material for ATV and to ensure the necessary interconnectivity of production equipment. Specific activities to be undertaken may include:

1. Documentation of studio signal formats and interfaces in both digital and analog forms.

2. Television recording formats and related operating practices.

3. Documentation to support the use of motion picture film in ATV production and program release.

4. Quality measurements and assessments related to production.

5. Operational and interoperability matters.

Institute of Electrical and Electronics Engineers

1. Broadcast Testing and Measurement Standards — Equipment used to deliver ATV programming to the home will have to be effectively tested and their technical parameters measured. FCC may need to include this information in one of their OET Bulletins in order to guide manufacturers in the development of new products. The IEEE should assume responsibility for this work.

2. Terminology.

Electronic Industries Association

1. Consumer Ancillary Data — As discussed above, the ATSC will assume responsibility for the documentation of the standards for closed captioning and similar Consumer Ancillary Data services. However, other services are possible with the new ATV digital delivery system. For example, electronic program guides may be desirable in the future. EIA should assume responsibility for the documentation of all other data services which rely on the television receiver as the decoder and display device.

2. Receiver Interface Standards — It is likely that the ATV receivers will be provided with a multiport connector which will be used to interconnect a wide variety of future electronic devices such as cameras, computers, ISDN feeder cable, etc. EIA is the appropriate organization to document standards for this equipment.

3. Consumer VCR and Videodisc Interchange Standards — With the advent of a new terrestrial digital ATV delivery system, consumer tape/disc interchange

format standards will need to be developed. EIA is the appropriate organization to specify those standards.

4. Consumer Equipment Testing and Measurement Standards — To efficiently develop consumer electronic products, a baseline procedure is needed in this totally new product area. This may alternately be in the form of industry guidelines. EIA has been responsible for these types of documents in the past.

National Cable Television Association

1. Cable Distribution — Sixty percent of today's television households are now served by the cable television industry. NCTA will need to document standards for delivery of the new ATV signals to the home through the local cable system. EIA should be involved to ensure interconnection with ATV receivers. NAB should be involved because many of the cable channels carry terrestrial broadcast signals.

Satellite Broadcasting and Communications Association

1. DBS Distribution — In the United States, several companies have stated their intention to provide satellite delivery systems for ATV programming. The SBCA, although not a member organization of the JCIC, may be the appropriate organization to complete this work. This work will parallel that of NCTA regarding cable delivery and should be jointly entered into by both organizations. EIA should be involved, as well, to ensure interconnection with ATV receivers.

2. Satellite Commercial Distribution — Commercial distribution of ATV programming will be used to deliver programming to local outlets. The SBCA may be the appropriate organization to complete these standards but NAB and NCTA should be involved to ensure that the standards meet the needs of their members.

For ATSC to complete the work outlined above, about $400,000 will be required to operate for one year beyond the Advisory Committee's recommendation. The efforts of ATSC began ten years ago and have laid the groundwork for ATSC's role as decisions are being made. An industry-wide private sector organization is needed more than ever to conclude the standards work. The support — both technical and financial — of ATSC's members will be required.

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Doc. T3/210
20 Nov 1992

Advanced Television Systems Committee
T3/S1 Specialist Group on Macro Systems Approach

ATV SYSTEM DOCUMENTATION GUIDELINES

Introduction

On June 5, 1992, ATSC provided information to the FCC outlining proposed industry actions to fully document the advanced television standard. Supporting this activity, the ATSC Executive Committee requested that the T3/S1 Specialist Group on Macro Systems Approach meet and suggest which portions of an ATV broadcasting standard should be incorporated into the FCC Rules and which portions should be voluntary. Subsequently, T3/S1 held meetings on July 24, August 13, September 11 and October 27, 1992. Recommendations were developed in two areas:

1. Principles upon which documentation of the ATV standard should be based; and

2. A list of characteristics of an ATV system that should be documented. The list tentatively identifies the industry group(s) that would provide the documentation information as well as identifying the standards document where the information would likely appear.

These recommendations, as developed in the T3/S1 Specialist Group and modified at the November 20 meeting of the T3 Technology Group, are shown below.

1. Principles for Documenting the ATV Standard

1. The selected ATV system proponent must be the principal supplier of information for documenting the ATV standard with support from ATSC and others.

2. Advance determination of FCC requirements for the ATV standard should be obtained as soon as possible.

3. Complete functional system details (permitting those skilled in the art to construct a working system) should be publicly available; however, details of specific system implementations may be proprietary. Protection of any proprietary content must be by patent or copyright as appropriate.

4. System specifications should explain how compatible improvements are to be achieved, whether through the use of a header-and-descriptor structure or by other means.

5. The ATV standard should include the necessary system information such that ATV encoders may be manufactured to deliver the system's full demonstrated performance quality.

6. The current level of technical disclosure from proponents is not adequate for the task of documenting the ATV standard for the FCC and the television industry. Proponents are encouraged to begin drafting the essential elements of system details as soon as possible to avoid delays in producing the ATV standard documentation.

7. The ATV standard must guarantee backward compatibility of future improvements with all generations of ATV receivers and inherently support production of lowest cost receivers (notwithstanding that cost reduction through reduced performance quality may also be used to achieve inexpensive products.)

8. The ATV standard should not foreclose flexibility in implementing ATV receivers at different price and performance levels.

9. As ongoing improvements take place in the ATV system, manufacturers of encoders and decoders should coordinate their efforts to insure compatibility.

2. List of System Characteristics to be Documented in the ATV Standard

System characteristics are listed in four categories: Source Coding, Data Multiplex and Channel Coding, RF/Transmission, and Receivers. Most of the characteristics have sub-characteristics listed underneath them, showing examples of details that should be included in fully documenting the associated system characteristic. The list shows also the entity that will be the source for the information pertaining to each system characteristic and identifies the document or organization that is expected to provide documentation of that characteristic. Until a system is chosen and full technical details are available, this list is, of necessity, tentative. It may contain characteristics that do not apply to the chosen system, and it may be missing characteristics that do apply. Also, to provide flexibility for future improvements, the degree to which each characteristic is specified in the standards will need careful consideration. Note that where the FCC is listed, it is anticipated that ATSC will perform the documentation task.

System Characteristic	Information Provider	Standardization Document
Source Coding		
Input source format	proponent	SMPTE/FCC Rules
aspect ratio		
number of vertical scanning lines		
sequence of line scanning		
number of bits per pixel		
sampling rate		
anti-aliasing		
Input colorimetry/transfer characteristics/pre-processing	proponent	SMPTE/FCC Rules
pre/post processing filter		
color conversion matrix		
color decimation filter and filter factors		
chroma interpolation filter		
Compression algorithm	proponent	FCC OET Bulletin
internal DCT word length		
accuracy of DCT coefficients		
classified DCT		
fast DCT algorithm		
Quantizer/inverse quantizer	proponent	FCC OET Bulletin
number of tables		
adaptive step size		
adaptive quantization		
human visual system weighting		
adaptive bit allocation		
dynamic range		
DPCM prediction loop	proponent	FCC OET Bulletin
predictor coefficients		
refresh interval		
leak factor and adaptation		
inter/intra frame switching		
Variable length coder/decoder	proponent	FCC OET Bulletin
number of look-up tables		
adaptive table generation algorithm		
initialization routine		
Motion estimation	proponent	FCC OET Bulletin
motion vector search algorithm		
motion search range		
number of storage frames		
number of motion vectors		
components used for search		
motion vector encoding		
vector search accuracy		
Buffer rate controller	proponent	FCC OET Bulletin
quantizer bit allocation		
components multiplexing		
Audio transform coding compression	proponent	FCC OET Bulletin
transform window size		
number of transform bands		
psychoacoustic model		
dynamic bit allocation model		
spectral envelope shape		
Maximum coding delay	proponent	FCC Rules
Total acquisition time	manufacturer	

System Characteristic	Information Provider	Standardization Document
Data Multiplex and Channel Coding		
Audio services	proponent	FCC
main program multi-channel audio modes		
3/2 ch. program		
3/0 ch. program		
2/0 ch. program		
language multi-channel audio modes		
3/2 ch. program		
3/0 ch. program		
2/0 ch. program		
independently coded channels		
program for visually impaired		
program for hearing impaired		
2/0 ch. stereo main program		
2/0 ch. language program		
audio control		
headroom		
dynamic range		
user bits		
language		
Captioning service	EIA	FCC Rules
Teletext service	EIA	EIA
Program guide service	EIA	EIA
Program and source identification service	EIA	EIA
Other services	TBD	TBD
Conditional access control information	proponent	NCTA/EIA
encryption		
key management		
scrambling		
addressability		
Bit stream syntax	proponent	FCC Rules
sync		
equalization/ghost canceling training sequence		
channel error protection (location)		
channel error protection specification/control data		
block/segment numbering/ordering		
information prioritization		
video data		
quantization tables and coefficients		
motion vectors		
YUV multiplexing; luminance and chrominance blocks		
motion compensation processor		
macroblocks		
spatial transform size and shape		
frame type		
group of pictures		
intra/inter frame		
leak factor		

System Characteristic	Information Provider	Standardization Document

- audio multiplexing
  - main program multi-channel audio modes
    - 3/2 ch. program
    - 3/0 ch. program
    - 2/0 ch. program
  - language multi-channel audio modes
    - 3/2 ch. program
    - 3/0 ch. program
    - 2/0 ch. program
  - independently coded channels
    - program for visually impaired
    - program for hearing impaired
    - 2/0 ch. stereo main program
    - 2/0 ch. language program
  - audio control
    - headroom
    - dynamic range
    - user bits
    - language
- data multiplexing
  - captioning
  - program and source identification
  - conditional access control information
  - non-program data
    - program guide
    - teletext
    - reserved/test/service data
    - other data
- headers/descriptors/data type identifiers
  - channel error protection (location)
  - channel error protection specification/control data
  - block/segment numbering/ordering
  - information prioritization
  - video data
    - quantization tables and coefficients
    - motion vectors
    - YUV multiplexing; luminance and chrominance blocks
    - motion compensation processor
    - macroblocks
    - spatial transform size and shape
    - frame type
    - group of pictures
    - intra/inter frame
    - leak factor

System Characteristic	Information Provider	Standardization Document
audio multiplexing		
main program multi-channel audio modes		
3/2 ch. program		
3/0 ch. program		
2/0 ch. program		
language multi-channel audio modes		
3/2 ch. program		
3/0 ch. program		
2/0 ch. program		
independently coded channels		
program for visually impaired		
program for hearing impaired		
2/0 ch. stereo main program		
2/0 ch. language program		
audio control		
headroom		
dynamic range		
user bits		
language		
data multiplexing		
captioning		
program and source identification		
non-program data		
program guide		
teletext		
reserved/test/service data		
other data		
Channel error protection	proponent	FCC Rules
forward error correction		
convolutional coding		
linear block coding		
data interleaving		
depth of interleaving		
block		
convolutional		
channel multiplexing		
concatenated coding		
trellis/set partition modulation codes		
RF/Transmission		
Allotment/Assignment	FCC	FCC Rules
table of allotments/assignments		
basis for channel assignments		
power and antenna height limits		
prediction of coverage		
Modulation	proponent	FCC Rules
modulation method		
carrier/subcarrier frequencies/relative levels		
number of bits per symbol		
bit and frame sync recovery		

System Characteristic	Information Provider	Standardization Document
Transmitter	TBD	FCC Rules
transmitter pulse shape (matched filter)		
output power requirements		
spectral mask requirements		
frequency stability		
phase stability		
spurious response		
Test and Monitoring	IEEE	FCC Rules
power measurement method		
monitoring equipment		
compliance methods		
Receivers		
Noise figure	EIA	EIA
Adjacent channel rejection	EIA	EIA
Taboo rejection	EIA	EIA
Antenna gain measurement method	EIA	EIA
Antenna front-to-back ratio measurement method	EIA	EIA
Direct pick-up	EIA	EIA/FCC?
Adaptive equalizer	manufacturer	EIA guideline?
speed of adaptation		
number of taps and precision		
adaptation algorithm		
equalization range		
tap spacing		
training sequence		
Error detection and correction	manufacturer	
error detection method		
maximum correction range		
coding gain at threshold		
Error concealment	proponent	EIA guideline?
header parameters		
tables		
DCT coefficients		
sync recovery		
slice recovery		
motion vectors		
audio dropout		
Local oscillator radiation	EIA	FCC Part 15
IF frequencies	EIA	EIA
other local oscillator requirements		
heterodyne technique		
tuner return loss		
bandpass spectrum		
AGC	manufacturer	
AFC	manufacturer	
Post reconstruction filter	manufacturer	
Consumer interface standards	NCTA/EIA	NCTA/EIA/FCC
Caption presentation (display) system	EIA	EIA/FCC
Conditional access	proponent	NCTA/EIA
Other services	TBD	TBD

****

JEGI-DOC-012

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ADVISORY COMMITTEE ON ADVANCED TELEVISION
PLANNING SUBCOMMITTEE
WORKING PARTY 4

INTERIM REPORT

DECEMBER 31, 1991

Reference for "Interoperability" definition.

DEFINITIONS

Interoperability

The capability of providing useful and cost-effective interchange of electronic image, audio and associated data: among different signal formats, among different transmission media, among different applications, among different industries, among different performance levels.

Extensibility

A property of a system, format or standard that allows changes in performance or format within a common framework, while retaining partial or complete compatibility among systems that belong to the common framework.

Harmonization

The coordination of different advanced image standards in an orderly process.

Scalability

The degree video and image formats can be combined in systematic proportions for distribution over communications channels for varying capacities

Advanced Video and Imaging Data

Digital information representing images and video processed by leading-edge (1991) digital circuitry and algorithms.

Scope of Services and Features

The range of services and features supportable by the control functions and channel capacity devoted to ancillary data in an advanced TV system.

Header/Descriptor

Headers (preceding a digital datastream) provide packetized identifiers of encoding standard, image block length, optional error protection and block synchronization; descriptors add time, data, various ID.

TABLE 2

JEGI-DOC-013

FACSIMILE MESSAGE FROM
ROBERT SANDERSON, EKC
PHONE: 716-726-7763 (O) FAX: 716-253-6284
716-381-2563 (H)

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August 30, 1993

8 Pages Including This Cover

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Grand Alliance			
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G. Reitmeier	Dave Sarnoff	609-734-2523	609-734-2124
cc:			
J. Flaherty	CBS	212-975-2213	212-975-3646

Message

Revised announcement letter for the October 6/7 meeting per our teleconfernece call last Friday.

1. Please review and provide comments/changes ASAP
2. Review the "Experts Panel" list for completeness
3. Provide addresses that are missing wherever you made the nominations for additions to the list.

We'll do our best to get this letter out over the next few days --- as soon as we have all the changes you sugesst agreed to AND we have addresses to direct the mail to. Need your help since we are short staff here this week due to vacations.

DRAFT

Dr./Mr./Ms. Interoperability Expert Panel Member
XXX Organization
USA

On behalf of the Technical Subgroup of the FCC Advisory Committee for Advanced Television (ACATS), we invite you to participate in an Interoperability Review of the Grand Alliance System Proposal.

As part of the final evaluation process for proposals for a new U.S. television format, the ACATS Technical Subgroup recently formed a Joint Experts Group on Interoperbility to help evaluate the Grand Alliance proposal. In order to accomplish this important work we seek input from industries and communities (including, for example, the emerging National Information Infrastructure) affected by the FCC ATV standardization. Specifically, we are soliciting inputs from experts representing those affected industries and communities, and in sufficient technical detail that those inputs can beneficially shape the Grand Alliance system definition. You are being invited to participate on an Experts Panel based on your demonstrated expertise, in your field, and in the industry or public interest area you represent. (Please see the attached list of invitees.)

In order to conduct the planned review, gather input for the Grand Alliance and draw conclusions/recommendations, we would expect your participation in two meetings (preliminary details are provided below). The Joint Experts Group on Interoperability is currently working with the Grand Alliance to structure the review in which we are asking you to participate. Starting point for the review will be the earlier interoperability study and recommendations by ACATS PS-WP/4 (we enclose copy of a report of that work for those of you that did not directly participate). Further, the Grand Alliance will prepare a formal response to the PS-WP/4 interoperability recommendations, detailing the consideration they have given to meeting interoperability recommendations as well as rationale for the trade-offs they have made where conflicting requirements have made that necessary. Ultimately, the Joint Experts Group will report conclusions and recommendations from the review, including and based on your expert opinion and judgment.

We can't be absolutely precise in predicting the amount of effort required to accomplish the review. However, with some appropriate structuring and advance work on our part and yours, we believe we can accomplish the work in two meetings of one to two day duration. Meetings will be held in Washington DC. Plans, as we currently envision them are as follows:

Interoperability Review Mtg #1

October 6 (10:00AM - 5:00PM) & October 7 (8:00AM - 4:00PM)

Agenda:

- Review ACATS PS-WP/4 Interoperability Study & Recommendations
- Grand Alliance Interoperability Response
- Interoperability questions from Experts Panel
- Preliminary conclusions and recommendations (to be reported at the ACATS Technical Subgroup October 21 meeting)

November (date to be set)

Agenda:

- Final conclusions and recommendations

In order to accomplish our work with a minimum of formal meetings, we will expect to provide additional materials along the way for your review. These will likely include a system definition summary for the Grand Alliance proposal as well as draft of the Grand Alliance "Interoperability Response". By providing these materials before the review meeting, we would expect you to be able to provide more specific inputs to the review. In particular, we will be looking for specific technical suggestions that can guide the Grand Alliance design — what would you change in order to interoperability in the field of your expertise and interest? We will ask that your inputs be in document form as much as that is possible and framed in the context of the Grand Alliance system proposal.

Please confirm your willingness to participate in this important work and, if so, confirm your attendance in the October 6/7 meeting. We will provide more detailed requests, notices and expectations along the way. Meanwhile, we wanted to give early notice of the October 6/7 meeting, gain your commitment to participate in this important work and get the meeting on already busy calendars.

Cordially

Robert L. Sanderson
Eastman Kodak Company
Chairman
(716-726-7763)

Michael Liebhold
Apple Computer, Inc.
Vice Chairman
(408-974-6025)

Joint Expert Group on Interoperability
Advisory Committee on Advanced Television

Attachments:

- Interoperability Experts Panel List
- Interoperability Definition
- ACATS Joint Experts Group on Interoperability
- ACATS System Recommendation (Executive Summary)
- ACATS PS-WP/4 Final Report

INTEROPERABILITY DEFINITION

Reference: ACATS PS-WP/4 INTERIM REPORT December, 31, 1992

Definition: The cabability of providing useful and cost-effective interchange of electronic image, audio and associated data: among different signal formats, among different transmission media, among different applications, among different industries, among different performance levels.

ACATS Technical Subgroup
Experts Panel — Joint Experts Group on Interoperability

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Executive Director
Bellcore

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Nemours Center for Biomedical Comm.

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NBC TECHNOLOGY
TELEFAX MESSAGE

Number of pages including this one: 9

TO: ACATS Joint Experts Group on Interoperability

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Grand Alliance Representatives

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cc:	J.Flaherty	CBS	Fax: 212-975-3646
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DT: 30 Aug 93

RE: Teleconference Call, Friday, 27 August 1993

Attached are the draft Teleconference Call summary notes.

JEGI Doc./1

ACATS Joint Experts Group on Interoperability (JEGI)

Summary Notes - Teleconference Call, Friday, 27 August 1993

All members of the Experts Group and the identified Grand Alliance representatives participated in the teleconference call which was called to order at 15:06 hrs:

ACATS Joint Experts Group on Interoperability

R.Sanderson (Chair)	Eastman-Kodak
M.Liebhold (Vice-Chair)	Apple
S.Baron (Sec.)	NBC
B.Gerovac	Digital
M.Haley	IBM
P.Hearty	ATEL
R.Hopkins	ATSC
C.Tanner	CableLabs

Grand Alliance Representatives

R.Keeler	AT&T
G.Reitmeier	DSRC

The stated objective of the teleconference call was to:

define outline for a report (verbal and written) from the GA on "interoperability of the GA system ... response to the ACATS PS/WP4 interoperability study and recommendations."

with the agenda to be as follows:

1. Definition of Interoperability.
2. Outline for GA Interoperability Report.
3. Invite letter for October 6/7 Meeting.
4. Meeting locations for September 20 & October 6/7 Meetings.
5. Additions to Joint Expert Group on Interoperability.

1. Definition of Interoperability.

The Expert Group accepted as its definition of Interoperability, that definition adopted by PS/WP4:

"The capability of providing useful and cost-effective interchange of electronic image, audio and associated data; among different data formats, among different transmission media, among different applications, among different industries, among different performance levels."

The question was raised as to whether the Experts Group was to deal with Interoperability applied only within the transmission channel or did the charter include dealing with Interoperability "up and down" the chain. It was agreed that our concern dealt with the latter with the understanding that the primary focus was on the FCC transmission standard for ATV broadcasting.

2. Outline for GA Interoperability Report
G.Reitmeier presented a draft Outline for the Grand Alliance Interoperability Report. (See attached.)

- The following suggestions for improvement were adopted:

* Adding a section on "Migration";

* Adding, early in the report, an overall summary of the Grand Alliance response to the PS/WP4 list of critical parameters (i.e. progressive scan within the transmission channel, square pixels, etc.);

* Address interoperability examples for specific applications; and

* Address the issue of the National Information Infrastructure (NII).

G.Reitmeier will update GA Outline to include these items.

- R.Hopkins raised a question on how a practical interface between devices would be implemented. The concept of a simple, practical hardware interface and employment of Headers as a service identification mechanism was discussed.

This led to a discussion on identifying the family of standards that must be developed beyond those that might be adopted by the FCC. R.Hopkins informed the group that the ATSC has prepared documents addressing these issues. Hopkins agreed to distribute the documents to the participants on this teleconference.

3. Invite letter for October 6/7 Meeting.

- It was agreed that we should be seeking input from industries and communities affected by the FCC's standardization of ATV.

- It was further agreed that the members of the Experts Panel would be asked to prepare presentations on requirements deemed important by the industries or communities that represented. The presentations are to focus on technical requirements (i.e. picture resolution, latency, formats, etc.) to aid the Grand Alliance in selection of the system parameters.

B.Gerovac and M.Liebhold agreed to prepare a guide for use by the Experts Panel as a framework within the context of the Grand Alliance proposal. The following schedule was adopted:

> 03 Sep: Draft document by Gerovac and Liebhold to this meeting's participants for comment.
>
> 08 Sep: Response by participants to draft document.
>
> 10 Sep: Final document forwarded to Experts Panel invitees as a followup to the letter of invitation.

- It was resolved that the letter of invitation should inform the invitees that 1). the above mentioned guideline would be forthcoming; 2). the goal of the meeting was to solicit information that would be of assistance to the GA in designing their system; 3). they should be specific in presenting those technical changes they would ask to be made to provide additional "interoperability" for their applications; and 4). they should be prepared to discuss why those changes are warranted when they reduce the level of "interoperability" for another community of interest. The following schedule was agreed to:

> 03 Sep: letter of invitation redrafted by Sanderson and forwarded to this meeting's participants for comment.
>
> 08 Sep: Response by participants to draft document.
>
> 09 Sep: Final document forwarded to Experts Panel.

It was also resolved to modify the text of the agenda of the October 6/7 meeting so that the note about the 21 October date clearly indicated that this is the date for submitting a preliminary report and is not the date for a future Experts Panel meeting.

- There was a significant discussion on expanding the list of invitees to make sure that all industries and communities of interest have an opportunity to participate in the Experts Panel discussion. This view was strongly supported by the Grand Alliance representatives. This led to a discussion on whether there needed to be a balanced representation within each community (i.e. all four networks ABC, CBS, NBC, and PBS, all major computer companies, all major cable MSOs, etc.). It was also recognized that the meeting would be open to the public and that interested parties would be able to attend whether they received a formal invitation of not. R.Sanderson agreed to study this issue.

- It was further resolved that the meeting would be extended to two days (October 6: 10:00 - 17:00 and October 7: 08:00 - 17:00)

4. Meeting locations for September 20 & October 6/7 Meetings.

- It was agreed that the September 20 meeting would be held at Kodak in Roslyn, VA.

- There was no final selection of a site for the 6/7 October meeting. The site must be capable of accommodating 70 people. The NAB was suggested as a possible site.

5. Additions to Joint Expert Group on Interoperability.

- R.Sanderson suggested we consider expanding this Joint Experts Group on Interoperability by one or two individuals. The individuals suggested were:

1. Jules Bellisio (Bellcore), and
2. Tice DeYoung (ARPA/CSTO)

The teleconference was terminated at 17:33 hrs.

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