

IT/00-0300

NCITS W1 2000-0166

Project Proposal Concerning Determination of Image Quality For Printer Systems

1. IDENTIFICATION OF PROPOSED PROJECT

- 1.1 TITLE: Image Quality For Printer Systems**
- 1.2 DATE SUBMITTED: 9 March 2000**
- 1.3 PROPOSER: NCITS W1**

2. PROCESS DESCRIPTION FOR THE PROPOSED PROJECT

- 2.1 PROJECT TYPE: D development within NCITS**
- 2.2 TYPE OF DOCUMENT: Not yet fully determined -- The working group will produce a document that is a standard, but may also produce a supplemental technical report if a report would be an effective means of communicating image quality concepts.**

2.3 DEFINITIONS OF CONCEPTS AND SPECIAL TERMS

The intent of this work is to create reference standards that would include three major elements:

Element One: Precisely defined measurement procedure(s) for each objective metric. These metrics are intended to be appearance-based rather than technology-based. The work on individual metrics will be done with the clear intent to combine them into broad visual attributes.

Element Two: Test images from which the defined measurements can be obtained.

Element Three: A correlation of the defined and measured attribute with visual assessment. This step is a validation of the process.

2.4 EXPECTED RELATIONSHIP WITH APPROVED REFERENCE MODELS, FRAMEWORKS, AND ARCHITECTURES

It is expected that the document will be related in form and character to the descriptions of ISO International Standard (IS) 13660 - 2000, but will be more extensive in scope. ISO 13660 is concerned only with binary black text. The proposed document will consider the black and color output of printers that may be both binary and gray level imaging.

2.5 RECOMMENDED NCITS DEVELOPMENT TECHNICAL COMMITTEE: NCITS W1 (Office Equipment)

2.6 ANTICIPATED FREQUENCY AND DURATION OF MEETINGS:

It is expected that much of the work of the committee will be conducted using email and bimonthly telephone conferences. An annual meeting in-person meeting will be held probably in conjunction with the annual Spring W1 committee (in-person) meeting. In addition, working groups will meet as necessary and convenient in conjunction with other well attended industrial meetings with an image quality focus such as the Imaging Science and Technology (IS&T) "PICS" conference.

2.7 TARGET DATE FOR INITIAL PUBLIC REVIEW (MILESTONE 4): January 2002

2.8 ESTIMATED USEFUL LIFE OF STANDARD: Indefinite (over 10 years)

3. BUSINESS CASE FOR DEVELOPING THE PROPOSED STANDARD:

3.1 DESCRIPTION

The perceived quality of a printed image is governed by the visual characteristics of the image not by material's or engineering specifications. Examples of these visual characteristics are sharpness, color rendition and graininess. These visual characteristics are related to

objective metrics by vision models or through psychometric scaling. The connecting relationship gives information on how changes in the magnitude of the objective metric affect the visual characteristic. Various visual characteristics of an image can be combined into broad based attributes that characterize perceived image quality.

The technical work proposed here will address three vital steps in quantizing image quality: a) the careful specification of an objective metric related to the quality of the image and the measurement process by which it can be obtained, b) a specification of a test image from which the objective metric can be obtained, and c) determining the relationship between objective metric and visual attribute. Therefore, the committee will produce a standard that identifies key metrics, defines measurement methodology and characterizes the visual significance of the metrics.

3.2 EXISTING PRACTICE AND THE NEED FOR A STANDARD

At present there are no generally accepted standards for specifying image quality with the single exception of the very limited standard ISO 13660. Even with its limited scope ISO 13660 has had a significant impact on the printing industry, indicating a serious need.

There are no technical specifications of the functioning of printers that would allow consumers to reasonably assess the value of printers for their individual needs. Quite the contrary, there exists misunderstood and misused numeric specifications within the industry that mislead the prospective buyer of printers as to the quality that will be produced. One example is the widely used practice of using dpi, dots-per-inch (dpi), to describe image quality. Usually dpi refers to addressability, the spatial frequency with which the exposing device can address the photosensitive film. There is usually no correlation between addressability and image quality as the specification does not take into

account the effects of major elements of the imaging process. Having a well defined standard would eliminate marketing confusion and provide commonly accepted criteria on which printer performance could be assessed.

3.3 IMPLEMENTATION IMPACTS OF THE PROPOSED STANDARD

3.3.1 DEVELOPMENT COSTS

To carry out this project the committee participants will draw on their previous experience or will conduct experiments focused on specific parts of the needed information. There will be expenditures of time, experimental effort, and travel to bring this standard to completion. It is not feasible to estimate the magnitude of these costs until the specific scope of the work is defined by the working group.

3.3.2 IMPACT ON EXISTING OR POTENTIAL MARKETS

The existence of an image quality standard will raise the awareness of manufactures as to how they could better meet customer needs and will allow consumers to make more knowledgeable choices. Also, a standard will provide a firm technical basis for their work of evaluation and assessment. Printer manufacturers would benefit from having a fair and equitable assessment of their products that would reward high quality manufacturing.

3.3.3 COSTS AND METHODS FOR CONFORMITY ASSESSMENT

The costs of conformity assessment can not be estimated at this time as the model for conformance or use of the standard has not yet been determined. It is possible some manufacturers may use specifications in marketing. Others may use the data supplied by independent laboratories or consultants. Sophisticated companies may extend their own internal analytical capability. At any rate, an image quality specification would not force compliance since there is no defined numeric goal. The image quality measurement methods proposed for development would provide tools to describe and compare competitive products.

3.3.4 RETURN ON INVESTMENT

Image quality standards generally available and used would encourage manufacturers to use sound methodology and evaluation tools in developing their products which would ultimately lead to better products developed faster. The consumer obviously benefits from quality products fairly represented in the analysts literature and marketing.

3.4 LEGAL CONSIDERATIONS

3.4.1 PATENT ASSERTIONS

The methods of measurement required to produce the data on which standards can be based is generally available in the open technical literature. No unique process or technique that is patented or could be patented would be considered for a standard. In addition, the methods of combining visual attributes into overall quality, some of which may be considered proprietary, will be considered.

3.4.2 DISSEMINATION OF THE STANDARD

Drafts of the standards document will be exchanged and distributed electronically. No hindrances to the distribution of the document are known or anticipated.

4. RELATED STANDARDS ACTIVITIES

4.1 EXISTING STANDARDS

ISO IS 13660 is an existing standard which contains measurement methods for a number of print quality characteristics. It was developed with goals similar to the goals for this project and uses an overall scheme similar to the approach described above.

4.2 RELATED STANDARDS ACTIVITY

In addition, ISO/IEC JTC1/SC28 has currently active projects to extend ISO IS 13660 with additional calibration approaches and also has a project to include a banding metric. The proposed work described here is complementary rather than competitive with the current work.

4.3 RECOMMENDATIONS FOR COORDINATING LIAISON

There is no known committee pursuing similar or strongly interacting objectives. However, the interest on the part of groups such as those within the Commission Internationale de L'Eclairage (International Commission on Illumination ---- the "CIE") will be ascertained.

4.4 RECOMMENDATIONS FOR CLOSE LIAISON

W1 will maintain close connection with SC28 where a parallel effort is being proposed. As the US TAG to ISO/IEC SC 28, W1 established liaisons with the ISO Technical Committee TC171 (document applications) US TAG, administered by the Association for Information and Image Management (AIIM) International of Silver Spring, MD.