IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

U.S. PHILIPS CORPORATION, Plaintiff, v. EASTMAN KODAK COMPANY, Defendant.	)	Case No. 06-0251 GMS

EASTMAN KODAK COMPANY'S APPLICATION FOR ISSUANCE OF A LETTER OF REQUEST FOR INTERNATIONAL JUDICIAL ASSISTANCE PURSUANT TO THE HAGUE CONVENTION OF 1970 ON THE TAKING OF EVIDENCE ABROAD IN CIVIL OR COMMERCIAL MATTERS

1. Defendant Eastman Kodak Company ("Kodak") respectfully applies for the issuance by the Court of a Letter of Request filed concurrently herewith, seeking the assistance of the judicial authorities of England and Wales for purposes of obtaining witness testimony and documents from United Kingdom residents.

2. This Application is made pursuant to, and in conformity with, the Hague Convention of 1970 on the Taking of Evidence Abroad in Civil or Commercial Matters, T.I.A.S. 7444, 23 U.S.T. 2555, *reprinted in* 28 U.S.C.A. § 1781, ("the Hague Convention") and Rules 28 and 30 of the Federal Rules of Civil Procedure.

3. Issuance of a Letter of Request under the Hague Convention is the proper method for seeking testimony and documents of persons residing abroad. Fed. R. Civ. P. 28; *Pain v. United Technologies Corp.*, 637 F.2d 775, 788-90 (D.C. Cir. 1980).

4. Kodak seeks evidence from: (1) Mike Low, Director of the British Standards Institute and (2) Ms. Theodora N. Ngosi (collectively referred to herein as "the

witnesses"). Each of the witnesses is a United Kingdom resident and a current or former employee of the British Standards Institute ("BSI").

5. The witnesses will produce documents and testimony sufficient to show that Philips employees were active within BSI and, in their capacity as BSI representatives, actively participated in the standards-setting organizations responsible for the promulgation of the Joint Photographic Experts Group's international standard for still image compression ("the JPEG standard"), which Philips now claims its patents cover.

6. Kodak anticipates that the testimony and documents requested from the witnesses will establish that Philips, through its participation in BSI: (1) knew the technical details of the proposed JPEG standard; (2) was aware of the patent disclosure policies of each organization which required its members to disclose patents and patent applications relevant to the JPEG standard; (3) failed to disclose its patents, including the Patent-in-Suit and related patent applications it now claims are necessary to implement the JPEG standard; and (4) voted on several occasions to approve the JPEG standard.

7. Kodak tried to resolve the issue without Court intervention. First, on August 8, 2006 and again on January 24, 2007, Kodak informally sought documents from BSI through Richard Clark, chair of the BSI sub-committee that studied the JPEG standard and included Philips employees. (*See* Declaration of Nicole Wyll ("Wyll Decl.") Exhs. 1, 2). BSI responded by indicating that while production of documents produced by BSI committees is within BSI discretion, BSI does not provide documents to third parties, and therefore, BSI would not meet Kodak's request. (Wyll Decl., Ex. 3.)

8. Next, on April 19, 2007, Kodak served a subpoena on BSI Management Systems America, Inc., ("BSI America") seeking documents and testimony related to Philips' participation in BSI. (Wyll Decl., Ex. 4.) On May 2 and 16, 2007, in two separate letters, BSI America responded that it did not have any involvement with the circumstances surrounding the subpoena and that it would not provide documents or testimony to Kodak. (Wyll Decl., Exhs. 5, 6.) It is under these circumstances that Kodak brings this application.

9. Therefore, Kodak requests that the Court approve and sign the attached Letter of Request. Kodak further requests that after the Court has signed the Letter of Request, that the Clerk of this Court authenticate the Court's signature under the seal of this Court, and that the Letter of Request be thereafter returned by the Clerk to counsel for Kodak. Counsel will promptly cause the Letter of Request to be transmitted to the appropriate judicial authorities in England and Wales, in conformity with Article 2 of the Hague Convention.

10. The undersigned attorneys stand ready to reimburse this Court and/or the judicial authorities of England and Wales for any expenses incurred in connection with the execution of this Letter of Request.

11. In accordance with Local Rule 7.1.1, counsel for Kodak conferred with counsel for Philips on several occasions concerning whether Philips would oppose this Application. On August 14, 2007, pursuant to the parties' previous communication on August 7, Kodak provided Philips its draft Letter of Request and sought a response by August 17. On August 17, Philips provided several comments to Kodak, and that same day Kodak sent another draft and correspondence to Philips which addressed Philips

concerns. Kodak requested a final response by Monday, August 20. On Tuesday, August 21, Kodak again attempted to procure a response from Philips. At this time, Philips has not indicated whether it will or will not oppose this Application for Issuance of a Letter of Request.

ARGUMENT

12. Kodak seeks evidence from a current employee, Mr. Low, and former employee, Ms. Ngosi, of the British Standards Institute ("BSI"), a United Kingdom based standards-setting organization. Ms. Ngosi has knowledge regarding Philips' participation in the standards-setting organizations responsible for promulgation of the Joint Photographic Experts Group's international standard for still image compression ("the JPEG standard"), which Philips now claims its patents cover. Mr. Low has access to BSI documents which demonstrate Philips' participation in the JPEG standard setting organizations. Because BSI has indicated that it will not voluntarily produce evidence and because the witnesses have information essential to Kodak's counterclaims and defenses, Kodak seeks to compel testimony and document production through the 1970 Hague Convention on the Taking of Evidence Abroad in Civil or Commercial Matters ("Hague Evidence Convention").

I. THE ISSUANCE OF LETTERS OF REQUEST IS THE APPROPRIATE PROCEDURE FOR OBTAINING FOREIGN EVIDENCE

13. The Hague Evidence Convention requests that signatory nations, such as the United States and the United Kingdom, respond to requests from other signatories for evidence related to civil or commercial matters. 23 U.S.T. 2555. Such requests are styled as a Letter of Request. A Letter of Request is directed to the foreign judicial authority in order to enlist the cooperation of the courts of that nation in compelling

evidence from witnesses. *See* Fed. R. Civ. P. 28(b). Letters of Request for the examination of witnesses are properly issued pursuant to the Hague Evidence Convention when, as here, the evidence is "significant to the resolution" of the litigation. *See DBMS Consultants v. Computer Assocs. Int'l Inc.*, 131 F.R.D. 367, 369 (D.Mass. 1990).

14. Federal courts have statutory power under 28 U.S.C. § 1781 and also "inherent" authority to issue letters of request to foreign countries. *See United States v. Reagan*, 453 F.2d 165, 172 (6th Cir. 1971); *see also* 28 U.S.C. § 1651 ("All Writs Act") and Fed. R. Civ. P. 28(b). Kodak respectfully requests that the Court grant this application and issue the attached proposed Letters of Request.

II. KODAK REQUIRES FOREIGN EVIDENCE-TAKING TO FULLY AND FAIRLY PRESENT ITS DEFENSES AND COUNTERCLAIMS AT TRIAL

15. Philips' infringement allegations are based on Kodak's manufacture and sale of products that implement the JPEG standard. The JPEG standard resulted from a collaborative effort ("the JPEG committee") that consisted of representatives from at least two international standards-setting organizations—the International Telegraph and Telephone Consultative Committee ("CCITT") and the International Standards Organization ("ISO"). The CCITT and ISO each had a subcommittee dedicated to developing a worldwide standard for still-image compression and decompression: CCITT Study Group VIII and ISO Working Group 8. The JPEG committee also coordinated its efforts and initiated a "formal liaison" with CCITT Study Group XV, which developed Recommendation H.261, a precursor to the MPEG standard.[1]

[1] MPEG, short for "Motion Picture Experts Group," is a CCITT-ISO standards effort similar to JPEG, which standardized the compression of video and audio rather than still images.

16. Philips, by and through its related entities and employees in the Philips group of companies, was a member and active participant in BSI, ISO and CCITT JPEG related subcommittees as well as the JPEG committee itself. However, Philips never disclosed the Patent-in-Suit, or its related foreign counterparts and applications, in connection with JPEG standardization. Instead, Philips remained silent and ignored applicable patent disclosure obligations and explicit disclosure requests to committee members. Philips' misleading silence led the relevant committees to believe that the techniques adopted as the JPEG standard were free from Philips' patent claims. Had Philips disclosed the Patent-in-Suit and made the royalty demands it now makes, the JPEG related committees would have chosen one of the available alternative compression techniques. Based on Philips' misleading conduct, Kodak has asserted defenses and counterclaims that include waiver and equitable estoppel, laches, implied license, unclean hands, fraud, negligent misrepresentation, and deceptive trade practices under Delaware state law.

17. The witnesses are residents of England and Wales and currently or formerly employed by BSI. BSI is a United Kingdom standards-organization which was an organizational member of CCITT Study Groups VIII and XV, and the JPEG committee itself. In addition, Ms. Ngosi acted as secretary in BSI meetings in which Philips employees participated. These same Philips employees participated in numerous meetings of CCITT Study Groups VIII and XV, and JPEG during development and ultimate adoption of the JPEG standard. Kodak anticipates that the testimony and documents requested from the witnesses will establish that Philips:

(i) knew the technical details of the proposed JPEG standard;

(ii) was aware of the patent disclosure policies of each organization that required disclosure of patents and patent applications relevant to the JPEG standard;

(iii) failed to disclose its patents including the Patent-in-Suit and related patent applications it now claims are necessary to implement the JPEG standard; and

(iv) voted on several occasions to approve the JPEG standard.

18. Finally, Kodak sought to avoid Court intervention by seeking the assistance of BSI through Richard Clark, Chair of BSI subcommittee IST/37. (*See* Wyll Decl., Exhs. 1, 2.) BSI responded by indicating that they would not meet Kodak's request for BSI committee documents. (*See id.* at Ex. 3.) Kodak then subpoenaed BSI Management Systems America, Inc., ("BSI America") for documents and testimony. (*Id.*, Exh. 4.) BSI America responded that it did not have any involvement in the matters referred to in the subpoena and therefore could not provide documents or testimony. (*Id.* at Exhs. 5, 6.)

19. Ms. Ngosi is a United Kingdom resident, and BSI is a United Kingdom based organization. As such, Ms. Ngosi and BSI are outside the subpoena power of the United States. Kodak therefore requests that the Court issue the attached proposed Letter of Request seeking judicial assistance from the appropriate judicial authorities of England and Wales to obtain testimony and documents from the witnesses.

20. Kodak further asserts that this application is timely and appropriate, in that the evidence it seeks through The Hague Evidence Convention is evidence for trial. Given that trial is now only months away, Kodak is taking the appropriate steps to obtain evidence in support of its defenses and counterclaims.

III. CONCLUSION

21. The questions and document requests in the attached proposed Letter of Request are narrowly tailored to obtain relevant testimony and evidence and are necessary in order for Kodak to fully and fairly present its defenses and counterclaims at trial. For the foregoing reasons, Kodak respectfully requests that the Court grant this Application and issue the attached Letter of Request to the appropriate Court in England and Wales.

Dated: August 21, 2007

Respectfully submitted,

By: /s/ Kristen Healey Cramer

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CERTIFICATE OF SERVICE

I, Kristen Healey Cramer, hereby certify that on August 21, 2007, I caused to be electronically filed a true and correct copy of the foregoing document with the Clerk of the Court using CM/ECF, which will send notification that such filing is available for viewing and downloading to registered counsel of record via e-mail.

I hereby further certify that on August 21, 2007, I caused a copy of the foregoing document to be served on the following counsel of record by the manner so indicated:

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Kristen Healey Cramer (#4512)

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

U.S. PHILIPS CORPORATION, **Plaintiff,** **v.** **EASTMAN KODAK COMPANY,** **Defendant.**	**CIVIL ACTION NO. 06-00251 GMS**

DEFENDANT EASTMAN KODAK COMPANY'S
REQUEST FOR INTERNATIONAL JUDICIAL ASSISTANCE
PURSUANT TO THE HAGUE CONVENTION OF 18 MARCH 1970
ON THE TAKING OF EVIDENCE ABROAD IN CIVIL OR COMMERCIAL MATTERS

The United States District Court for the District of Delaware presents its compliments to the Senior Master of the Queen's Bench Division of the Supreme Court of England and Wales and requests assistance in obtaining evidence to be used in a civil proceeding before this Court in the above-captioned matter.

The District Court requests that the Senior Master approve the Defendant's nomination of a practicing Barrister or such other qualified person as the Court deems fit to act as Examiner for the purpose of obtaining oral testimony and documents for trial from non-party witnesses Theodora N. Ngosi, former employee of the British Standards Institute, and Mike Low, current director of the British Standards Institute.

This request is made pursuant to, and in conformity with, Chapter II, Articles 17, 18 and 21 of the *Hague Convention of 18 March 1970 on the Taking of Evidence Abroad in Civil or Commercial Matters*, to which both the United States and the United Kingdom are parties.

The District Court considers that the evidence sought is directly relevant to the issues in dispute and is not discovery within the meaning of Article 23 of the Hague Evidence Convention,

that is, testimony or documents merely intended to lead to relevant evidence for trial. This Request fully complies with the United Kingdom's reservations under the Hague Evidence Convention. Trial in this action is scheduled to commence on April 28, 2008.

The particulars of this Hague Evidence Request are as follows:

1.	***Sender***	Hon. Gregory M. Sleet United States District Judge United States District Court for the District of Delaware 844 N. King Street, Room 4324 Wilmington, DE 19801 U.S.A. ***(CIV NO. 06-00251 GMS)***
2.	***Central Authority of the Requested State:***	COMPETENT AUTHORITY FOR ENGLAND AND WALES Senior Master of the Supreme Court of Judicature Queen's Bench Division ROYAL COURTS OF JUSTICE Strand London WC2A 2LL UNITED KINGDOM ***On behalf of:*** THE CENTRAL AUTHORITY FOR THE UNITED KINGDOM Her Majesty's Principal Secretary of State for Foreign Affairs FOREIGN AND COMMONWEALTH OFFICE King Charles Street London SW1A 2AH, England, UNITED KINGDOM
3.	***Person to whom the executed request is to be returned:***	***Defendant's United Kingdom Legal Representative:*** Steven Loble, Esq. LOBLE SOLICITORS The Grain Stores 70 Weston Street London SE1 3QH UNITED KINGDOM Tel.: + 44 (0) 20.7939.9100 Fax: + 44 (0) 20.7939.9111 Email: steven@loble.co.uk

on behalf of:

Hon. Gregory M. Sleet
United States District Judge
United States District Court for the
District of Delaware
844 N. King Street, Room 4324
Wilmington, DE 19801
U.S.A.

4. In conformity with Article 3 of the Convention, the undersigned applicant has the honor to submit the following request:

5. Requesting judicial authority: Hon. Gregory M. Sleet
United States District Judge
United States District Court for the
District of Delaware
844 N. King Street, Room 4324
Wilmington, DE 19801
U.S.A.

To the competent authority of: The United Kingdom of Great Britain and Northern Ireland

6. Names and addresses of the parties and their representatives:

a. Plaintiff **U.S. PHILIPS CORPORATION**, a Delaware corporation with offices in New York

Plaintiff's U.S. Legal Representatives:

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b. Defendant

EASTMAN KODAK COMPANY, a New Jersey corporation with offices in New York

Defendant's U.S. Legal Representatives:

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Defendant's United Kingdom Legal

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6. Nature and purpose of the proceedings and summary of the facts:

PARTIES

Plaintiff/Counterdefendant U.S. Philips Corporation ("Philips") is a corporation organized and existing under the laws of Delaware, with a place of business in New York, New York. Philips is a subsidiary of global parent Royal Philips Electronics N.V., one of the world's largest publicly-traded electronics companies.

Defendant/Counterclaimant Eastman Kodak Company ("Kodak") is a corporation organized and existing under the laws of New Jersey, with a place of business in Rochester, New York. Kodak is a public company, providing a wide range of products, equipment and services in the areas of photographic film, digital photography, health imaging, and printing.

ALLEGATIONS IN THE COMPLAINT

Plaintiff Philips initiated a civil lawsuit in the United States District Court for the District of Delaware against Defendant Kodak on April 18, 2006, pursuant to the Patent Laws of the United States, 25 U.S.C. § 1 *et seq*. Philips alleges that Kodak has infringed, and continues to infringe, United States Patent Number 4,901,075 ("the '075 patent") (Exhibit 1) through Kodak's manufacture and sale of products that comply with the Joint Photographic Experts Group ("JPEG") standard for digital still image compression and decompression (the "JPEG standard").

Philips seeks a judgment that Kodak has infringed the '075 patent and that the infringement was deliberate and willful; that Kodak be permanently enjoined from making, using,

selling or importing within the United States all JPEG compliant image encoding hardware and software products and services, including products made by such products and services; for damages; reasonable attorneys' fees, and such other relief as the Court deems proper.

DEFENDANT KODAK'S DEFENSES AND COUNTERCLAIMS

In its Answer and Counterclaims, Kodak denies that its products infringe the '075 patent and asserts that the '075 patent is invalid and unenforceable. Furthermore, Kodak asserts that Philips' claims fail due to Philips' participation, through its related corporate entities and representatives, in the development and adoption of the JPEG standard.

Kodak asserts that the JPEG standard is the result of almost a decade of worldwide collaboration by representatives of numerous companies, countries and standards-setting organizations. The Joint Photographic Experts Group committee ("the JPEG committee") was a collaborative effort that consisted of representatives from at least two international standards-setting organizations—the International Telegraph and Telephone Consultative Committee ("CCITT") and the International Standards Organization ("ISO"). The CCITT and ISO each had a subcommittee dedicated to developing a worldwide standard for still-image compression and decompression: CCITT Study Group VIII and ISO Working Group 8. Kodak asserts that Philips was a member and active participant in both subcommittees as well as the JPEG committee itself. Kodak also asserts that Philips was a member of CCITT Study Group XV, which developed Recommendation H.261, a precursor to the MPEG standard. MPEG, short for "Motion Picture Experts Group," is a CCITT-ISO standards effort similar to JPEG, which standardized the compression of video and audio rather than still images. The JPEG committee coordinated its efforts and initiated a "formal liaison" with CCITT Study Group XV. In addition, Kodak asserts that Philips was an active participant in a third standards-setting body involved with JPEG standardization, the British Standards Institute ("BSI") and its subcommittee IST/37.

Kodak asserts that Philips, by and through its related entities and representatives in the Philips group of companies, was a member of CCITT Study Groups VIII and XV, ISO Working

Group 8, BSI subcommittee IST/37 and the JPEG committee. Kodak further asserts that Philips:

(i) knew the technical details of the proposed JPEG standard;

(ii) was aware of the patent disclosure policies of each organization that required it to disclose patents and patent applications relevant to the JPEG standard;

(iii) failed to disclose its patents including the '075 patent and related patent applications it now claims are necessary to implement the JPEG standard; and

(iv) voted on several occasions to approve the JPEG standard.

Kodak also asserts that despite specific requests by committee leaders for patent disclosure and patent disclosures by other standards-setting committee members, Philips never disclosed that it owned patents or patent applications that might be relevant to the JPEG standard. Kodak asserts that it also participated in the development and adoption of the JPEG standard and that, along with other JPEG standardization participants, reasonably relied on Philips' silence and/or misrepresentations to conclude that Philips did not possess patents or patent applications relevant to the JPEG standard.

Kodak further asserts that Philips waited an unreasonably long period of time to assert its patent. Kodak asserts that it began making and publicly marketing, advertising and selling its products which incorporated the JPEG standard in the early 1990s. Despite Kodak's widespread public marketing and sale of JPEG standard-enabled products, Philips did not inform Kodak of its purported belief that Kodak infringed its patent rights until a communication dated October 1, 2002. Philips did not file suit until April 18, 2006. Kodak asserts that in the intervening years of Philips' delay, the JPEG standard became deeply entrenched as the preeminent standard for the digital compression, storage and transmission of still images, and Kodak has made significant investments in developing and marketing products and services that implement that standard. Kodak asserts that as a result of Philips' conduct, Kodak has incurred damages and will continue to be damaged in the future.

Based on the above facts, Kodak asserts defenses and counterclaims based on waiver and equitable estoppel, laches, implied license, unclean hands, fraud, negligent misrepresentation, and deceptive trade practices under Delaware state law. Kodak seeks a judgment that Kodak has not infringed the '075 patent; that the claims of the '075 patent are invalid; that Philips is barred from enforcing the '075 patent based on equitable estoppel; that Kodak has an implied license for the '075 patent; that Philips has engaged in deceptive trade practices, fraud and negligent misrepresentation; for a permanent injunction prohibiting Philips' deceptive trade practices and further enforcement of the '075 patent; damages; and attorneys' fees and such other relief as the Court or jury deems proper.

STAGE OF THE PROCEEDINGS

Philips commenced this action on April 18, 2006 when it filed its Complaint. Kodak filed its Answer and Counterclaims on October 17, 2006. Philips filed its Answer to those Counterclaims on November 6, 2006. Responses to written interrogatories and requests for production of documents have been served by the parties. Trial is scheduled to commence on April 28, 2008.

THE WITNESSES FROM WHOM EVIDENCE AND DOCUMENTS ARE SOUGHT

1. Ms. Theodora ("Teddie") N. Ngosi, former Secretary of ISO/lEG JTG 1/SC 2/WC 8 accredited to SC 2/WC 8 and ISO as noted by the UK National Technical Committees.

2. Mike Low, Director, BSI British Standards. BSI was active in the adoption of the JPEG standard as a member of ISO Working Group 8. Numerous representatives of BSI, as well as representatives of the Plaintiff and Defendant attended ISO Working Group 8 committee meetings during development of the JPEG standard between 1984 and 1994.

RELEVANCE OF THE EVIDENCE SOUGHT

Kodak asserts that the JPEG standard is the result of almost a decade of worldwide collaboration by representatives of numerous companies, countries and standards-setting organizations. The work was largely done by the JPEG committee that consisted of

representatives from at least two international standards-setting organizations—the International Telegraph and Telephone Consultative Committee ("CCITT") and the International Standards Organization ("ISO"). Each organization had a subcommittee dedicated to developing a worldwide standard for still-image compression and decompression: CCITT Study Group VIII and ISO Working Group 8.

Kodak asserts that Philips was a member and participant in these two subcommittees as well as the JPEG committee itself, formed as a collaboration between them. In addition, Philips was a member of BSI and its subcommittees IST/2 and IST/37, which were active in the JPEG standards-setting process and whose members participated in ISO Working Group 8 meetings. The JPEG standard was ultimately adopted by BSI as a British standard on July 15, 1994.

Kodak also asserts that Philips was a member and participant in CCITT Study Group XV, which developed Recommendation H.261, a precursor to the MPEG standard. MPEG, short for "Motion Picture Experts Group," is a CCITT-ISO standards effort similar to JPEG, which standardized the compression of video and audio rather than still images. The JPEG committee coordinated its efforts and initiated a liaison with CCITT Study Group XV.

Kodak asserts that Philips, by and through its related entities in the Philips group of companies, was a member of CCITT Study Groups VIII and XV, ISO Working Group 8, the JPEG committee, and BSI subcommittees IST/2 and IST/37 and that Philips:

(i) knew the technical details of the proposed JPEG standard;

(ii) was aware of the patent disclosure policies of each organization that required it to disclose patents and patent applications relevant to the JPEG standard;

(iii) failed to disclose its patents including the '075 patent and related patent applications it now claims are necessary to implement the JPEG standard; and

(iv) voted on several occasions to approve the JPEG standard.

Kodak also asserts that despite specific requests by committee leaders for patent

disclosures and patent disclosures by other standards-setting committee members, Philips never disclosed that it had patents or patent applications that might be relevant to the standard adopted by JPEG.

Kodak asserts that JPEG and the related standards-setting committees sought to adopt an "open" standard that would be free from patent infringement claims and would be widely available for industries, companies, and consumers worldwide to use. Kodak asserts that had Philips disclosed the '075 patent during the JPEG standardization process and made the royalty demands it now makes, JPEG and the related standards-setting committees would have chosen one of the available alternative compression techniques for standardization.

Kodak asserts that since its adoption, the JPEG standard has become deeply entrenched as the preeminent standard for the digital compression, storage and transmission of still images, and Kodak has made significant investments in the products and services that implement this standard. Based on these facts, Kodak asserts defenses and counterclaims of waiver and equitable estoppel, laches, implied license, unclean hands, fraud, negligent misrepresentation, and deceptive trade practices under Delaware state law.

Kodak asserts that the testimony of Ms. Ngosi and the BSI documents to be provided by Mr. Low are relevant to prove: (1) BSI's participation in JPEG standardization; (2) BSI's adoption of the JPEG standard; (3) Philips' participation in JPEG standardization; (2) Philips knowledge of the technical specifications of the JPEG standard; (3) Philips' knowledge of ISO Working Group 8 and BSI patent disclosure policies; and (4) Philips' failure to properly disclose the '075 patent.

Kodak further asserts that documents obtained by Kodak demonstrate that BSI was an active participant in ISO Working Group 8 ("ISO WG8") and further that BSI actively participated in adopting the JPEG standard. BSI members involved in these activities included employees of Philips Research Laboratories, a subsidiary of Royal Philips Electronics, N.V. On July 15, 1994, BSI ultimately adopted the ISO JPEG standard (ISO/IEC 10918-1) as a British

Standard. (Exhibit 2 – the first 4 pages of 184 pages are exhibited to show the Plaintiff's involvement in the project.)

Kodak asserts that a January 1990 BSI membership list details those experts from the United Kingdom who were recognized as actively participating in ISO Working Group 8 and accredited to both Working Group 8 and the ISO as noted by the United Kingdom National Technical Committees. This list included the following BSI members employed by Philips Research Laboratories: Mr. Simon Turner, Dr. John Morris, and Mr. Norman Richards. (Exhibit 3, pp. 1, 3.) Mr. Turner is designated as "Convenor" of BSI IST/2/-1. (Exhibit 3, p. 1.) This document also identifies Ms. Ngosi as secretary to BSI subcommittee IST/2/-1. (Exhibit 3, p. 1.)

In addition, Kodak asserts that a WG8 mailing list dated June 1989 lists Turner, Morris and Richards as employees of Philips Research Laboratories in the United Kingdom, and "active" members of WG8. (Exhibit 4, pp. 3, 8.) "Active" members were able to attend WG8 meetings and receive relevant documents. (Exhibit 4, p. 1.) A final WG8 mailing list from April 18, 1990 lists Dr. Morris and Mr. Turner as attendants at four ISO WG8 meetings (Exhibit 5 p. 4) and Ms. Ngosi as a Committee Administrator affiliated with BSI. (Exhibit 5, p. 22.)

Kodak asserts that all three Philips employees attended ISO WG8 JPEG meetings throughout the development of the JPEG standard. Mr. Turner attended an ISO WG8 JPEG meeting on March 24-26, 1987 in Darmstadt, Germany, on behalf of Philips Research Laboratories. (Exhibit 6, p. 8.) During this meeting, the attendees established compression techniques for consideration as the JPEG standard, and members were informed that an updated initial description of the techniques would be mailed directly to those on the WG8 mailing list. (Exhibit 6, pp. 4, 10, 12.)

Kodak asserts that Mr. Richards attended a ISO WG8 JPEG meeting in Copenhagen, Denmark, held from January 25-27, 1988, where "it was agreed by JPEG that the resulting ADCT technique should be the basis of the future [JPEG] standard." (Exhibit 7, pp. 5, 8.)

Finally, Kodak asserts that Dr. Morris attended three separate ISO WG8 JPEG meetings.

In July, 1988 Dr. Morris attended a meeting of the JPEG Ad Hoc Technical Development group in Rennes, France, where technical experts gathered to discuss their work and progress. (Exhibit 5, p. 4; Exhibit 8, p. 1.) During an ISO WG8 meeting in Stockholm, Sweden (July 3-7, 1989) attended by Dr. Morris, members were informed that a working draft of the JPEG standard would "soon" be ready and distributed to the WG8 membership upon completion. (Exhibit 9, p. 3.) Furthermore, Dr. Morris attended a 1989 ISO WG8 JPEG meeting in Japan (Exhibit 5, p. 4) where ANT and Hitachi provided relevant patent filings, and the committee engaged in significant technical discussions regarding arithmetic coding methods under consideration for JPEG. (Exhibit 10, pp. 3, 4.)

Kodak asserts that the facts surrounding BSI's creation of subcommittees IST/2 and IST/37, and its participation in ISO Working Group 8 will establish: (1) Philips' participation in JPEG standardization; (2) Philips' knowledge of the technical specifications of the JPEG standard; (3) Philips' knowledge of BSI and other standards-setting organizations' patent disclosure policies; and (4) Philips' failure to properly disclose the '075 patent. (Exhibit 1.)

The District Court asserts that the facts surrounding BSI's participation in JPEG standardization, and ultimate adoption as a British standard, are essential evidence in relation to the matters in issue between the parties. Justice cannot be completely served without the testimony of Ms. Ngosi and documentary evidence from Mr. Low.

8. Evidence to be obtained or other judicial act to be performed:

The District Court seeks the oral testimony and specific documents from Mr. Low of BSI and Ms. Ngosi.

Defendant asserts that BSI's cooperation in giving evidence in this matter has been sought but that BSI has indicated to Kodak's counsel that it is only prepared to give evidence pursuant to a formal Request in conformity with the Hague Evidence Convention. Counsel for Kodak previously sought the assistance of BSI and requested documents relating to Philips' participation in IST/37 and their consideration and adoption of the JPEG standard. (Exhibits 11

and 12.) BSI informed Kodak that distribution of documents produced by internal committees was within BSI discretion, and they were unable to meet Kodak's request for documents. (Exhibit 13.)

For the reasons set forth above, the District Court believes that the witness, Ms. Ngosi, (whose contact details are given below) will be able to provide evidence directly relevant to the main issues between the parties and without which the ends of justice could not be properly met. The District Court believes that this evidence is not available from any other source.

SUBJECT MATTER FOR ORAL EXAMINATION

1. Background and foundational information regarding the witness.
2. Background and foundational information regarding the British Standards Institute.
3. The background of BSI-established subcommittees that were involved with the study and adoption of the JPEG standard.
4. BSI patent disclosure policies.
5. BSI's participation in ISO Working Group 8 committee meetings.
6. BSI's knowledge of the subject matter and specification of the JPEG standard gained as a member of ISO Working Group 8.
7. Knowledge of Philips Research Laboratories voting in ISO Working Group 8 to approve the JPEG standard.
8. BSI's adoption of ISO/IEC 10918-1 as a British standard.
9. BSI's knowledge of and compliance with ISO Working Group 8 patent policies.
10. Philips' participation in BSI established sub-committees IST/2 and IST/37, and the ISO WG8 committee.
11. Kodak's participation in BSI established sub-committees IST/2 and IST/37, and the ISO WG8 committee.

LIST OF DOCUMENTS TO BE PRODUCED FROM MS. NGOSI

1. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on August 6, 1986;

2. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on April 26, 1989;
3. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on July 31, 1989;
4. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on November 27, 1989;
5. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on February 12, 1990;
6. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on February 16, 1990;
7. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on May 17, 1990;
8. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on October 5, 1990;
9. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on May 21, 1991;
10. Ms. Ngosi's notes and materials from the BSI IST/2 meeting on September 28, 1991;
11. Ms. Ngosi's notes and materials from the BSI IST/37 meeting on November 1, 1991;
12. Ms. Ngosi's notes and materials from the BSI IST/37 meeting on March 2, 1992;
13. Ms. Ngosi's notes and materials from the BSI IST/37 meeting on June 11, 1992;
14. Ms. Ngosi's notes and materials from the BSI IST/37 meeting on September 2, 1992.

LIST OF DOCUMENTS TO BE PRODUCED FROM MIKE LOW

The District Court requests that Mr. Low, as a representative of BSI, produce and authenticate the following documents in BSI's possession, custody, or control and answer questions relating to those documents:

1. BSI draft specifications of the JPEG standard for 1986;
2. BSI draft specifications of the JPEG standard for 1987;
3. BSI draft specifications of the JPEG standard for 1988;
4. BSI draft specifications of the JPEG standard for 1989;
5. BSI draft specifications of the JPEG standard for 1990;
6. BSI draft specifications of the JPEG standard for 1991;
7. BSI draft specifications of the JPEG standard for 1992;
8. BSI draft specifications of the JPEG standard for 1993;
9. BSI draft specifications of the JPEG standard for 1994;

10. Final BSI specifications of the JPEG standard;

11. BSI patent disclosure policies from 1986;

12. BSI patent disclosure policies from 1987;

13. BSI patent disclosure policies from 1988;

14. BSI patent disclosure policies from 1989;

15. BSI patent disclosure policies from 1990;

16. BSI patent disclosure policies from 1991;

17. BSI patent disclosure policies from 1992;

18. BSI patent disclosure policies from 1993;

19. BSI patent disclosure policies from 1994;

20. Meeting minutes for BSI IST/2 on August 6, 1986;

21. Meeting minutes for BSI IST/2 on April 26, 1989;

22. Meeting minutes for BSI IST/2 on July 31, 1989;

23. Meeting minutes for BSI IST/2 on November 27, 1989;

24. Meeting minutes for BSI IST/2 on February 12, 1990;

25. Meeting minutes for BSI IST/2 on February 16, 1990;

26. Meeting minutes for BSI IST/2 on May 17, 1990;

27. Meeting minutes for BSI IST/2 on October 5, 1990;

28. Meeting minutes for BSI IST/2 on May 21, 1991;

29. Meeting minutes for BSI IST/2 on September 28, 1991;

30. Meeting minutes for BSI IST/37 on November 1, 1991;

31. Meeting minutes for BSI IST/37 on March 2, 1992;

32. Meeting minutes for BSI IST/37 on June 11, 1992;

33. Meeting minutes for BSI IST/37 on September 2, 1992;

34. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1986;

35. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1987;

36. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1988;

37. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1989;

38. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1990;

39. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1991;

40. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1992;

41. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1993;

42. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Simon Turner in 1994;

43. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1986;

44. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1987;

45. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1988;

46. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1989;

47. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1990;

48. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1991;

49. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1992;

50. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1993;

51. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG 8 for Dr. John Morris in 1994;

52. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1986;

53. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1987;

54. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1988;

55. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1989;

56. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1990;

57. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1991;

58. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1992;

59. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1993;

60. BSI's letters of appointment or accreditation to ISO/IEC JTC 1/SC 2/WG for Mr. Norman Richards in 1994;

61. Membership list of BSI committee IST/2 for 1986;

62. Membership list of BSI committee IST/2 for 1987;

63. Membership list of BSI committee IST/2 for 1988;

64. Membership list of BSI committee IST/2 for 1989;

65. Membership list of BSI committee IST/2 for 1990;

66. Membership list of BSI committee IST/2 for 1991;

67. Membership list of BSI committee IST/2 for 1992;

68. Membership list of BSI committee IST/2 for 1993;

69. Membership list of BSI committee IST/2 for 1994;

70. Membership list for BSI committee IST/2-1 for 1986;

71. Membership list for BSI committee IST/2-1 for 1987;

72. Membership list for BSI committee IST/2-1 for 1988;

73. Membership list for BSI committee IST/2-1 for 1989;

74. Membership list for BSI committee IST/2-1 for 1990;

75. Membership list for BSI committee IST/2-1 for 1991;

76. Membership list for BSI committee IST/2-1 for 1992;

77. Membership list for BSI committee IST/2-1 for 1993;

78. Membership list for BSI committee IST/2-1 for 1994;

79. Membership list for BSI committee IST/37 for 1986;

80. Membership list for BSI committee IST/37 for 1987;

81. Membership list for BSI committee IST/37 for 1988;

82. Membership list for BSI committee IST/37 for 1989;

83. Membership list for BSI committee IST/37 for 1990;

84. Membership list for BSI committee IST/37 for 1991;

85. Membership list for BSI committee IST/37 for 1992;

86. Membership list for BSI committee IST/37 for 1993;

87. Membership list for BSI committee IST/37 for 1994;

88. Attendance lists for BSI IST/2 meeting on August 6, 1986;

89. Attendance lists for BSI IST/2 meeting on April 26, 1989;

90. Attendance lists for BSI IST/2 meeting on July 31, 1989;

91. Attendance lists for BSI IST/2 meeting on November 27, 1989;

92. Attendance lists for BSI IST/2 meeting on February 12, 1990;

93. Attendance lists for BSI IST/2 meeting on February 16, 1990;

94. Attendance lists for BSI IST/2 meeting on May 17, 1990;

95. Attendance lists for BSI IST/2 meeting on October 5, 1990;

96. Attendance lists for BSI IST/2 meeting on May 21, 1991;

97. Attendance lists for BSI IST/2 meeting on September 28, 1991;

98. Attendance lists for BSI IST/37 meeting on November 1, 1991;

99. Attendance lists for BSI IST/37 meeting on March 2, 1992;

100. Attendance lists for BSI IST/37 meeting on June 11, 1992;

101. Attendance lists for BSI IST/37 meeting on September 2, 1992;

102. Working Group 8's plenary report presented at May 17, 1990 BSI IST/2 meeting;

103. Copy of DIS 10918-1 (draft of JPEG standard) with comments, that was circulated during a meeting of IST/37 on November 1, 1991;

104. Report issued by Mr. Turner at October 5, 1990 BSI IST/2 meeting regarding reorganization of Working Group 8;

105. Written report submitted by IST/2-/1 to IST/2 in May, 1990 regarding BSI concerns about JPEG draft specifications;

106. Copy of BSI vote approving ISO Standard 10918-1 submitted to ISO;

107. Copy of British version of ISO 10918-1 signed by Mr. Simon Turner;

108. Copy of nomination of Mr. Simon Turner by BSI to Working Group 8 as an expert in or about 1987;

109. Formal ballot from ISO/IEC JTC1 received by BSI committee IST/37 regarding approval of JPEG standard in or about 1994;

110. Copy of DIS 10918-1 circulated to IST/37 for review in or about 1994;

111. Copy of Formal Ballot submitted by BSI approving DIS 10918-1 in or about 1994.

9.	***Identities and addresses of persons to be examined:***	Mike Low British Standards Institute 389 Chiswick High Road London W4 4AL United Kingdom Tel: +44 (0)20 8996 9001 Theodora N. Ngosi 29 Forest Gardens Haringey, London N17 6XA United Kingdom
10.	***Questions to be put to the persons to be examined or statement of the subject matter about which they are to be examined:***	Please see list of subject matters itemized above.
11.	***Documents or other property to be inspected:***	Please see list of documents itemized above.
12.	***Any requirement that the evidence be given on oath or affirmation and any specific form to be used:***	The witness should be examined under oath or affirmation, or in the alternative, should be instructed of the consequences for the giving of untruthful and false answers under the laws of the England & Wales.

13. Special methods or procedure to be followed:

The District Court respectfully requests, with respect to the oral testimony being sought:

- That the High Court appoint an Examiner for the purpose of compelling documents and oral testimony from the witness for use at trial;
- That Plaintiff's counsel, Steven Loble, a solicitor with the London firm of Loble Solicitors, arrange for the nomination of a barrister to act as Examiner in this matter in conformity with Article 18 of the Hague Evidence Convention of

March 18, 1970; the Evidence (Proceedings in Other Jurisdictions) Act 1975; and Part 34 of the Civil Procedure Rules;

- That the parties' representatives or their designees, and a court reporter be permitted to be present during the examination, at Kodak's expense; that the representatives or designees be permitted to examine and cross-examine the witnesses; and that the court reporter be permitted to make a verbatim record of the proceedings.
- That a videographer be permitted, at Kodak's expense, to make a videotape recording of the proceedings.

In addition, the District Court requests, with respect to the documents being sought that the Examiner ensure that any documents produced are authenticated in accordance with its normal practice and procedures.

The District Court additionally requests that the confidentiality of any evidence produced as a result of this Request be maintained pursuant to the laws of England.

14.	***Request for notification of the times and place for the execution of the Request and identity of the person to be notified:***	It is requested that testimony be taken at such place, date or time as ordered by the Senior Master and/or as otherwise scheduled by the representatives of the Plaintiffs and/or as otherwise agreed to by the witnesses and the respective representatives of the Parties. Notice thereof should be made to Plaintiffs' UK designee: Steven Loble, Esq. LOBLE SOLICITORS The Grain Stores 70 Weston Street London SE1 3QH UNITED KINGDOM Tel.: + 44 (0) 20.7939.9100 Fax: + 44 (0) 20.7939.9111 Email: steven@loble.co.uk

15.	***Request for attendance or participation of judicial personnel of the requesting authority at the execution of the Letter of Request:***	None.
16.	***Specification of privilege or duty to refuse to give evidence under the laws of the State of origin:***	Under the laws of the United States, a party has a privilege to refuse to give evidence if the evidence discloses a confidential communication between that party and an attorney for that party that was made for the purpose of obtaining legal advice. Parties also enjoy limited privileges on other grounds not relevant here such as communications between physician and patient, psychotherapist and patient, husband and wife, or clergy and penitent. U.S. law also recognizes a privilege against criminal self-incrimination. Outside the strict area of privilege, certain limited immunities are available that may place restrictions on the giving of evidence, such as the limited protection of documents created as the work product of attorneys during or in anticipation of litigation.
17.	***The fees and costs incurred which are reimbursable under the second paragraph of Article 14 or under Article 26 of the Convention will be borne by:***	Defendant Eastman Kodak Company ***c/o Defendant's legal representative: in the U.S.:*** Francis DiGiovanni, Esq. CONNOLLY BOVE LODGE & HUTZ LLP The Nemours Building 1007 N. Orange Street Wilmington, DE 19899 U.S.A. Tel: +1.302.658.9141 Fax: +1.302. 658-5614 Email: fdigiovanni@cblh.com ***and*** John Allcock, Esq. Sean C. Cunningham, Esq. Timothy Lohse, Esq. John D. Kinton, Esq. Nicole Wyll, Esq.

Jesse Hindman, Esq.
DLA PIPER US LLP
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Email: John.Allock@dlapiper.com
Email: Sean.Cunningham@dlapiper.com
Email: Timothy.Lohse@dlapiper.com
Email: John.Kinton@dlapiper.com
Email: Nikki.Wyll@dlapiper.com
Email: Jesse.Hindman@dlapiper.com

18. Date of Request:

_____

19. Signature and seal of the Requesting Authority:

_____

Hon. Gregory M. Sleet
United States District Judge
United States District Court for the
District of Delaware
844 N. King Street, Room 4324
Wilmington, DE 19801
U.S.A.

EXHIBIT 1

United States Patent [19]
Vogel

[11] **Patent Number: 4,901,075**
[45] **Date of Patent: Feb. 13, 1990**

[54] **METHOD AND APPARATUS FOR BIT RATE REDUCTION**

[75] Inventor: **Peter Vogel**, Diepersdorf, Fed. Rep. of Germany

[73] Assignee: **U. S. Philips Corporation**, New York, N.Y.

[21] Appl. No.: **96,177**

[22] Filed: **Sep. 11, 1987**

[30] **Foreign Application Priority Data**

Sep. 13, 1986 [DE] Fed. Rep. of Germany 3631252
Nov. 8, 1986 [DE] Fed. Rep. of Germany 3638127
May 23, 1987 [DE] Fed. Rep. of Germany 3717399

[51] **Int. Cl.**[4] **H03M 7/46**
[52] **U.S. Cl.** **341/63**; 341/59; 358/261.1
[58] **Field of Search** ..... 340/347 DD; 358/13, 358/136, 138, 261.2, 261.3, 261.4, 263, 261.1; 341/63, 106; 375/25

[56] **References Cited**

U.S. PATENT DOCUMENTS

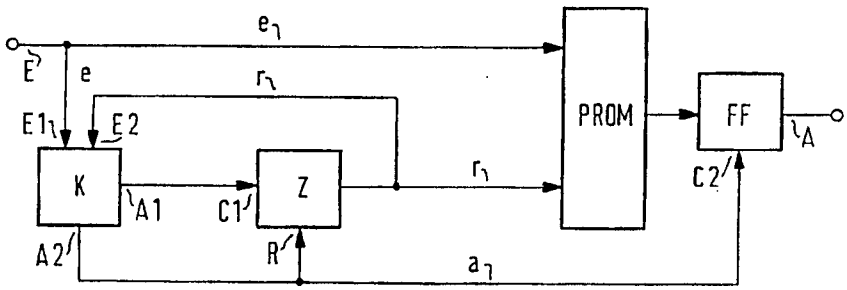
4,101,934 7/1978 Fukuoka 341/63
4,316,222 2/1982 Subramaniam 358/261.4
4,394,774 7/1983 Widergren et al. ..... 340/347 DD
4,698,672 10/1987 Chen et al. 358/136

Primary Examiner—William M. Shoop, Jr.
Assistant Examiner—Brian K. Young
Attorney, Agent, or Firm—Michael E. Marion

[57] **ABSTRACT**

A method and apparatus for coding a signal for transmission in order to achieve improved reduction in the bit rate. A signal is a transform coded in order to form a sequence of zero coefficients and non-zero coefficients, and run lengths of zero coefficients together with preceding or subsequent non-zero coefficients are grouped as events and coded.

13 Claims, 5 Drawing Sheets



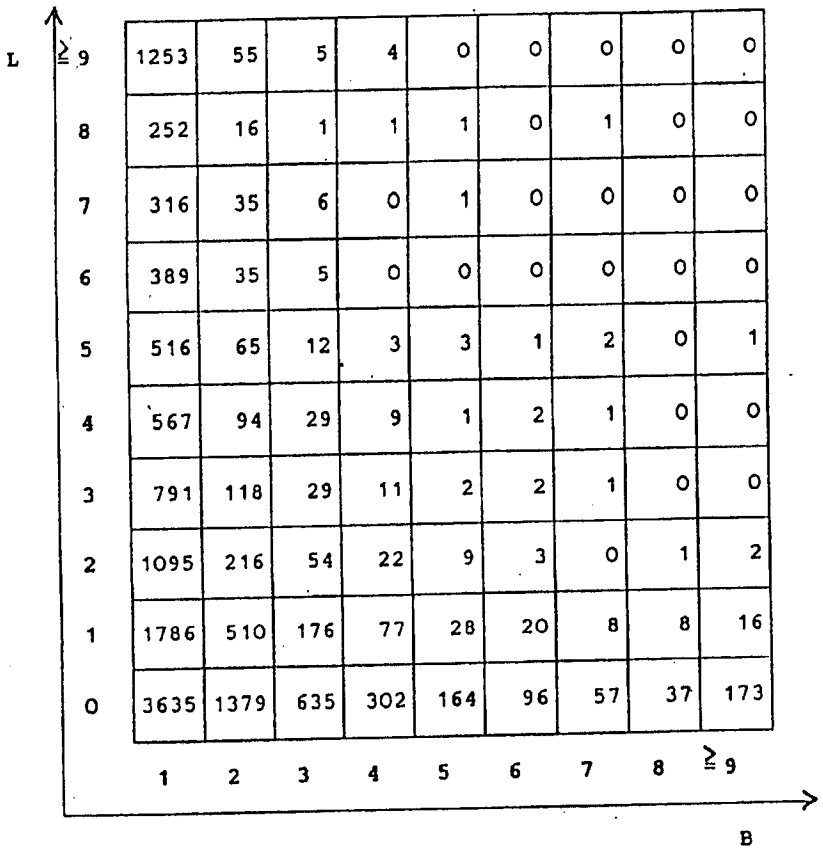

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1253 55 5 4 0 0 0 0 0
252 16 1 1 1 0 1 0 0
316 35 6 0 1 0 0 0 0
389 35 5 0 0 0 0 0 0
516 65 12 3 3 1 2 0 1
567 94 29 9 1 2 1 0 0
791 118 29 11 2 2 1 0 0
1095 216 54 22 9 3 0 1 2
1786 510 176 77 28 20 8 8 16
3635 1379 635 302 164 96 57 37 173
1 2 3 4 5 6 7 8 ≧9
B

FIG. 1

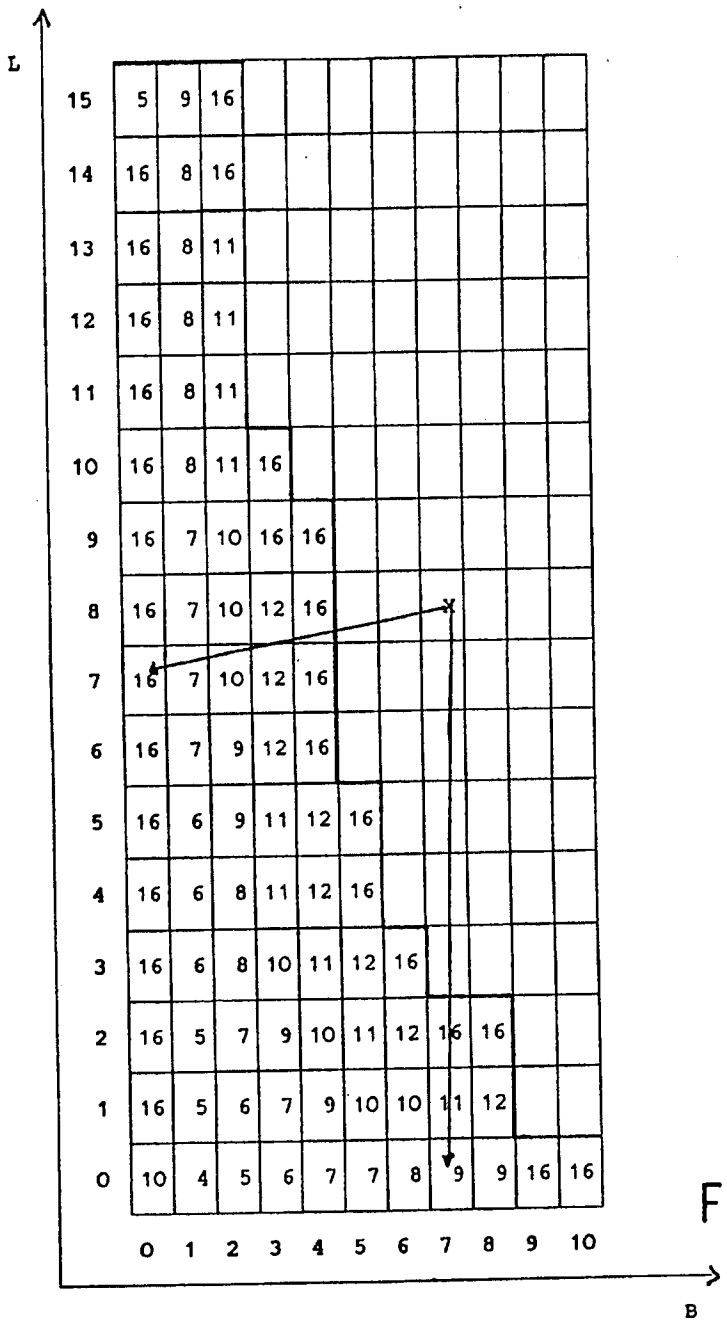

L
B
15 5 9 16
14 16 8 16
13 16 8 11
12 16 8 11
11 16 8 11
10 16 8 11 16
9 16 7 10 16 16
8 16 7 10 12 16
7 16 7 10 12 16
6 16 7 9 12 16
5 16 6 9 11 12 16
4 16 6 8 11 12 16
3 16 6 8 10 11 12 16
2 16 5 7 9 10 11 12 16 16
1 16 5 6 7 9 10 10 11 12
0 10 4 5 6 7 7 8 9 9 16 16
0 1 2 3 4 5 6 7 8 9 10

FIG. 2

Nr.	B	L	code word		length
1	-	-	11	(end of block)	2
2	1	0	010s		4
3	1	1	1000s		5
4	1	2	1001s		5
5	2	0	1010s		5
6	0	15	10110		5
7	1	3	10111s		6
8	1	4	01100s		6
9	1	5	01101s		6
10	2	1	01110s		6
11	3	0	01111s		6
12	1	6	001000s		7
13	1	7	001001s		7
14	1	8	001010s		7
15	1	9	001011s		7
16	2	2	001100s		7
17	3	1	001101s		7
18	4	0	001110s		7
19	5	0	001111s		7
20	1	10	0001000s		8
21	1	11	0001001s		8
22	1	12	0001010s		8
23	1	13	0001011s		8
24	1	14	0001100s		8
25	2	3	0001101s		8
26	2	4	0001110s		8
27	6	0	0001111s		8
28	1	15	00001000s		9
29	2	5	00001001s		9
30	3	2	00001010s		9
31	4	1	00001011s		9
32	7	0	00001100s		9
33	8	0	00001101s		9

FIG. 3

Nr.	B	L	code word	length
34	2	6	00001110s	9
35	2	7	000001000s	10
36	2	8	000001001s	10
37	2	9	000001010s	10
38	3	3	000001011s	10
39	4	2	000001100s	10
40	5	1	000001101s	10
41	6	1	000001110s	10
42	0	0	0000011111	10
43	2	10	0000011110s	11
44	3	4	0000001000s	11
45	3	5	0000001001s	11
46	4	3	0000001010s	11
47	5	2	0000001011s	11
48	7	1	0000001100s	11
49	2	11	0000001101s	11
50	2	12	0000001110s	11
51	2	13	0000001111s	11
52	3	6	00000001000s	12
53	3	7	00000001001s	12
54	3	8	00000001010s	12
55	4	4	00000001011s	12
56	4	5	00000001100s	12
57	5	3	00000001101s	12
58	6	2	00000001110s	12
59	8	1	00000001111s	12
60	9	0	00001111s+++++++	16
61	0	1	00000000100000--	16
62	0	2	00000000100001--	16
63	0	3	00000000100010--	16
64	0	4	00000000100011--	16
65	0	5	00000000100100--	16

FIG. 4

Nr.	B	L	code word	length
66	0	6	00000000100101--	16
67	0	7	00000000100110--	16
68	0	8	00000000100111--	16
69	0	9	00000000101000--	16
70	0	10	00000000101001--	16
71	0	11	00000000101010--	16
72	0	12	00000000101011--	16
73	0	13	00000000101100--	16
74	0	14	00000000101101--	16
75	2	14	00000000101110s-	16
76	2	15	00000000101111s-	16
77	3	9	00000000110000s-	16
78	3	10	00000000110001s-	16
79	4	6	00000000110010s-	16
80	4	7	00000000110011s-	16
81	4	8	00000000110100s-	16
82	4	9	00000000110101s-	16
83	5	4	00000000110110s-	16
84	5	5	00000000110111s-	16
85	6	3	00000000111000s-	16
86	7	2	00000000111001s-	16
87	8	2	00000000111010s-	16

FIG. 5

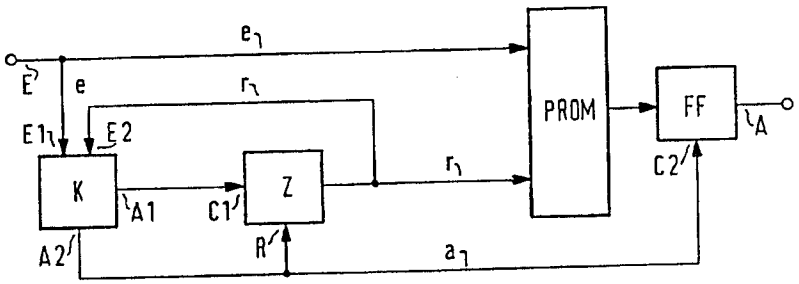


FIG.6

METHOD AND APPARATUS FOR BIT RATE REDUCTION

BACKGROUND OF THE INVENTION

The invention relates to a method of and a circuit arrangement for bit rate reduction. Bit rate reduction is carried out when coding a signal, which comprises a series of digital signal values and has a signal value A, occurring most frequently in runs.

An Article by Wen-Hsiung Chen and William K. Pratt (Chen, When-Hsiung and Pratt, William K.; Scene Adaptive Coder IEEE Transactions on Communications, vol. Com-32, No. 3, March 1984, pages 225–232) describes a coding process of video signals for the purpose of transmitting video pictures of satisfactory quality at a minimum possible bit rate. Coding is effected in several steps. First, equally large video picture sections which are represented by blocks of pixels are subjected to a Discrete Cosine Transform. In this transform process, a special two-dimensional Fourier transform is used. By the transform, a new block of values (coefficients) is obtained from the original block. This coefficient block has the property that a large number of its elements—thus a large number of the coefficients—are approximately 0 or exactly 0. A subsequent quantization of the coefficients always renders the greater part of the elements 0 so that a subsequent Huffman coding would therefore already involve a considerable bit rate reduction. The authors of the above-mentioned Article achieve a further bit rate reduction in that the frequent occurrence of zero runs in the intermediate signal in which the coefficients are serially arranged is utilized by means of a Huffman coding.

It is known that in a Huffman coding in which the codewords have different lengths, statistic properties of the signal to be coded are utilized. In the present case this particularly implies that the frequency with which zero runs having lengths 1, 2, 3, etc. occur in the above-mentioned intermediate signal is investigated. The shortest Huffman codeword is then assigned to the run that occurs most frequently. The next larger codeword is assigned to the run that occurs less frequently, and so forth.

For coding the intermediate signal two Huffman code tables are required according to the above-mentioned Article. A first table shows how the (quantized) coefficients different from 0 are to be coded. Only the coefficient values are coded because equally large coefficients also occur at the same frequency. The signs are transmitted in a separate bit. A second table shows how the run length is to be coded. In order that the codewords of one table can be distinguished from those of the other table during decoding, a separate codeword, the so-called run length prefix, is used for the identification of the coded run length.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a coding method for a signal of the kind mentioned in the opening paragraph and comprising in a special case, an intermediate signal resulting from a picture coding operation, leading to a bit rate reduction which is larger than that hitherto known.

This object is achieved by assigning a Huffman codeword to each run of signals having the value A, where A having length 0, 1, 2 etc., together with the signal value subsequent to the run or together with the signal value preceding the run.

Advantageous embodiments of the invention, particularly for exeptional cases of the signal characterized in the opening paragraph as well as a circuit arrangement for carrying out the method according to the invention, can be derived from the sub-claims.

BRIEF DESCRIPTION OF THE DRAWING

The invention will now be described in greater detail by way of examples with reference to the accompanying drawings in which

FIG. 1 is a table stating the occurrence of events,

FIG. 2 is a further table elucidating the split-up of the events,

FIG. 3 to FIG. 5 show a coding table, and

FIG. 6 shows the circuit diagram of arrangements for coding video signals according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

In the following embodiments, the intermediate signal referred to results from the transform coding of blocks of picture elements (pixels). The signal values of the intermediate signal thus represent the transform coefficients. As stated above, the coefficient which occurs most frequently in runs within the intermediate signal is represented herein as having the signal value A. In the following embodiments, signal value A equals zero or approximately zero zero (referred to hereinafter as the "zero-coefficient") because it appears most frequently in runs after transform coding. All coefficients not having a value of zero will be referred to hereinafter as "non-zero coefficients".

As used in the following description, a run of zero coefficients and the non-zero coefficient which immediately precedes or follows this run, is referred to as an event. Each non-zero coefficient which is not preceded or followed by one or more zero coefficients is also referred to as an event. According to the invention these events are to be coded.

It is to be noted that some events are more likely to occur than others. For example coefficients having small values will occur more frequently than coefficients having large values, and it is more likely that a coefficient having a small value will be preceded by a run of zero coefficients.

FIG. 1 shows the frequency distribution of the above-mentioned events in the case of a cosine-transformed and subsequently quantized video signal. Each field of the table represents an event characterized by the zero run length L and by the value B of the subsequent (quantized) coefficient. The values B proceed through the natural numbers without the zero and the length L proceeds through the natural numbers with the zero. In order that the table does not become arbitrarily large, all events with B larger than or equal to 9 are combined to an overall event. The same applies to L when larger than or equal to 9.

The numbers in the different fields indicate how often the associated event occurs in a quantized video signal with approximately 15000 signal values. The assignment of Huffman codewords is shown in the table: the series L=0, B=1 acquires the shortest codeword; this is followed by the series L=1, B=1 with the next longer codeword, and so forth.

If the assigned codewords instead of the frequencies are introduced in the event fields of the table, a two-dimensional coding table is obtained. It is not shown for the events according to FIG. 1 because such coding tables can generally be set up by those skilled in the art. For the sake of completeness it is to be noted that a maximum number of 11 bits follows for the events in which L is larger than or equal to 9 or in which B is larger than or equal to 9 after the assigned Huffman codeword, which bits give the receiver accurate information about the value of L and the value of B, respectively.

An additional bit rate reduction of 12% is obtained when coding video signals in accordance with the above-mentioned two dimensional coding table as compared with the coding method described in the opening paragraph.

This additional bit rate reduction is possible because, for example if the probability of a coefficient having the value 2 occurring equals P1, and the probability of run of three zero-coefficients occurring equals P2, and the probability of the run of three zero-coefficients occurring followed by a coefficient having the value 2, equals P3; probability P3 will not be equal to the product of probabilities P1 and P2.

The limitation of FIG. 1 will now be considered in greater detail. As is evident from the above-mentioned embodiments the number of the events to be coded in accordance with FIG. 1 is kept within efficient limits because all zero runs with an equally large subsequent value of a coefficient are considered as an event if the run length L is larger than eight.

Similarly, all zero runs of equal length are considered as an event if the subsequent value B of a coefficient is larger than eight.

As is shown in FIG. 1, relatively rarely occurring events are concerned, and therefore they are coded with relatively long Huffman codewords. Since the receiver for decoding should know the exact zero run length or the exact value of a coefficient without any loss of information, an additional codeword is added to the Huffman codeword—as already indicated above—from which the exact length or the exact value or both can be derived.

A clearly defined state is encoded by the Huffman codeword and the additional information. Since the number of bits of such combinations is also dependent on the statistic properties of the signal, such combinations should also be present at the receiver and the decoder in order that the state which is based on these combinations can unambiguously be recognized at the receiver end.

The Huffman codewords defined in this sense may be up to 30 bits long. Since the processing of codewords which are at most 16 bits long does not require any special arrangements, but is possible, for example with a 16-bit microprocessor, given events are split into sub-events—to improve the method described so far—such that codewords whose length is at most 16 bits are sufficient for coding all events and sub-events. This split-up will now be described in greater detail.

Firstly, an event to be coded consisting of an L=Lm zero run with subsequent coefficient of the value B=Bm is designated by (Lm, Bm). In contrast to the foregoing, Bm=0 is now also explicitly admitted. It is true that the two-dimensional diversity of events (Lm, Bm) occurring in practice is finite, because arbitrarily large values of coefficients do not occur, but it is very large. Consequently, the Huffman codewords to be used are correspondingly large as regards number and length. To reduce the overall number of the events to be coded the starting point is that, for example a run of 19 zeros with subsequent coefficient of the value 7 can be split up into sections, the first of which represents a run of 16 zeros, the second of which represents a run of 3 zeros and the third of which is a run without a zero and subsequent coefficient of the value 7. Each of these sections is now considered as a sub-event which is coded by a Huffman codeword. The length of each section is below a given value which can be predetermined and which will be further dealt with below.

This split-up is illustrated in FIG. 2. In the horizontal direction all occurring values B—including the value 0—of the coefficients are shown. In the vertical direction the length—also starting at 0—of coefficient runs of the value 0 is shown. The "events Fields" shown symbolize the event (Lm, Bm) i.e. Lm zeros followed by a coefficient of the value Bm. The event (0, 3) for example, means that a coefficient of the value 3 is preceded by a run length 0 which means that there is no coefficient of the value 0 preceding. Isolated zeros in the signal are symbolized by the event (0, 0). The reference (3, Bm) refers inter alia to the event in which a coefficient of the value Bm is succeeded by three successive zeros. Since the value of zero is also admitted for Bm, the event (3, 0) means that there are four successive zeros.

FIG. 2 shows a polygonal curve in a solid line dividing the series fields into two ranges. The left-hand range comprises the events which are referred to as being codable and the right-hand range shows the events which are referred to as non-codable. The maximum length for a section of signal values—corresponding to a codable event—is 16; the events (0, 15), (1, 15) and (2, 15) are involved. All other codable events correspond to signal sections which are shorter. The division into codable and non-codable events is not completely arbitrary; the most frequently occurring event should be associated with the codable ones. The crossed non-codable event (8, 7) is split, for example, into the events (0, 7) and (7, 0). There are various possibilities for the split-up; the simplest is the indicated "projection on the event axes".

The numbers in the event fields which are associated with the codable events signify the length—hence the number of bits—of the Huffman codewords with which the events are coded. The codewords also comprise the signs of the coefficients and possibly data about the magnitude of the value B; none of them is longer than 16 bits. In setting up the Huffman codewords it was assumed that coefficients having values of more than 136 do not occur.

FIGS. 3 to 5 show the exact structure of the Huffman codewords used. The first codeword 11 represents the coded signal value for characterizing a block end; at the transmission it succeeds the last codeword which is associated with a coefficient block. The first column of these figures states consecutive numbers, the second column states the values B of the coefficients and the third states the lengths L of the zero runs. The two latter data combined result in the "coordinates" of a codable event according to FIG. 2. In the fourth column of FIGS. 3–5 the code words are shown bitwise. The bit s denotes the sign bit, the positions indicated by "–" are meaningless, and the positions indicated by "+" comprise the coded values of the coefficients in so

far as they are larger than eight. The last column once more states the length of the Huffman codewords.

A possibility of further reducing the bit rate results from the fact that—as in the present embodiment—the signal to be coded is structured in accordance with blocks. As already indicated, the coefficients of a coefficient block are separated from those of the next block by an "end-of-block" signal. Also this "end-of-block" signal is converted into a codeword (compare FIG. 3) while the sequence of m (codable) events of the type

(L1, B1) (L2, B2) . . . (Lm, Bm)	(1)

and into a sequence of assigned codewords. The number m of the events is dependent on the special values of the coefficients. If the overall coefficient block comprises, for example 63 zeros with subsequent coefficients of the value 1, it is split up into only one event, namely (63, 1) or into several codable events according to FIG. 2. As it is not known in advance into how many codable events a coefficient block is split, the separate blocks must for this reason already be separated from one another by means of an "end-of-block" signal. At the receiver end the transmitted Huffman codewords are retransformed into events and these events are again converted into a sequence of coefficients. The receiver knows that, for example, 64 coefficients are associated with a coefficient block.

For further explanation and for the sake of simplicity, it is assumed that 4×4 blocks are concerned, so that one block comprises a total of 16 coefficients. All data associated with a block are separated from the data of the subsequent block by an "end of block" sign. This sign and the corresponding codeword is excepted from the split-up of the signal to be coded in accordance with the events. If, for example the sequence of coefficients of a block in a decimal representation has the form of

XX 4005000050000001 XX, (2)

The block is split up according to scheme (1) into the following events.

(0, 4) (2, 5)(4, 5) (6, 1)	(3)

In order that the coefficient sequence of a block can at any rate be split into events in accordance with scheme (1) or (3) above, the coefficients are temporarily stored before they are further processed. The temporal sequence of the coefficients in scheme (2) and that of the events in schemes (1) and (3) corresponds to the sequence of their written registration (European writing direction assumed). The symbols XX in the embodiment according to scheme (2) symbolize the "end-of-block" signs of the previous block and the represented block.

The coefficients in scheme (2) which are different from 0 are all positive and are represented as integral multiples of the smallest unit, namely 1. As can be seen from scheme (3), the last event is the event (6, 1). The Huffman codewords assigned to the events are not indicated.

Firstly, the weight of reception of the last event, namely (6, 1) of the block according to (2) is checked for the receiver. In the coding of pictures general experience has proved that the transmission of events with a run of more than five zeros become less worthwhile as the value of the subsequent coefficient is smaller. If in accordance with the rule based on experience, checked events for which L=5 and B=1 are not transmitted, the transmission of the last event does not take place. In that case the preceding series (4, 5) is checked in accordance with the same criterion. In the example according to (2) the check for this block is ended because the event (4, 5) and the assigned Huffman codeword must be transmitted.

After decoding the Huffman codewords at the receiver end all coefficients of the block according to scheme (2) can be recovered, but for those which are associated with non-transmitted events. However, since these are associated with the last coefficients of the block, the decoded coefficients at the receiver end are augmented with coefficients of the value 0 until the overall number of coefficients is 16.

FIG. 6 shows a circuit arrangement realising a simple split-up of the sequence of coefficients in accordance with codable events. The supply of clock pulses and details of the logic operation of binary values are not shown because they are known to those skilled in the art. In the circuit arrangement according to FIG. 6 events are coded which consist of a run of coefficients of the value zero and a subsequent coefficient. If the run length L in the signal to be coded exceeds a predetermined length Lmax, the associated event cannot be encoded and is split into codable events. Due to the predetermined maximum length Lmax which is independent of the subsequent coefficient, no delays or intermediate storages of the coefficients are required.

The coefficients are serially applied from an input E via a multiple lead e to the address inputs of an addressable memory PROM and to a first input E1 of a comparator circuit K. The multiple lead e comprises as many wires as bits are required for the binary representation of a coefficient. A coding table is filed in the memory PROM.

The position of a counter Z is applied to a second input E2 of the comparator K—via a multiple lead f. The multiple lead f is simultaneously connected to further address inputs of the memory PROM.

It is assumed that a coefficient which is different from zero is present at the input E1. In this case the comparator circuit K supplies a pulse from an output A2, which pulse is applied via a lead a to the reset input R of the counter Z and to the clock input C2 of a flipflop circuit FF. The counter is reset to the zero position with this pulse and the codeword which is present at the output of the memory PROM is bit-parallel taken over in the flipflop circuit FF. The codeword can be derived from the output A of the circuit arrangement according to FIG. 6. The codewords present at output A are not the ultimate Huffman codewords because all of them have the same length. To convert codewords of the same length into codewords of unequal length, and conversely—the latter conversion is required at the receiver end—reference is made to patent applications DE 35 10 902, DE 35 10 901 and DE 36 32 682.

If a zero is present at the input E1, the comparator circuit K supplies a counting pulse from a further output A1 and applies it to the clock input C1 of the counter Z which increases it count by one unit. The comparator circuit K continuously compares the actual

counting with the value Lmax which is stored in one of its memories not shown. If the count reaches the value Lmax, the supply of a further counting pulse does not take place. Instead, the reset or transfer pulse is supplied from the output A2.

The complete coefficients—thus also their signs—are processed in the circuit arrangement according to FIG. 6. In a modification the signs of the coefficients are applied via a separate wire to the output A of the circuit arrangement and to accept them from a comparison by the comparator circuit K and from determining the codewords by the programmable memory PROM.

What is claimed is:

1. A circuit arrangement for coding a signal comprising a run of zero coefficients and a subsequent coefficient, wherein said coefficients are applied with predetermined delays to the address inputs of a memory (PROM) and to a first input (E1) of a comparator circuit (K), in that a counter (Z) is provided whose count is applied to further address inputs of the memory (PROM) and to a second input (E2) of the comparator circuit (K), in that the comparator circuit (K) supplies a counting pulse to the counter (Z) from a first output (A1) if a zero coefficient is present at the first input (E1) and if the count has not exceeded a value stored in a memory of the comparator circuit (K) supplies a pulse from a second output (A2) if the conditions for the supply of a counting pulse are not fulfilled, and in that the counter (Z) is reset by means of the pulse at the second output (A2) of the comparator circuit (K), and in that the codeword present at the outputs of the memory (PROM) is transferred to an intermediate memory (FF).

2. A circuit arrangement as claimed in claim 1, characterized in that only the values of the coefficients are applied to the address inputs of the memory (PROM) and the comparator circuit (K) and in that the sign bits of the coefficients are supplied through a separate wire to the output (A) of the circuit arrangement.

3. In a method of coding a signal comprising a sequence of coefficients which results after a blockwise transform of pixels of a video signal with subsequent quantization, for transmission at a reduced bit rate, said signal comprising a plurality of zero coefficients, and a plurality of non-zero coefficients said method comprising the steps of:

(a) deriving from said signal, a plurality of events each comprising a run of said zero-coefficients having a respective run length and preceded or followed by at least one non-zero coefficient, and

(b) for each of said events, determining said respective run length and assigning a code word to represent said non-zero coefficient and said run length.

4. The method of claim 3, wherein said code words are Huffman code words.

5. A method as claimed in claim 4, characterized in that a Huffman codeword is not transmitted if the length of the associated run of zero-coefficients exceeds a barrier which is dependent on the magnitude of the subsequent non-zero-coefficients.

6. A method as claimed in claim 4, characterized in that the signal comprises a sequence of coefficients which results after a blockwise transform of pixels of a video signal with subsequent quantisation and in that a checked Huffman codeword is not transmitted if the length of the associated zero run is larger than five and if the magnitude of the subsequent non-zero-coefficient has the smallest possible value different from zero.

7. A method as claimed in claim 4, characterized in that the Huffman codeword is independent of the sign of that non-zero coefficient which succeeds or precedes the run of zero-coefficients and in that the sign is coded by a separate bit.

8. A method for coding a signal for transmission at a reduced bandwidth, comprising the steps of:

(a) transforming said signal into a sequence comprising zero coefficients occurring in runs and non-zero coefficients;

(b) deriving from said sequence, a plurality of events each comprised of a run of zero coefficients having a respective run length, which is preceded or followed by at least one non-zero coefficient, and

(c) for each of said events, determining the run length and assigning a code word to represent said run length and said non-zero coefficient.

9. The method of claim 8, comprising the additional steps of:

determining for each event, whether the run length of said run of zero coefficients exceeds a predetermined length and if so assigning the same code word to represent each said run length and respective non-zero coefficient.

10. The method of claim 8, comprising the additional steps of:

determining for each event, whether the non-zero coefficient exceeds a predetermined value and if so assigning the same code to represent said run length and said non-zero coefficient.

11. The method of claim 8, comprising the additional steps of:

determining whether the run length of each event exceeds a predetermined run length and if so, splitting said respective event into a plurality of sections so that each of said sections has a run length below said predetermined run length, and assigning a code word to each section.

12. An apparatus for coding a signal comprising a run of zero coefficients and a subsequent coefficient, said apparatus comprising:

(a) means for determining if the length of said run exceeds a predetermined length;

(b) splitting means coupled to said length determining means, for splitting a run which exceeds said predetermined length into a plurality of codable events; and

(c) coding means coupled to said splitting means for assigning a code word to represent each said codable event.

13. In a method of coding a signal comprising a sequence of coefficients which results after a blockwise transform of pixels of a video signal with subsequent quantization, for transmission at a reduced bit rate, said signal comprising a plurality of first coefficients having a signal value A and occurring in runs most frequently in said signal, and a plurality of second coefficients having values not equal to A, said method comprising the steps of:

(a) deriving from said signal, a plurality of events each comprising a run of said first coefficients having a respective run length, which is preceded or followed by at least one second coefficient, and

(b) for each of said events, determining said respective run lengths and assigning a code word to represent said second coefficient and said run length.

* * * * *

EXHIBIT 2

BRITISH STANDARD

BS ISO/IEC
10918-1:1994

Implementation of
ISO/IEC 10918-1:1994

Information technology — Digital compression and coding of continuous-tone still images: Requirements and guidelines

ICS 35.040.00

UDC 681.3.04(084.14)

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Information Systems Technology Standards Policy Committee (IST/-) to Technical Committee IST/37, upon which the following bodies were represented:

British Broadcasting Corporation
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Philips Research Laboratories
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The following bodies were also represented in the drafting of the standard through subcommittees and panels:

British Computer Society
CCTA (the Government Centre for Information Systems)
Department of Trade and Industry (IT Standards Unit)
Digital Equipment Co. Ltd.
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This British Standard, having been prepared under the direction of the Information Systems Technology Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 July 1994

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The following BSI references relate to the work on this standard:
Committee reference IST/37
Draft for comment 92/60192 DC

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Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	vi
Text of ISO/IEC 10918-1	1

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National foreword

This British Standard reproduces verbatim ISO/IEC 10918-1:1994 and implements it as the UK national standard.

This British Standard is published under the direction of the Information Systems Technology Standards Policy Committee whose Technical Committee IST/37 has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international committee any enquiries on interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO/IEC title page, pages ii to vi, pages 1 to 173 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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EXHIBIT 3

IEC/ISO JTC1/SC2/WG8 N948
February 20,1990

our ref: IST/2/-/1
date : 16 January, 1990

NOTE: The following are the UK experts who are recognised as actively participating in ISO/IEC JTC 1/SC 2/WG 8 and as such should be accreditated to SC 2/WG 8 and ISO as noted by the UK National Technical Committees.

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EXHIBIT 4

I S O

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONAL DE NORMALISATION

ISO/IEC JTC1/SC2/WG8

CODED REPREZENTATION OF PICTURE
AND AUDIO INFORMATION

ISO/JTC1/SC2/WG8 N867REV
June, 1989

SOURCE : Hiroshi Yasuda Convenor of WG8

TITLE : WG8 Mailing List (June 1989)

WG8 Mailing List

1. Active Mewmbers (1000--, 700--)

Active members: Who has the possibility of attending WG8 meeting.
Can receive relevant documents.

2. Liaison Members (1200--)

Liaison Members: Who can only receive important documents such as recommendations, minutes and meeting notice, etc..

3. Members to keep contact (1400--)

They are old members of WG8 and keep contact for information and advices.
: Who can only receive important documents such as recommendations, minutes and meeting notice, etc..

Please check your address and TEL/FAX numbers, and if you find any inconvenience please let me know as quick as possible to complete this list. (To Dr. H. Yasuda, FAX:+81(468)59-2806)

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EXHIBIT 5

I S O

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONAL DE NORMALISATION

ISO/IEC JTC1/SC2/WG8

CODED REPREZENTATION OF PICTURE
AND AUDIO INFORMATION

ISO/JTC1/SC2/WG8 N975REV
April 18, 1990

SOURCE : Hiroshi Yasuda, Convenor of WG8

TITLE : WG8 Mailing List (April 18, 1990)

Following is the new mailing list of WG8.

Qualification as an active member will be checked using this table in the near future, namely too many spaces will disqualify your active member status.

Rule to Register on Mailing List

1. One person per location•company,
2. Two conscutive absence from WG8/Subgroup Meeting will cause deletion from the List
   (O & X in the participation status is necessary)

please check your status and if you find corrections please let me know as quick as possible.

Wordings

----:	A person who would receive document via representatives (numbered in the list)
xxxx:	A representative whose address is not available
PORT:	PORTO Meeting (WG8, JPEG, JBIG, MPEG, MPEGAUDIO, MHEG)
USA:	Tampa Florida Meeting (WG8, JPEG, JBIG, MPEG, MPEGAUDIO(MHEG)
JPN:	Japan Meeting (WG8, CGEG, JPEG, JBIG, MPEG, MPEGAUDIO, MHAG)
STH:	Stockholm Meeting (WG8, CGEG, JPEG, JBIG, MPEG, MPEGAUDIO, MHAG)
REN:	Rennes Meeting (MPEG, MPEGAUDIO, MHAG)
W:	will to attend WG8
C:	CGEG
P:	JPEG
B:	JBIG
M:	MPEG
A:	MPEGAUDIO
H:	MHAG
?:	have will to attend, but without particular subgroups name
O:	Attended
X:	Not attended, but some contribution or notice submitted
Space:	No information nor participation

Please inform me as quick as possible, if you find any correction in the list

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WJ00 Yasuda, Dr. Hiroshi :NTT ECL JAPAN	0	0	0	0		
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WF01 Trocherie, Mr. Bernard :BULL FRANCE		0	X	0		
WF02 Wallace, Mr. Gregory K. :DEC USA		0	0			
WF11 Hampel, Mr. Horst :SEL FRG		0	0	0		
WF03 Chiariglione, Dr. Leonardo :CSELT ITALY	0	0	0			
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WF05 LeGall, Dr. Didier J. :C Cube USA	0	0	0			
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WF06 Kretz, Mr. Francis :CCETT FRANCE	0	0	0			
WF07 Friemelt, Mr. Joachim :Siemens FRG		0	X			
WF08 Sebestyen, Dr. Istvan :Siemens FRG		0	0	0		
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WF10 Smith, Mr. Colin :INMOS UK	0	0	0			
WJ02 Suzuki, Mr. Haruyoshi :SONY JAPAN	0		0	0		
WJ03 Kogure, Mr. Takuyo :Matsushita JAPAN	0	0	0	0		
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WJ05 Nishitani, Mr. Takao :NEC JAPAN			0			
WJ06 Taka, Mr. Masahiro :NTT ECL JAPAN		0	X			
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F057 Kilpinen, Mr. Timo T. :P&T FINLAND		0		0		
---- Kultanen, Mr. Pekka :P&T FINLAND		0				
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---- Guichard, Dr. Jacques :CNET FRANCE		0	0	0		
---- Mahieux, Mr. Yannick :CNET FRANCE	0	0	0			
F030 Petit, Mr. Jean Pierre :CNET FRANCE	0	X				
F062 Price, Mr. Roger :IBM FRANCE			0	0		
F027 Lefvre, Mr. Jean-Paul :OROS FRANCE	0	X	X			
F036 Jolivet, Mr. Jean Clade :SAT FRANCE			0			
---- Gicquel, Mr. Serge :SAT FRANCE		0		0		
F072 Komly, Mr. Alain :TELEDIFFUSION FRANCE				0		
F055 Saini, Mr. Jaslit :Thomson FRANCE		0				
---- Fujita Mr. Mutsumi :Thomson FRANCE				0		
F009 Lohscheller, Dr. Herbert :ANT FRG		0		0		
F031 Noll, Prof. Peter :Univ. Berlin FRG		0	0	0		
F054 Tallet, Mr. Paul :DEC FRG		0				
F029 Meier-Engelen, Dipl.-Ing. Egon :DFVLR FRG			0	0		
F024 Gerhaeuser, Dr.-Ing. Heinz L. :FhG FRG	0	0	0	0		
F035 Stoll, Mr. Gerhard :IRT FRG	0	0	0	0		
---- Theile, Mr. Guenther :IRT FRG	0	0				
F021 Butera, Mr. William J. :ITT FRG		0	0			
F008 Krupa, Mr. Burkhard :PKI FRG						
F041 Hammer, Dr. Bernard :Siemens FRG		0	0	0		
F026 Kummerow, Dr. Thomas :Telenorma FRG	0	0	0	0		
F025 Hepper, Mr. Dietmar :Thomson FRG	0	0	0	0		
---- Spille, Mr. Jens :Thomson FRG	0	0	0	0		
F020 Brandenburg, Dipl.-ING. Karlheinz :UNIV. of Erlang						
F019 Fuchs, Mr. Hendrik :Univ. Hannover FRG	0	0	0	0		
---- Adolph, Mr. Dirk :Univ. Hannover FRG	0			0		
1242 Fenn, Mr. John Barry :Wang FRG				0		

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F010 Park, Mr. Sang Gyu :ETRI KOREA		X	0	X		
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F066 Turner, Mr. S. R. :Philips UK						
F071 Robinson, Dr. A. Harry :STC UNITED KINGDOM				0		
F061 Yung, Mr. Benjamin :Apple Computer			0	0		
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J015 Kudo, Mr. Yoshimichi :HITACHI JAPAN				0		
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---- Takizawa, Mr. Masaaki :HITACHI JAPAN			0			
---- Tsuboi, Mr. Yukitoshi :HITACHI JAPAN			0			
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J004 Yamada, Mr. Yasuhiro :JVC JAPAN	0	0	0	0		
---- Fujimoto, Masahiro :JVC JAPAN			0			
---- Konishi, Mr. Masaya :JVC JAPAN			0	0		
---- Mori, Mr. Toshinori :JVC JAPAN			0			
---- Onoe, Mr. Hideo :JVC JAPAN	0	0	0	0		
---- Ozawa, Mr. Keiji :JVC JAPAN			0			
---- Sugiyama, Mr. Kenji :JVC JAPAN			0	0		
J002 Endoh, Mr. Toshiaki :KDD JAPAN		0	0	0		
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J006 Asai, Mr. Kohtaro :Mitsubishi JAPAN	0	0	0			
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---- Murakami, Dr. Tokumichi :Mitsubishi JAPAN	X	X	0			
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---- Yoshida, Mr. Masayuki :Mitsubishi JAPAN			0			
J000 Omachi, Mr. Takao :NEC JAPAN		0	0	0		
J007 Ohta, Mr. Mutsumi :NEC JAPAN			0			
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J003 Hagiwara, Mr. Hiroyuki :NTT JAPAN		0	0	0		
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J017 Hayashi, Mr. Shinji :NTT ECL JAPAN			0	0		
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J018 Suzuki, Mr. Kouichi :NTTDATA JAPAN			0			
---- Nakamura, Mr. Taichi :NTTDATA JAPAN			0			
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---- Tateishi, Mr. Toru :Toshiba JAPAN			0			
J020 Matsuyama, Mr. Takeshi :YAMAHA JAPAN			0			
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EXHIBIT 6

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ORGANISATION INTERNATIONAL DE NORMALISATION

ISO/TC97/SC2/WG8

CODED REPRESENTATION OF PICTURE AND AUDIO INFORMATION

ISO/TC97/SC2/WG8 N480 Rev 1
March 1987

Source:

Graham P Hudson, British Telecom
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Title:

Report Of The Joint Photographic Experts Group Meeting 24-26 March 1987, Darmstadt

0 Approval Of The Agenda And Review Of Papers (N454, N455, N456)

The agenda, N454, shown in annexe 1 of this report was approved. All the papers tabled, listed in N457 and in annexe 2, were assigned to various agenda items. The delegates attending the meeting are given in N456 and in annexe 3.

1 Approval Of The Report Of The Last Meeting (N402)

The report of the Parsippany '86 meeting was approved.

2 Liaison With Other Groups (N436, N450, N460)

Mr Worlitzer, chairman of the CCITT SGVIII WP1 NIC, presented a report (N450) of the December '86 meeting. He stated that NIC was endeavouring to find commonality between telematic services for natural image communication and to find a common coding technique. Of particular interest to JPEG was NIC's revised requirements which were discussed under agenda item 3.

Paper N460 giving a summary of the ESPRIT 563-PICA project over the last six months of '86 was presented by the ESPRIT project's chairman Mr Hudson. He reported that the consortium had reduced the number of techniques under development from 10, to the 2 techniques to be presented to the JPEG.

Dr Yamazaki stated that the Japanese Natural Image Standard (NIS) group had expanded to include Sony and another press representative. Four proposals were to be presented by the group to the meeting.

A special meeting had recently been convened by Mr Thelen, the chairman of the ANSI videotex task group, to discuss photographic coding. Interest was shown by DEC, AT&T, Bellcore and IBM. Mr Thelen will distribute JPEG reports to his group members.

Mr Wallace presented the liaison letter N436 from Ms Murphy of ACR-NEMA. Mr Wallace said there were three compression techniques under consideration, S transform (Philips), DPCM (Siemens) and DCT (Robert Wake). The former 2 techniques are lossless. We are awaiting ACR-NEMA's draft proposal and will send JPEG reports to Ms Murphy.

3.0 Discussion Of Test Pictures, Required Results, Evaluation Criteria And Verification

3.1 Test Pictures (N449, N466, N468)

The COST 211 magnetic tape format for storing digitised images as described in N468, was presented by Mr Vivian. This format is used for the test pictures and is to be used for the results. The IBA provided the four agreed test pictures (Zelda, blackboard, boats and Barbara) in COST 211 format. Tapes were given to ANSI and NIS representatives to distribute in the USA and Japan respectively. ESPRIT will distribute the tapes in Europe. The test pictures may be freely used for ISO purposes. These pictures must be used as the source for the picture to be supplied following compression to the Copenhagen meeting. Only if a major defect is found in their quality will another set be issued and if necessary this will be done within a month. If, as mentioned in N466, the test pictures do not have sufficient high frequency components then within one month NTT will provide a 'girl' picture to replace Barbara.

Mr Postl, N449, suggested that printed half tone pictures should be included in the test set and possibly printed output should be included for subjective testing. It was agreed to stick with the existing test set and to view the results on studio video monitors.

3.2 Required Results (N450, N458, N463)

NIC (N450) confirmed the nominal requirement for compression for each stage of 0.25, 1.0 and 4.0 bit/pixel. At the request of several members a 4th test compression rate is to be provided of 0.75 bit/pixel for each picture. This will be used if the 1.0 bit/pixel pictures do not allow for sufficient discrimination.

Pictures should be compressed to less than or equal to the nominal values. The bit rates are to be the total for luminance and chrominance and must include any address and code table/quantiser downloads and identification data. The rates for stages 2 and 3 should be for the total information to get to that stage (eg 2nd stage of 1 bit/pixel = 0.25 + 0.75 bit/pixel). Compression should be expressed both as bit/pixel and as total number of bytes in the compressed data file.

Digitised pictures must be provided to show the result at the end of all three stages of compression, plus an alternative main (2nd) stage at 0.75 bit/pixel, for all test pictures. Result must be supplied by the 29 May to KTAS prior to the Copenhagen meeting. All pictures must be in colour and to the full CCIR resolution of 720 x 576 pixels. KTAS asked for a 'single volume' format to be used.

The chairman presented N453 stating the information that should be provided by proposers for a technique to be considered for selection in Copenhagen and the information to be included in the

eventual standard. Because of ISO's limited photographic printing capability it was decided that result pictures would not be included in the standard. Consideration will be given to ISO selling digitised test and result pictures on disc. The ISO directive on inventions within standards was discussed and a statement is to be given on the licensing conditions for all candidates. The specification matrix is to be modified to include a row on the patent situation as shown in annexe 7. The complete information to be provided by 24 April in an updated initial description is given in annexe 6.

The revised schedule, N463, was updated as shown in annexe 5.

3.3 Evaluation Criteria (N447, N448, N450)

NIC in annexe 1 of N450 propose classifying the parameters of algorithms in three groups - mandatory, first and second order. Japan's NIS group proposed in paper N447 weightings for each parameter.

It was agreed that only the feasibility of 64 kbit/s decoding need be shown. Also universal applicability with regard to binary coding was considered to be secondary and not mandatory. The mandatory requirements are -

* progressive build-up in at least three stages
* feasibility for 64 kbit/s decoding
* complete implementations information must be provided
* world-wide licences must be available.

The chairman asked delegates to consider the weightings in table 1, shown in annexe 8, and submit comments by 24 April. It was agreed to remove the distinction of a 1st and 2nd order category, and to add a miscellaneous parameter for special features of a technique. Also the main (2nd) stage (0.75/1.0 bit/pixel) subjective testing should be given the highest weight.

3.3 Verification (N459, N488)

The need and means to verify results by supplying executable code for a separate encoder and decoder to establish genuine results and therefore a good standard was presented in N459 by the chairman. It was made clear that the executable code will not allow complexity to be judged.

If, as is believed, the porting of executable code between the machines is technically possible, then executable code is to be provided at the Copenhagen meeting, see N488. The code will either be in VAX VMS, IBM PC/MS DOS or NEC format. Assistance on these systems can be obtained from Mr Wallace, Mr Touchton or Mr Omachi respectively. The code is to be provided for testing purposes only and must be treated in confidence.

3.4 Selection (N472)

The possibility of full subjective testing of all techniques as part of the initial selection was discussed but it was concluded that there was insufficient time within the standardisation schedule. It is proposed to perform an initial screening at the

Copenhagen meeting followed by a full subjective testing on the shortlisted techniques after the meeting.

As proposed in N472 by Dr Yasuda, at Copenhagen, subjective quality and the rating of parameters for all techniques will be performed by all JPEG members attending the meeting who also attended the Darmstadt meeting. All parameters will be rated out of 10 marks and then following weighting a total will be calculated for each technique out of 100. A selection committee comprising one nominated member from each country in the JPEG will decide on the number of techniques to go into the final selection process. Dr Yasuda proposed the objective should be just two techniques. The full subjective testing and the verification of results from the executable code will be completed by 29 July.

For the 0.25 bit/pixel pictures, all pictures will first be quickly viewed to gain an overall impression of the quality and then they will be individually rated. The 1.0 and 4.0 bit/pixel pictures will be judged using the double stimulus method.

4 Registration And Presentation Of Compression Techniques (N446, N449, N453, N457, N461, N462, N464, N465, N471)

The registration list was completed with 12 techniques as shown shown in N457 and annexe 5 . A short presentation was made of each of these. It was confirmed that only techniques documented, presented and registered at this meeting would be considered for standardisation. During the presentation proposers stated the licensing situation for their techniques and this is shown in annexe 5.

As suggested in N466 it was possible to categorise the techniques. Three classes were chosen - Discrete Cosine Transform, Predictive and Other. The category of each technique is shown in annexe 5.

It was agreed that in future publications concerning any of the registered techniques reference should be made to the fact that the technique is a candidate for standardisation by ISO.

5 Developmment Of The Standards For The Development Of The Standards For Photographic Functionality DPX3 And Coding DPX2 Part 2 (N232)

The chairman asked proposers to take into account the draft N232 New in producing syntaxes later in the year. It is proposed to produce a new standard on the principles for binary coding which will be needed for photographic data. Photographic experts are urged to participate in this topic in WG8.

6 Any Other Business

There was no other business.

Annexe 1

Agenda Of The Joint Photographic Experts Meeting

0 Approval Of The Agenda And Review Of Papers (N454, N455, N456)

1 Approval Of The Report Of The Last Meeting (N402)

2 Liaison With Other Groups (N436, N450, N460)

3 Discussion Of Test Pictures, Required Results, Evaluation Criteria And Verification (N447, N448, N449, N458, N459, N463, N466, N468, N472)

4 Registration And Presentation Of Compression techniques (N446, N449, N453, N457, N461, N462, N464, N465, N471)

5 Developmment Of The Standards For The Development Of The Standards For Photographic Functionality DPX3 And Coding DPX2 Part 2 (N232)

6 Any Other Business

Annexe 2

Documents Presented At The Joint Photographic Experts Group Meeting

WG8 N-	Author	Title
402 R1	Hudson	Report Of The Joint Photographic Experts Group Meeting, Parsippany
436	ACR-NEMA	Liaison Statement From ACR-NEMA, 11 December 1986
446	Japan	Flowcharts Of Candidate Algorithms For Standardisation
447	Japan	Evaluating Items For Compression Techniques
448	Japan	Mutual Communication Between Binary Image, Still Image And Moving Picture
449	Postl	Quadtree Extension Of Block Truncation Coding
450	Worlitzer	Brief Report Of The NIC Group Meetings Within CCITT SGVIII, December 1986
453	Leger	Adaptive Discrete Cosine Transform For Still Image Comm Services On ISDNs
454	Hudson	Agenda For The Joint Photographic Experts Group Meeting, Darmstadt
455	Hudson	Delegates Attending The Joint Photographic Experts Grp Meeting, Darmstadt
456	Hudson	Documents Presented At The Joint Photographic Expts Grp Mtg, Darmstadt
457	Hudson	Registration List For Photographic Compression Techniques
458	Hudson	Information To Be Given On Photographic Compression Techniques
459	Hudson	Verification Of Results Of Photographic Compression Techniques
460	Hudson	ESPRIT 563-PICA Summary Of Report For The Second Half of 1986
461	Tricker	Progressive Recursive Binary Nesting
462	Germany	A Hybrid Algorithm (Adaptive Transform And Differential Entropy Coding)
463	Hudson	Revised Schedule For Selecting A Photographic Compression Technique

464	Wallace	A DCT Image Coder With Low Block To Block Distortion
465	AT&T	Block List Transform (BLT) Coding Of Images
466	Japan	On Photographic Compression Algorithm Evaluation
468	Vivian	Note On COST 211 Magentic Tapes For Compression Technique Evaluation
469	Seelman	Flowchart Of HPC Coding Algorithm
471	Touchton	DPCM Using Adaptive Binary Arithmetic Coding
472	Yasuda	Proposal On Selection Criteria
477	Wallace	DEC VAX VMS Executable Code Format

Annexe 3

Delegates Attending The Joint Photographic Experts Group Meetings

Name	Meetings Attended		
	Darmstadt	Copenhagen	Martlesham
Chiariglione, Leonardo	X		
Clark, Richard	X		
Endoh, Toshiaki	X		
Hudson, Graham	X		
Leger, Alain	X		
Lohscheller, Herbert	X		
Kwan, Andrew	X		
Mitchell, Joan	X		
Ogura, Kenji	X		
Omachi, Takao	X		
Pennebaker, William	X		
Park, Sang	X		
Postl, Wolfgang 26 Mar	X		
Poulsen, Henning	X		
Seelmann, Gerhard	X		
Sebestyen, Istvan	X		
Starck, Alexander	X		
Thelen, Donald	X		
Touchton, Charles	X		
Turner, Simon	X		
Tricker, Dennis	X		
Vivian, Roy	X		
Wallace, Gregory	X		
Worlitzer, Manfred	X		
Yamazaki, Yasuhiro	X		
Yasuda, Hiroshi	X		

Annexe 4

Registration List For Photographic Compression Techniques

Title	Proposer	Doc	Pat	Cat
Generalised Block Truncation Coding	Ogura Japan	446	R	O
Progressive Coding Scheme	Yamazaki Japan	446	R	P
Adaptive DCT With Vector Quantisation	Endoh Japan	446	R	T
Component Vector Quantisation	Omachi Japan	446	R	O
Block Truncation Coding With Quadtree Extension	Postl Germany	449	R	O
Adaptive Discrete Cosine Transform	Leger ESPRIT/UK	453	R	T
Progressive Recursive Binary Nesting	Tricker ESPRIT/France	461	R	P
Adaptive DCT And Differential Entropy Coding	Lohscheller Germany	462	R	T
Block List Transform	Haskell USA	465	R	O
Hierarchical Predictive Coding	Seelmann Germany	469	F	P
DPCM Using Adaptive Binary Arithmetic Coding	Touchton USA	471	R	T

Notes of explanation of the abbreviations -

Doc = Document number describing the technique

Pat = Patent situation - R = licenses available on reasonable terms
F = free licenses

Cat = Technique category - T = discrete cosine transform coding
P = predictive coding
O = other coding

Annexe 5

Revised Schedule For Selecting A Photographic Compression Technique

Date	Meeting Place	Action
24-26 Mar	Darmstadt, FTZ	Register techniques for consideration Supply initial description of the techniques including flow diagrams Distribute test pictures in COST 211 magnetic tape format Agree on results required Agree on selection criteria Agree on verification procedure
24 Apr	Post direct to all members	Updated complete initial description
22 May	Post to proposers and GH and HY	Comments on initial description
22 May 29 May	Post to KTAS arrive at KTAS	Initial results tape for all 4 pictures
15-20 Jun	Copenhagen, KTAS	Select techniques for final selection Supply executable code for encoder and decoder for verification Appoint verifiers for each technique Establish refiners for each technique
29 Jul	Post direct to all members	Report on subjective testing and report on verification
25 Sep	Post direct to all members	Distribute final complete description including quantisers and syntax
16 Oct 23 Oct	Post to BTRL arrive at BTRL	Final results tapes for agreed test pictures
9-13 Nov	Martlesham Heath BTRL	Select technique for standardisation Incorporate technique into syntax

Annexe 6

Updated Initial Description Requirements

An updated initial description including the features given below should be mailed by 24 April '87 directly to those on the WG8 mailing list.

* a description of the principles of the technique

  outline the techniques involved and how compression is achieved

  mention quantisers, classification, differential coding, variable length coding

  (typically 2-4 A4 pages)

* an outline of how the techniques will meet the requirements

  how progressive build up is achieved

  how real time decoding could be achieved

  expand upon the following topics -

    encode complexity, adaptibility, compatibility (including with binary), error propagation limitation, reversibility and special feature

  (typicaly 1-2 A4 pages)

* an annexe containing complete flow diagrams
  (typically 5-10 A4 pages)

* an annexe containing a completed specification matrix for the technique

* a list of patents owned that are applicable to the technique

Digitised Picture Results Required

Results are required on magnetic tape in COST 211 format (single volume) to be mailed (by 22 May) to arrive at KTAS, Copenhagen by 29 May '87.

Results are required from Zelda, boats, blackboard and Barbara test pictures for compressions of less than or equal to 0.25, 0.75, 1.0 and 4.0 bits/pixel.

A paper should be included describing the arrangement of pictures on the tape.

Also a paper should be included giving the compression in terms of bits/pixel and the actual data in the compressed picture file for luminance and chrominance.

Annexe 7

Modified Specification Matrix

Photographic Compression Technique - Specification Matrix

Compression Technique (title)		
Decode Complexity	exper.	Implementation
		decoding time
	real	Implementation (*expect.)
		decoding time (*expect.)
Encode Complexity	exper.	Implementation
		encoding time
	real	Implementation (*expect.)
		encoding time (*expect.)
Progressive Build-up	1st stage	compression
		subj. quality/artefacts
	build - up	no of stages
		subj. effect
	final stage	compression
		subj. quality
Adaptivity	editor - quality/compression	
	content - quality/compression	
Error Propogation		
Maturity		
Applicability	symmetry encode/decode	
	resolution range (low and/or high)	
	multilevel mono/colour (yes or no)	
	binary (yes or no)	
	compatibility	
	comments	
Patent/ licensing (yes/no, free/reasonable)		

Annexe 8

Evaluation Matrix

Photographic Compression Technique - Evaluation Matrix

Compression Technique (title)		NIS weightings	JPEG Chairman's suggested weightings	your weightings
Mandatory Requirements	Progressive build up in at least 3 stages			
	Feasibility of real time decoding at 64kbit/s			
	World-wide license			
Subjective Quality	1st stage	10%	10%	
	2nd stage	18%	35%	
	3rd stage	8%	5%	
Decode Complexity		14%	15%	
Encode Complexity		10%	10%	
Sequential build up		18%	5%	
Progressive Build-up in more than 4 stages		6%	3%	
Adaptivity (quality/compression)		4%	3%	
Compatibility (including binary coding)		4%	3%	
Error Propogation		4%	5%	
Reversibility		4%	3%	
Special Features			3%	

EXHIBIT 7

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONAL DE NORMALISATION

ISO/JTC1/SC2/WG8

CODED REPRESENTATION OF PICTURE AND AUDIO INFORMATION

ISO/JTC1/SC2/WG8 N517 Rev 0
January 1988

Source:

Graham P Hudson, British Telecom
(Chairman Of The Joint Photographic Experts Group)

Title:

Report Of The Joint Photographic Experts Group Meeting 25-27 January 1988, KTAS, Copenhagen

0.0 Introduction (Papers And Agenda) N643

The papers tabled, listed in annexe 3, were assigned to agenda items. The agenda, N643 Rev 1, was agreed at the start of the meeting but was modified during the week as shown in annexe 1. The members attending this and the previous selection meetings are shown in annexe 2.

1.0 Comments On The Report Of The Last JPEG Meeting N599, N629, N630, N633, N634, N635, N637, N642, N644

Comments received on the reports of the Winchester and Washington meetings, and on the subjective testing procedure and schedule, were discussed at a special ad hoc pre-meeting held on Sunday afternoon 24 January (agenda N642). Proposed solutions were formulated at this meeting and presented to the JPEG meeting on the Monday.

N644 from KTAS questioned whether the requirement in clause 3.4 of the report N599 for sequential build-up to an identical picture was agreed at the Washington meeting. The report was agreed and will be reissued as N599 Rev 2.

N637 was correct and N630 incorrect, neither Y, Cr, or Cb scans need be complete for the subjective testing. A 50% time tolerance should be allowed for dynamic build-up timing, so N634 was correct and N630 incorrect. N635 also points out corrections to N630 and these were agreed.

Japan, in N633, raised a number of points concerning the selection procedure described in the Winchetser report N629 Rev 1. Modification were agreed to clauses 2.1.2, 2.2, 2.3, 2.4, and 2.5 as shown in N629 Rev 2 and these were agreed. A significant clarification to clause 2.5 was that the requirement to include binary image coding may be reconsidered. The report was approved and will be reissued as N629 Rev 3.

2.0 Review Of The Procedure And Subjective Testing Method N631, N650, N660

Dr Sebestyen in N631 queried which type of subjective testing rating scale should be used, quality or impairment. After studying CCIR 500 Issue 3 (N660) Mr Wallace (N650) suggested a double stimulus with all pictures mixed, with mixed compressions and with the same picture

subject not appearing in sequence. It was also stated that the full range of the marking scale should be used for the test as a whole. This proposal was accepted and it was decided to use a five point quality marking scale (excellent, good, fair, poor, bad). A decimal scale was used to enter the figures to the results program.

Using the same scale for all compressions allows for the scores to be readily combined. At Winchester it was agreed that normalising the scores for different compressions would cause a bias inaccuracy for lower quality/higher compression pictures.

To anchor the scale it was agreed to preview all 60 pictures with each picture being displayed once for 15s, taking in all 15 minutes. Each double stimulus pair consists of showing the original and compressed picture five times for five seconds, making 50 seconds in all. The whole run of sixty pictuires takes approximately 1 hour. Taking account of the CCIR recommendations the run was split into two sessions of thirty minutes. A preview of 30 pictures was given at the start of the second session.

This change in procedure meant that the results analysis programmes had to be substantially rewritten and so it was not possible to process any results until the middle of the week.

3.0 Subjective Testing

3.1 Run 1 (Mixed compressions and pictures)

Run 1 was held on the afternoon of Monday 25 January. Thirty one members participated in the test. There were 5 monitors provided and so there were nominally 6 viewers around each monitor. These were seated in two arcs at 4 and 6 times the screen diagonal distance (48cm). There were typically 4 in the front and 2 in the back row.

The feeling of many members after the 1st run was that they were able to separate the pictures of different compressions into different quality bands but they were not confident that they had accurately relatively judged the pictures of the same subject at the same compression rates. This was not thought to be such be problem for the good quality pictures, produced at compressions of 2.25 and 0.75 bit/pixel, where the compressed pictures were of similar quality to the originals with which they were being compared. At 0.25 and 0.083 bit/pixel, however, the quality was significantly removed from the originals and the same pictures were never adjacent in the sequence so it was difficult to judged their relative quality.

3.2 Run 2 (Mixed compressions and pictures, repeat of Run 1)

In order to verify the results of Run 1 it was decided to repeat the same procedure on Tuesday morning. Viewers felt they had performed better on Run 2.

3.3 Run 3 (Separated compressions and pictures)

To enable the possibility of a more accurate relative scoring of pictures it was decided to have a run with pictures of the same subjects grouped together and for the pictures of same compression to be together. Although if this test were to be performed in isolation it would be difficult to know which areas of the marking scale to use for different compressions, the experience of the previous two runs provided the necessary training.

Run 3 was performed on Tuesday morning. Most viewers were well satisfied with their scoring ability on Run 3.

3.4 Run 4 (Separated compressions and pictures, comparison test)

To establish the order of techniques at each compression it was decided to have a 4th test using a double stimulus but comparing pictures from the three compression techniques. That is A-B, B-C, C-A, although the order was randomised. (It should be noted that this decision was taken before any of the earlier test results were available to the meeting). The same scoring procedure was used and viewers were asked to try to mark in the same area of the scale as they had previously used for a given picture and compression technique.

There were again a total of 60 double stimulus pair tests and the test was split into two sessions, the first for picture compressed to 2.25 and 0.75 and the second for 0.25 and 0.083 bit/pixel. Before testing each picture at a each compression a preview was given of each of the compressed pictures displayed in double stimulus mode with the original 3 times.

Run 4 was performed on Wednesday morning.

4.0 Prototype Decoder Evaluation
N674, N680

4.1 Procedure

It had been hoped to use the prototype decoders to perform the dynamic subjective testing and to evaluate technique complexity. The details of the evaluation procedure had not been finalised at the previous meeting so it was decided that actual scoring for quality and complexity would not be performed. It was, however, agreed that the opportunity should be taken use the demonstration to show the technical feasibility of real time decoding and see different dynamic progressive build-up effects.

The prototype decoders represented the state of the art in picture decompression technology and at the beginning of the meeting intensive effort was being put into getting the decoders working away from their home laboratories. The demonstrations were rescheduled for Tuesday evening to allow as much time as possible to get software/hardware working. No further time was available as some equipment had to be shipped out on Wednesday.

Each of the four decoders were connected via a video switch box to the group of subjective testing monitors and so the different progressive build-ups could be viewed without knowing the technique producing them.

Viewers were invited to write comments on the subjective appearance of the progressive build-up and these were submitted to Richard Clark who summarised the comments in N680. Some details of the number of scans in the progressive build-up and the decode times were noted in N674. Following the viewing details of each of the prototype terminals were briefly presented to the group.

4.2 Decoders
N666

4.2.1 ADCT (Hardware) N666

The French company SAT, under contract from CCETT, had produced a hardware realisation of the earlier ADCT technique (N502) incorporating a multiplier for the inverse transform. The decoder was driven at 80kbit/s and produced pictures in under 5s which is exactly real time. The decoder was not able to work beyond the 0.75 bit/pixel compression stage.

4.2.2 ADCT (Software) N665

KTAS had written a software decoder in C and 286 assembly language for the latest version of ADCT (N640) but excluding the initial sub-sampling. Using a CAF PC AT with a 20 MHz 386 processor the decoder operated at just over real time but within the agreed tolerance.

The decoder had to be restarted after the 0.75 bit/pixel stage to carry on to the 2.25 stage. Some arithmetic errors were noticed.

4.2.3 ABAC N664

An ABAC software decoder had been produced by IBM with some assistance from BT. The decoder was demonstrated on an IBM RT and an AT with a 16 MHz 386. The RT operated at real time and the AT at about half real time.

4.2.4 GBTC N658

Fujitsu demonstrated a hardware decoder for GBTC (N510), which is one of the two techniques that are the basis of BSPC. The decoder incorporated a 68000 processor with discrete decoding logic. The 0.75 and 2.25 bit/pixel stages took 3 and 4 scans to build-up and were decoded a little over real time. It was not possible to get an impression of the appearance of the progressive build-up as the screen was blanked in between scans whilst the display memory was being written to by the processor.

4.3 Observations
N680, N681

It was noted in N680 that several viewers found a large number of scans in quick succession (eg >10 in 5s) distracting and irritating. For the ISDN where good quality is achieved in a short time (eg 5s) fewer stages are necessary. If the first stage is quickly replaced then its quality is less relavent. An initial luminance only stage was also disliked.

Major discontinuities between stages were found unacceptable. There were differences of opinion as to which type of artefacts were least objectional at the initial stages A single artefact occuring in one area of the screen can be more annoying than a regular artefact over the whole screen.

The high compressions now achieved make photographic transmission possible at lower data rates and in future tests should also be performed at PSTN rates from 1.2 to 9.6kbit/s. At these speed a large number of stages may again be desirable.

It was thought that the subject matter for testing should be extended to include faces, signature and text. The use of the highest compressions for indexing icons and montages should be examined. The ways of extending the techniques for higher and lower resolutions and for increasing accuracy (eg number of bits/pixel) also needs to be studied.

5.0 Presentation Of Results And Analysis
N686

As well as to accomodate the changes in procedure the results programs were also modified to enable data to be input from separate data discs. Data from the scoring sheets was entered onto floppy discs late on Wednesday night and Thursday morning. The data from the floppies was printed out and given back to the members for checking and where necessary was corrected.

The first results that were produced showed the median scores for each compression value for each picture subject and for each run. Also the overall WG8 and NIC weighted results were produced. It was clear from the results that ADCT had produced the best quality pictures and the chairman proposed that future development of the standard be based on ADCT. The statement in 5.1 was agreed as N692 at the meeting as the way forward.

Any other results generated by members from the raw data should not be published without the agreement of the JPEG.

It was decided that KTAS should not go ahead at the present time with the verification of the subjective testing with untrained viewers. After further development the enhanced ADCT will be subjectively tested with the present ADCT technique (N640) using a new set of pictures to reflect a wider range of applications. KTAS will hold the master software for N640.

5.1 Agreed Statement
N692

In all the subjective testing sessions the ADCT technique achieved significantly higher quality results at all bit rates than the ABAC and BSPC techniques. The prototype real time decoders exhibited indicated that all techniques will be economically implementable. Also the demonstrations and presentations showed that the mandatory technical features can be met by all techniques.

In view of the unequalled quality of ADCT the chairman asked delegates to determine in the future if an ADCT technique can meet all JPEG requirements. The chairman proposed that the JPEG should concentrate on a joint development to refine and enhance an ADCT technique for standardisation.

It was agreed by JPEG that the resulting ADCT technique should be the basis of the future standard (for colour/grey scale pictures). If any JPEG defined application cannot be directly met by this ADCT technique, at the quality level shown at Copenhagen in January, then the inclusion in the standard of another techniques (ABAC and/or BSPC) will be examined. It is the aim of the group to produce a standard with one technique.

6.0 Complexity Evaluation Procedure

The criteria for judging complexity was not finalised at the last meeting and was not further discussed at this meeting. The demonstration showed that all techniques were implementable and that ADCT could be implemented in both hardware or software.

7.0 Binary Coding Selection Procedure
N699

In N669 the convenor of WG8, Dr Yasuda, proposed an extended organisation for WG8, which includes the formation of a new group to specify a procedure and select a technique for Binary Image Coding.

8.0 Combination Of Results And Overall Selection Procedure

This topic was not specifically discussed as it was apparent that all techniques were similar on grounds of complexity and met all the features requirements and so the decision to further develop ADCT was based on superior quality. The optimum binary image coding technique will by studied by the newly formed group.

9.0 Examination Of Deliverables And Verification Of Results
N639, N640, N641, N645, N661, N683, N685, N688

Documentation was submitted by the 8 Januray deadline (N645, N661) on ABAC (N639), ADCT (N640), and BSPC (N641). These documents were presented by the TDG chairpersons on Thursday afternoon and Friday morning. It was agreed that these documents were satisfactory but it was thought that in some instances further detail would be required to allow implementation. Copies of the overhead projector slides used are given in N683 (ABAC), N685 (BSPC), and N688 (ADCT).

The results shown at the meeting will be verified to ensure that they are achievable from the executable code submitted on January 8. The ADCT code will be verified by NIS and ATG, BSPC will be checked by ANT, and BT will verify ABAC.

Mr Leger agreed to remain as chairman of the Transform Technique Development Group. Dr Michell was asked to formulate a new functionality proposal for the transform technique.

The JTDG and PTDG are now disbanded and the chairman acknowledged the fine results produced by both these groups.

It was confirmed that in line with WG8/JPEG policy all personal and approved WG8 documents are open for public distribution including N639, N640 Rev 1, and N641. It was also confirmed that the digital test pictures may be publicly distributed for research purposes.

10.0 Any Other Business

10.1 Publicity
N670, N682

In order to publicise the work and progress made in WG8/JPEG the convenor suggested that a press release and conference paper should be produced. In N670 the convenor suggested papers should be presented at the HDTV Workshop (Turin, February), PCS (Turín,September) and Globecom 88 (Florida, November). The chairman, in N682, suggested a list of papers and authors. Because of limited time available at Globecom a shortened list of paper is shown in annexe 5.

A draft press release was produced by the chairman (N673) briefly describing the progress in JPEG and giving some background information. Mr Touchton also produced an extended version. It was decided to use the original version because of its more punchy style but to include some of the additional information given in the alternative. The new draft will be circulated for comment within a month and an approved version will be distributed by the convenor. The convenor will also produce photographs of 'Hill' and 'Girl' at 0.75 and0.25 bit/pixel compression and distribute copies with the press release. Members are encouraged to distribute the information as widely as possible to their national and international press organisations.

10.2 General

It was agreed that image processing facilities will be required at future JPEG meetings. This will allow progress on the enhancement of the technique to be seen by the whole group. The facility should be able read digitised pictures from a COST 211 tape or AT floppy disc. The pictures should be displayed to the CCIR 601 format of 720 X 575 pixels on a 48cm/19inch studio quality monitor. The image processing capability should either be based on a DEC VAX or IBM AT.

The Canadian PTT has kindly offered to host the next WG8/JPEG meeting in Ottawa. It is now proposed to ask for the meeting to be held on 9-13 May 1988.

Mr Hudson, chairman of the JPEG, announced during the week that owing to a change of responsibility within BT he would regrettably have to resign as chairman after the Ottawa meeting. It was proposed that Mr Wallace of DEC should take over as chairman.

The chairman thanked all members for their cooperation, goodwill and patience which had lead to such a successful outcome. He especialy thanked KTAS for their providing excellent facilities, efficient administration and warm hospitality. The chairman was asked to write a letter of thanks to Mr Rindorf, Vice President of Research and Development of KTAS.

Annexe 1

Draft Agenda And Timetable For The JPEG Meeting
25-27 January 1988, KTAS, Copenhagen

0	Introduction (Papers and Agenda)		Monday
1	Comments On The Report Of The Last JPEG Meeting		
2	Review Of The Procedure And Subjective Testing Method		
3	Subjective Testing		
	3.1	Run 1 (Mixed Compression And Pictures)	
	3.2	Run 2 (Mixed Compression And Pictures)	Tuesday
	3.3	Run 3 (Separated Compression And Picture)	
	3.4	Run 4 (Separated Compression And Picture, Comparison)	Wednesday
4	Prototype Decoder Evaluation		Tuesday/Wednesday
	4.1	Procedure	
	4.2	Decoders Demonstration	
	4.3	Observations	
5	Presentation And Analysis Of Results		Thursday/Friday
6	Complexity Evaluation Procedure		
7	Binary Coding Selection Procedure		
8	Combination Of Results And Overall Selection Procedure		
9	Examination of Deliverables And Verification Of Results		
10	Any Other Business		

Annexe 2 -

Delegates Attending The Joint Photographic Experts Group Meetings During The Technique Selection Process

Name	Company	Country	Meetings Attended				
			Dar Mar 87	Cop Jun 87	Was Oct 87	Win Nov 87	Cop Jan88
Allman, Lascoe	IBM	USA	-	-	x	-	x
Bauer, Wolfram	FTZ	W Germany	X	-	-	-	-
Beaumont, Mark J	BTRL	UK	-	-	X	-	-
Braams, Johannes	Dr Neher Lab	Netherlands	-	-	X	-	X
Chamzas, Christos	AT&T Bell	USA	-	-	X	-	X
Chiariglione, Leonardo	**CSELT**	**Italy**	**X**	**X**	**X**	**S1**	**X**
Clark, Richard	App Telemat	UK	X	-	-	-	X
DeGrasse, Bruce J	Xerox Corp	USA	-	-	-	-	X
Dunn, Thomas	T Dunn Inc	USA	-	-	X	-	-
Durroux, Alain	SAT	France	-	-	-	-	x
Endoh, Toshiaki	KDD	Japan	X	X	X	-	X
Fountaine, Claude	SAT	France	-	-	-	-	x
Friemelt, Joachim	Siemens	W Germany	-	X	-	-	-
Gicquel, Serge	SAT	France	-	-	-	-	x
Guerillot, Stephane	AFP	France	-	-	-	-	X
Guglielmo, Mario	CSELT	Italy	-	-	-	X1	-
Guillemot, Christine	CCETT	France	-	-	X	-	-
Haskell, Barry	AT&T Bell	USA	-	X	X	-	-
Hagiwara, Hiroyuki	NTT	Japan	-	X	-	-	X
Hudson, Graham	**BTRL**	**UK**	**X**	**X**	**X**	**X**	**X**
Ito, Atsushi	Mitsubishi	Japan	-	X	-	-	-
James, Normile	Edran Corp	USA	-	-	-	-	X
Jacobs, Yolanda	TASC	USA	-	-	X	-	-
Jacobson, Charles	Xerox	USA	-	-	X	-	-
Jolivet, Joen	SAT	France	-	-	-	-	x
Le Chevalier	SAT	France	-	-	-	-	x
Le Gall, Didier J	Bellcore	USA	-	-	X	-	-
Leger, Alain	**CCETT**	**USA**	**X**	**X**	**X**	**X**	**X**
Lohscheller, Herbert	ANT Telecom	W Germany	X	X	-	-	X
Kwan, Andrew	DOC	Canada	X	-	-	-	-
McCarthy, Thomas	IBM	USA	-	-	X	-	-
Mitchell, Joan	**IBM Res**	**USA**	**X**	**X**	**X**	**X**	**X**
Moorhead, Robert J	IBM Res	USA	-	-	x	-	x
Mori, Masahiro	Fijitsu Lab	Japan	-	-	X	-	X
Murakami, Tokumichi	Mitsubishi	Japan	-	X	-	-	-
Nemoto, Keiji	NEC	Japan	-	-	X	-	-
Noda, Tsugio	Fijitsu Lab	Japan	-	-	-	-	X
Niss, Birger	KTAS	Denmark	-	X	-	-	X*
Ogura, Kenji	NTT	Japan	X	X	-	-	X
Omachi, Takao	NEC	Japan	X	X	-	-	X
Park, Sang Gyn	ETRI	Korea	X	X	-	-	-
Pennebaker, William	**IBM Res**	**USA**	**X**	**X**	**X**	**X**	**X**
Postl, Wolfgang (26 Mar)	Siemens	W Germany	X	-	-	-	-
Poulsen, Henning	**KTAS**	**Denmark**	**X**	**X**	**X**	**X**	**X**
Rabbani, Majid	Kodak	USA	-	-	X	-	-
Richards, Norman	Philips Res	UK	-	-	-	-	X2
Rutledge, Charles	AT&T Lab	USA	-	-	-	-	X

Sebestyen, Istvan	**Siemens**	**W Germany**	**X**	**X**	**X**	**X**	**X**
Seelmann, Gerhard	Un Hanover	W Germany	X	-	-	-	-
Shaw, Venson	AT&T Bell	USA	-	-	-	-	X
Starck, Alexander	Seimens	W Germany	X	X	-	-	-
Takizawa, Masaaki	Hitachi	Japan	-	X	-	-	-
Thelen, Donald	AT&T Bell	USA	X	-	-	-	-
Touchton, Charles	**IBM Corp**	**USA**	**X**	**X**	**X**	**X**	**X**
Tricker, Dennis	**BTRL**	**UK**	**X**	**X**	**X**	**X**	**X**
Trocherie, Bernard	Bull	France	-	-	-	-	X
Tsugio, Noda	Fujitsu	Japan	-	-	-	-	x
Turner, Simon	Philips Res	UK	X	-	-	-	S2
Urban, Stephen	Delta	USA	-	-	X	-	X
Vaaben, Joegen	KTAS	Denmark	-	X	X	-	X*
Van Helden, Johannus	Dr Neher Lab	Netherlands	-	X	-	-	-
Vivian, Roy	**IBA**	**UK**	**X**	**X**	**X**	**X**	**X**
Wallace, Gregory	**DEC**	**USA**	**X**	**X**	**X**	**X**	**X**
Worlitzer, Manfred	FTZ	W Germany	X	-	-	-	-
Yamazaki, Yasuhiro	**KDD**	**Japan**	**X**	**X**	**X**	**X**	**X**
Yasuda, Hiroshi	**NTT**	**Japan**	**X**	**X**	**X**	**X**	**X**

Notes

X = attended JPEG meeting
x = demonstrator only
- = did not attend meeting
X* = did not take part in subjective testing
S1 = substituted by X1

A total of 66 different members attended the meetings, 13 members attended all meeting as shown in bold print.

Annexe 3

Documents Tabled At The JPEG Meeting, 25-29 January 1988, Copenhagen

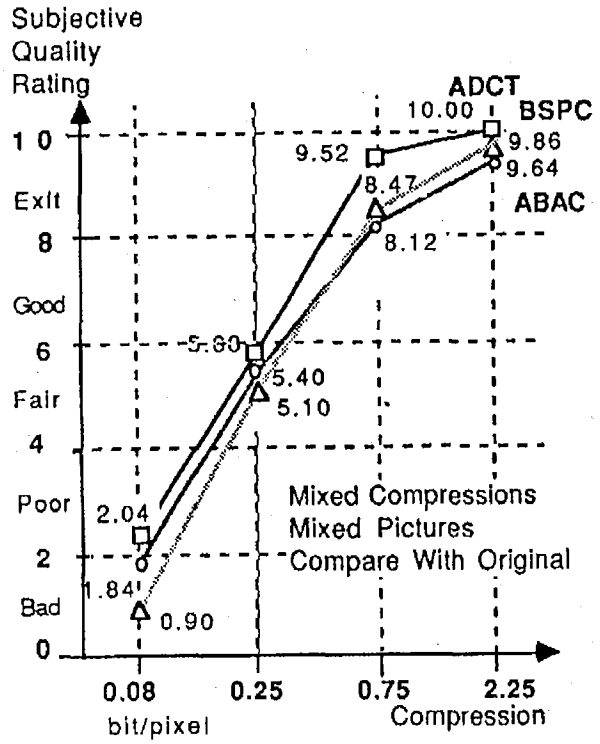
WG8 No	Author	Abbreviated Title
N599	Hudson	Report of JPEG Meeting, Oct '87, Washington
N629	Hudson	Report of JPEG Special Meeting, Nov '87, Winchester
N630	Vivian	Criteria for Subjective Testing
N631	Sebestyen	*Comments on the Criteria for Subjective Testing*
N632	Leger	Report of ADCTG Meeting, Rennes, Dec '87
N633	Japan	Comments and Additions to N627, N629 and N631
N634	Pennebaker	Comments on N630
N635	BTRL	Comments on N630 and N631
N636	WG8	Liaison between ISO/TC97/SC2/WG8 and CCITT SGVIII
N639	Pennebaker	Comments on N630 Rev 1
N638	Kwan	Data and Venue of April '88 Meeting
N639	Mitchell	Jan 8th '88 ABAC Document
N640	Leger	Jan 8th '88 ADCT Document
N641	Ogura	Jan 8th '88 Document of BSPC and Binary PCS
N642	Hudson	Notice of A Special Test Procedure Ad Hoc Group Meeting
N643	Hudson	Draft Agenda and Tiem table for JPEG Jan '88
N644	Poulsen	Comments on Documents N599 Rev 1
N645	Sebestyen	Confirmation of Documents and Tapes
N647	Japan	Comments on N643 Rev 0 and others
N649	Sebestyen	Confirmation of Tapes
N650	Sebestyen	CCITT Input
N651	Lohscheller	Verification of GBTC
N657	Japan	PCS for Binary Image Coding
N658	Japan	Real Time Decoder Implementation of BSPC
N659	Wallace	Recommendation for Static Subjective Testing Procedure
N660	CCIR	Recommendation 500-3
N661	Sebestyen	Confirmation of Documents
N662	Vivian	Scoring Sheet
N663	IPTC	Liaison from IPTC
N664	PTDG	ABAC Real Time Demonstration
N665	KTAS	Real Time Decoder for N640 Algorithm
N666	CCETT/SAT	ACDT Real Time Decoder Implementation
N667	Chianglione	Coded Representation of Moving Picture

N669	Convener	Future Prospect of WG8 Activities
N670	Convener	Publicity Activity of Still Picture Coding Standardization
N672	Michell	ABAC Updated and Extended Specification Matrix
N673	Hudson	Draft Press Release on Progress in JPEG
N674	Hudson	Real Time Decoder Demonstrations
N678	AT&T	Single Chip Solution for an 8 by 8 Two Dimensional DCT
N679	KTAS	Subjective Test Sequence Lists
N680	Clark	Dynamic Test Results Questionnaire
N681	Yasuda	Comment on N680 Dynamic Test Results
N682	Hudson	Publicity of JPEG Work
N683	PDTG	ABAC Transparencies
N684	SGXV	Liaison from SGXV
N685	Ogura	BSPC Transparencies
N686	Vivian	Final Results of Static Subjective Tests
N688	ADCTG	ADCT Transparencies
N691	Clark	Equipments Prepared
N692	Hudson	Item for Report on Future Development in JPEG
N693	KTAS	ADCT Algorithms as used in the Simulation Systems
N694	Mitchell	Draft of the Functionalties for a Standard

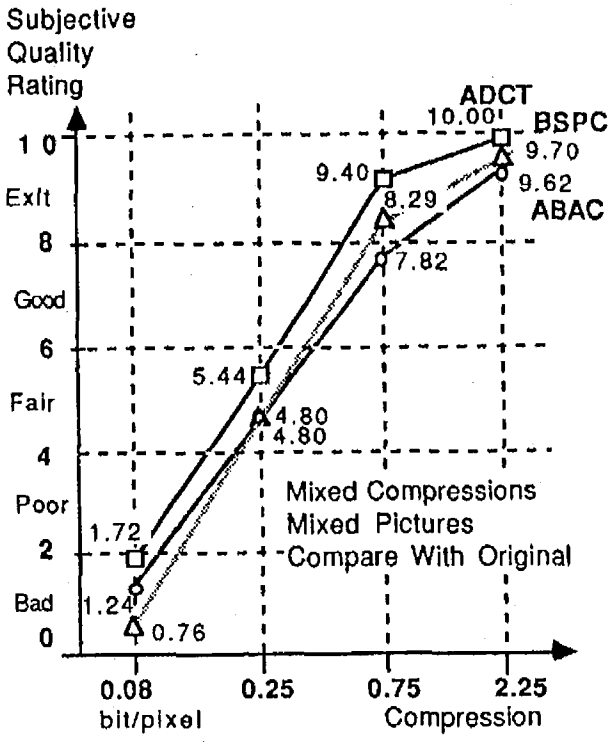
Annexe 4

Average Results For All Five Pictures For Each Compression Value

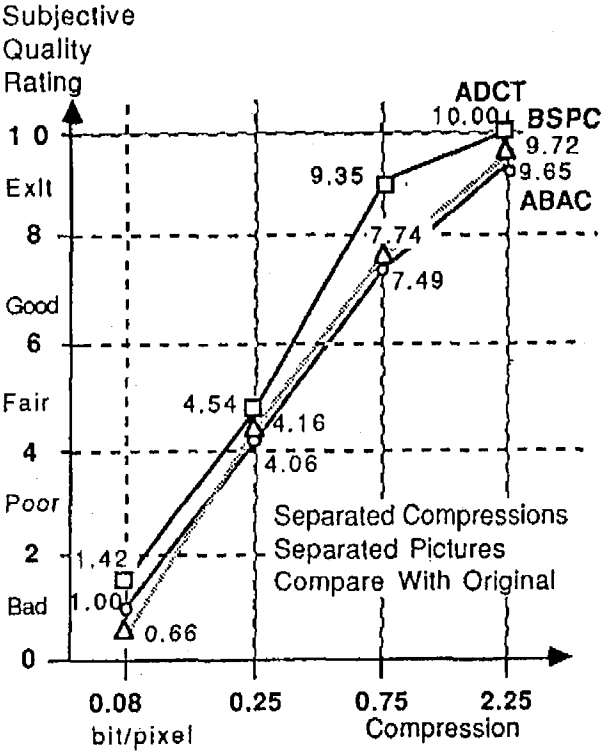
RUN 1



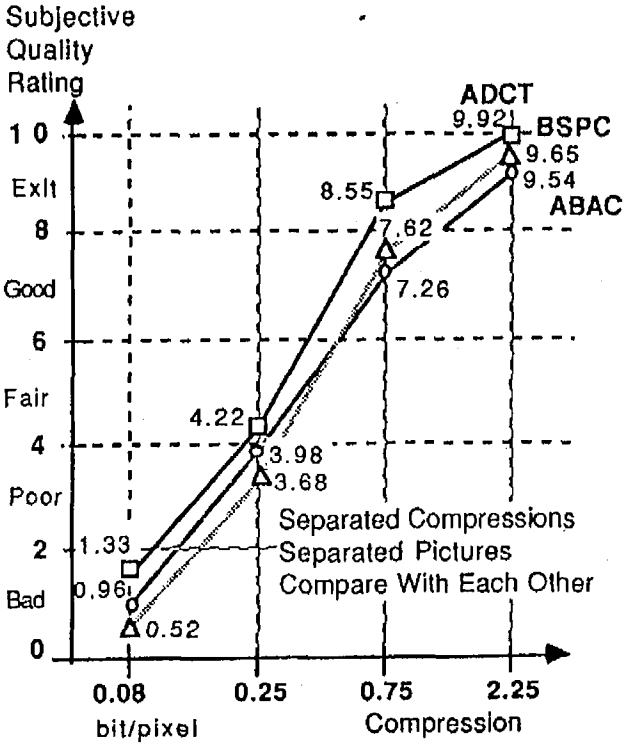
RUN 2



RUN 3



RUN 4



Annexe 5

Publicity For JPEG Work

Jan 88 Press Release N673 - Hudson

Feb 88 HDTV Workshop - Yasuda

Sep 88 Picture Coding Symposium, 12-14 September, Tunin
A session at PCS is to be arranged by Dr Yasuda. Short papers (< 500 words) should be prepared. Suggestions are -

Hudson/Yasuda	Selection a Still Picture Compression Technique in ISO/CCITT
Leger	Development Of The ADCT Technique In ISO/CCITT
Mitchell	Development Of The ABAC Technique InISO/CCITT
Ogura	Development Of The BSPC Technique In ISO/CCITT

Nov 88 Globecom 88, 28 Nov - 1 Dec, Holywood, Florida, USA
A session has been arranged by Dr Yasuda. Longer papers (~ 2000 words) should be prepared. Suggestions are -

Yasuda*	Picture Coding work in ISO/IEC and the Proposed Digital Audio and Picture Architecture
Hudson*	Progress on the Selection a Still Picture Compression Technique in ISO/CCITT
Wallace/Vivian	Analysis of the Subjective Testing of the Still Picture Compression Techniques in ISO/CCITT JPEG
Sebestyen*	New Image Communication Service Requirements
Leger*	The ADCT Picture Compression Technique and its Fuctionality
Mitchell	The ABAC Picture Compression Technique and its Fuctionality
Ogura	The BSPC Picture Compression Technique and its Fuctionality
Vaaben*	Real Time Decoding of ADTC by Software on a PC
SAT*	Real Time Decoding of ADTC using Hardware
Pennebaker	Q Coder In Picture Coding Applications
Yamazahi	Progressive Coding Scheme for Binary Images

In view of the restricted time available possibly only those papers marked by * will be presented. This will have to be further discussed when more details of the conference arrangments are known.

EXHIBIT 8

January 1989

JPEG
JOINT PHOTOGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-12.2-R0
December 1988

SOURCE: JPEG Chairman
Gregory Wallace, Digital Equipment Corporation

TITLE: Rennes JPEG Meeting Report

1. Meeting Location and Purpose

A meeting of the JPEG "Ad Hoc Technical Development" group took place in Rennes, France, July 11-13, 1988. The meeting was hosted by Alain Leger and the CCETT, and conducted at the Rennes CCETT facility. The purpose of the meeting was to review technical work conducted by JPEG members, since the May Ottawa meeting, for the purpose of improving the ADCT proposal prior to final standardization, and to plan any final technical work necessary to choose between proposed enhancements by the September meeting.

It was agreed beforehand that the purpose of this meeting would be strictly technical, that is, for the technical experts to come together to review their progress and propose work for the next period. No "policy" decisions, such as changing the requirements of the algorithm, were to be made at this meeting.

2. Papers Submitted

At the meting, the following papers were submitted and discussed on the indicated topics. The title and submittor of each paper is listed in Document Register JPEG-4.1-R2.

Administrative Matters: JPEG-110, 111, 113, 114, 117, 118, 121, 128, 139, 155, 156, 157, 162, 163.

Related Standards Activities: JPEG-108, 109, 119, 138, 158.

Entropy Coding: JPEG-122, 123, 131, 161.

DCT/IDCT Transform Specification: JPEG-124, 125, 126, 130, 132, 143, 145, 159.

Reversibility: JPEG-127, 150.

Progressive Buildup: JPEG-135, 136, 140, 141, 142, 147, 152, 153, 165.

Hardware Implementations: JPEG-137, 146, 148, 151, 154.

Structuring of the Standard: JPEG-116, 129, 149, 164.

Miscellaneous: JPEG-122, 115, 120, 133, 134, 144.

3. Meeting Resolutions

No resolutions were made at this meeting, because of its Ad Hoc status. In fact, we did not fully accomplish our objective of planning all remaining technical project prior to the September meeting (even though we worked until Midnight July 13, thanks to the generous flexibility and patience of our host Alain Leger!) The planning was continued by correspondence during the weeks following the Rennes meeting.

EXHIBIT 9

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONAL DE NORMALISATION

ISO/IEC/JTC1/SC2/WG8

CODED REPRESENTATION OF PICTURE AND AUDIO INFORMATION

ISO/IEC JTC1/SC2/WG8 N 914
1989 AUG 30

TO: WG8

FROM: CONVENOR, WG8

SUBJECT: MEETING REPORT (DRAFT)

REFERENCE: WG8 PLENARY SESSIONS: STOCKHOLM: JULY 3 - 7, 1989

INTRODUCTION

The subject meeting was held in Stockholm, Sweden, during the period July 3-7, 1989, at the facilities of the meeting host, Statskontoret (Swedish Agency for Administrative Development) (SAFAD).

During this meeting, SC2/WG8 met twice in plenary session: once on the opening day of the meeting, and once on the closing day.

During the intervening time, WG8's subgroups met in working sessions pursuant to the attainment of their respective objectives.

Recommendations resulting from the meeting are contained in Annex A.

Details of the activities of the two plenary sessions are described in the following pages.

SESSION ONE: MONDAY, JULY 3, 1989

SESSION OPENING

DR. HIROSHI YASUDA (NTT) (JAPAN), WG8 Convenor, called the meeting to order at approximately 9:30 AM.

As the opening item of business, Mr. Wolf Arfvidson (SAFAD) welcomed the group on behalf of the host. Mr. Arfvidson also introduced the group to a number of logistical and procedural matters which had been arranged to make the meeting both more enjoyable and more efficient.

The Convenor then introduced the draft agenda for the meeting (WG8/N865). Following a brief discussion, the agenda was approved unanimously.

The Convenor asked meeting attendees to review the meeting participation list (WG8/N871Rev2) and advise him of the need for any additions, deletions, or corrections.

C.F.TOUCHTON (CFT) (IBM) (USA) reminded the Convenor of JTC1's requirement that meeting attendees be accredited by their respective national bodies, and asked whether or not such accreditation had been received for all attendees present. Because of continuing uncertainty on the part of the convenor as to the mechanism whereby such accreditation could be obtained, the Convenor asked that the WG8 Advisory Group (AG) consider this matter further for clarification and resolution.

Following completion of the above introductory matters, the Convenor asked that the respective subgroup chairmen present their introductory reports concerning the current status of their respective subgroups.

SUBGROUP REPORTS

WG8 ADVISORY GROUP

CFT, Chairman, WG8 Advisory Group, reviewed the items presented in the report of the WG8 Advisory Group given at the last meeting of WG8 in Livingston, NJ, and discussed briefly the nature of those matters which were expected to arise at the present Stockholm meeting.

These matters were identified as having to do with:

1. the accreditation of WG8 meeting attendees,
2. the external availability of committee documentation, and
3. the proposed MHAG New Work Item.

CHRISTOS CHAMZAS (CC) (ATT) (USA) asked about the decision making process within WG8, and the nature of the consensus which is required within the group in order for the group to arrive at a decision or conclusion.

CFT responded with a brief description of the means by which decisions are generally made within ISO, and extended the associated principles to the working group environment. He also stated, however, that for a number of reasons having to do with the current structure of WG8, together with an absence of clear ISO and/or JTC1 directives having to do with the decision-making process within working groups, it wasn't clear how these principles applied to WG8.

Recognizing that resolution of the issues involved was clearly not feasible at the working group level, the Convenor suggested that the matter be taken up by the WG8

Advisory Group, and subsequently pursued more fully within JTC1. The group agreed, and further discussion on the topic terminated.

There were no further questions.

COMPUTER GRAPHICS EXPERTS GROUP (CGEG)

JOACHIM FRIEMELT (JF) (SIEMENS) (FRG), acting in the absence of BERNARD TROCHERIE (BT) (BULL) (FRANCE), CGEG Chairman, presented a report on the current status of CGEG. This report had to do primarily with the results of a recently completed ballot on DIS 9282 (results which requir partial redrafting and subsequent reballoting), and with a coding requirements statement which has recently been received from SC24. An additional element of the report, however, was the statement that there are essentially no persons currently associated with CGEG who are in a position to address either of these two activities.

Based on these conditions, JF stated his view that the ongoing absence of people resources interested in working on CGEG-related activities has become a critical problem, and that executive attention needs to be devoted to this problem.

This problem was assigned to the WG8 Advisory Committee.

JOINT BI-LEVEL IMAGE GROUP (JBIG)

YASUHIRO YAMAZAKI (YY) (KDD) (JAPAN), Chairman JBIG, made a brief report concerning the status of JBIG activities during the period between the Livingston meeting and the Stockholm meeting. A brief discussion followed. There were no questions.

JOINT PHOTOGRAPIC EXPERTS GROUP (JPEG)

GREG WALLACE (GCW) (DEC) (USA), Chairman JPEG, gave a brief report on the activities of JPEG which had occurred during the period between the Livingston and Stockholm meetings. This activity consisted primarily of that having to do with documenting the JPEG algorithm at a level consistent with the consensus agreement arrived at in Livingston. It was emphasized, however, that the document was still incomplete, was still in draft form, and had still not been approved within JPEG.

In making his report, GCW singled out for particular credit the efforts of JOAN MITCHELL (IBM) (USA) and BILL PENNEBAKER (IBM) (USA) in connection with their documentation of the JPEG algorithm specification, and the work of TAKAO OMACHI (TO) (NEC) (JAPAN) in developing the extensive set of comprehensive and incisive questions which had contributed so substantially to the development of this specification.

A question arose from the floor as to the availability of a working draft of the JPEG "standard", with the desire expressed that the document be distributed to the WG8 membership now so that members could begin to become familiar with its content. GCW replied that distribution of the document in its present form would be premature, but that the document would be ready for such distribution "soon", and would be distributed to the WG8 membership at that time.

The Convenor suggested that perhaps the document in its present form could be made available now on a selective basis to interested parties so that their review could begin. CFT questioned the fairness of such an approach, however, expressing his view that the document should either be distributed to the entire WG8 membership, or else not at all (i.e. that distribution should be kept within JPEG until the document was complete.) The outcome of the discussion was an agreement that distrib-

ution policy with respect to the JPEG draft specification would be left to the discretion of the JPEG Chairman.

In another context, but still with regard to the same question, CFT cautioned the group with respect to referring to the algorithm now under development within JPEG as the JPEG "standard". He described his concern as being based on the fact that neither the algorithm nor its evolving description had as yet been adopted as a "standard", and that therefore, for the committee and/or its participants to be referring to either the algorithm or its documentation as a "standard" could potentially be misleading to persons both inside and outside the group who were not familiar with the precise status of the algorithm's current level of development. As an alternative, he suggested that the algorithm and/or its description be referred to as the "evolving JPEG algorithm", or the "JPEG draft specification". The caution was accepted, and the Convenor asked the members of the group to be sensitive to the need to refer to the algorithm and its documentation in the correct manner.

There were no further questions.

MULTI-MEDIA CODING AD HOC GROUP (MHAG)

FRANCIS KRETZ (FK) (CCETT) (FRANCE), Chairman MHAG, gave a brief report on the activities of MHAG between the Livington and Stockholm meetings.

The primary element of this activity was an initial meeting of the MHAG group which took place in Rennes, France this past May. The primary outcome of this activity was the development of a proposal (WG8/N866) for a New Work Item (NWI) intended to lead to a new project (and subsequently a new subgroup) aimed at accomplishing the objectives being defined for MHAG.

The Convenor then announced that he had made special arrangements with a/ the SC2 Secretariat whereby the MHAG NWI was already being processed for balloting within SC2, and urged WG8 members to strongly encourage support for this ballot when it arrived within each attendee's country.

CFT expressed concern, however, that this balloting activity was being undertaken by SC2 without there having been any prior review of the issue either by the members of WG8, or by the technical advisory groups (TAGs) of the corresponding national bodies. He further expressed his objections to the proposal having gone forward to SC2 for balloting in the absence of such review.

The Convenor responded that the action had been pursued in this manner because of the need for speed in getting the new project started, and that it was his intent to have the NWI reviewed and approved by the WG8 membership at this currently ongoing meeting, albeit after the fact. Recognizing the nature of the procedural problems presented by this issue, the Convenor asked that further consideration of the issue be undertaken within the WG8 Advisory Group.

There were no further questions.

MOVING PICTURE CODING EXPERTS GROUP (MPEG)

LEONARDO CHIARIGLIONE (LC) (CSELT) (ITALY), Chairman MPEG, presented a report on the activities of MPEG during the period following the Livingston meeting.

Based on the content of this report, CFT asked LC to express his views as to the degree to which MPEG activity was application-oriented as opposed to being coding-oriented, the basis for the question being WG8's mission as a "coding" committee, and not an application-oriented committee.

LC's response was that MPEG's activities were application-oriented only to the degree necessary to permit its coding activities to be performed, but that the basic objective of MPEG was to develop coding standards necessary for the implementation of MPEG--oriented applications, with such applications to be developed outside the scope of MPEG itself.

There were no other questions.

LIAISON REPORTS

CCITT STUDY GROUP VIII: SRG ON IMAGE COMMUNICATION

ISTVAN SEBESTYEN (IS) (SIEMENS) (FRG), Special Rapporteur for CCITT ONENTS SG VIII SRG on Image Communication (CCIC), gave a brief report on the meeting of CCITT SG VIII which occurred in Geneva this past April. As a part of this report, IS described the growing interest in the activities of JPEG and JBIG which is becoming increasingly apparent in SG VIII's various subgroups, and the high degree of anticipation which is concurrently becoming apparent relative to receipt of their respective work products.

During this same report, IS reasserted his view that his function as a "co-parent" of JPEG and JBIG enabled him to speak only in his SG VIII CCIC Special Rapporteur capacity, and did not enable him to speak for other components of SG VIII or CCITT. Accordingly, he then expressed the view that WG8 needs to establish liaison with other groups within CCITT such as SG XV (Teleconferencing), so that the needs of these other groups could properly be considered in JPEG's and JBIG's standardization activities.

CCITT AT LARGE

JOACHIM FRIEMELT (JF) (SIEMENS) (FRG), Designated WG8 Liaison to CCITT, echoed the view of IS, and urged that WG8 undertake the degree of liaison recommended in IS' report.

SESSION ADJOURNMENT

Following completion of the above reports, the Convenor adjourned the WG8 Plenary Session in favor of individual subgroup sessions, with plans to resume the WG8 Plenary on Friday morning, July 7, 1989.

SESSION TWO: FRIDAY, JULY 7, 1989

SESSION OPENING

DR. HIROSHI YASUDA (NTT) (JAPAN), WG8 Convenor, called the second session of the WG8 Plenary to order at 10:15 AM on Friday, July 7.

The Agenda for this second session of the meeting was reviewed and approved.

URGENT SUBGROUP REPORTS

None.

PLANS FOR FUTURE MEETINGS

Plans for the next three meetings of WG8 were reviewed as follows:

- The next meeting of WG8 will be held in Japan during the period October 16 - 23, 1989.

  The first week's activities will be hosted by the Japan Victor Corporation at its Kurihama laboratories approximately 60 kilometers south of Tokyo.

  The second week's activities will be hosted by Matsushita Corporation in Osaka.

  Detailed information concerning the meeting is contained in WG8/N873 REV 2.

- The meeting following the Japan meeting will be hosted by the IBM Corporation in Tampa, Floria, USA, during the period February 26 - March 2, 1990. Detailed information concerning this meeting will be made available at the Japan meeting.

- Considering the increasing difficulties associated with holding meetings of WG8 subgroups in parallel, it is anticipated that meetings of WG8 and its subgroups subsequent to the Tampa meeting will all be independent. Information concerning such meetings will be forthcoming at a future date.

SUBGROUP REPORTS AND RECOMMENDATIONS

WG8 ADVISORY GROUP

C. F. TOUCHTON (CFT) (IBM) (USA), Chairman WG8 Advisory Group, presented a brief report on the activities of the WG8 AG during the Stockholm meeting.

A particularly significant accomplishment of the group during this period was a change in the title of the group from "WG8 Advisory Group" to "WG8 Technical Advisory Group". The significance of this change is that it corresponds to a change in the scope of the committee from one of dealing with both planning matters and administrative and procedural matters to one of dealing with planning matters only. The Convenor will now look directly to the chairman of the now renamed Technical Advisory Group (TAG) for advice on administrative and procedural matters, thus relieving the remainder of the TAG from having to deal with such matters.

The remaining items in the (now) TAG meeting report are addressed in the WG8 Recommendations (WG8/N894 REV ___) (Annex A).

Action on these items was deferred to the end of the meeting.

COMPUTER GRAPHICS EXPERTS GROUP (CGEG)

The Convenor presented CGEG's Report and Recommendations as contained in Annex B.

There was no discussion.

Action was deferred to the end of the meeting.

JOINT BI-LEVEL IMAGE GROUP (JBIG)

DR. YASUHIRO YAMAZAKI (YY) (KDD) (JAPAN), Chairman JBIG, presented JBIG's Report and Recommendations as contained in JBIG ~~N122 REV 1~~ N121, and provided here as Annex C.

There was no discussion.

Action was deferred to the end of the meeting.

JOINT PHOTOGRAPHIC EXPERTS GROUP (JPEG)

MR. GREG WALLACE (GCW) (DEC) (USA), Chairman JPEG, presented JPEG's Report and Recommendations as contained in JPEG N375, and provided here as Annex D.

During ensuing discussion, the words in Item 6 of the Report were changed from "Complexity of implementation of arithmetic coding is an important issue for (consideration of) selection in JPEG" to "Complexity of implementation of arithmetic coding is one of the important issues for (consideration of) selection in JPEG."

There was no further discussion.

Action was deferred to the end of the meeting.

MULTI-MEDIA AD HOC GROUP (MHAG)

FRANCIS KRETZ (FK) (CCETT) (FRANCE), Chairman MHAG, presented MHAG's Report and Recommendations as contained in WG8/N890 and provided here as Annex E.

BARRY HASKELL (BH) (ATT) (USA) observed that in view of the many new terms which are becoming prevalent by virtue of the new MHAG and MPEG activities, it would be desirable for a "dictionary of terminology" to be established to collect these many new terms. CFT volunteered that creation of such a "dictionary" was totally consistent with recent requests from the CCITT SG VIII Special Rapporteur on Terminology that new terms be submitted to SG VIII for incorporation into the CCITT directory of terms and definitions, and that accordingly, he would undertake to create a WG8 forum for the definition of such a dictionary.

There were no further questions or observations.

In closing his report, FK reminded committee members that a JTC1/SC2 ballot concerning MHAG was forthcoming, and urged WG8 members to encourage their respective national bodies to support that ballot when it was encountered.

Action on the MHAG report was deferred to the end of the meeting.

MOVING PICTURE CODING EXPERTS GROUP (MPEG)

DR. LEONARDO CHIARIGLIONE (LC) (CSELT) (ITALY), Chairman MPEG, presented a MPEG'S Report and Recommendations as contained in Annex F.

In presenting his report, LC made reference to the importance of compatibility of the MPEG coding algorithms with those developed by JPEG. In this regard, he also made notice of the fact that MPEG is clearly out of phase with JPEG from a schedule standpoint, yet is clearly dependent upon JPEG compatibility as part of the MPEG proposal process, and hence asked that JPEG personnel conceptually consider the MPEG environment as they converge on their final algorithm selections.

There was no further discussion.

Action on the MPEG report was deferred to the end of the meeting.

MOVING PICTURE / AUDIO CODING EXPERTS GROUP (MPEG/AUDIO)

DR. HANS MUSSMAN (HM) (UNIVERSITY OF HANOVER) (FRG) presented a report t on MPEG/AUDIO's activity during the Stockholm meeting as contained in Annex G.

There was no discussion.

Action on the report was deferred to the end of the meeting.

WG8 MEETING RECOMMENDATIONS.

Following the subgroup reports, the Convenor presented for group approval his proposed Meeting Recommendations for the overall WG8 meeting as contained in WG8/N894 (and provided here as Annex A).

These Recommendations provided for incorporation and approval by reference all of the Reports and Recommendations previously presented by the respective WG8 Subgroups.

In addition, they also provided for:

- Correspondence to be sent to all JTC1/SC2 National Bodies asking that they provide formal accreditation for their respective attendees at meetings of WG8.
- Drafting of a resolution for review at the Japan meeting setting forth the reasons why WG8 should be escalated to SC-level, and requesting that JTC1 seriously consider pursuing the formation of such an SC.
- An expression of support for the MHAG NWI contained in WG8/N866.
- Authorization for the Special Rapporteur for CCITT SG VIII SRG on CCIC to be the source of accreditation for attendees from CCITT at JPEG and JBIG meetings.
- Expressions of appreciation for the outstanding hospitality and support provided by SAFAD, by the city of Stockholm, by IBM Sweden, and by the many people in all of the above who contributed so much to the success of the Stockholm meeting.

Following presentation of these Recommendations, the Convenor called for their approval in a "sense of the group" manner, including, by reference, the approval of all of the subgroup reports and recommendations included by reference therein.

There being no objections, the Recommendations were adopted.

Following this action, LC called for a "sense of the group" expression of support for the Convenor being named as chairman of the new SC, should such an SC be approved, which in turn drew an immediate and enthusiastic response.

MEETING CONCLUSION

Upon completion of all of the above, the Convenor proposed that the Stockholm meeting of WG8 be adjourned.

There being no objections, this was done.

ANNEX A

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONAL DE NORMALISATION

ISO/IEC JTC1/SC2/WG8

CODED REPRESENTATION OF PICTURE AND AUDIO INFORMATION

ISO/IEC JTC1/SC2/WG8 N894 REV1
1989 JUL 07

TO: WG8

SOURCE: CONVENOR

SUBJECT: RECOMMENDATIONS: STOCKHOLM MEETING: JULY 3-7, 1989

PURPOSE: WORKING GROUP REVIEW AND APPROVAL

RECOMMENDATION 1:

The Reports and Recommendations of the following WG8 subgroups are accepted and approved:

- WG8 TAG
- CGEG
- JBIG
- JPEG
- MPEG
- MPEG AUDIO
- MHAG AD HOC

RECOMMENDATION 2:

The WG8 Convenor is requested to send letters to all JTC1/SC2 National Bodies asking that they accredit to WG8, representatives from their respective countries, and that wherever possible, such representatives include as a minimum those individuals currently in good standing on the WG8 Active Member list.

RECOMMENDATION 3:

The WG8 Convenor and TAG members are requested to draft for review at the WG8 Tokyo meeting a Resolution setting forth the reasons why the creation of a new JTC1 Subcommittee on Multi Media Information Processing and Representation has become desirable, and requesting that JTC1 seriously consider pursuing the formation of such a Subcommittee.

RECOMMENDATION 4:

WG8 supports the MHAG New Work Item proposed in WG8/N866 and urges all of its members to encourage its support within their respective National Bodies.

1

RECOMMENDATION 5:

WG8 is pleased to have the support of CCITT SG VIII in its JPEG and JBIG activities, and explicitly authorizes the Special Rapporteur for the CCITT SG VIII SRG on Image *Communication* to be the source of accreditation for CCITT representatives at JPEG and JBIG meetings.

RECOMMENDATION 6:

The WG8 Convenor is requested to express to Mr. Wolf Arfvidson and the entire management staff of Statskontoret the sincere thanks of WG8 for the outstanding hospitality which they extended to the committee during the meeting now ending in Stockholm.

RECOMMENDATION 7:

The WG8 Convenor is requested to express to Mr. Lemmet Loof, President of the Stockholm City Council, the sincere thanks of WG8 for the graciousness and hospitality which he and the people of Stockholm have extended to the committee and its members during the week we have been in Stockholm.

RECOMMENDATION 8:

The WG8 Convenor is requested to express to Mr. Sten Lindberg, IBM Sweden, a sincere thank-you for providing for WG8 use the IBM Personal System/2 computer systems which contributed so significantly to the continuing development of the Technical Specification for the JPEG Algorithm.

RECOMMENDATION 9:

The WG8 Convenor is requested to express to Mrs. Karin Nordin, Mrs. Inga Mattsson-Hellberg, and Mr. Ake Karlsson, all of Statskontoret, the sincere thanks of the entire WG8 committee for their able assistance with administrative matters, coffee service, and audio/visual equipment.

ANNEX B

4 Recommendations to the SC2/WG8 Plenary being held in Stockholm

The CGEG has agreed during its meeting in July 1989 at Stockholm to recommend to the SC2/WG8

- to send document SC2/WG8 N 888 to the JTC1/SC2-secretatiat for distribution to all SC2 National Bodies in order to obtain a clarification on the future of the WG8/CGEG,

- to send document SC2/WG8 N 883 to JTC1/SC24/WG3 as a liaison response on the

  - encoding of point and colour lists
  - character encoding of CGI

Annex C

ISO SC2/CCITT SGVIII
JBIG
3-7 July 1989
Stockholm

JBIG N121

JBIG N. 122 Rev. 1

SOURCE : Chairman of Joint Bi-level Image Group
TITLE : Recommendation of 5th JBIG meeting

1. Evaluation method

It was confirmed that the scoring method which was agreed at Livingston meeting and shown in JBIG N93 Rev2 and clarified by JBIG N103 Rev1 was applied.

2. Evaluation images

Ten evaluation images including half tone images were prepared and distributed to each proposer by Mr. Dellert with assistance of Mr. Yoshida, Mr. Endoh and Mr DiMaggio

Image type, reduction method and distribution format are shown in JBIG N. 105 Rev 2.

3. Reduction rule

An improved Reduction Rule called PRES (Progressive Reduction Scheme for Bi-level Images), which was developed based on PCSB and BIHC according to the agreement at Livingston meeting, was introduced as shown in JBIG N-111 and submitted for verification.

4. Evaluation of coding efficiency and complexity

According to the evaluation formula, scores for each proposed algorithm were calculated. The results are shown in JBIG N 117 Rev.

5. Framework of future work

5.1 Reduction rules

- Verification and improvement of PRES is to begin.
- If no problems are found, PRES will be adopted as JBIG recommended Reduction rule.
- No further formal testing (beyond that of Livingston) is planned.

5.2 Template and entropy coding

- Cooperation toward best JBIG algorithm has begun.
- Verification of the three proposal methods are to be done in order to create an even better JBIG system.

- The purpose of verification is to get the base idea of proposed algorithms. The purpose of refinement is to get the best JBIG algorithm.
- The proposed three algorithms are to be verified by all other proposers
- During refinement, further competition is undesirable. New approaches are acceptable if benefit is clear and JBIG admits, however,

- There is left room for improved combinations.

5.3 Deterministic prediction

- Refinements of the Templa and TP (Typically Predictable) Deterministic Prediction methods, will be pursued to find even better ways to reduce byte count and obtain increased speed.

5.4 Executable code for Progressive/Sequential Build-up

- All three proposers must submit by September 30, to Mr. Dellert, working executable code corresponding to their underlying proposed algorithms. This code must be progressive/sequential encoding/decoding as it is described in JBIG N. 96 (pr 5.4) and JBIG N. 95 (pr 8).
- All three proposers are requested to send code string data and progressive/sequential formatting software to Mr. Dellert by September 30. (In September, an operating system is an acceptable form of such formatting software.)
- Image data processed by PRES are to be send to Mr. Dellert and each proposer from Mr. Endoh and Mr. Yoshida by 5 August 1989.

6. JBIG tasks and schedule

JBIG tasks and schedule are desided as follows.
Detail information is shown in JBIG N. 121 Rev 1

6.1 Reduction rule

- responsible person : Mr. Endoh and Mr. Yoshida
- Action
  1) provide sufficient information to duplicate PRES by Aug. 5
  2) suggestion for improvement by Aug. 30
  3) test results by Sep. 10
  4) final version by Sep. 20

6.2 Deterministic Prediction

6.2.1 DP-task 1

- responsible person : Dr. Duttweiler
- study computational burden by Aug. 15.

6.2.2 DP-task 2

- responsible person : Dr. Duttweiler and (Dr. Pasco)
- study advantage/disadvantage of scan order by Sep. 15

6.2.3 DP-task 3

- responsible person : Dr. Pasco, Mr. Endoh, Mr Yoshida and Dr. Chanezas
- * examine wether DP is worthwhile,
  * recommend the PLA based or other RAM based DP rule
  * recommend minimum dimensions for PLA or RAM

} by Sep 3

6.3 Template and entropy coding

6.3.1 THPL-1

- responsible person : Dr. Chamzas, Mr. Endoh, Mr. Yoshida (Mr. Pellert)
- Action :

  examine and recommend a set of Template by Oct 16.

6.3.2 GABAC-1

- responsible person :

  PED-2 : Dr. Chamzas

  PCBIS : Mr. Ono

  PBIC-6 : Dr. Arps (Dr. Chamzas and Mr. Ono)
- try alternative GABAC by Sep. 15

6.3.3 GABAC-2

- responsible person : Dr. Arps, Dr. Duttweiler and Mr. Ono
- integrate the best feature of GABAC coders into a common QM coder

6.4 Other tasks

6.4.1 Boundary condition

- responsible person : Dr. Duttweiler
- study compatible sequential/progressive boundary conditions

7. Acknowlegement

JBIG expresses its deep thanks to the excellent contribution of tollowing people

(1) Mr. H. Hampel (SEL):
Chairmanship on JBIG tasks and schedule

(2) Mr. Dellert, Mr Yoshida, Mr Endoh and Mr DiMaggio.
Evaluation Images.

(3) Mr. W. Artvidson and his staff of SAFAD:
Meeting arrangement and hospitality

ANNEX D

7/7/89

STOCKHOLM

[redacted] JPEG RESOLUTIONS TO WG8

JPEG-375

(1) THANKS TO PRIMARY EDITORS IN JPEG:

- DR. W. PENNEBAKER
- DR. J. MITCHELL (ALSO: MR. G. WALLACE)
- DR. T. OMACHI

JPEG COULD NOT HAVE MADE SUCH PROGRESS WITHOUT THEM.

(2) THANKS TO HOSTS

(3) JPEG [redacted] AT STOCKHOLM HAS SUBSTANTIALLY AGREED ON THE TECHNICAL CONTENT OF THE BASELINE SYSTEM (JPEG-8-R3, CHP.5), SUBJECT TO VALIDATION TESTING BEFORE OCT. WG8.

(4) JPEG RESOLVES TO FINALIZE ALL TECHNICAL POINTS OF THE JPEG STANDARD AT OCT. JPEG, JAPAN, AND SO, ALL ITEMS NOT FULLY DOCUMENTED TECHNICALLY

(5) ~~RELEASE OF TECHNICAL SPEC.~~ WELL BEFORE THE ~~MEETING~~ BY SEPT. 15, 1989 WILL BE DROPPED.

[redacted] JPEG-8-R3 (JPEG TECHNICAL SPEC.)

~~DIS~~ (FIRST VERSION OF JPEG-8 TO BE APPROVED BY JPEG WILL BE JPEG-8-R3).

PLANNED [redacted] DATE: PRIOR TO OCT 89 JPEG

(6) COMPLEXITY OF IMPLEMENTATION OF ARITHMETIC CODING IS ONE OF THE IMPORTANT ISSUES FOR SELECTION IN JPEG.

ANNEX E - 1 -

MHAG Report and Recommandation

(MHS N890)

MULTIMEDIA and HYPERMEDIA information coding Ad-hoc Group

Stockholm, July 7, 1989

RENNES meeting May 18-19

Basic definitions

Study of standards environment

Manuscript for rational of NWI

NWI proposal : N885 & 886

N 885 Rational for a NWI proposal on multimedia and hypermedia information coded representation

N 186 NWI proposal form

(SC2 ballot : June - Sept 15)

MHEG report and recommendation (Continued)

Future meeting

TOKYO, October 17-20, 1989.

Recommendation to WG8 plenary

TOKYO meeting issues to be addressed:

- classification of basic and composite objects
  (monomedium, multimedia, hypermedia)
- first attempt to draw a list of manipulation functions for each object class
  (output, input, synchronize, concatenate, link ...)
- terminology of terms

ANNEX F

RECOMMENDATIONS OF MPEG

(Stockholm, 3-6 July 1989)

- 37 Proposals accepted
  - Video 23
  - Audio 14
  - 1 Possibility registered
- Time schedule towards DP stage reviewed
- Principles of test methodology reviewed
  - Reduced no. of implications used for preselection
- Applications - implications weights finalised
- MPEG-V: test procedure for October tests finalised (Mr. Hidaka)
- MPEG-A: four scoring methods agreed
- Preselection rules defined
  - MPEG-V: proposal package defined
    7 implications used
  - MPEG-A: method of preselection of audio algorithms agreed
    3 implications used
- Study of system aspects started (Mr. Morrison)
  - MPEG-A: study items elaborated

(2)

2. List of registered proposers

The following is the complete list of those who have registered an intention to register an algorithm as per MPEG89/132 and 133.

Company/Organisation name	Audio Ref. Name	Video Ref. Name
American Telephone and Telegraph	N. S Jayant	B. G. Haskell
Bell Communications Research		D. Le Gall
BTRL	P. Challener	
CCETT	Y.-F. Dehery	
~~CGE Cratec GmbH~~	~~M. Koslar~~	
Creative Circuits Corp.		A. Ligtenberg
COST 211 bis		H. Seguin
Deutsche Thomson-Brandt GmbH	E. F. Schroeder	D. Hepper
Digital Equipment Corporation		B. Szabo
France Télécom - CNET	P. Combescure	N. Texier
Fraunhofer Gesellschaft	H. Gerhaeuser	
Fujitsu Limited	S. Unagami	K. Matsuda
Graphics Communications Technologies	~~H. Uwabu~~	H. Fujiwara
IBM Corporation		C. A. Gonzales
Institut für Rundfunktechnik	G. Stoll	
Intel		A. Simon
ITT Intermetall		B. Butera
Japan Victor Company Ltd.	Y. Yamada	T. Hidaka
Matsushita Electric Industrial Company	T. Kogure	T. Kogure
MIT		A. Lippman
Mitsubishi Electric Company		T. Murakami
NEC Corporation	T. Nishitani	T. Omachi
Nippon Telegraph and Telephone Corporation	S. Hayashi	H. Watanabe
OKI Electric Industrial Company		K. Koro
Philips Consumer Electronics	G. Lokhoff	J. van der Meer
Sony Corporation	K. Akagiri	Y. Hashimoto
Telenorma /University of Hannover		T. Kummerow
Toshiba Corporation		F. Sugiyama

Note 1: B. Hammer (Siemens) has stated a possibility of making a proposal satisfying the time scale of para. 3

Note 2: Two more proposals for audio were received. One was withdrawn and the other was rejected on 3rd July for failure to comply with the first requirement of para. 3.

(3)

3. Time schedule towards DP stage.

General	Moving Images	Sound
03/07/89		Top level description delivered
07/07/89 Weights finalised Complexity measure defined Proposal package finalised System aspects started	Test procedure finalised Additional performances finalised	Test procedure finalised Additional performances finalised Test sequences finalised
15/09/89	D-1 tapes delivered to JVC	
06/10/89	Full proposal registration deadline	
16/10/89		Detailed algo. description provided
20/10/89 System aspects defined Dec 89 xx/02/~~88~~ 90 or xx/03/90	preselection Clustering/~~elimi~~ ~~Selection~~ of ~~two~~ algorithms Collaborative algorithm improvements starts Final selection Collaborative improvement starts	Preselection! Fully verifiable package provided
xx/04/90		Test tapes prepared
xx/05/~~88~~ 90		Execution of subjective tests
xx/06/90		Final selection
xx/07/90	Verification of ~~codec~~ using hardware decoder	Verif. of ~~codec~~ using hardware decoder
01/09/90 Hardware demo. of system DP ready		

IPEG-V Preselection

Performances to be tested

- Image quality in normal play back
- " " " reverse " "
- " " " still-HR mode
- Random access
- CCITT Transcoding capability
- JPEG Transcoding capability
- VLSI Implementability

N.B.: Fast forward / reverse to be provided but used only for the purpose of identifying proper ways to score them

SYSTEM ISSUES

1. IS MPEG CONTRIBUTION, DISTRIBUTION. ?

2. MULTIPLEX NEEDED SO THAT PARALLEL "CHANNELS" ARE PUT ON SERIAL MEDIA.

3. CONCEPT OF DEVICE INDEPENDENT FORM AND CONVERSION TO STORAGE DEPENDENT FORM.

4. TEMPORALLY CORRESPONDING EVENTS IN AUDIO, VIDEO CHANNELS PLACED CLOSE TOGETHER ON MEDIUM.

MAY BE NECESSARY TO PLACE "MARKERS" IN DATA TO DO RANDOM ACCESS.

- PRIMARY ERROR HANDLING IS BY PLAYBACK DEVICE. DECODERS SHOULD BE INFORMED OF UNCORRECTED ERRORS.
- POSSIBILITY OF MULTIPLE AUDIO CHANNEL DECODING AND MIXING BY SINGLE DECODER HARDWARE?
- FREQUENCY OF EDIT POINTS FOR AUDIO?
- AUDIO "JARRING" AT EDITS? NEED FOR GAIN INFO?
- INTERACTION WITH MHEG
  - REAL TIME IS MPEG.
  - 1.5 MBITS/S THROUGHPUT IS MPEG ONLY.
- "COMPUTER GRAPHICS".

III. MULTIPLE VIDEO CHANNELS AT LESS THAN ≃ 1 MBIT/S EACH.

5

Definition of applications/implications and corresponding weights are given below.

4.1 Application weights

Definition of Applications	Weight	Standard deviation		
1. Electronic Publishing (End user)				
a. Integrated and interactive text, graphics, sound and video	~~3.89~~	3.37	~~130~~	1.73
b. Electronic newspaper	~~3.66~~	3.04	~~124~~	1.61
2. Electronic Publishing (Production)				
a. Digital video editing	~~2.14~~	2.00	~~128~~	1.43
b. Digital audio editing	~~2.80~~	2.45	~~130~~	1.46
3. Travel guidance				
a. Preview of city views	~~3.11~~	2.67	~~124~~	1.48
b. Flight and driving simulation	~~2.51~~	2.08	~~113~~	1.27
c. Interactive video in public spaces (e.g. airports)	~~3.03~~	2.78	~~113~~	1.50
d. Active guidance	~~3.02~~	2.78	120	1.54
e. Surrogate travel	~~2.77~~	2.61	~~122~~	1.52
4. Educational applications				
a. Electronic book (high level of interaction)	~~3.77~~	3.47	~~124~~	1.79
b. Electronic book (low level of interaction)	~~3.66~~	3.26	~~122~~	1.64
c. Remote classroom instruction	3.06	2.63	~~114~~	1.41
5. Business applications				
a. Electronic book (as 1.a for catalog shopping)	~~3.86~~	3.53	~~127~~	1.81
b. Multimedia E-mail (as in 9.b)	~~2.89~~	2.51	~~124~~	1.43
6. Games				
a. Stand alone games	~~3.31~~	2.80	~~128~~	1.55
b. Multilocation games (through telecom network)	~~2.46~~	2.04	~~140~~	1.43
7. Entertainment applications				
a. MTV (or other video/audio clips) on CD	~~3.77~~	3.12	~~142~~	1.73
b. TV program/movie storage and distribution	~~3.54~~	2.96	~~127~~	1.60
c. Broadband stereo distribution	~~3.26~~	2.59	~~157~~	1.73
d. Previewing systems (both audio and video)	~~3.20~~	2.55	~~127~~	1.47
e. Audio recording	~~2.40~~	2.31	~~196~~	1.88
8. Database applications				
a. Audio databases applications	~~3.06~~	2.63	~~141~~	1.57
b. Audio + video either with onsite or offsite databases	~~3.34~~	3.00	~~112~~	1.53
9. Multimedia memo and bulletin board				
a. Electronic News Gathering	~~3.00~~	2.41	~~129~~	1.48
b. Bulletin board	~~2.86~~	2.49	~~0.83~~	1.21
c. Computer conferencing with multimedia memos	~~2.77~~	2.43	~~107~~	1.32
d. Face-to-face teleconferencing using MPEG standard	~~2.49~~	1.88	~~146~~	1.53
10. Broadcast sound				
a. Production	~~2.89~~	2.71	~~169~~	1.65
b. Transmission of "contribution quality" audio	~~3.00~~	2.78	~~174~~	1.70
c. Transmission for distribution	~~3.34~~	3.20	~~167~~	1.51
d. Digital audio broadcasting	~~3.23~~	3.08	~~179~~	1.89
11. Multimedia Art	1.69		~~126~~	1.34
12. Medical Applications				
a. Education	~~2.91~~	2.71	~~140~~	1.64
b. Diagnostic Imaging	~~2.26~~	2.08	~~146~~	1.49

(6)

4.2 Implication weights

Definition of Implications	Weight	Standard deviation
1. Motion video decoding (playback)		
a. Forward video playback	~~130~~ 108	~~41~~ 24
b. Reverse video playback	~~066~~ 50	~~44~~ 20
c. Fast forward video playback	~~110~~ 91	~~43~~ 23
d. Fast reverse video playback	~~102~~ 84	~~45~~ 24
2. Wideband audio decoding (playback)		
a. Forward audio playback	~~140~~ 121	~~32~~ 26
b. Reverse audio playback	~~045~~ 34	~~32~~ 19
c. Fast forward audio playback	~~084~~ 67	~~34~~ 21
d. Fast reverse audio playback	~~063~~ 52	~~33~~ 21
3. Single frame video accessibility	~~104~~ 78	~~45~~ 22
4. Random access	~~135~~ 118	~~27~~ 26
5. Still mode video	~~093~~ 76	~~44~~ 21
6. Zoom capability	~~055~~ 49	~~44~~ 19
7. Compatibility with computer graphics	~~075~~ 58	~~44~~ 19
8. Ability to encode in real time		
a. Audio	~~056~~ 55	~~32~~ 21
b. Video	58	
9. Reduced frame rate video at higher resolution	~~058~~ 47	~~43~~ 17
10. Data capacity for ancillary information	~~108~~ 93	~~31~~ 23
11. Direct transcoding of CCITT px64 kbit/s video	~~029~~ 26	~~48~~ 15
12. Direct transcoding of Studio/Production audio	~~077~~ 54	~~43~~ 23
13. Direct transcoding of consumer standard audio	~~081~~ 57	~~44~~ 23
14. Real time mixing of audio channels	~~054~~ 49	~~40~~ 20
15. Ability to synchronize audio and video signals	~~127~~ 109	~~30~~ 26
16. Ability to withstand multiple coding/decoding (audio)	~~040~~ 29	~~46~~ 17
17. Ability to do insert/cut editing (audio)	~~062~~ 50	~~38~~ 21
18. Ability to tolerate audio processing during production	~~044~~ 31	~~36~~ 17
19. Need of stereo wideband (20 kHz) audio	~~095~~ 86	~~34~~ 23
20. Intermediate audio quality	~~106~~ 96	~~34~~ 24
21. Toll quality audio	~~059~~ 54	~~32~~ 19
22. Robustness to bit errors in storage/transmission		
a. Video	~~093~~ 73	~~46~~ 21
b. Audio	~~111~~ 89	~~38~~ 24
23. Encoder cost and/or complexity		
a. Video	~~049~~ 42	~~42~~ 17
b. audio	~~066~~ 59	~~31~~ 20
24. Decoder cost/complexity		
a. Video	~~123~~ 103	~~44~~ 23
b. Audio	~~136~~ 117	~~31~~ 25
25. Ability to handle 20/24 bits input audio	~~035~~ 30	~~41~~ 17
26. Short decoding delay		
a. Video	~~078~~ 66	~~47~~ 20
b. Audio	~~089~~ 72	~~37~~ 22
27. Short encoding delay		
a. Video	~~027~~ 24	~~45~~ 15
b. Audio	~~045~~ 30	~~35~~ 18

MPEG VLSI Cost Estimation Questionnaire

Section One - Silicon Area

Area μm^2	Circuit element
	SRAM Cell
	SRAM Support
	DRAM Cell
	DRAM Support
	ROM Cell
	ROM Support
	Multiplier Cell (Integer)
	Bit of Register
	Bit of Adder (Integer)
	Bit of ALU (Integer)
	2-input Gate
	Bond-Pad
	Multiplier Cell (Floating point)
	Bit of Adder (Floating point)
	Bit of ALU (Floating point)

Section Two - Packaged Chip Cost

Plastic Packaging

Pin Count	Chip Area mm^2						
	0-9	10-49	50-100	101-144	145-196	197-256	257-
0-32							
33-68							
69-100							
101-180				109			
181-256							
257-400							
401-							

Ceramic Packaging

Pin Count	Chip Area mm^2						
	[illegible]	[illegible]	50-100	101-144	145-196	197-256	257-
0-32							
33-68							
69-100							
101-180							
181-256							
257-300							
401-							

Section Three - System Issues

Weight (%)	Parameter
	Total cost of VLSI chips ~~(estimated from Sect. Two)~~
	No. of Mbits of DRAM (i.e. made of commercially available 256Kbit, 1Mbit, 4Mbit etc. devices)
	No. of VLSI Chips (including DRAM chips)
	No. of Pins (in units of 100 pins) (i.e. the total number of pins in the system, this gives a measure of interconnect complexity)

ANNEX 6

MPEG AUDIO

Results of the Stockholm meeting

1. A list of items has been assembled which have to be clarified by the SYSTEM ASPECTS GROUP.

2. A procedure for pre-selection of audio proposals has been elaborated and agreed.

3. The test methodology has been revised:
   - only 13 implications will be considered for testing
   - for 4 implications methods for scoring have been elaborated.

4. A set of 20 test sequences has been for subjective tests.

EXHIBIT 10

JPEG
JOINT PHOTOGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-12.7-R0
Mar. 15, 1990

** Draft. To be approved by committee. **

Source: JPEG Chair
Title: Report of October 1989 JPEG Meeting, Japan

1. Introduction

This document reports on the major discussions, decisions, plans, and all contributed documents for the October 1989 JPEG Japan meeting. This meeting took place from October 16-20 at the JVC facility in Kurihama, Japan, and from October 23-24 at the Matsushita facility in Osaka, Japan.

1. Meeting Opening, Agenda, Document Distribution

The meeting was opened at 9:00 AM, October 16, at the JVC facility in Kurihama, Japan. Dr. H. Yasuda, Convenor of ISO SC2/WG8, and Dr. I. Sebestyen, Special Rapporteur of CCITT SGVIII, urged JPEG to finalize all major technical decisions before the close of this Japan JPEG meeting.

Mr. N. Starkey of Databeam kindly accepted the task of note-taking during the JPEG meeting. His detailed, excellent notes have made this meeting report possible. Mr. S. Kino of Mitsubishi and his colleague kindly accepted the task of managing the document copying and distribution process throughout the meeting.

Introductions were made, and an attendance sheet was distributed. Several observers and first time attendees were present. The attendance sheet is attached as Annex 1.

The process of document distribution began. The following documents were made available and distributed at the meeting as necessary. These included:

(a) Documents submitted to and registered by the JPEG Chair between the Stockholm and Japan meetings, which had already been distributed by mail to JPEG members: documents JPEG-377 through JPEG-418, from document register JPEG-4.7-R2;
(b) New documents, beginning with JPEG-419, received by the JPEG chair in the week prior to the Japan meeting;
(c) New documents, submitted during the Japan meeting, including important work foils created during meeting discussions.

Documents from categories (b) and (c) are listed in JPEG-4.8-R1. JPEG-4.7-R2 and JPEG-4.8-R1 comprise the list of all documents presented at the meeting, and are attached to this report as Annex 2.

[Note: on November 4, Dr. H. Yasuda faxed to the JPEG Chair two contributions from Dr. H. Lohscheller, which had been faxed to Dr. Yasuda's NTT office on October 16. Unfortunately these documents were not brought to JPEG's attention during the Japan meeting, so they will be registered as documents received after the Japan meeting.]

A meeting agenda was proposed by the Chairman and approved by JPEG. This agenda, JPEG-429-R1, is attached to this report as Annex 3. These foils were annotated throughout the meeting whenever new contributions were registered, distributed, added to the agenda, and presented. JPEG-429-R1 is the copy of these foils as of the close of the meeting. The foils list all numbered documents presented at the meeting. As each document was presented, its number on the agenda foil was checked
off.

2. Liaison Reports

2.1 CCITT

2.2 ODA Color Addendum (and SC18)

Though there is no person designated as a regular liaison between SC18 and JPEG, the groups have had productive ongoing communication. The one official communication between the groups since the Stockholm meeting was JPEG-380, an advance copy of the 2nd Proposed Draft Color Addendum (PDAD) to ISO 8613, which was submitted by Dr. B. Shepherd to the JPEG Chair. It was noted during discussion that JPEG had sent a letter to Dr. Shepherd and to SC18, recommending that SC18 consider including a provision for representation of CCIR-601 images, but that this provision had not been incorporated into the 2nd PDAD. Also, Mr. M. Nier observed that the ODA Color Addendum would be supplemented, and possibly superseded, by the new TOSCA work item in SC18.

2.3 MPEG (SC2/WG8)

It was observed that the JPEG Chair, at the request of the MPEG Chair, had written a document, JPEG-382, giving a technical description of the JPEG Baseline System, in order that MPEG could define the "JPEG Compatibility" requirement for its algorithm submission process.

2.4 National Member Body Reports

2.4.1 U.S.

At its September 1989 meeting, the U.S. Member Body, ANSI X3L2.8, made six recommendations to JPEG, listed in the document JPEG-438. These were presented by Mr. M. Nier, the representative at JPEG of the U.S. delegation. By the close of the Japan meeting, JPEG had adopted all 6 recommendations. Mr. M. Nier and the JPEG Chair will develop a draft response to the JPEG-438, and circulate it by mail for JPEG approval, before sending the letter to the U.S. Member Body.

2.4.2 Other National Member Body Reports

There were no reports from other National Member Bodies. The JPEG Chair urged members to make an effort to form and participate in official National Member Body organizations, so that JPEG could gain a good understanding of each voting country's view of the evolving JPEG standard.

2.5 IPTC

Mr. S. Guerillot, the IPTC (International Press Telecommunications Council) liaison, reaffirmed the strong desire on the part of the IPTC and the ANPA (American Newspaper Publishers Association) to make use of the JPEG standard compression method for digital transmission of photographs for press/newspaper applications.

Mr. Guerillot distributed a document (JPEG-433), which he summarized in a slide presentation (JPEG-448), entitled "Draft IPTC-ANPA News Photo Parameters Record," a draft version of a document which will specify the descriptive parameters for an image for digital transmission. One such parameter is "Data Compression Method," where which one or more codes indicating the JPEG method could ultimately be assigned. Mr. Guerillot indicated the IPTC will assess the
applicability of the JPEG algorithm through participation in the Test Image Plan, by submitting typical digital news photos for processing by a JPEG volunteer and return to the IPTC, for subjective quality assessment. (See JPEG-449).

2.6 Other Liaisons

3. JPEG Member Status Reports

The status reports of JPEG members submitted to between the Stockholm and Japan meetings were briefly summarized with little discussion. These documents were 387-390, 399, 402, 403, 408, 421.

4. Patent Items

The first patent item discussed was a series of correspondences, (numbers JPEG-377, 405, 418, and 419) between ANT and the JPEG Chair, which can be summarized as follows. As Dr. Lohscheller was absent, the JPEG Chair summarized these as follows:

During the JPEG Stockholm meeting, it had been noted that JPEG had not yet received a statement from Dr. Lohscheller on his (or his company's) patent status, with respect to techniques being considered for JPEG standardization. JPEG-377 contains the patent statement, on behalf of ANT, which Dr. Lohscheller promptly forwarded to the JPEG Chair following the Stockholm meeting. This letter fulfilled the ISO and CCITT rules, and so JPEG is permitted to consider for standardization the methods covered by these patent applications.

Subsequently distributed (by the JPEG Chair) for JPEG's information, was JPEG-405, an English translation of one of the patent applications referenced in JPEG-377. Next was JPEG-418, a letter from the JPEG Chair to ANT, requesting any additional information ANT might be able to provide to JPEG about ANT's view of these patent applications in relation to the JPEG standard. JPEG-419 was the reply from ANT, expressing (in part) ANT's "...understanding that this...method would not require practice of the pending ANT patent applications..."

In the discussion which followed, the JPEG Chair expressed thanks to ANT for its reply. The Chair also reminded the members present that this letter (JPEG-419) must be regarded only as information, that neither ISO nor CCITT are able to take any position or make any interpretation of the ANT letter, and that ANT had met the ISO and CCITT rules by submission of the letter in JPEG-377.

The second patent item discussed was JPEG-432, which made reference to a Hitachi patent filing in Japan, and offered an English summary of the filed patent, which concerned an "AC Prediction" method. At JPEG's request, Dr. Takizawa of Hitachi also provided a copy of this patent filing (Japanese language), which was assigned JPEG-439 and distributed.

5. Publicity and External Communications

A number of papers on JPEG activities had been submitted by various JPEG authors to various technical conferences since the Stockholm meeting. Those submitted for JPEG's information were: to the International TV Symposium, JPEG-378 by Dr. H. Lohscheller; to Electronic Imaging '89, JPEG-391 by Dr. J. Mitchell, JPEG-392 by Dr. W. Pennebaker, and JPEG-393 by Mr. G. Wallace; to Globecom '89, JPEG-420 by Mr. G. Wallace.

The JPEG Chair requested that members continue to copy him on any future technical papers concerning JPEG activities, and to do so in advance, if possible, for any conferences at which there are likely to be other JPEG presentations, so coordination with other JPEG authors might be possible. In particular, please contact the JPEG Chair by November 15 if you wish to present a paper at PCS in Boston next Spring. To date, Mitchell, Pennebaker, Ligtenberg, and Wallace have expressed such interest.

6. Major Technical Discussions and Agreements

This section summarizes the presentation of paper submitted, and agreements made, on the major technical issues that were outstanding at the start of the Japan meeting.

6.1 Extended System: Arithmetic Coding

A major outstanding technical issue at the start of the Japan meeting was specification of the Arithmetic Coding (A.C.) method to be used within the Extended System. The Q-Coder and the MEL-Coder were the two candidate A.C. methods that had been under consideration in JPEG for some time.

Before discussing how to decide on the A.C. specification, the large number of papers concerning A.C. were presented and discussed briefly. JPEG-numbered documents 383-386, 394-398, 409-410, and 416 contain example MEL-Code source code supplied by Dr. F. Ono and his colleagues, as well as detailed technical correspondences between Dr. Ono and Dr. W. Pennebaker, Dr. J. Mitchell, and Mr. M. Nier (and his colleagues at Kodak) on the source code and previously distributed MEL-Code flow charts. The JPEG Chair extended thanks to Dr. Ono and his colleagues for supplying the source code to JPEG as requested, as an aid to members attempting to understand and implement the MEL-Code flow charts which were distributed at Copenhagen.

A few of the papers presented (417, 426-428) described various efforts to compare the Q-Coder and MEL-Coder according to relative compression performance, complexity, and other aspects. Other papers discussed use in the Q-Coder of a higher resolution probability estimator like that used in the MEL-Coder (424), and a method for overlapping Marker Codes with the final bits of an A.C. code string.

Some key papers for the decision making process were JPEG-415, 430, and 431. JPEG-415 was the Chair's announcement of the formation of a JPEG Ad Hoc Group on A.C., to meet in the days just before the JPEG Japan meeting. The purpose (described in detail in 415) of the group was for the JPEG A.C. experts to work together to devise and propose to JPEG a common JPEG A.C. proposal. The Ad Hoc group achieved this goal, and JPEG-430 describes this proposal. JPEG-431 contains the minutes of this meeting. The JPEG Chair extended thanks to Dr. Ono, his colleagues, and to Mitsubishi for hosting this Ad Hoc meeting on short notice.

After presentation of 415, 430, and 431, the JPEG Chair recognized the A.C. situation in WG8: that since JBIG and JPEG were both evaluating A.C. methods, it was desirable on one hand to have a common A.C. technique for two image coding standards from WG8, but on the other hand the coding environments differed, and JPEG would be delayed if it had to wait for JBIG A.C. consensus. Therefore, the Chair presented the proposal of JPEG-440 (Annex 4): that JPEG should tentatively adopt the 430 proposal, that JBIG should independently achieve its own consensus, and once JBIG consensus is achieved, JPEG and JBIG should form a joint A.C. experts Ad Hoc committee to consider a possible common coder. (The wording of JPEG-440 overrides any questions of meaning of the previous sentence).

JPEG unanimously approved the proposal in JPEG-440, and then unanimously gave tentative approval to the A.C. proposal of JPEG-430, subject to the JPEG-440 agreement.

6.2 Baseline System

Dr. A. Leger summarized the papers that he and his CCETT colleagues submitted on definition of Default Huffman (VLC) tables to be used in the Baseline System. While Dr. Leger had provided default VLC tables at Stockholm, the Baseline coding structure had been revised at that meeting, so the work had to be redone. JPEG-401 described preliminary results of CCETT's work, and JPEG-406 the full results of the CCETT work. Dr. Leger mentioned that he and his colleagues were willing to consider expanding the training set if JPEG felt it was necessary and could supply images for an expanded set.

The next issue considered was the US recommendation (in JPEG-438) that JPEG eliminate any default Quantization Matrices from the Baseline System, which would lead to the requirement to always send these Matrices within the image header for each encoded image. The JPEG Chair expressed his opinion that the JPEG standard would more fully achieve its stated purpose of being a "general-purpose" compression standard in the world's eyes if this recommendation were adopted, because the standing requirement that Baseline System Decoders store default Matrices based on CCIR-601 images and displays suggests to many a bias in favor of certain applications. After some discussion, JPEG unanimously adopted this recommendation, and also agreed to place the CCIR-601 matrices in an informational annex to the standard.

6.3 Extended System: Progressive Methods (Non-Hierarchical)

Another major decision outstanding at the start of the Japan meeting was the decision about which extended features would be included as part of the (Non-hierarchical) Progressive mode of the Extended System, and whether all or only some of these features would be mandatory for a Progressive-mode decoder.

Dr. Leger and his colleagues presented JPEG-423, their analysis and opinion of which features were useful for which purposes, and what would make technical sense for the standard. JPEG-435 was presented by Dr. Omachi, on behalf of the Japanese National Body, giving the Japanese recommendation on this matter. Mr. Giquel presented JPEG-422, a proposed draft for how to incorporate the so-called "Old Spectral Selection" (S-S) into the Technical Specification. Dr. Omachi presented his document JPEG-437, containing detailed comments on 422. The JPEG Chair that 422 and 437 be forwarded to the Editing Committee for further detailed discussion.

Through discussion, it became clear that there were two modes of operation of interest to those present. One mode, which we called "Set 1" for discussion purposes, was "Old Spectral Selection" only. The other mode, "Set 2," consisted of "New S-S," Successive Approximation (S-A), 2D DC Prediction, and AC Prediction. One strong view was in favor of Set 1, but was willing to allow Set 2 as an additional progressive mode. The other strong view was in favor of Set 2 only, and did not want to allow Set 1 as an additional set.

After considerable discussion of the pros and cons of Set 1 with respect to Set 2, the JPEG Chair stated his view that there were legitimate points made in favor of both sets: that, in his opinion, Set 1 had the advantage of being about the simplest imaginable extension to the Baseline System to provide Progressive Build-up, but that Set 2 had the advantage of providing a rich and flexible Build-up capability. The Chair also stated his view that there was no technically "correct" answer to the dilemma, but that we must reach consensus.

After a prolonged break, the Chair made the proposal contained in JPEG-442 (Annex 5). This proposal was that the Non-Hierarchical Progressive mode should be comprised of a "Set A," defined as New S-S only, and a "Set B," defined as New S-S plus S-A in combination. A Progressive Decoder could conform either to Set A (only) or to Set B. But since Set A is a subset of Set B, a Set A Decoder would at least be able to decode the first "slice" of an Encoder which conformed to Set B, i.e., which used S-S and S-A in combination. This proposal was unanimously adopted by JPEG. See Annex 5 for more detail. (The wording of JPEG-440 overrides this paragraph on any questions of meaning of the technical agreement).

** DRAFT: TO BE COMPLETED **

6.4 Extended System: Extended Precision

7. Editing Committee

7.1 Marker Codes

7.2 Other

8. Test Image Plan

9. Work Plan to Next Meeting

ANNEX 6, 7

10. Schedule Toward Standardization

11. Japan JPEG Recommendations

ANNEX 8

12. Meeting Schedule

ANNEX 1

JPEG Attendance
Japan Meeting, October 1989

C. J. Starkey	DataBeam
M. C. Nier	Eastman Kodak
A. Gill	Zoran
H. Kato	KDD
S. Guerillot	AFP
Y. Kuwabara	NTT
S. G. Park	ETRI
A. P. Wise	Inmos, Limited
J. M. Costa	BNR, Canada
L. Conte	CSELT, Italy
H. Poulsen	KTAS, Denmark
E. Hamilton	C-Cube Microsystems, Inc.
A. Leger	CCETT, France
B. Peigne	CCETT, France
J. C. Jolivet	SAT, France
K. Shimizu	JVC
K. Yanaka	NTT
T. Noda	Fujitsu Laboratories
M. Takizawa	Hitachi, Ltd
W. Pennebaker	IBM
J. Mitchell	IBM
H. Ichimura	Ricoh
K. Kuroe	Chronix (Matra MHS)
S. Ochi	Fuji Photo Film
S. Kino	Mitsubishi Electric Corp.
M. Sasaki	Toshiba Co.

ANNEX 2, p.1

JPEG
JOINT PHOTOGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-4.7-R2
10 October 1989

Source: Chairman (G. K. Wallace, Digital Equipment Corporation)
Title: Document Register JPEG-377 thru JPEG-418

This register contains all documents submitted after the July 1989 Stockholm, and before the October 1989 Japan meeting.

JPEG No.	Issued /Rev'd	Source	Title
377	07/89	Lohscheller	ANT Patent Statement
378	07/89	Lohscheller	Paper Presented at International TV Symposium
379	07/89	Sebestyén	Liaison letter to CCITT SGVIII, WP4
380	07/89	Shepherd	ISO 8613 2nd PDAD to Add Colour Capability
381	07/89	Omachi	Comments on JPEG-363-R1
382	08/89	Chair	JPEG-Compatibility Document for MPEG
383	08/89	Ono	C Program Source for Encoder and Decoder of MELCODE
384	08/89	Ono	MELCODE Test sequence for a small data set
385	08/89	Ono	Correction to the Program Source for Encoder of MELCODE and Test Sequence
386	08/89	Pennebaker	Correspondence on MELCODE Documentation
387	08/89	Chair	Status Letter to JPEG Members
388	08/89	Poulsen	Status of JPEG work
389	08/89	Sebestyén	Status of JPEG work
390	08/89	Léger	Status of JPEG work
391	09/89	Mitchell	Paper Submitted to Electronic Imaging '89
392	09/89	Pennebaker	Paper Submitted to Electronic Imaging '89
393	09/89	Wallace	Paper Submitted to Electronic Imaging '89

ANNEX 2, p. 2

394	09/89	Rabbini, Nier	Comments and Questions regarding MEL-CODE documentation JPEG-8-R3, Section M
395	09/89	Ono, Kino	Response to JPEG-394-R0
396	09/89	Ono	MELCODE Source correction to have the same illegal code pattern with Q-coder
397	09/89	Tran, Tabbini, Nier	Comments and Questions regarding MEL-CODE Source Code
398	09/89	Ono, Kino	Response to Questions and Comments dated August 31, 1989
399	09/89	Nier	Status of JPEG work
400	08/89	Pennebaker	Response to JPEG-381
401	09/89	Léger, et.al.	Predefined VLCs for the "Baseline System"
402	09/89	Omachi	Status of JPEG work
403	09/89	Chair	Status letter to JPEG Members
404	09/89	JPEG Test Committee	Call for Additional Test Images
405	09/89	JPEG Chair	Translation of European Patent Application of 0 283 715 A2
406	09/89	Léger, et.al.	Predefined VLCs for the "Baseline System" (2)
407	09/89	Chair	Correspondence regarding bits needed for delta-DC coding
408	09/89	Webb	Attendance of WG8/JPEG Meeting in Japan
409	09/89	F. Ono, S. Kino	Response to the "Comments and Questions regarding MEL-CODE Source Code" dated Sept. 27
410	09/89	Ono	3bit-flush in arithmetic coding with bit-stuffing technique
411	10/89	Poulsen	Proposal for a new header structure and related matters
412	10/89	Takao	Comments to "DRAFT of the JPEG algorithm" (JPEG-8-R4) [Section 5, Baseline system]
413	10/89	Léger	Comments on JPEG-8-R4, Section 5.6.5.1.1 (generation of all-1-bit Huffman codes)
414	10/89	Poulsen	Suggested Editorial changes to JPEG-8-R4
415	10/89	JPEG Chair	JPEG Ad Hoc Arithmetic Coding Meeting Announcement

ANNEX 2, p. 3

416	10/89	Rabbani, et.al.	Review and validation of MEL-coder documentation and source code
417	10/89	Rabbani, et.al.	Recommendation for selection of an Arithmetic Coder for the JPEG Extended System
418	10/89	JPEG Chair	Letter to ANT Concerning Patents

ANNEX 2, p.4

JPEG
JOINT PHOTOGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-4.8-R1
6 November 1989

Source: Chairman (G. K. Wallace, Digital Equipment Corporation)
Title: Document Register JPEG-419 thru JPEG-458

This register contains all documents submitted at the Japan JPEG meeting.

JPEG No.	Issued/Rev'd	Source	Title
419	10/89	ANT	Letter Concerning Patents
420	10/89	Wallace	Globecom '89 Pre-print
421	10/89	Vaaben	Letter on Further JPEG Participation
422	10/89	Gicquel, et.al.	Draft for Progressive Coding, Version A
423	10/89	Léger, et.al.	Evaluation of the extended funtionalities of the ISO-ADCT
424	10/89	Pennebaker, et.al.	Extending the precision range of the Q-Coder
425	10/89	Pasco, et.al.	Overlap of Marker Codes with the Final bits of an Arithmetic Code String
426	10/89	Pennebaker, et.al.	Comparison of Q-Coder and MEL-Coder for the JPEG algorithms
427	10/89	Pennebaker, et.al.	Comparison of the Complexity of Software Implementations of the MEL-Coder and Q-Coder
428	10/89	Pennebaker, et.al.	System Performance with the Huffman Coder, the Q-Coder and the MEL-Coder
429	10/89	Chair	Japan Meeting Agenda
430	10/89	Ad Hoc Committee on A.C.	Proposal for a Single JPEG Arithmetic Coder
431	10/89	Ad Hoc Committee on A.C.	Minutes of the JPEG Ad Hoc Committee on Arithmetic Coder
432	10/89	Hitachi	Patent Status
433	10/89	IPTC	Draft IPTC - ANPA Newsphoto parameters
434	10/89	Omachi	Comments to "DRAFT of the JPEG Algorithm" [Section 4, R, 7, 8, 9]
435	10/89	JAPAN	Selection of Progressive set

436	10/89	Omachi	ADCT coding results for printing images
437	10/89	Omachi	Comments on "Draft for Progressive Coding - Version A -"
438	10/89	U.S. National Body	U.S. National Body Resolutions to WG-8 (JPEG Resolutions)
439	10/89	Hitachi Ltd.	Patent "Video Coder"
440	10/89	Chair	Proposal on JPEG/JBIG Joint Arithmetic Coding Work
441	10/89	IPTC-NPDWP	Submission of Test Images by IPTC for JPEG Test
442	10/89	Chair	Proposal for Non-Hierarchical Progressive
443	10/89	IT8	Fax from Tom Dunn (IT8) to H. Yasuda Re. IT8 Images for JPEG Test
444	10/89	Sebestyen	Liaison Statement to CCITT Q14 SGVIII
445	10/89	Editing Committee	Editing Committee Agreements, Part I
446	10/89	Editing Committee	Proposal to Reduce Size of Huffman Tables
447	10/89	Hamilton	Proposal on EOB-Runlengths
448	10/89	Guerillot	IPTC Liaison Presentation
449	10/89	Test Image Committee	Chart on Test Image Plan
450	10/89	Editing Committee	Editing Committee Agreements, Part II
451	10/89	Poulsen	Examples
452	10/89	JPEG	Time-Line for Validation Testing
453	10/89	Chair	Accomplishments of JPEG Japan Meeting
454	10/89	Chair	JPEG Japan-meeting Recommendations
455	10/89	JPEG	Homework Assignments
456	10/89	IPTC-NPDWP	Need for Error Detection Codes
457	10/89	Editing Committee	Editing Committee Agreements, Part III
458	10/89	JPEG	How to Generate Default VLC Tables

ANNEX 3, P. 1

JPEG
JOINT PHOTOGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-429-R1
October 16, 1989

Title: JPEG Agenda: Japan
Source: JPEG Chair

JPEG AGENDA: JAPAN

• Opening, Welcome, Remarks	
• Document Distribution	
• Review Stockholm Meeting Report	
• Liaison Reports	
- CCITT	JPEG-379, 444
- ODA	JPEG-380
- MPEG	JPEG-382
- National Body Reports	
* US	JPEG-438
* Other	
- IPTC	JPEG-433
- ETSI	
- Other?	
• JPEG Status Reports	JPEG-387, 388, 389, 390, 399, 402, 403, 408, 421
• Patent Issues	JPEG-377, 405, 418, 419, 432
• Publicity, External Communications	
- Papers	JPEG-378, 391, 392, 393, 420
- Future: PCS, Other?	
• Arithmetic Coding Issues	JPEG-383, 384, 385, 386, 394, 395, 396, 397, 398, 409, 410, 415, 416, 417, 424, 425, 426, 427, 428, 430, 431, 438
• Baseline System Issues	JPEG-401, 406, 438
• Progressive-Buildup Issues	JPEG-411, 422, 423, 435, 437
• Editing Committee	JPEG-381, 400, 407, 412, 413, 414, 422, 434,

ANNEX 3, p. 2

437

- Test Image Committee — JPEG-404, 436, 441, 443
- Schedule Toward Standardization
- Other Technical Issues
  - Extended Precision — JPEG-438
  - Ind Function — JPEG-438
- Validation Procedures

JPEG-440

CHAIRMAN'S PROPOSAL ON JPEG/JBIG JOINT ARITHMETIC CODING WORK

THE WG8 CONVENOR HAS EXPRESSED TO ME THE DESIRABILITY OF ULTIMATELY HAVING, IF TECHNICALLY FEASIBLE, A COMMON ARITHMETIC CODER FOR JPEG AND JBIG. HOWEVER, JPEG MUST PROCEED ON A SCHEDULE INDEPENDENT OF JBIG. THEREFORE, I PROPOSE:

(1) JPEG SHOULD ADOPT, TENTATIVELY, THE ARITHMETIC CODING PROPOSAL OF THE JPEG A.C. AD HOC GROUP.

(2) AFTER JBIG MAKES ITS A.C. DECISION, BASED ON TECHNICAL CONSIDERATIONS OF THE JBIG CODING ENVIRONMENT, THERE SHOULD BE FORMED A JOINT JPEG/JBIG A.C. AD HOC GROUP, TO EXAMINE EACH GROUP'S A.C. IN THE OTHER GROUP'S ENVIRONMENT.

(3) IF THE JOINT AD HOC GROUP AGREES THAT ONE A.C. WILL SATISFY BOTH GROUP'S REQUIREMENTS, AND IS BETTER THAN OR EQUAL TO EACH GROUP'S OWN A.C., THEN JPEG SHOULD SERIOUSLY CONSIDER ADOPTING A CONSENSUS RECOMMENDATION OF THE AD HOC GROUP TO ADOPT A COMMON A.C.

JPEG

ANNEX 5

JPEG
JOINT PHOTOGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-442
October 18, 1989

Source: JPEG Chair
Title: Proposal for Non-Hierarchical Progressive

SET A

- "New" Spectral Selection

SET B

- "New" Spectral Selection
- Successive Approximation
- For Slices with a band, after 1st AC slice, all slices are 1 bit only

COMPONENT INTERLEAVE ONLY

NOTES

- Set-A Decoders can (if they want) decode MSbits Successive-approx. scans of of Set-B images (but only have to do DC + 1st-AC scans)
- (Set-A is subset of Set-B)
- AC-Prediction can be done at decoder, if desired
- 2D DC Prediction exists in independent function only

ANNEX 6, p. 1

JPEG
JOINT PHOTOGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-455
October 1989

Title: Homework assignments from Japan meeting, October 1989
Source: JPEG Chair

WP • Send out document with thorough description of header, *(specify byte order for multi-byte int. [params] i.e. LSByte first)* Plus entire structure of coded image

GW • Detailed Description of Base-system
Validation Tape: *Specify Bit-Order-Within-Byte for Tape exchange*
- Complete Header
- Custom Tables Only *(with 12-bit & ESC Proposal)*
- CCIR-601 Image
- Block Interleave to Fr. Interleave
- Resync Markers *(Same data, end of BA block row)*

WP • Creation of 1st Tape

EH • Verification of 1st tape

AL • New VLC Tables *(12-bit proposal, if feasible)*
• Distribute VLC Tables

• Tape with other examples of Base-System, and description of contents:

MN - CMYK, with Fr. Interleave
AL - Default VLC Example *Tables from 8-bit pixel, not final Default*
2 Images:
(1) Defaults as custom
(2) Default Syntax

• Tapes for Extended Operations & Description
*WP/FO or Japan - A.C., Baseline System *(& Trace Data)*
*HP/AL/S-S - Progressive Huffman: Spec-Sel only; S-S+S-A *(GW goal)*
WP - Progressive A.C. For Above
Japan - Hierarchical
WP (AC) - Ind. Lossless

ANNEX 6, p. 2

GW	•	Write outline for DP; Circulate for comment to JPEG
GW/Ed-com	•	Write draft of DP; make available before next JPEG Meeting
WP/Ed-com	•	Write JPEG-8-R5, Incorporating Japan agreements
GW	•	Coordinate test image committee
GW	•	Write: Japan, Stockholm meeting reports; circulate by mail for approval
MN/GW	•	Draft replies to US; Circulate to JPEG for approval
MN/GW	•	Letter to SC18 asking for CIELUV, CIELAB images
AG	•	Draft of glossary
GW	•	Distribute (Express mail/fax) all documents from last two days

ANNEX 7

JPEG
JOINT PHOTGRAPHIC EXPERTS GROUP
ISO/IEC JTC1/SC2/WG8
CCITT SGVIII

JPEG-452
October 1989

Title: Time Line - Validation Testing
Source: JPEG Chair

VALIDATION TESTING

WP	11/10	Description of HDR + Structure
GW	11/10	Description of Base System Validation Tape
AL	11/10	Report on Feasibility (Complexity & Efficiency) of 12-bit-Huffman Proposal
WP & WH	11/30	Create & Verify Base System Validation Tape *Distribute tape to JPEG*
WP & FO	12/15	Create and Verify Base System & A.C.
AL	12/15	Distribute Def-VLC Syntax tape
HP Create	1/15	Progressive Huffman Tape
MN	1/15	Create CMYK,RGB Tapes
MN/Japan	1/20	Verify CMYK,RGB Tapes
HP/AL/GW	1/30	Verify Prog. Huff tape: S-S A.L.; S-S+S- A.G.W.
Japan	1/30	Create Hierarch Tape
WP	1/30	Create Ind. Lossless Tape (A.C.)
WP	1/30	Create Progressive, A.C.

OTHER WORK

WP/Ed-Committee	12/15	JPEg-8-R5 Ready
GW	11/20	DP Outline, 1st for comments
GW	12/15	Revised Outline, 1st for comments
GW/Ed-committee	1/30	1st Draft D.P., for comments
AG	1/30	Glossary Draft

ANNEX 8

JPEG-454

JAPAN MEETING:
JPEG RECOMMENDATIONS TO WG8

JPEG RECOMMENDS:

(1) THAT WG8 ADOPT THE MAJOR TECHNICAL DECISIONS MADE BY JPEG, CONCERNING:

- ARITHMETIC CODING *
- PROGRESSIVE MODE
- EXTENDED PRECISION
- BASELINE SYSTEM

THESE ARE THE ONLY MAJOR ISSUES THAT WERE OUTSTANDING, AND JPEG WOULD LIKE TO PROCEED WITH VALIDATION TESTING AND DP DRAFTING

* SUBJECT TO REVIEW BY JPEG/JBIG AD HOC A.C. COMMITTEE, AS DESCRIBED IN JPEG-440.

(2) RELEASE OF JPEG-8-RS, THE TECHNICAL SPECIFICATION THAT WILL INCORPORATE THE JAPAN MEETING DECISIONS, TO WG8 AND CCITT, AND EXTERNAL EXPERTS, ON TARGET DATE 12/15/89.

(3) THAT TARGET MEETING FOR REVIEW & APPROVAL OF DRAFT VERSION OF DP BE NEXT (FEB/MAR) JPEG MEETING.

(4) THAT WG8 EXTEND JPEG'S SINCERE THANKS TO JVC, MATSUSHITA FOR EXCELLENT FACILITIES AND HOSPITALITY, AND TO ALL WG8 JAPAN COLLEAGUES FOR SUCH WONDERFUL HOSPITALITY AND MEMORABLE VISIT.

EXHIBIT 11



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Admitted to practice in California

August 8, 2006

OUR FILE NO. 223612-25

VIA EMAIL & OVERNIGHT MAIL

Richard Clark
Managing Director, and Chair IST/37
Elysium Ltd.
Milton House, Whitehill Road
Crowborough
East Sussex TN6 1LB

Re: Philips Intellectual Property & Standards GmbH v. Kodak GmbH
U.S. Philips Corporation v. Eastman Kodak Company

Dear Richard:

My law firm represents Kodak GmbH and Eastman Kodak Company (collectively "Kodak") in two patent infringement actions recently brought by Philips Intellectual Property & Standards GmbH and U.S. Philips Corporation (collectively "Philips") in Dusseldorf, Germany and Delaware, USA. The lawsuits allege that certain Kodak products infringe European patent EP 0 260 748 B1 and U.S. Patent No. 4,901,075 ("the Vogel patents"). Philips also alleges that ISO/IEC International Standard 10918-1 ("the JPEG Standard") specifies certain methods for coding digital signals that are covered by one or more claims of the Vogel patents.

We are investigating involvement by Philips (and its parent, subsidiaries and related entities) in the development and adoption of the JPEG Standard. In addition to Philips' involvement in ISO and CCITT committees, we understand Philips participated in the IST/37 committee that reviewed and considered the JPEG Standard before its formal adoption in 1992. We also understand that Dr. Simon Turner of Philips Research served as the Chair of IST/37 during the adoption timeframe and, as such, appears to have had the responsibility of signing off on the British version of the JPEG Standard. We further understand that Philips voted—during the Fourth Meeting of IST/37 in June 1992—to approve the draft that eventually became the JPEG Standard and that Philips did so without disclosing the Vogel patents to IST/37.

In light of these facts, we respectfully ask that you—in your capacity as the Chair of IST/37—request the permission of IST/37 to provide us with the following documents: (i) a copy of the meeting report for the Fourth Meeting of IST/37 in June 1992, including any corresponding attachments or attendance lists, (ii) a copy of the UK published version of the JPEG Standard, including any corresponding appendices of participants, contributors, and/or disclosed patents, and (iii) a copy of any patent disclosure policies that applied to IST/37 and its members during the 1990-1993 timeframe.

DLA PIPER RUDNICK GRAY CARY

We look forward to your prompt response. Please let us know if you have any questions. If we can provide any additional information to help IST/37 consider this limited request, we are happy to do so.

Sincerely,

DLA Piper Rudnick Gray Cary US LLP

Bruce M. Watrous, Jr.

SD\1668947.2

Shipment Receipt

(Keep this for your records.)

Transaction Date 08 Aug 2006

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San Diego CA 92101
UNITED STATES

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EXHIBIT 12

DLA PIPER

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January 24, 2007

OUR FILE NO. 223612-25

VIA EMAIL & INTERNATIONAL MAIL

Richard Clark
Managing Director, and Chair IST/37
Elysium Ltd.
Milton House, Whitehill Road
Crowborough
East Sussex TN6 1LB

Re: Philips Intellectual Property & Standards GmbH v. Kodak GmbH
U.S. Philips Corporation v. Eastman Kodak Company

Dear Richard:

This letter is in follow up to Mr. Watrous's August 8, 2006 letter. Unfortunately, my office has not received any response from IST/37 in connection with our prior request for documents relating to Philips' participation in IST/37's consideration and adoption of the JPEG standard. In particular, we are interested in a copy of the Meeting Report or any minutes relating to the Fourth Meeting of IST/37 in June 1992, including any corresponding attachments or attendance list. Of course, any other documents relating to Philips' participation (in particular Dr. Simon Turner and Dr. John Morris) in the review and formal adoption of the JPEG standard by IST/37 would also be greatly appreciated.

DLA PIPER

We respectfully ask that you reiterate our request for these materials to IST/37. Please let us know if you have any questions. If we can provide any additional information to help IST/37 consider this limited request, we are happy to do so. We look forward to your prompt response.

Very truly yours,

DLA Piper US LLP

Jesse Hindman
Associate

Admitted to practice in California

JH:bkl

SD\1681527.1
223612-25

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Jesse Hindman
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13 February 2007

BY EMAIL AND MAIL

Dear Mr Hindman

RE: Phillips Intellectual Property & Standards GmbH v Kodak GmbH
U.S. Phillips Corporation v Eastman Kodak Company
Your file Number: 223612-25

I am a lawyer in the BSI legal department.

Your letter of 24 January 2007 to Mr Clark, as chair of IST37 was passed to me for review and response.

IST37 is a BSI committee. Custody of minutes and related documents produced by BSI committees lies with BSI and accordingly any decision regarding release of such documents rests with BSI.

I note your request for copies of certain documents as set out in your letter.

I have to advise you that BSI's policy is not to provide committee documents to third parties and it is therefore unable to meet your request.

Yours sincerely

A L J Thomas
Commercial Lawyer

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