

## Digital Data Exchange Standards (DDES) for the Graphic Arts Industry

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### Abstract

Less than a year ago we presented a paper at the TAGA national meeting in St. Paul entitled *The Issue of Standards for Electronic Prepress* (1), in which we presented our technical views on the needs and requirements for developing digital data exchange standards to facilitate the exchange of digital information between electronic prepress systems supplied by different manufacturers.

In conjunction with preparing this technical presentation we examined many of the evolving digital standards from many different industries, (e.g., GKS, CGI, CGM, PHIGS from the computer graphics industry; ACR/NEMA from the medical imaging world; IGES from the CAD/CAM industry) and found that although some of these evolving standards may have pieces to contribute to an overall DDES for the graphic arts industry, none of them, in our professional opinion, would suffice to serve as a complete exchange standard for the graphic arts industry. Subsequent to our continued investigations in this area this is an opinion that we maintain.

Today's paper is a report on the formation and progress of the **DDES Vendor Group**; a group that formed shortly after the 1985 *Lasers in Graphics Conference* to address the particular needs and concerns of developing digital data exchange standards for the graphic arts industry.

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Its particular focus is on the technical aspects of the **User Exchange Format** (UEF) for the exchange of color picture data between multi-vendor color electronic prepress systems (CEPS).

There were several reasons for addressing the issue of color picture data exchange as the DDES Vendor Groups first priority:

1. Color picture data bases have enormous requirements (e.g., 30 megabytes to store one 8-1/2 x 10 inch, four color image).
2. The databases of these four (and more) color images are still at the beginning stages of development, (a condition which we expect to see change rapidly).
3. There are a comparatively limited number of vendors directly involved with the development of color picture data bases for the graphic arts industry.

Our hope was that the aforementioned conditions would allow us to make fairly rapid progress in the development of a color picture data exchange format under the DDES activity, and to then proceed to Line Art and Geometric Art.

### **The DDES Vendor Group**

This group, representing the major suppliers of color electronic graphic arts prepress equipment, and their individual company managements, are owed a depth of thanks from the graphic arts industry for the spirit of cooperation and deep level of commitment they have contributed to the task of developing DDES for the graphic arts industry.

The level of commitment is apparent from the individuals each company has selected to be a member of this group. It is indeed gratifying to have the priviledge of working with a collective group that represents much of the high level expertise in the technical issues of color electronic prepress today. Part of the thanks owed to these vendor companies by the graphic arts industry is that these companies have chosen to dedicate the time of these top flight individuals to the task of developing

DDES.

Further, participation in the DDES Vendor Group has been of a purely voluntary nature. At each meeting we bring together an international body with representatives from England, Germany, Israel, Japan, and the United States. At each meeting of the DDES Vendor Group each company involved, including our own, has freely contributed the time of the participating individuals and the costs involved not only with having representatives present, but also the time involved with the development of various work projects assigned by the group in the development of DDES.

We have been working quietly and diligently toward the goal of developing digital data exchange standards for the graphic art industry.

In doing so we have kept sight of one of the initial premises of this activity, i.e., that "in order to be ultimately successful, digital standards for the graphic arts industry must emulate the attributes of film" (1). We identify some of these attributes as:

- Protects Against Memory Failure
- Easily Transportable
- Multi-Company Production on Same Job
- Printing Plate Re-Make
- Mature Archiving
- Contone and Halftone
- Changeable
- Physical

And why have we, the DDES Vendor Group been pursuing this activity? Partially because the vendors and users of electronic prepress equipment believe in the validity of the statement that we made here one year ago...

"As the proliferation of electronic systems withing the graphic arts industry continues, the need for a standardized information exchange format between different systems is going to become imperative to maintain a cohesive production flow through this industry's segmented work cycle. Further, in order for the design and manufacturing of images to

continue with any degree of freedom and flexibility the electronic tools which are employed in the process must begin to provide a degree of system compatibility. If this does not begin to transpire the progress currently being made in the area of electronic prepress will falter, leaving current electronic prepress installations trapped within the industry's existing framework as isolated and expensive islands of automation," (2).

Without the user's and the vendor's realization of the need for DDES to continue the development and growth of electronic prepress within the graphic arts industry I would be standing here today with nothing of any significance to report.

However, it is with a deep sense of gratitude to all parties concerned that I am pleased to report to you of the progress made by the DDES Vendor Group to date, with particular emphasis on the technical aspects of the User Exchange Format (UEF) for color picture data.

#### **DDES -- Background**

After our presentation at TAGA one year ago our company forged ahead with the vision and perceived need of developing digital data exchange standards for the graphic arts industry. In conjunction with the *1985 Lasers in Graphics/Electronic Publishing in the 80's Conference* we held a user/vendor panel on the issues and needs of developing DDES (3).

Participating Users included:

James D. Hitchman  
Assistant Vice President, Production  
Ottaway Newspapers, Inc.

Murray Oles  
Electronic Systems Manager  
Batten Graphics

Eric Bernstein  
Vice President, Manufacturing  
The Kordet Group

Richard Dannenberg  
Vice President  
Progress Graphics

Richard Littrell  
Manager, Electronic Production Systems  
Magna-Graphic Inc.

John Werner  
Director of New Product Development  
Publishers Phototype International, Inc.

Representatives from the Vendor Companies included:

Ralph Kennedy  
Chemco Photoproducts

Jim Thrush  
Gerber Scientific Instruments Co.

Ken Cloud  
Scitex America Corp.

Andrew Masia  
Eikonix Corp.

Ed Chrusciel  
Hell Graphic Systems

George Howard  
Crosfield Electronics

Gary Lefebvre  
Dainippon Screen Mfg., Co., Ltd.

In addition to the panel discussion, Dunn Technology Inc., (DTI) conducted a survey of the audience in regards to their perceived interest in the issue of DDES. This audience, which consisted of vendors and users both, responded to our questionnaire with some rather astonishing results:

"One hundred percent of the LiG audience survey respondents believe that in order for users to maximize their investment in electronic prepress the user needs to be able to interface some equipment from different vendors."

"Ninety-nine percent of the DDES survey respondents agreed that the industry needs to interface a variety of electronic prepress equipment in order to fully automate the prepress production process."(4).

A tentative schedule was established at *Lasers in Graphics* in which it was agreed that the vendors would meet in December to discuss and begin the implementation work of DDES via magnetic tape.

The reason for selecting magnetic tape as the initial medium used for the exchange of vendor data was that it was believed that this approach would be perceived as the least threatening to the vendor community, while at the same time providing a route for the initial exchange of digital information between multi-vendor systems.

The first DDES Vendor Group meeting was held in December of 1985. Representatives from the following companies were present:

Chemco Photoproducts

Crosfield

Dainippon Screen Mfg., Co. Ltd.

Eikonix Corp.

Gerber Scientific

Hell GmbH

Hell Graphic Systems

Sciex Corp.

At this meeting each company present exchanged what heretofore had been regarded as the proprietary information regarding its magnetic tape format with every other company present. Technical presentations on the documentation were provided to the group by representatives from each company.

This rather free-flowing exchange of information among some of the best color electronic prepress system experts in the world has been one of the significant contributing factors to the progress this group has made to date. Further, it was **this technical documentation, which provides information on how today's color electronic prepress systems operate, which provided the base-line data for the development of the User Exchange Format (UEF).**

In developing its work task priorities at the December meeting the DDES Vendor Group decided that it would first address the issues involved with exchanging color picture data. The group's next considerations would then be developing a format for the exchange of geometric and line art considerations.

#### **The User Exchange Format - UEF**

At the February 1986 Vendor Group meeting an additional company (3M/Comtal) joined the group.

The meeting, which ran for two days, focused on the development of the **User Exchange Format (UEF)** for the exchange of color picture data between multi-vendor systems.

It is perhaps important to point out here that every decision made by the DDES Vendor Group is based on consensus, with each company present having an equal vote on all the issues.

Thus, the UEF, which all vendors agreed to, is reflective of the entire groups best judgement on how a color picture exchange format should be structured, based on an understanding of how all major CEPS systems operate in today's products.

## **Approved DDES Preliminary User Exchange Format (UEF)**

The User Exchange Format (UEF) is a convenient path to exchange color picture data between color electronic prepress systems, and has not been designed as a generalized device driver.

The preliminary UEF will use a subset of the ANSI tape recorder format (X3.27-1978). It is not the intention of the DDES Vendor Group to support the full X3.27. The final format is to be agreed to by the DDES Vendor Group. However, ASCII characters will be used throughout all common fields in the headers.

**Interleaving:** The UEF for interleaving will be pixel interleaving. Each pixel will be described by one byte per color. Options will be defined for transferring line interleaved and color interleaved files.

**Color Sequence:** The order of the process colors within a four color file is Yellow, Magenta, Cyan, Black (YMCK).

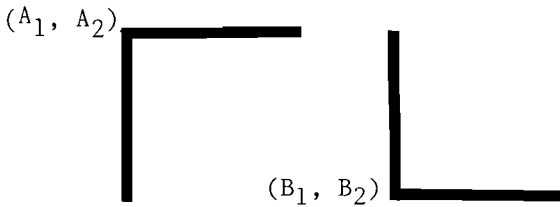
**Number of Colors per Picture File:** The number of colors per file will be four. A methodology will be developed for describing a subset of YMCK within the four color file.

**Number of Picture Files per Image:** Not Applicable.

**Multiple Tape Files:** The UEF will support files on multiple tapes.

**Orientation of Pictures:** The UEF requires that each vendor be able to write one of the following four orientations, and read all of the following four orientations: (A1, A2, B1 and B2).





NOTE: A Header Notation will describe which orientation is written.

**Color Value Description:** The color values of each color in a file will be described in printing dot percent in an 8 bit byte (0-255). The dot percent will be linear with respect to 0 to 255 and will be defined by the integers of 0 percent and 100 percent dot and their respective bit levels.

**Allowable Data Block:** The standard UEF block size is 8K byte, with non-UEF options to be defined.

1600 Phase Encoded and 6250 GCR: Both of these tape format (BPI Magnetic Tape) supported by UEF.

In agreeing to these formats the participating DDES Vendor Group has agreed to support all UEF functions by both reading and writing to tape the specified data. Non-UEF functions within UEF will currently be supported at the option of the individual vendors (these are options to the UEF).

It is the intention of the DDES Vendor Group to refine the preliminary UEF based on further discussions and experience in the initial user testing. It is not the intention of the group to change the actual picture formats as agreed to, unless a generally serious recognized flaw is discovered in

the UEF.

It is also the intention of the DDES Vendor Group to develop generalized formats for applications and device technologies that require formats other than the UEF. These DDES formats are for the interchange of data within a hybrid Color Electronic Prepress System or network of systems. These Device Exchange Formats (DEF) will be developed by the group at future meetings, and implemented as a superset, or extension, of the User Exchange Format (UEF).

### **Continuing the Progress**

Immediately following this meeting the DDES Vendor Group will again be meeting. Agenda items for this meeting include writing the header file description for the UEF with the goal of the meeting being to prepare the UEF with header files for distribution.

Discussions on considerations for scanned line art will also begin at this meeting, with geometric art discussions beginning at the May 9, 1986 DDES Vendor Group meeting to be held in Dusseldorf, Germany in conjunction with the **DRUPA** conference.

### **Thoughts on the Future**

With the initial success of DDES in the area of an agreement on the User Exchange Format for color picture data; and assuming successful implementation and general acceptance of UEF, the inevitable question arises -- What Next? (This is not a trivial question).

In venturing forth from these initial successes it is important to understand the current accomplishments and background.

First of all, the DDES activity deliberately attacked the color picture data first for the simple reason that we were aware that the color picture data for offset printing was stored and output in fairly similiar formats by the vendors of the systems. Thus we embarked on a program to get agreement through concessions from these vendors to a standard format. During this process we had one overriding guiding

principle--which was to not degrade the accuracy (signal to noise and useful range) of the data as it existed in any given system. To our knowledge this was preserved through the method of transferring the dot percent values. There remains an issue in our minds of the round-off error generated should a given set of picture data be transferred multiple times between systems that store 200 levels for 0 to 100 percent dot and systems that store 256 (or 255) levels for 0 to 100 per dot.

Our second guiding principle was to have as few options within UEF as could be negotiated amongst the vendors, while providing a sufficiently flexible transfer of the image data. Here we did not achieve as tight a result as might be desired in the area of picture orientation. However, we also believe that since only simple 90 and 180 degree rotations are involved it was not considered to be burdensome. The use of four orientations, especially where several system to system pairs would have required a rotation into UEF format and a rotation out of UEF. As written the orientation part of UEF will require only one rotation of 90 or 180 degrees between any two of the current systems, thus eliminating the potential of dual rotation between several system to system pairs where a rotation into a single UEF orientation format and a rotation out of UEF would have been required.

Finally, in developing UEF another criteria was to be able to write a UEF file without any prior knowledge of the next system to use the data; (i.e., that special "hooks" not be written in to facilitate the acceptance of the data by any one existing system to the possible exclusion of the others.) We believe this has been accomplished.

The tape recorder format was chosen as the most likely format that would appear to be the least threatening to the vendors. It was an approach in which some of the vendors were already working, i.e., to read each others tapes. Even though we sincerely hope that UEF goes well beyond the slow and cumbersome magnetic tape format we feel that learning to walk before running was the best approach to getting initial cooperation. Further, as each vendor sees the value (both in reduced software costs and increased overall market size) of DDES as initially implemented for color pictures on magnetic

tape, cooperation for direct system interfaces, device interfaces, and additional data standards for more of the Digital Data in Prepress will be forthcoming.

But, let no one misinterpret the progress: The progress has been very rapid and substantial. We have reached agreements no one thought possible to be able to achieve less than one year ago.

On the other hand, we expect that future progress will be more difficult. We expect more vendors to be involved and with that exists a higher level of threat to the emergence of vested interests. Further there are more difficult technical issues to be resolved in which there exist a greater variety and diversity of formats currently in use.

The DDES Vendor Group has set as its priorities, beyond the picture subset of UEF, scanned line art and geometric art (in that order). In these areas the issues immediately become more complex; especially when one considers the evolving interfaces between color picture systems and monotone text and graphic systems. So let's back up a little and try to take a look at the bigger picture:

If we assume color pictures are being controlled by UEF, then we hope that a subset of the UEF standard for color pictures can be used for monotone pictures. Only time and discussion with the monotone vendors will tell. This is not an effort to convert color pictures to monotone, for which good techniques exist, but merely to provide a standard format for monotone pictures.

Regarding compression of digitized continuous tone pictures: The vendors will consider this an evolving and very proprietary area of development. Some pressure will be building for common compression techniques in this area from multi-site, multi-vendor transmissions and common archiving media types of applications, but standarization of contone picture compression is not likely in the near term.

Scanned line art is typically stored in data compressed form, generally a form of run length code. Here, we believe

a definition of line art as a one-bit deep plane will be sufficient (whether or not separate color attributes are assigned to the art). This definition tends to preclude the consideration of gray scale for visually smoothing the edges of line art. The hope with scan line art is that sufficient commonality exists amongst the color system vendors to reach early agreement in this area. But here the interface to traditional monotone systems becomes more important and thus it is likely that further discussions will be needed with the monotone group of vendors if widespread transfer of compressed line art data is to be achieved under one format.

An underlying hope is that vendors may be able to agree on the coding schemes that are being reduced to the chip level, such as CCITT Group IV.

Here the chip would be the driving force to achieve widespread agreement. Obviously the overriding desire would be for the chip to run at disk transfer rates--which is not yet a reality.

Geometric art is difficult at the outset. What, for example is the definition of geometric art? The current DDES vendor group is primarily concerned with the interface between the CAD/CAM stripping and mask cutting systems and the color image processing systems. From this viewpoint geometric art will be somewhat easier to define. In the broadest sense a definition would include all of the possible functions used by any of the vendors.

Unfortunately, even though geometric art may be definable for the narrower application, the individual vendors involved in this application have all independently described these features without resort to any of the computer graphic standards in existence. More than one vendor claims that the overhead associated with these standards is too burdensome (time consuming).

Geometric art can be considered as any graphics generated by the software and generally speaking, vector graphics. These are descriptions of the masks, borders, rules, shrinks/spreads, etc., that are the basic stripping guides for a page. But problems arise such as: if one includes tints, then what about vignettes--both are routinely described by the software.

Beyond these issues, the geometric art being discussed is the instructions that strip the page. This leads to the question of how this encroaches on page description languages, or further, can page description languages be used for some parts of this task.

At the same time, now that page and document description languages have surfaced, will the sponsors of these device independent languages adopt UEF for the color data they are claiming they can already handle efficiently?

Once we get to this level we bump into the issue of standardized type -- for a solution to this we await the second coming of Gutenberg.

It is clear that as the DDES Vendor Group expands its objectives and membership, the issues addressed by this group will also grow more and more complex. With the good will of the vendors (which we continue to believe serves their own self interest) it is sincerely hoped that the DDES group will be able to at least standardize the basic data bases and, along the way, provide efficient interfaces with existing and developing applications oriented languages.

The final goal of the DDES group is to achieve ANSI and ISO recognition for its efforts. To this end the group is actively pursuing various organizational possibilities to provide the umbrella of legal advice and the required secretariate services.

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- (1). **The Dunn Report**, Vol. III, No. 6.5, June 1985, pp. 3.
  - (2). *The Issue of Standards for Electronic Prepress*, **TAGA 1985 Proceedings**, pp. 88 - 95.
  - (3). *Session Two: Digital Data Exchange, 1985 Lasers in Graphics Conference Proceedings*, Vol. 1 - Color Electronic Prepress Systems and Subsystems, pp. 32 - 75-5.
  - (4). **The Dunn Report**, Vol. III, No. 11, November 1985, pp. 4 - 8.
  - (5). **The Dunn Report**, Vol. IV, No. 2, February 1986, pp. 2.