

of the complaints raised by these members of the computer industry that they remain so completely oblivious to the needs of broadcasters in this endeavor, and it is telling that 91 broadcasters and broadcast organizations gave a ringing endorsement of the ATSC DTV Standard, while not a single broadcaster in the country has embraced the CICATS counterproposal.^{17,18}

The second key fallacy underlying these complaints is the mistaken notion that the ability to decode all of the ATSC DTV formats, including the HDTV formats, will make receivers prohibitively expensive for most consumers. As individual ATSC members will describe in detail in their reply comments, the costs of receivers *will be lower* using the ATSC DTV Standard than under the layered approach CICATS advocates, for *both* SDTV-quality low-end displays and HDTV-quality high-end displays.

CICATS (at 18, 28, 30) stridently complains about the Advisory Committee's proposal to support 18 formats¹⁹, saying it will cost consumers tens of billions more per year, will result in inferior products, will limit high-value growth, will restrict development of advanced applications, and that it appears to have been designed to guarantee huge financial rewards for TV receiver manufacturers.

displays used for HDTV for improving the NII. See Grand Alliance Fourth NPRM Reply Comments at 39, *Workshop on Advanced Digital Video in the National Information Infrastructure*, NISTIR 5457, Georgetown University, May 10-11, 1994, and *Advanced Digital Video and the National Information Infrastructure, Report of the Information Infrastructure Task Force*, Committee on Applications and Technology, Technology Policy Working Group, February 15, 1995.

¹⁷There is no chance of an industry consensus forming around any proposal that does not deliver proven HDTV performance from day one.

¹⁸CICATS (at 33-34) claims that unlike the Advisory Committee's "supply push" approach, their proposal is based on "demand pull" where consumers' tastes will guide the industry in adopting higher resolutions. But how would consumers ever express a desire for HDTV? Which manufacturer would offer the first HDTV receiver that could receive no broadcasts? And which consumer would buy this useless receiver? What would motivate any broadcaster to begin broadcasting in HDTV to zero viewers? Does CICATS mean that if HDTV ever became widespread in cable or DBS services, broadcasters could try to catch up before they lost all of their viewers?

¹⁹Several parties express dismay over the supposed great complexity inherent in decoding 18 different formats. In fact, there are really only three fundamentally different formats -- 1080, 720, and 480 vertical lines. The number eighteen comes by counting each combination of frame rate and aspect ratio associated with these vertical line rates as a different format.

All of these claims are wrong, and the last one, in particular, is an uninformed, irresponsible charge as the Commission who has shepherded this process knows full well. Broadcasters and equipment manufacturers and everyone else involved in the Advisory Committee process have fought hard at every turn to develop a system that keeps costs as low as possible, because all of us know that getting prices down is vital in order to stimulate massive consumer demand. HDTV is the main goal of the Grand Alliance system upon which the ATSC Standard is based, and the ability to support other formats as well at almost negligible additional cost is vital to the standard's ability to address multiple needs. Moreover, effective techniques have already been demonstrated by Hitachi America,²⁰ and others are being developed, to process all of the DTV formats, including the HDTV formats, with a cost-reduced decoder that can deliver lower-definition, lower cost receivers and converters.

Moreover, careful scrutiny of the CICATS Technical Description appendix (at 7-9) shows that their own proposal does not have only one format as they claim. They propose a reference decoder that accommodates variable aspect ratios and decodes any format up to 1024 x 512, at frame rates that include 24, 36 and 72 Hz. This means that far more formats and frame rates must be accommodated by a CICATS receiver than an ATSC receiver -- hardly the single format that they claim while lambasting the ATSC standard for being "unnecessarily complex and detailed"! (CICATS at 28)²¹

CICATS (at 35) presents a false Hobson's choice, saying consumers must either pay too much for an all-format receiver or risk not getting programming sent in higher resolution formats. CICATS should be relieved to learn that there is a strong consensus that all DTV receivers should and will decode all formats, and that they can do so economically for both

²⁰Hitachi America (at 8-9) explains that "[i]n order to meet the needs of set-top decoders for existing receivers and to provide a variety of price points, a low-cost all-format decoder is necessary. . . . [Hitachi America] hopes that its public demonstrations have helped establish the existence of an effective all-format decoding technology."

²¹Examples of valid CICATS formats include 640 x 480, 656 x 480, 672 x 480, . . . 1024 x 480, as well as 640 x 512, 656 x 512, 672 x 512, . . . 1024 x 512. These combinations alone number 48 different formats, not even counting CICATS' three frame rates.

low-resolution and high-resolution displays. As discussed later in these reply comments, no one, except possibly CICATS, opposes providing all-format capability in receivers.

CICATS (at 39, 41) claims that ATSC DTV receivers and set-top boxes will need four to five times more memory and processing speed than the CICATS baseline format which will provide equal or better quality than ATSC SDTV. CICATS puts forward cost comparisons, focusing first and foremost on set-top converters and then on receivers, concluding that the CICATS proposal offers dramatically lower costs than the ATSC Standard.

First, as discussed above, CICATS is evaluating the wrong question. Broadcasters demand HDTV capability on day one in any standard, but the CICATS proposal hardly mentions HDTV, and CICATS offers no cost estimates for high-definition receivers in their proposal. Indeed, their focus on 1996 converter prices demonstrates their preoccupation with SDTV, not HDTV. Under an HDTV-focused transition plan, the initial prices of receivers and how rapidly those prices can be expected to decline are key benchmarks, while the prices of converters become increasingly relevant as the *end* of the transition approaches.

Second, the CICATS numbers are wrong, in any event, because they completely ignore the fact that memory and other costs can be substantially reduced entirely within the ATSC standard, decoding *all* ATSC formats, using approaches such as one that has been developed and demonstrated to the Commission and the public by Hitachi America. Indeed, detailed cost estimates included in the reply comments of individual ATSC members generally show that the ATSC standard can deliver SDTV picture quality (from any of the formats, including the HDTV formats) at about the same cost or less than the CICATS proposal, and can deliver HDTV picture quality at a substantially lower cost than the CICATS approach, all while providing HDTV capability from day one of the transition to digital television. Thus, contrary to CICATS' assertions, there is no significant penalty for receivers (or converters) in providing the capability to decode all ATSC formats from day one, and for high-end receivers the ATSC standard costs less than the CICATS proposal.

But even making these cost comparisons risks lending undue credibility to the CICATS proposal. The CICATS proposal is just that -- a proposal -- and not a proven, implemented and tested system such as the Advisory Committee long ago decided was necessary as the basis for a DTV standard to which the entire industry would convert.

Furthermore, extensive work in the MPEG standards process and elsewhere has firmly established that layered coding (the CICATS proposal) is less efficient than direct coding (the ATSC standard).²² Consequently, it is extremely doubtful that the CICATS proposal, if ever embodied in prototype equipment, could deliver acceptable HDTV picture quality over a 6 MHz channel.²³

Moreover, the CICATS proposal violates the international MPEG-2 standard in numerous ways. Strict compliance with MPEG-2 is vital because it ensures that integrated circuits developed in conformance with the MPEG standard from a variety of suppliers will be able to decode the standard. Thus, compliance with this international standard will help ensure the lowest possible cost for both broadcast and consumer equipment. Conformance with MPEG is also an important characteristic for promoting interoperability and use of the U.S. standard elsewhere in the world. Indeed, one of the changes ordered by the Advisory Committee in the initial Grand Alliance proposal was the elimination of techniques that were not included in MPEG-2.

Appendix A to these reply comments reviews these MPEG compliance issues, giving a brief summary of violations of the MPEG standard and some discussion of the consequences.

²²In addition, some question the need for this type of technique in light of the rapidly falling cost of memory.

²³One of CICATS' own references states "[f]rom the HDTV experiment, it can be concluded with a good accuracy that the quality of the HDTV pictures in an embedded [layered] system at 20 Mbit/s is equivalent to the HDTV quality of a simulcast [direct] system at 16 Mbit/s. The difference in bitrate, for similar quality, is therefore 20% of the embedded [layered] system bitrate." See "A Comparative Study of Simulcast and Hierarchical Coding," J. De Lameillieure and D. Pallavicini, Feb. 1996, European RACE project. As the Advisory Committee test results demonstrated, a 20 percent penalty in bit rate means a very substantial penalty in picture quality. Indeed, because of these inefficiencies, it is our understanding that serious development of layered coding approaches has ceased around the world. To argue, as Demos does (at 5), that layered coding is *more* efficient than direct coding, challenges reason. If this were true, wouldn't a 240-line baseline format yield even better results? And wouldn't a 120-line baseline format be even better?

One salient conclusion of even this cursory review is that by prohibiting various frame rates and non-square pixel formats, all of which exist in MPEG and are embodied in currently available video products purchased by consumers, *CICATS receivers and converters would be unable to receive every known bit of digital TV that is currently transmitted in the U.S. via satellite, cable, MMDS, DVD or telephone company video delivery systems.*

As it did with consumer costs, CICATS (at 43-45) also presents similarly unreliable cost estimates for broadcast transmission equipment, concluding that broadcasters would save billions in the aggregate if they did not broadcast HDTV. They also claim (at 45, Selwyn appendix) that adoption of the Advisory Committee proposal will cost the public billions more by delaying the return of spectrum, since the transition to DTV under the Advisory Committee proposal will be much slower than under the CICATS approach with its alleged lower costs.

Of course, broadcasters could save money by not investing in HDTV capability. They also could save billions in the aggregate by ceasing operations, but neither course would preserve free over-the-air television in the years and decades to come, and neither course would be in the public interest. This comment again shows an utter disregard for the needs of broadcasters to remain competitive in the future, and helps explain why not a single broadcaster supports the CICATS proposal. And of course, lower costs will indeed spur demand, just as will the superior image quality offered by HDTV, and since the ATSC Standard offers the ability to get superior image quality from day one, with costs as low or lower than under the CICATS approach, it is the ATSC Standard, not the CICATS proposal, that will hasten the transition to DTV and free up valuable spectrum.

Never tiring, CICATS (at 46-49) argues that the Advisory Committee standard will adversely affect the competitiveness of the computer and entertainment industries by imposing requirements that limit their compatibility with DTV, saying "it makes no economic sense to penalize two of our country's most vital industries to reward the handful of electronics manufacturers that dominate the Grand Alliance."

As shown conclusively in the sections on interoperability that follow, the proposed ATSC Standard does not limit DTV compatibility with computers, and in any event, the specifications for the standard were developed by the Advisory Committee in a consensus-driven process, and were established principally by broadcasters assessing the needs of their consumer viewers.

CICATS (at 51-57) says the claims of the Grand Alliance that adopting the ATSC DTV Standard will create and preserve jobs and promote economic growth are flimsy, and that the Advisory Committee standard will stifle growth of the U.S. computer industry, will bring the convergence of television and computers to a screeching halt,²⁴ will eliminate U.S.-based manufacturers from the competition with non-U.S. television manufacturers, may dissuade U.S. computer hardware manufacturers from entering into the PC-TV business, and will threaten the appeal of U.S. films and undercut the motion picture industry.

None of these arguments has any merit, and the hyperbole of these claims belies their validity. It defies belief to argue that a new broadcast television standard of any kind, much less the most computer-friendly broadcast standard ever devised, could possibly *stifle the growth* of the U.S. computer industry. And the attempt to paint these issues as foreign TV manufacturers vs. American computer makers is completely baseless. First, the standard is driven by the needs of broadcasters and consumers, not manufacturers; second, except for what precious little profit flows to the owners of the highly price-competitive U.S. TV manufacturing industry, the industry is largely American;²⁵ and finally, to the extent that the deployment of broadcast television becomes a catalyst for the convergence of televisions and personal computers, no one doubts the ability of Microsoft and other computer and software companies to compete effectively

²⁴CICATS asks the Commission to believe that the convergence of TVs and computers is currently going just fine with analog NTSC television and several interlaced scan, non-square pixel digital television services, but that the introduction of the only digital television system on the planet that uses progressive scan and square pixels predominantly will bring this progress to a screeching halt.

²⁵Although this whole discussion ought to be irrelevant, it's worth noting that the vast majority of personal computer monitors are imported from Asia.

CICATS finally concludes (at 58-60) by saying that it should be obvious that they are committed to using DTV to its fullest potential and to the greatest advantage of the public, and that adopting their approach does not entail reinventing the wheel and would not incur any delay in implementing DTV.

On the contrary, their comments show no focus on or interest in free over-the-air television, HDTV, or the problems of broadcasters. Since broadcasters rightfully insist on a proven, tested system, adopting the CICATS approach would incur years of delay for assessment, development, testing and evaluation of an actual working system, with no real prospect that the resulting system would equal the proven performance of the Grand Alliance system already in hand. Meanwhile, other digital video standards that are far less interoperable with computers and telecommunications, including DVB, would take root here in the U.S. and throughout the world.

Demos (at 2, 5, 7), the architect of the CICATS counterproposal, in his own lengthy submission, urges the Commission not to adopt the Advisory Committee proposal, saying his firm has developed a better approach that outperforms the Advisory Committee proposal by a substantial margin in every video format. Demos (at 6) urges the Commission to submit his materials to an independent and unbiased outside group for an expert evaluation which he believes could be completed within a few weeks.

As Mr. Demos well knows, the Commission already established a process and procedures for evaluating the claims of system proponents -- its Advisory Committee. Despite his active involvement in the Advisory Committee during the last several years, his system was never proposed to the Advisory Committee and therefore, was never subjected to the rigorous and thorough Advisory Committee processes for certification, evaluation and testing. His claim that an evaluation could be completed within a few weeks is disingenuous. There is no support among broadcasters, the primary users of a terrestrial DTV standard, for any system that does not have proven, tested performance, including top-quality HDTV, and even if there were any reason to believe that the Demos approach could deliver such

performance, it would take years, not weeks, to repeat the type of thorough evaluation and testing of prototype equipment that broadcasters require.²⁶ The Commission has no valid basis for further consideration of Demos' proposal, and certainly none for scrapping the entire Advisory Committee process in favor of these last-minute, unproven claims.²⁷

Throughout the nine-year Advisory Committee process there has been no shortage of impressive sounding claims about what systems could be devised if only the particular visionary involved had enough time and money to make the proposal work. Early on, the Advisory Committee determined to use a careful, open process to scrutinize various proposals, relying on peer review by technical experts in a variety of specialists' committees headed by impartial leaders, and to accept only a system with proven, tested performance as the basis of a standard. This process served the involved industries and the public well, yielding breakthrough digital technology and ultimately the world's leading digital television system. There is absolutely no basis for the Commission to depart from this careful process now, based on the fallacious cost estimates and the dubious performance claims surrounding the CICATS proposal. The Commission should reject the CICATS counterproposal.²⁸

²⁶In Appendix A we note one deficiency of the proposed system which could easily be overlooked in a simulation, but would have been readily apparent if the system had been implemented in real-time hardware.

²⁷Demos (at 2, 7-8) finds fault with almost every aspect of the ATSC DTV Standard, and urges the Commission to adopt a lengthy list of restrictions that go even beyond the CICATS proposals, including a variety of requirements on receivers, something the members of CICATS generally oppose. For instance, he urges the Commission to reject the colorimetry aspects of the Advisory Committee recommendation and to give the task of defining appropriate colorimetry to "a qualified committee." We believe that the Society of Motion Picture and Television Engineers (SMPTE) and the International Telecommunication Union (ITU) which have standardized the default colorimetry are in fact highly qualified committees. The ATSC and MPEG standards provide the means to signal alternative colorimetry to receivers, once again highlighting the flexibility of the standard.

We note a clear pattern with Mr. Demos. He does not have any respect for any standards committee that does not completely adopt his views. The only committee he considers "qualified" is a committee of one, himself.

²⁸Microsoft, Compaq, CompTIA and BSA generally repeat the same positions reflected in the CICATS Comments, often with the same kind of distortion and hyperbole that characterizes the CICATS submission. Compaq (at ii, 15) criticizes the ATSC Standard first for supporting *too many* formats, and then for *not enough* aspect ratios. Intel (at 1-2, 7), although a member of CICATS, takes somewhat more moderate positions. Intel advises against adopting the standard in its entirety, but if the Commission does, it should ensure that the transport system includes the ability to deliver executable code; it should recommend, not require, image formats, and should consider incorporating the CICATS approach; it should allow alternative coding and compression techniques; and it should not regulate receivers beyond ensuring that they don't

B. Other Complaints about the Standard Are Also Unfounded

The Film Makers Coalition (at *i*, 3) follows the CICATS line, urging the Commission to make "relatively minor" changes to the Advisory Committee recommendation and adopt a 480-line, progressive scan, flexible baseline transmission standard with picture refresh rates of 24, 36 or 72 Hz, and a requirement that broadcasters transmit all films in their original aspect ratios. Along with Robert Primes (at 3, 4) they discuss at length their concern about potential cropping of their motion pictures for display on televisions

We needn't repeat here all of the reasons why a single-format baseline transmission standard should not be adopted. However, we are puzzled that these members of the motion picture industry speak so passionately about the artistic integrity of their work in the context of potential cropping of their pictures, but seem perfectly willing to forgo high-definition resolution in a transmission standard. With the ATSC DTV Standard, using the 720-line and the 1080-line progressive scan transmission formats, for the first time in history film makers will have the ability to display something like movie theater resolution on home television screens. Everything they say about the emotional appeal of their content would seem to apply with at least as much force to the resolution of pictures as it does to the aspect ratio. We would expect film makers to be the last people on earth to support the CICATS baseline standard, because it fails to guarantee proven HDTV performance from day one of the transition to digital television.²⁹

CFA/MAP (at 2, 6, 8) also endorses the progressive scan baseline standard proposed by CICATS, saying it will reduce the cost of digital receivers and converters and will permit

interfere with each other. Compaq (at 21) and CICATS (at A-12) join Intel in noting the need for ensuring that the transport system includes the ability to deliver executable code, saying that the Commission need not postpone adoption of a standard pending completion of this work. Intel has recently joined ATSC and a representative of Intel chairs a working group within ATSC that has begun work on a supplemental data broadcast standard to meet this need.

²⁹One reason these film makers support the CICATS proposal appears to be their desire to have their movies transmitted in progressive scan. They may not be aware that the Grand Alliance system video encoder contains a feature that automatically detects material originally produced in film and transmits it using the 24 frames per second progressive scan format.

the convergence of video and computer technology. They repeat the erroneous and misleading CICATS cost figures, and parrot back some of the unfounded hyperbole spouted by others, including claims that the Advisory Committee proposal would freeze technology in the 20th century, and that the dispute over the standard is about who gets a monopoly on receivers. As demonstrated above, these claims have no merit.

William Schreiber (Vol. II at 1-3) says that if the Grand Alliance system works as generally expected, it will deliver benefits fully commensurate with the expenditures involved, but that the standard is not perfect. He registers strong objections on some aspects of the standard (discussed in later sections), but other "imperfections" are mentioned, we believe, more by way of an academic tutorial on his view of the perfect system than as essential changes that must be made.

PCUBE (at 1-3) opposes the Advisory Committee recommendation, saying it will stifle innovation and the rapid development of new services and technologies, favoring instead a modular, open systems approach and giving various specifications for what might be included at each layer, in many cases quite similar to the ATSC DTV Standard. Here again, PCUBE has been heavily involved in the Advisory Committee process for years, and knows full well that the time for specifying the architecture of the perfect digital terrestrial broadcast system is long since past. Broadcasters, manufacturers, and consumers need to act now on the basis of proven, effective technology to begin a rapid transition to digital television.

Digital Theater Systems ("DTS") (at 1) argues that the ATSC DTV Standard must not require conformance with Dolby AC-3, saying that the Dolby AC-3 technology is obsolete, is incapable of recreating the artist's intent, and is poised to limit further innovation. DTS (at 4, 6) finds fault with the Advisory Committee test procedures, says subjective assessments have been conducted that prove better efficiency for its system, and makes a specific alternative proposal, including standardized hardware for an audio decoder. Universal Studios (at 1) supports the proposed standard, but urges that Dolby AC-3 not be permitted exclusively, claiming that the DTS system is superior.

Like other claims of superior technology, this proposal comes too late, and its benefits are asserted, not proven. Several other excellent audio systems, including three developed by members of the Grand Alliance themselves, were considered and in some cases evaluated as part of the Advisory Committee process, but the Dolby AC-3 audio system was selected as the clear winner by the Advisory Committee. There is no consensus within the industry for opening up the standard to another audio system or to multiple audio systems, and no compelling reason to believe that the present standard is not as good or better than any other.

McKnight and Bailey (at 1) urge the Commission to adopt a less complex and less costly progressive scan version of the standard, while the Research Program on Communications Policy ("RPCP") (at 5) advises the Commission to choose a system with progressive scan, square pixels, specifiable aspect ratios and frame rates, and digital coding, but no specific compression scheme³⁰. As with proposals discussed above, the Commission should reject these suggestions, since supporting multiple formats is neither substantially more complex nor costly, and the time to design the ideal theoretical DTV system is long since past.

Digital Imaging (at 3) urges the Commission to reject the ATSC DTV Standard and any other proposal that is not compatible with NTSC, and Blue Mountain Translator District (at 2) also urges that any DTV system be backward compatible with existing equipment. The Commission wisely determined many years ago to adopt a simulcast approach to enable a smooth and rapid transition to advanced television, and the Commission should follow through on that plan. The advantages of digital technology make it overwhelmingly clear that the days are and should be numbered for the analog NTSC transmission system, even though it has served the nation well for more than 50 years.

We believe that these extensive comments on the Advisory Committee's recommendation emphatically confirm that the ATSC DTV Standard represents the world's

³⁰While supporting multiple defined picture formats in a receiver does not add any appreciable cost, supporting multiple compression techniques would be extremely costly. The Commission should adopt the full ATSC DTV Standard, including the compression specifications.

best digital television technology and that it is *far more than adequate* for the nation's next generation of broadcast television service. A remarkable consensus in favor of the standard exists among those parties directly involved in broadcast television, and the arguments raised against it by parties less directly involved, although voluminous and sometimes extravagant, lack merit and reflect a myopic concern with supposed interoperability difficulties while ignoring the Commission's fundamental objectives in this proceeding. All in all, the comments articulate a compelling case for adopting the ATSC DTV Standard in its entirety, just as the Commission's Advisory Committee has recommended

IV. The Advisory Committee Process Warrants Adoption of its Recommendation

Many commenters join ATSC in praising the Advisory Committee process. NTIA (at 2) calls it an open process, to be commended, while the Grand Alliance (at *iv*) says the Commission has championed a unique process, providing leadership, policy direction and support, while relying on private investment, competition and a volunteer army of experts and leaders from the affected industries to develop a stunning technological achievement. The Broadcasters (at 3), Dolby (at 2) and MECA (at 2.7) state that the standard was developed through a uniquely open and inclusive process. Hitachi America (at 3) describes the concerted effort that included representatives of all affected industries, and Sony (at 1) describes the process as fair, open, deliberate, and dedicated to searching out the best solutions. Philips (at *v*, 12) says the process was perhaps as impressive as the technology it produced, and that the goal was always to get the system that best serves the needs of the American people.

Schreiber (Vol II at 1, 8) says that although the Advisory Committee has done its job well it has been hampered by the fact that almost all the participants work for companies with a financial interest in the outcome. Saying the public has been inadequately represented, Schreiber urges the Commission to appoint a small panel of independent experts, including FCC staff, to make the final desirable modifications to the system, with the Commission making the ultimate decisions. These experts must have business knowledge of both

industries (computer and TV), as well as technical expertise on the matters to be decided, not necessarily in the same individuals, but they must not have any financial interest in the outcome. Primes (at 13) makes a similar suggestion, urging the Commission to delay acceptance of the Advisory Committee proposal until the potential problems he's identified can be verified independently by parties without vested interests in the results.

These suggestions are silly and an affront to the hundreds of volunteers who labored diligently in the Advisory Committee for almost a decade. It is not only necessary, but desirable in such a process to involve all of the parties who have a stake in the outcome, and more often than not, the best experts in a particular field are actually employed by themselves or someone else in that field. The members of the Advisory Committee were chosen by the Commission to represent a broad spectrum of interests and expertise, but proponents of specific systems were not allowed to vote on the recommendation, and impartial leaders who operated fairly and openly were selected for every Advisory Committee working group and avenues of appeal were established and frequently used. Furthermore, as so many of the participants testified in the comments summarized above, the constant focus of every group within the Advisory Committee was to achieve a standard that best met the needs of the public. Between the Advisory Committee and the Commission's own review in this docket, all of the bases are covered to ensure that the Commission's decision is in the public interest.

CFA/MAP (at 1) laments that the Advisory Committee didn't include even one member of the public (even though the subcommittees and working parties were open to all interested parties).³¹ All of the thousand or so participants in the Advisory Committee process are members of the public, TV viewers, and consumers. Moreover, the consistent focus of the whole process was to develop the best system possible whereby broadcasters

³¹CFA/MAP complains about being excluded from the Advisory Committee process, yet they have embraced a completely unproven proposal formulated by a few computer companies behind closed doors with no input at all from the public or from other interested stakeholders. As a consequence, they have repeated false claims and endorsed unsound technical proposals that would actually harm consumers. The checks and balances inherent in the peer review-oriented Advisory Committee process would have prevented this kind of mistake.

could provide the most useful and attractive services to the viewing public through the most effective and affordable consumer equipment possible

Demos (at 2) says that the Advisory Committee remained insular to his input, and didn't accept his ideas and that "the participants who developed the ATSC DTV proposal were a relatively closed group who did not cooperate with those outside of their group" (25), that "the Advisory Committee testing process at the ATTC was neither thorough nor appropriate for the digital television systems" (14), that "the Advisory Committee process never established any process or mechanism for working to adjust the Grand Alliance proposal" (16), and that "the Grand Alliance proposal remains unmodified since it was originally proposed in mid-1993." (16)

Although Demos has been a long-standing participant in the Advisory Committee process, he never proposed a system to the Advisory Committee. That his specific suggestions may not always have been adopted says more about the merits of his ideas than about the fairness of the process, since virtually every other participant in the process attests to the openness and fairness of the process. We will not respond to every erroneous statement in his submission, but we will address some of the outright falsehoods. From its own monitoring of the Advisory Committee process, the Commission knows that the standard was in no way established by a closed group. And contrary to his assertion, the Advisory Committee established an elaborate set of specialist groups within its Technical Subgroup to evaluate every detail of the Grand Alliance proposal, and the Advisory Committee required *significant* changes in the Grand Alliance system as a result, e.g., the requirement to increase the 960-line formats to 1080 vertical lines, the requirement to use only square-pixel formats for HDTV, and the requirement to modify the system to conform strictly to the international MPEG-2 standard for video compression. The Advisory Committee also played a key role in the final selection of the transmission sub-system including consideration of a potential alternative system, and in the final selection of the audio system

Demos can hardly expect the Commission or anyone else who knows the truth about the Advisory Committee process to believe his unsubstantiated technical claims, when he so flagrantly misrepresents the process itself.

The Advisory Committee performed an invaluable service for the Commission and for the industries involved by forging a strong consensus over the course of nearly a decade for an advanced television transmission standard. By virtually all accounts, the process was remarkably open, thorough, fair and successful. Such a consensus cannot be lightly ignored or cast aside, but should guide the Commission's final decisions in this manner. The excellence and integrity of the Advisory Committee process fully warrants the Commission's acceptance of its recommendation. Accordingly, the Commission should act swiftly to adopt the ATSC DTV Standard recommended by the Advisory Committee.

V. The Commission Should Rely on Existing Processes in Making Modifications to the Standard

In our initial comments, we stated our strong belief that a sunset provision on the mandatory use of the ATSC DTV Standard is completely unnecessary and would undermine the Commission's goal to promote a smooth and swift transition. Every other party who addressed this issue also urged against adopting a sunset provision on the mandatory nature of the standard, finding no good reason for any such provision.³² Most of these parties also argued against (and no one argued for) setting a specific schedule whereby the Commission would review the standard, saying that any indication now of a need to modify the standard is premature and would be counterproductive to establishing the certainty that is required for the rapid implementation of digital television service. Many of these parties urged the

³²See, e.g., Broadcasters Comments (at 24), Thomson Comments (at 6), Zenith Comments (at 5), Tektronix Comments (at 3), MCEA Comments (at *i*, 4), MECA Comments (at 7), Hitachi America Comments (at 6), Sony Comments (at 36), EIA/ATV Comments (at *ii*, 10-12), Grand Alliance Comments (at *ii*, 11-12), and ATTC Comments (at 5).

Commission to rely on its existing processes and on industry groups like the ATSC for recommendations as to modifications to the standard.

Accordingly, the Commission should not adopt a sunset provision on the mandatory use of the standard and should not schedule any specific reviews, but should rely on industry organizations such as ATSC and on its existing processes to make any necessary modifications to the standard.

VI. The ATSC DTV Standard Provides Far More Than Adequate Interoperability

A. Computer Interoperability

In our initial comments, we described in detail the extensive efforts in the Advisory Committee to promote easy interoperability, saying that after these years of effort and tremendous progress, we're convinced that the ATSC DTV Standard provides *far more than adequate interoperability* with alternative media, that no critical interoperability problems remain, and that the Commission need not take any further actions to facilitate interoperability. Here again, virtually all of the parties directly involved in the provision of terrestrial broadcast television service agree, but some parties less directly involved oppose various aspects of the standard, claiming they limit interoperability with computers.

The Broadcasters (at 7-8), urging the Commission to keep in mind its main goal -- the preservation and enhancement of free over-the-air TV, note that interoperability was emphasized from the beginning, and that the proposed standard excels in the areas of interoperability and compatibility. NTIA (at 2) praises the flexibility, interoperability and headroom for growth offered by the proposed standard, and AFCCE (at 2) says the interoperability aspects of the standard should satisfy even those non-TV industries clamoring for an inflexible standard based on a single scanning mode

The Grand Alliance (at *ij*, 14, 16-26) states that the standard is more interoperable by far than any other digital television system on the planet, and that the Commission need take no further action in this area. Thomson (at 8-10), Zenith (at 7-9), ATTC (at 2, 6), EIA/ATV

(at 5), and Philips (at 8-9) make similar strong statements, with Philips noting a big payoff for NII applications that might be lost if further FCC delays mean that DVB becomes entrenched. General Instrument (at 6-8) gives an excellent discussion of the flexible capabilities of the standard and explains how the ATSC DTV Standard supports interoperability without limiting flexibility.

MECA (at 5-10) notes the standard's ability to enable a host of NII applications and its tremendous flexibility for future improvements, saying that interoperability is a matter of degree, and that the ATSC Standard strikes a balance that delivers interoperability unparalleled in the world. Hitachi America (at 4, 7) says that interoperability has been designed into the standard to a degree unprecedented in a universal service, noting the computer images that were included as part of the Advisory Committee tests.

Tektronix (at 6) argues that changes advocated by some in the computer industry are not in the public interest. Sony (at 3) states that critics of the standard offer nothing positive and stubbornly ignore the grueling tests to which the system was subjected and the strong industry consensus around the result, saying these critics would deny the benefits of the proposed standard without offering a practical alternative. Sony (at 9-10) also states that first and foremost the standard is a television standard and those who criticize virtually all primary technical parameters of the standard show either a profound lack of understanding of all that constitutes a television system, or a cynical and parochial dismissal of the critical priorities of the television industry. The ATSC Standard and the Grand Alliance system provide truly exemplary interoperability, but even so, interoperability debates almost by definition are destined to be interminable, and there is no rational technical resolution to this debate that can fully satisfy all factions. (Sony Comments at 35)

The Motion Picture Association of America ("MPAA") (at 4) says that the Advisory Committee proposal strikes the best balance between various technical considerations and the needs of different industries, and Universal Studios (at 2) endorses the MPAA comments regarding interoperability considerations. However, the Film Makers Coalition (at 2, 6)

parrots the CICATS comments, saying (mistakenly) that the Advisory Committee standard is not open and flexible and doesn't have headroom for future technologies.

The American Homeowners Foundation (at 2) states that some computer companies told them that the Advisory Committee proposals could add \$400 to the price of a personal computer to make it compatible with the Advisory Committee standard, but it would add very little if the CICATS approach were taken. Similarly, CFA/MAP (3-4) says that the Advisory Committee system provides for few, if any, changes, and that only the CICATS baseline standard is capable of convergence. They claim that consumers will have to buy two boxes, not one, because interlaced scanning, non-square pixel spacing, and low frame rates make convergence cost-prohibitive.

McKnight and Bailey (at 1) refer to receivers, VCRs and production equipment that use progressive scan as "interoperable," while any equipment using interlaced scan is called "noninteroperable," saying the standard will fail if it includes interlaced scanning.

Carver (at 2) says the proposed transmission is specific to television, and though it contains hooks for transporting alternative data, it departs greatly from state-of-the-art data transmission and communications practices -- a weakness that will surface to jeopardize the entire system.³³ Bove, *et al*, (at 3) say that the Grand Alliance standard is fatally flawed in its over-specificity and lack of extensibility

Intel (at 3) says the proposed standard limits interoperability between computer and TV systems, and that the use of interlaced scanning, non-square pixels, and 60 Hz frame rates does not permit the use of graphic and textual images necessary for computer applications. Compaq (at *ii*, 3) says the 18 formats with inferior technology (interlaced scanning, non-square pixels, computer unfriendly picture rates and limited aspect ratios) interfere with

³³We agree with Carver that the standard is focused primarily on television, but we strongly disagree that this is a weakness that will jeopardize the system. We believe that digital television service will be a powerful base upon which a host of other potential information services can flourish.

computer compatibility, while BSA (5) says ATSC DTV is incompatible with personal computer applications

Demos (at 1,3) says the proposed system has complete incompatibility with computers. He quotes the prices of NTSC/PAL converters at \$50,000 to \$250,000 depending on quality, and more for HDTV conversion, concluding that the barriers against computer compatibility are practically insurmountable ³⁴

These opposing comments make clear, as several parties warned, that the debate on computer interoperability is often characterized by absolute statements and hyperbole that shed no light at all on the real issues involved. Labeling progressive scan equipment "interoperable" and interlaced scan equipment "noninteroperable" is a semantical ploy designed to win adherents simply by the advantageous choice of labels. And those who simply claim that a standard that includes any interlaced scanning will surely fail, offer nothing but a bald assertion, and seem to ignore the fact that numerous *exclusively* interlaced digital television systems are thriving while we debate whether to permit four of the eighteen ATSC formats to be interlaced.

The absolute statements in these opposing comments, such as "not open and flexible," "doesn't have headroom for change," "provides for few if any changes," "is fatally flawed in its overspecificity and lack of extensibility," "consumers will need two boxes," "only CICATS is capable of convergence," "incompatible with personal computer applications," and "does not permit use of graphics and textual images" are demonstrably false and should not convince the Commission of anything

³⁴Demos' conclusion is completely unfounded. Incredibly, he seems to be suggesting that it will cost \$50,000 or more in a consumer receiver to provide high-quality conversion of an interlaced DTV format for use on a progressive scan display! As the reply comments of individual ATSC members will show, high-quality deinterlacing required for HDTV receivers will probably cost no more than \$35 in 1998 when DTV service begins, will fall to about \$5 by 2002, when all stations will be on the air, and will be negligible by 2004 when significant penetration of the market is attained. Such gross exaggeration does little to inspire confidence in any other of Demos' estimates and claims.

Another theme of these comments is also apparent. Various parties are being "told" false or misleading information about the interoperability issues surrounding the standard. As we discuss further elsewhere in these reply comments, an estimate of \$400 to make a personal computer compatible with the standard is wildly inaccurate. Moreover, home owners might better inquire what cost-effective options they might lose if valuable capabilities are banned from the standard.

As we have explained before, the ATSC DTV Standard based on the Grand Alliance system is first and foremost a broadcast television system, but it also offers better interoperability with computers than any other digital television system ever conceived. It offers the maximum interoperability with computers possible without sacrificing its ability to fulfill its primary purpose and to provide *other* types of interoperability that are also important. For example, although it has virtually limitless ability to carry data, it is not and never was intended to be a general purpose data communications system, nor should it be

B. Progressive vs. Interlaced Scanning

The debate over progressive vs. interlaced scanning occupied a great deal of attention in the Advisory Committee over the course of several years, and the breakthrough finding that an interlaced format could be included within a predominantly progressive scan system, at an almost negligible added cost, was pivotal in forming the Grand Alliance and in the ability to achieve a strong industry consensus around the Advisory Committee recommendation. On this ever-contentious issue, most of the commenters directly involved in the provision of broadcast television service and equipment offer strong support for the Advisory Committee recommendation to include interlaced scanning formats, including many who fought hard to achieve a primarily progressive scan system. However, a number of other parties continue to register strong objections to the inclusion of any interlaced transmission formats.

As we stated in our initial comments, we believe that *interlaced scanning formats should not be prohibited*, and that any further debate on this issue ironically will serve only to

entrench the many completely interlaced scanning television systems that are rapidly being adopted in the U.S. and throughout the world.

The 91 broadcasters and broadcast organizations who are among the primary users of the proposed standard (at 10-11), favor the inclusion of interlaced scanning, saying that far from detracting from the DTV Standard, inclusion of the interlaced format actually adds value. The Broadcasters state that "[t]he inclusion of interlaced scan as an option accommodates the interests of the broadcasters who favor it for some applications while still accommodating the needs of others in both broadcasting and computer and film industries that favor progressive technologies." MPAA (at 2), supported by Universal Studios (at 2), also endorses the inclusion of both progressive and interlaced transmission formats.

A wide range of other participants in the Advisory Committee process and other parties strongly endorse the Advisory Committee's recommendation to include some interlaced formats in the predominantly progressive-scan ATSC transmission standard.

Thomson (at 10) and Zenith (at 10) argue that by supporting both progressive and interlaced scanning, the standard meets the needs of a broad range of different users. General Instrument (at 7) echoes this view, noting how the standard meets the special needs of the computer industry, but observing that "[w]e are amazed that some computer industry proponents, who have no stake whatsoever in the broadcasting industry, would presume to limit the flexibility of the ATSC standard and dictate technologies to be used by broadcasters." Thomson (at 11-12), Zenith (at 10-11), and the Grand Alliance (at 19-20) note the emphasis of the standard on progressive scanning and stress the great amounts of material that will be transmitted using progressive scan formats, including all material originated in film (all movies and about 80% of prime time programming). Thomson (at 10), Zenith (at 10) and the Grand Alliance (at 23) reinforce our own view that any delay in adopting the standard out of

interoperability concerns will only serve to entrench interlaced scanning in the U.S. and throughout the world.³⁵

Tektronix (at 5) notes that it has strongly advocated the adoption of progressive scan formats, but does not oppose the inclusion of interlaced scanning, saying it's not practical to demand that all video displays resolve fine text and graphics when viewed from short distances. "There are some who advocate a system whose parameters are chosen solely to facilitate operation with computers, and suggest that any concession to interoperability with existing television systems is inappropriate. Tektronix believes that such an approach is not in line with the Commission's intent, nor is it in the public interest."

MCEA (at 1, 2) believes proposals to excise interlaced scanning lack merit and would impede ATV, while MECA (at 5) views the issue as one of idealism vs. pragmatism, saying there is great genius in the proposed solution, and the Commission shouldn't tamper with it.³⁶ Hitachi America (at 4) notes the emphasis of the proposed standard on progressive scanning, saying that interlaced is included as a practical means of optimizing delivered image quality.

Sony (at 2, 14-25) offers an extensive and convincing discussion, saying that interlaced scanning deserves whole-hearted support and simply must be preserved as a critical component of our flexible new standard, that the inclusion of interlaced is essential to the timely marketplace acceptance of HDTV, and that only the inclusion of interlaced and progressive scanning will permit the immediate broadcast of both film and live events TV in full high-resolution HDTV

The Grand Alliance (at 21-22) defends the inclusion of interlaced formats, saying they are useful for transmitting archived interlaced material and for interoperability with current high-definition production equipment and the installed base of NTSC production and studio

³⁵Expressing some bewilderment with those who still claim the standard lacks interoperability in spite of all of these features, Thomson (at 11), Zenith (at 11), and Sony (at 24) suggest that some in the computer industry are simply trying to derail the Commission's standard setting process for anticompetitive purposes.

³⁶MECA (at 8-9) also states that all-progressive HDTV production is the goal and they are investing resources to achieve it, and that the continuing debate on the comparative advantages of interlaced and progressive scanning is pertinent only to HDTV production.

equipment, and that for video not originally produced on film, more SDTV programs can generally be offered simultaneously using interlaced scan.

Many parties, including the Broadcasters (at 10), MECA (at 9), MPAA (at 6), Sony (at 27), and the Grand Alliance (at 20, 24), point out the ability in a digital system to separate production, transmission and display capabilities in a total system, in some cases criticizing the opponents of interlaced scanning for confusing transmission formats with display or production formats. Sony (at 23), the Grand Alliance (at 20) and MECA (at 9) stress that deinterlacers work well and are affordable.³⁷ ATTC (at 7) states that with the cooperation of several manufacturers it "has demonstrated to the Commission that consumer-level technology is now available for products that will enable consumer receivers to display selectively a wide range of field rates, aspect ratios, type of scanning, and even colorimetry characteristics independent from the parameters chosen for production or transmission. Such technology makes it both feasible and affordable at the consumer level to combine computer scanning and any of the broadcast video scanning standards on any chosen display, regardless of its native characteristics."³⁸

Notwithstanding all of these compelling reasons for including both progressive and interlaced scanning formats in the standard, a number of parties continue to oppose any inclusion of interlaced scan in the transmission standard. They raise a wide variety of complaints, ranging from unfounded assertions that amount to little more than name calling, to highly technical claims about compression and coding efficiencies, backed up by "supporting" papers that often contain data that calls into question their conclusions or that don't support

³⁷Sony has demonstrated to the Commission a commercially available HDTV home receiver that accepts a 60 Hz interlaced scanned input television signal and displays it at full 60 frame progressive. "We emphasize that such de-interlacing is today a well-known art -- cost effective, implementable in VLSI, already available in some receivers, and finally, as the Commissioners recently witnessed, it works very well." (Sony Comments at 23) Similarly, Carroll (at 3) says deinterlacing is no longer a big deal, because converters can output progressive or interlaced regardless of how the signal is received, since the hardware (memory) cost of storing a frame is trivial.

³⁸See Letter of Lawrence Petak to the Acting Secretary of the Commission re an oral *ex parte* presentation by IBM and Snell & Wilcox describing their *Multi-Media Bridge*, a device capable of processing any current broadcast standard as input and displaying any desired picture standard as output.

the referenced conclusion at all. We do not attempt to address every error or misconception expressed in the comments, nor every opinion that differs from ours, but we do address enough here to demonstrate the folly of any attempt by the Commission to adjudicate every claim and counterclaim in what is practically a religious debate. That's why the Commission established an Advisory Committee, and the Advisory Committee did a superb job forging a consensus. That several vocal detractors remain *in industries not directly involved in the provision of free over-the-air television* should not deter the Commission from bringing a successful conclusion to this historic effort

One of the most responsible comments, even though we disagree with it, is made by ITI (at 2). Although they support the rapid adoption of a DTV standard, they state that the Commission can minimize the cost of DTV investment by going directly to progressive scanning, and that including interlaced scanning will perpetuate an inferior technology and delay the convergence of technologies. As described in our initial comments, we believe that including some interlaced formats in the predominantly progressive scan standard offers important benefits to broadcasters. And as explained more fully below in our responses to other complaints about the standard, we believe concerns that incorporating some interlaced scanning formats in the standard will delay the convergence of technologies are completely overblown.

In one of the least responsible comments, McKnight and Bailey (at 1) state that failure to eliminate the costly and unnecessary interlaced formats will cost consumers billions of dollars, and may in fact doom the whole enterprise to failure, saying Japan introduced an interlaced HDTV system which failed in the marketplace; Europe introduced an interlaced HDTV system which failed in the marketplace; and there is no reason to believe that the Grand Alliance standard will not meet a similar fate unless interlace is eliminated. McKnight further adds that the Commission will accelerate the abandonment of broadcast TV by including interlaced scanning.

Logic such as this could easily prove that pigs can fly! No informed observer of digital television developments believes that the presence of interlaced scanning is the cause of slow growth of analog HDTV. For example, the lack of programming is clearly the most significant factor in the slow growth of HDTV in Japan, where years after introduction of the service, there is still only one channel available. And apart from the obvious hyperbole in these statements, they take no account of the rapid adoption in the U.S. and elsewhere of digital television systems that use interlaced scanning *exclusively*. Indeed, as we continue this endless debate, interlaced scanning is becoming entrenched here and around the world. Furthermore, it seems unlikely to us that McKnight and Bailey know more about what is needed to help preserve broadcast television than the collective voice of the entire terrestrial broadcast community that is united in its support for the proposed standard.

Other "experts" on this issue believe interlaced scanning must be banned for just the opposite reason. Compaq (at 16) says "[c]ommentators have cautioned that the inclusion of interlaced scanning will doom progressive scanning to extinction, despite the technical and economic advantages of progressive scanning. Compaq attributes this opinion to Delogne, but Delogne's paper does not make this assertion at all, but in fact compares the U.S. situation *favorably* to that in Europe *because* of the inclusion of progressive scan formats here. CICATS (at 12-13, A-5) makes an argument similar to Compaq's assertion. Both parties also reference a similar statement made by William Schreiber in March, 1996, but his more moderate statement in these comments (Vol. I at 2-4) is that the presence of interlaced scanning formats will inhibit the migration to progressive scan, although he does mention his earlier statement regarding "the danger that progressive scan will never be used if interlaced transmission is permitted." Schreiber also argues that including interlaced scan will eliminate the possibility for the system to be improved over time in a manner that does not make unusable much of the equipment first deployed, especially receivers in the hands of the public. And Demos (at 1-2) urges the Commission to forbid interlaced transmission formats, or else they'll get the Japanese interlaced standard for HDTV and the NTSC format for SDTV.