 1990, WP-5 presented an initial scenario for the transition to ATV service by local stations. For full conversion to ATV service, the financial investment was daunting to many broadcasters. However, it is recognized that the investment required to effect the first phases of conversion, which would permit the pass-through and local retransmission of network or syndicator-delivered

HDTV programming, will be reduced as equipment prices fall. From these and other considerations, a new transition scenario is being developed. This scenario will also take account of the impact of the FCC's recent Notice of Proposed Rule-making on the rate at which stations may start conversion. This, in turn, will affect the rate at which the consumer equipment market may grow.

(iv) The Impact of Cable, Home video, and Satellite Service

The opportunity exists for these alternative delivery media to start the penetration of the consumer market with ATV service at the time, or shortly after, the FCC establishes the ATV terrestrial transmission standard. While there is some doubt that cable systems would introduce ATV service before a local broadcast ATV service is in operation, it is noted that a limited inauguration of ATV cable service is planned for 1992.

Home video, on the other hand, operates as an independent program delivery service which could start at any time, and is constrained only by the need for the consumer to purchase an ATV display unit in addition to the ATV player. Because the Home Video player is used largely with programming originally produced on high definition 35mm. film, a ready supply of programming is assured.

From these considerations, a range of assumptions concerning the timing and the rate of penetration of the ATV market will be developed.

(v) Funds for the purchase of ATV equipment

Dependent on the perceived value to the consumer of ATV service and the other considerations listed above, assumptions will be made on the portion of discretionary funds available to the consumer and which are now applied to the purchase of consumer electronics, that may be applied to the purchase of ATV home equipment.

A "strawman" penetration projection based on the most optimistic assumptions relative to the above factors has been circulated to the membership of the Working Party, and is being critiqued to arrive at a most realistic projection.

4. FURTHER WORK

The further work of WP-5 is to continue to work closely with SS WP-3 in their work on economic assessment, and to complete the new projection of consumer market penetration of ATV equipment. This work will also require the necessary revisions of the earlier transition scenarios for local stations converting to ATV service.

WP-5 will continue to work jointly with SS WP-3 to determine the cost and complexity of each proponent's encoder, but will now extend the work to include the decoder in the consumer equipment, because the design of the proponents' decoder is likely to be a critical element in the total cost of the consumer equipment. Each proponent

will be asked to present a full account of the complexity and the projected cost of the proposed decoder, at both the introductory stage and when in full-scale manufacture.

5. DOCUMENTS

The following documents have been recorded during the period.

- PS WP-5-0049 Work statement for the fifth period.
- PS WP-5-0050 Notes on a meeting with Robert Crandall, 8.15.91
- PS WP-5-0051 Minutes of the 8th. meeting of PS WP-5
- PS WP-5-0052 Impact of ATV Policies on Manufacturing and International Trade.
- PS WP-5-0053 Minutes of 9th meeting of PS WP-5
- PS WP-5-0054 Minutes of 10th. meeting of PS WP-5
- PS WP-5-0055 Minutes of 11th. meeting of PS WP-5

6. MEETINGS

Formal meetings of PS WP-5 were held on:

- 9.19.91
- 9.19.91 Joint meeting with SS WP-3.
- 10.17.91 Ditto
- 11.26.91 Ditto

September 19, 1991

IMPACT OF ATV POLICIES ON U.S. MANUFACTURING
AND INTERNATIONAL TRADE

There continues to be an interest in the impact of the development of ATV on U.S. manufacturing and U.S. exports. Implicit in this interest is a general belief that ATV policies can and should be guided in part by the goal of increasing U.S. participation in the manufacturing of ATV equipment and the software that will be broadcast by ATV.

An earlier report submitted by AG-2 to the Planning Subcommittee on January 29, 1989 documented the extensive U.S. manufacturing of current NTCS receivers. A large percentage of such sets are now assembled in the United States, and the share of U.S. value added in these receivers rises sharply with the size of the receiver. This manufacturing activity -- particularly the final assembly of the receiver -- is undertaken, however, largely in U.S. operations of foreign manufacturers.

Where Will ATV Equipment for the U.S. Market Be

Produced?

It is likely that the first receivers produced under the FCC's ATV standard, when it is finally announced, will reflect the same market forces that currently drive the geographical location of the larger NTSC sets produced for the U.S. markets. In short, final assembly of these large, wide-aspect-ratio sets for the U.S. market is likely to take place largely in the United States, as will the manufacture of the large displays and associated cabinetry. The integrated circuits required may also be produced in the United States, but the importation of these devices is much more likely.

Given the high transportation costs of cabinets and large displays, there is little possibility that receiver manufacture could shift from the United States to the domiciles of the Japanese, Korean, or European consumer electronics firms who own most of the television receiver production capacity in the United States. However, if a U.S.-Mexico Free Trade Agreement is consummated, it is possible that a substantial share of NTSC and ATV receiver manufacture could shift to Mexico.

The geographical location of production of the

electronics required for ATV receiver manufacture is more difficult to predict. Indeed, much of the controversy over an "industrial policy" for ATC stems from the hope that the production of electronic components -- particularly semiconductors -- can be steered to the United States by some policy measure. However, it seems likely that consumer electronics manufacturers will source these components in much the same fashion as they currently source them unless there is some major new technical breakthrough in the components required that suddenly gives U.S. companies a comparative advantage for producing them in the United States.

U.S. Production or U.S.-Owned Companies?

The United States consumer electronics industry has changed dramatically in the past quarter century. U.S. companies have found it difficult to compete with Japanese, Korean, and European companies and have therefore closed their U.S. operations or sold them to the foreign companies. U.S. television-set manufacturing remains relatively healthy, but it is now owned by foreign companies.

There would appear to be little that U.S. policymakers

can do to restore U.S. companies to prominence in television-set manufacture. It is a safe prediction that those companies who have proved successful in producing large, analog NTSC receivers for the U.S. market will be the principal suppliers of large, digital ATV receivers. These companies were the most adroit in shifting from tube-type sets to solid-state receivers. They have recently developed high-quality NTSC receivers in extremely large sizes and are selling them at rapidly-declining prices. There is no reason to expect that their success in NTSC receiver development, production, and marketing will not carry over to ATV production.

Policies to Stimulate U.S. ATV Production.

There are a number of policies that could be used to accelerate the development of a U.S. ATV industry, but each suffers from two problems: (i) its benefit may have to be made available to foreign companies producing in the United States if it is offered to U.S. companies and (ii) there is little reason to limit the policy to ATV production alone.

The policy instruments often suggested to stimulate a U.S. ATV industry are generally:

- i. Government funding of R & D
- ii. Tax preferences to investors in new ATV technology
- iii. Antitrust exemptions for R & D or production joint ventures.
- iv. Choice of a "United States" ATV technology for the terrestrial standard

Policy instruments i.-iii. may or may not provide the U.S. economy with benefits greater than its costs, but if they are desirable for the ATV equipment industry, why should they not be extended to all industries? Surely, there is no reason to prefer ATV development over, say, supercomputers, fiber optics, or medical technology. Moreover, each of these policies has received wide general attention in recent years, and their general appeal will not hinge on a new set of claimants appearing on the scene.

The fourth option, choosing an ATV terrestrial standard that would benefit domestic companies, is even more problematical. Who are these domestic companies? Do they have the ability or even the desire to become full-fledged consumer-electronics firms? And if some -- such as Zenith, AT&T, or IBM -- have the ability to compete in consumer-electronics markets, why would they be better able to compete

with Japanese, Korean, or European companies if the ATV standard is based on U.S. patents? Recall that the early patents on color television sets and VCRs were U.S. patents.

An Alternative Approach

Given the large size of the U.S. television industry, particularly for the larger sets produced for the U.S. market, the best current policy would appear to move as quickly as possible to finalize the ground rules for the launch of ATV service in this country. Now that it appears that we are on the road to selecting a digital technology that can be used by cable and terrestrial broadcasters alike and that program producers are beginning to produce ATV programs, a rapid conclusion of the FCC process would place domestic producers -- whether Japanese-, Korean-, European-, or American-owned -- in an enviable first-mover position.

The rapid culmination of the FCC process would leave European and Japanese producers struggling in their home markets with what may prove to be poor choices of technology while their American subsidiaries and competitors move quickly to begin exploiting the learning curve in U.S. manufacture of sets for North America.

Equally important, new developments in display and

electronics technologies will be stimulated by the real-world demand for better and less expensive receivers for an up-and-running U.S. market. At present, the expected returns from R&D in these technologies may be depressed by the political expectation that regulatory details will not be settled for years or even a decade.

In short, a policy of moving expeditiously to a U.S. ATV standard is likely to be far superior to delaying the standard for, say, another five years while we argue about the need for U.S. preferences, tax policy, or government funding of R&D.

F. Chairman's Report: Working Party 6

FIFTH INTERIM REPORT
OF THE
PLANNING SUBCOMMITTEE WORKING PARTY 6
OF THE
FCC ADVISORY COMMITTEE
ON
ADVANCED TELEVISION SERVICE

Craig K. Tanner, Chairman
Bronwen L. Jones, Vice-chairman

January 23, 1992

EXECUTIVE SUMMARY

This is the fifth interim report of Working Party 6 on Subjective Assessments. The majority of the tasks of this Working Party were completed during the fourth period. As stated in the Fourth Interim Report, two tasks were in the process of being completed while that report was being written: the final verification of the multi-format telecine and the computer-based rendering of the 10-second motion and still images by AT&T Bell Laboratories. Both were subsequently delivered, in four and five formats respectively, to ATTC. These tasks were completed on schedule. Since they were part of the fourth interim period tasks and were covered in the Fourth Interim Report, they will not be discussed further in this report.

During the fifth period, the efforts of the Working Party were centered on recruiting and certifying expert viewers. As of the date of this report, the Working Party has provided the ATTC with lists of certified expert observers from which it has been successfully soliciting viewers for subjective tests of the DSRC, NHK and GI proponent systems.

Working Party 6 held its only meeting on July 17, 1991 at the request of Chairman Wiley, to discuss a proponent request for additional subjective test material. The Working Party agreed that a single-format shoot of approximately an hour of several agreed-upon sports, including tennis and golf, would be a valuable addition to the existing test material and should be completed in time to allow its use in evaluating the system selected for field tests.

I. INTRODUCTION

This is the fifth interim report of the Planning Subcommittee Working Party 6 on Subjective Tests. The majority of the tasks of this Working Party were completed during the fourth period. This report summarizes the activities and the one meeting of the Working Party between January 1990 and January 1991.

The remaining task of the Working Party is the production of approximately one hour of additional test material for the field tests. A single-format shoot of several agreed-upon sports, including tennis and golf, will be produced as a valuable addition to the existing test material. This can only be done when the system or systems to undergo field testing are known, so the cost and identity of the test material can be kept as precisely under control as possible.

This report summarizes what has been (and is being) done with the expert observers and what has been agreed, to date, regarding the test material production. For a complete description of the original test material production, the reader is referred to the Fourth Interim Report of PSWP6. For a status report on the actual use of the test material, see the Fifth Interim Report of SSWP2 and/or the report on that subject written by Dr. Hearty and submitted to SSWP2.

II. PROGRESS REPORT

A small Task Force including the Chairman, Vice-chairman B. Jones and ATEL Director P. Hearty was formed to approve and certify expert observers who were (and are being) contacted by the ATTC. If willing and able to serve, they are asked to fill out a form attesting to their qualifications as "experts" and to their lack of affiliation with any of the proponents. These statements are

reviewed by the Task Force, and approval is sent to Ms. P. Shearmur at ATTC. The experts are further screened for both visual acuity and color vision at the Test Center.

This system is working, although a larger pool of experts to draw upon would be desirable. Quite naturally, the local experts get called upon an inordinately large number of times. Their proximity to the test site enables them to fill in when scheduled experts find themselves unable to appear due to last minute changes of plans, missed airplanes, snow storms, etc.

At the only PSWP6 meeting held during the year (July 17, 1991), called by Chairman Wiley at the request of at least one proponent, a new piece of test material was agreed upon. It will be at least one-hour long and will contain segments of specific sports which have difficult movement for motion compensation schemes to handle smoothly. These will include motions such as golf swings, tennis serves, horse racing or jumping and basketball shots. In addition, content such as news, faces, a complex still and computer graphics were discussed.

Work will not begin on the actual production of this new piece of test material until the system(s) qualifying for field tests have been identified. This will keep costs and identity precise and under control. A maximum of two formats was agreed upon but obviously one format is much preferred.

The substitution of a skiing (motion) segment for a still was also agreed at that meeting, but was later rejected by the ATTC as too late, due to the fact that the tests were already well underway.

Attached to this report is a statement of funds collected and disbursed to date for the production of the subjective test materials. (statement to be forwarded when obtained from PBS).

III. FURTHER WORK

The only further work anticipated at this time is the production of the hour-long test material which can not begin until close to the completion of the ATTC lab tests anticipated in the late summer of 1992. It has been suggested that prior to that date a meeting should be held with the Field Test Task Force. At this time it is planned that Vice-chairman Jones should attend the February meeting of the Task Force and place this issue on the agenda.

C. K. Tanner

B. L. Jones

January 23, 1992

VIII

EVALUATION OF ADDITIONAL PROPOSED ATV
SYSTEMS AND TECHNIQUES

Review of Technology

An Evaluation of Additional ATV Systems and Techniques

I. INTRODUCTION

In November 1990, the Advisory Committee, the ATTC, and the CableLabs entered into a Memorandum of Understanding ("MOU") with the FCC that would formalize the government-industry partnership to develop a terrestrial ATV standard. Among other things, the MOU requires that the Advisory Committee review the state of technology to identify whether there exist any

new technical advancements in the state of the art, not already provided by the ATV systems pre-certified by the Advisory Committee, that appear to offer important benefits to the public and are sufficiently concrete so as to be tested contemporaneously with the pre-certified systems.¹

To comply with this requirement, the Chairman of the Advisory Committee requested the Planning Subcommittee to investigate ATV proposals other than those systems certified for testing, and determine whether any were sufficiently concrete. This investigation was conducted by the Chair of PS/WP-1 in consultation with the Chair of SS/WP-1.

II. NEW TECHNIQUES

All of the digital ATV systems submitted to the Advisory Committee for system analysis, certification, and testing are

¹ MOU, November 14, 1990, at p. 3. The MOU further required that the Advisory Committee, by early 1992, prepare a report and recommendation to the Commission on whether any of these new developments should be tested. *Id.* at pp. 3-4.

based on discrete cosine transform (DCT) technology. Other techniques are under study and were investigated for possible inclusion in the Advisory Committee's work.

A. Wavelets

A method of achieving video data compression known as "wavelets" is being researched by Columbia University and others. A wavelet-based compression system would develop a transmitted picture from a series of equations representing gradually higher resolution components (the "waves") so that, by properly arranging the digital transmission signal, the reduction in picture quality with increasing distance from the transmitter would be gradual, rather than abrupt. Thus, fringe areas would receive a lower resolution picture instead of suddenly receiving no picture at all. It should be noted that several of the proposed systems certified for testing, all of which use DCT, also claim a gradual fringe area fall-off in picture quality.

B. Fractals

Another technique, is being studied by the Georgia School of Technology and Iterated Systems, Inc., and others, is the application of "fractals." This compression technique relies on fundamental equations, called fractals, in the encoding/decoding algorithms. These equations, first demonstrated by Mandelbrot of MIT in the late 1970's, require less bandwidth to transmit than other transforms. Compression ratios of more than 1000 to 1 have

been reported. One problem of the fractal technique is in generating the correct fractal equations at the encoder. Although this difficulty can be overcome with sufficient computing power, hardware available at present takes several seconds to generate a single frame of the image.

C. Vector Quantization

Another non-transform compression technique is called "Vector Quantization." With this technique, a block of picture elements is used to form either a 2D or 3D vector, and the image is examined at the encoder to determine which vectors, out of a large universe, are most likely to follow. The difficulty with vector quantization lies in selecting a small enough group of vectors to achieve adequate compression while also achieving adequate picture quality. Scientific Atlanta has demonstrated vector quantization for NTSC quality pictures, but has not publicly done so for HDTV.

III. THE E3TV SYSTEM

In January 1992, the Scabbard Corporation announced that it is working on a new system, called "E3TV," with over 2000 lines of resolution. A very brief summary of this technology has been submitted to SS/WP-1. Scabbard plans to use a new type of camera sensor combined with unique signal processing. Although development has just begun, Scabbard has informed Advisory

Committee personnel that it expects to have prototypes available by July, 1992.

IV. CONCLUSION

Although the techniques and systems described above have been publicly discussed by their respective proponents, none has apparently reached the stage where it can be submitted to SS/WP-1 for system analysis and test certification. Computer simulation of short sequences of material cannot be substituted for hardware capable of real-time ATV testing at the test centers, and none of the new systems appears to have such hardware available. Thus, at present, no new technical advancements are "sufficiently concrete so as to be tested contemporaneously with the [pre-] certified systems," and no additional ATV systems have been submitted for consideration in accordance with the Advisory Committee's procedures and schedule.

D Chairman's Report: Working Party 4

**ADVISORY COMMITTEE ON ADVANCED TELEVISION
PLANNING SUBCOMMITTEE
WORKING PARTY 4**

INTERIM REPORT

DECEMBER 31, 1991

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Attachment A: Definitions.

Attachment B: Reference Models / Architecture.

Attachment C: Headers / Descriptors.

Attachment D: Minutes Of Working Party 4 Meetings.

October 18, 1991 Meeting Minutes.

November 13, 1991 Meeting Minutes.

December 17, 1991 Meeting Minutes.