

An Incremental Approach to Scanning and Document Management

by: David J. Wilson

Despite the proliferation of computers, networks and CAD, manually distributed, produced, and revised engineering drawings still dominate much of the design/information used today. Capturing, managing, reproducing, and distributing documentation is a necessity for most organizations including manufacturers, utilities, and AEC firms.

This paper will introduce an incremental approach and an overview of the technologies related to bringing paper assets into CAD, EDM (Engineering Drawing Management) and PDM (Product Data Management) environments. These tools are essential for companies to remain competitive, improve product quality, and meet quality (ISO), regulatory (OSHA) and company rightsizing requirements.

Plan Globally, Invest Incrementally

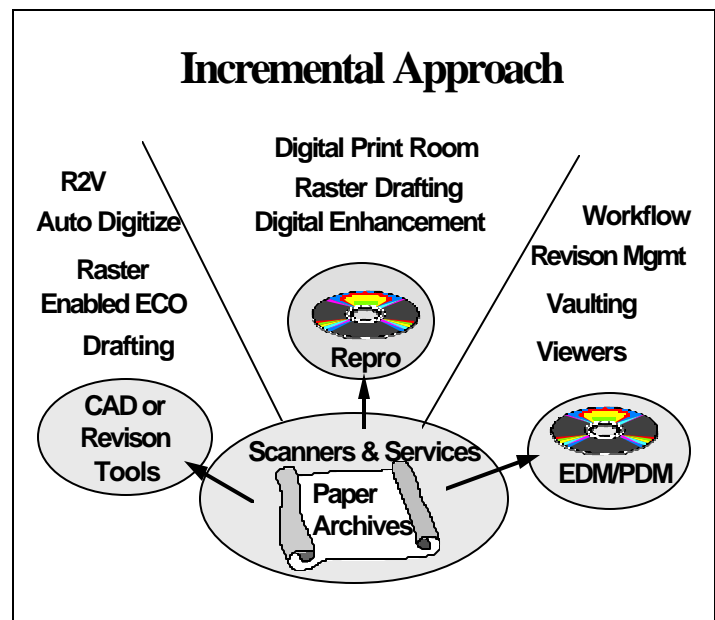
Before deployment of any document automation tools, look at the broader business issues related to the life cycle of paper drawings. Select the most critical and timely issues and implement the appropriate technology. Plan for a gradual implementation of the bigger issues of document management and workflow systems.

Measurable issues with which to start the implementation are an electronic ECO cycle, paper into CAD integration, and vaulting or digital reprographics solutions. This allows for a more critical evaluation of an enterprise EDM/PDM while enabling the initial paper conversion process. Users have more time to model workflows, design

ECO/ECN processes, define security and inter/intranet strategies, and determine other control issues best handled by EDM/PDM.

With long implementation cycles for an enterprise-wide EDM/PDM system, payback and user acceptance can drag and stall throughout the initial stages of a full-scale implementation. Integrating manual paper-based archives as a first step can help to successfully launch such a system. An incremental approach that starts with paper-enabling can produce a more immediate payback and faster end user buy-in.

A paper-enabled approach incorporates elements of EDM/PDM before deploying a full-blown system. This step-by-step process allows initial payback benefits while addressing the larger aspects of integrating multitudes of paper designs into CAD and positioning the company for an electronic dis-



tribution environment.

Drawing value increases along with your existing CAD drafting systems by implementing a hybrid or raster CAD system. This allows scanned archives to be manipulated within the same tool set used for newer design work. The emergence of cost-effective, expandable, and reliable scanning hardware and services makes this a justifiable possibility.

The Costs of Paper

Manual methods for handling, storing and maintaining paper drawings are cumbersome, time-consuming, and costly. The following are some of the most obvious problems with maintaining paper archives:

- ◆ Paper drawings are susceptible to aging and damage over time.
- ◆ Paper is not geometric or accurate in nature.
- ◆ Manual-based revisions are costly, particularly drawings requiring frequent updates.
- ◆ Paper is slow to distribute.
- ◆ Paper driven design environments require more costly change order cycles and more time to prototype.
- ◆ Many transactions between subcontract or supplier companies are inefficiently conducted with paper.
- ◆ Electronic searching is more efficient.
- ◆ Paper is restricted in format, while electronic documents can contain hyperlinks, audio, and video.
- ◆ Paper is static. It can be out of date even before it is distributed because of lengthy release cycles.
- ◆ Facilities costs for paper archives can be substantial.
- ◆ 5 to 7 percent of technical assets are lost or misfiled.

The Transition

The process by which paper drawings are converted into an electronic environment can be accomplished several different ways:

Manual Redraw. Manual redraw means exactly that - just place your drawings on the desk by your CAD system and redraw them from scratch. A complete redraw of the original drawing is, and will always be, time extensive, but the most accurate method of conversion.

Digitizing. Digitizer tablets are a common CAD peripheral. Place your drawing on the tablet and recreate the drawing using basic CAD drafting commands and techniques.

Service Bureau. Outsourcing to Service Bureaus is a common method for handling small jobs, pilot projects, or quick turnarounds. You save on resources and have little to no capital outlay for equipment, but may incur security issues.

Scanning. Scanning archives into compressed raster format allows them to be enabled for faster revisions either in your CAD system or with non-CAD raster/hybrid solutions. This process can be painless and cost-effective. Once the drawings have been scanned, their subsequent value increases as electronic archive opportunities now exist as well as the benefits of revising the drawing with your CAD system.

Your Investment

Moving forward with the technology presented in this paper requires an investment in equipment, resources, and software. These investments include:

- ◆ \$10,000-15,000 for a large format scanner.
- ◆ \$295 - \$595 for viewing software.
- ◆ \$1,000 to \$3,000 for raster or hybrid editing software
- ◆ \$2,000 - \$6,000 for raster to vector conversion software
- ◆ \$1,000 to \$100,000 for mass storage subsystems

- ◆ \$295 - \$3,000 for EDM software per seat
- ◆ Consulting and integration services

Paper Enabling

The paper enabling process has to start with a scan. From here, all the benefits of an electronic environment can begin. These include electronic archiving, viewing and document management, easy revisions, and better payback from your CAD system. The following identifies some of the available choices after scanning.

Digital Reprographics. Many organizations initially look at implementing a digital print-room. This approach sets achievable short-term goals to improve the productivity of the print room and the methodology of making print requests. It also necessitates the implementation of a digital archive and the basic search, view and print functions of an EDM system.

Paper-Enabling PDM. Companies with more progressive implementation strategies may have already installed a PDM system to help manage their existing 3-D modeling CAD / CAE environment. Most PDM systems can be expanded by adding raster-literate viewers and hybrid raster editing systems. This allows paper archives to be managed by the same system that manages the complex CAD models.

Paper-Enabling Revisions & ECO's.

The need to modifying older legacy archives is often a key driver for evaluating scanning alternatives. Some of the different approaches available today using scanned engineering archives are raster drafting, raster to vector conversion, and hybrid editing.

Raster Drafting. Raster editing or drafting is the simplest, most productive, and lowest cost method to modify scanned paper drawings. Raster drafting

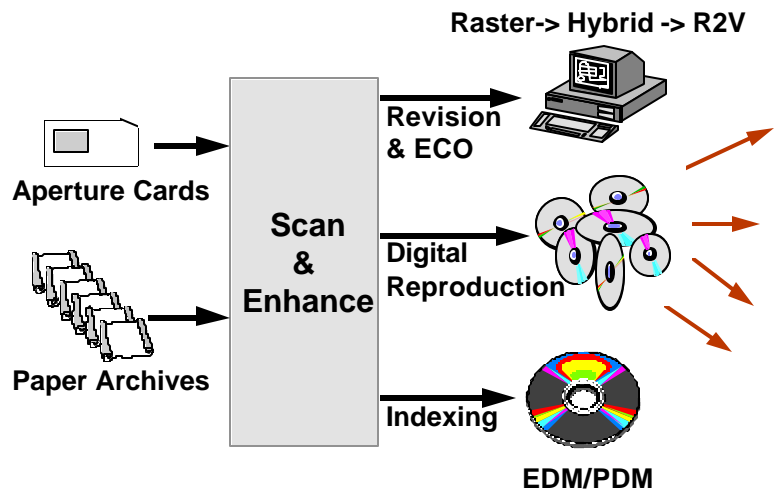
works best when simple updates are required in non-dimensioned or analysis oriented drawings.

More advanced systems are capable of selecting and manipulating raster “entities” just like vector CAD entities. You can even accurately “raster snap” to raster intersections making the editing process even easier. Some specialized features that are available are distortion correction, auto deskew and raster layering.

Raster to Vector Conversion (R2V). Drawings with the highest degree of corporate value are those used within analysis and modeling systems. These need to be in a fully vectorized format to allow for 3-D design, calculations, and planning purposes.

Most users first looking into scanning technology will want to bring paper drawings into their vector CAD environment. However, their expectations for automated conversion are difficult to meet and

Paper Enabling Process



can still implementation.

Conversion software will not produce an unattended 100% conversion. It is best used as a component of the conversion process rather than a

total solution. This is where the hybrid method needs to be understood.

The Hybrid Approach. The most promising revision method for scanned drawings is Hybrid. A hybrid approach is when both raster and CAD (vector) are maintained for a drawing. Changes can be made within either environment (hybrid editing). Information can be exchanged back and forth between the two distinctive formats thus offering the most efficient manner for modifying the old within the added value of CAD.

Deteriorated drawings can be scanned, cleaned up, and stored in raster. Modifications can be made to the drawing in raster, or areas of the drawing can be converted into CAD vectors, if it becomes necessary. This combination of raster and vector can also be plotted and stored.

Working in a hybrid environment allows immediate use of the scanned drawings. Decisions to modify, plot, or vectorize can be made as needed. Investing time and money to convert existing drawings can be done on a “just in time” and just what is needed basis.

Life Cycle Cost Analysis of Various Revision Methods

Scanning

What Is A

A scanner is like a photo instead of p conversion j ment feature deskew and gle most val better end re

Good separa ometry are a

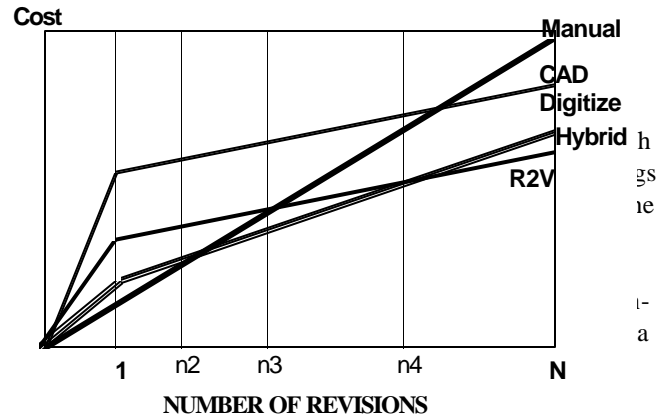
when selecting a scanning solution. Conversion to full vector CAD format is the most sensitive to a well-scanned image and higher resolutions may be required for certain applications.

Raster File Types

Scanners produce compressed raster files that are color, greyscale, or monochrome in nature. File types can be split into two broad types; compressed and uncompressed. The most common format found in companies is black and white monochrome images stored in the TIFF or CALS Group 4 compression format.

Compression Methods

Data compression techniques have emerged in the market to allow raster based drawings to be stored in less storage space than a 3D CAD file. Two-dimensional compression can reduce an 8 MB uncompressed raster file to approximately 100KB without any loss of information. The most popular formats found in the market today are the CALS Raster and TIFF format, both utilizing the CCITT Group 4 compression method.



Source: Document Management Magazine

Cost Justification

Cost justification for the technologies described in this paper can be based on labor savings in the drafting process as well as improved data and information access and management.

Life Cycle Savings. In an article first appearing in Document Management Magazine, the inherent cost to recreate and revise a complex drawing, using each of the methods we have discussed,

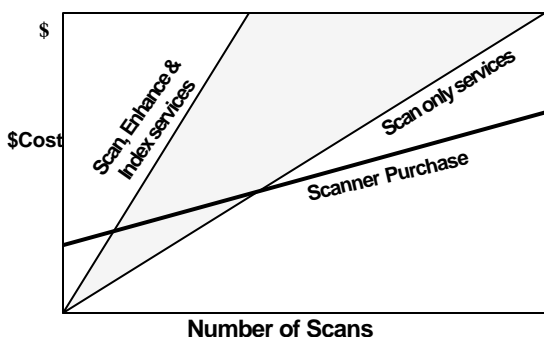
were compared. This comparison considered both the initial capture time, various labor rates, and the time associated with making revisions to the drawing once it had been captured.

The hybrid raster/CAD approach, which eliminates the redraw, clean up, and verification process found with vectorization, offers the greatest immediate cost benefit. It incurs the least labor requirements for the first revision and is the best approach when vector CAD is not necessary. Vector CAD represents the best subsequent revision cost savings.

A revision life-cycle analysis can help determine the best revision method for your situation.

To Buy or Outsource. To move ahead and create your raster images (scan), a decision needs to be made between purchasing a scanner or outsourcing your documents. The factors to consider are your labor rates, availability of staff, security concerns, volume, time frame, and enhancement and indexing demands. The following model identifies a point of optimum cost benefit depending on drawing volumes.

**Scanner Procurement vs. Services
Break-Even model**



Benefits of Scanning. The direct benefits of integrating paper within CAD and EDM can be seen

with labor savings in the revision cycle and retrieval. But there are also many other benefits:

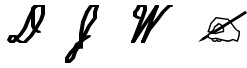
- ◆ Increased value of your CAD system by eliminating its use for tedious redraw. It can now be used for productive design and analysis functions.
- ◆ A common and secure database.
- ◆ Reduced retrieval and print times.
- ◆ Improved flow of information with Workflow and E-mail tools.
- ◆ Improved conformance to ISO 9000 or OSHA regulations.
- ◆ Increased paper drawing value from integration with CAD and EDM tools.

Conclusion

Scanning drawings into digital raster form is the essential first step for the methods provided in this analysis. The justification for scanning to a raster image can be made easily by assessing the increased value incurred from a document management system. Simply put, it will improve company-wide document accessibility and reduce drawing revision and facilities costs.

With reduced labor costs and improved usage of CAD, the benefits of revising drawings electronically are clear. The trade-off between investing in the up front conversion to full CAD vs. taking advantage of lower costing hybrid and raster CAD systems needs to be evaluated on an individual basis.

A proven and well-utilized transition procedure is incremental conversion. Products that offer this capability have a full raster CAD drafting tool set as well as the ability to convert selective parts of the drawing to full vector CAD on-demand. The question surrounding your decision to enable your drawing archives into an electronic environment should not be if, but when.



About The Author

David J. Wilson, principal of Open Archive Systems, Inc., specializes in paper-enabling consulting services and proven solutions for implementing document management, raster, and CAD systems. Open Archive Systems, Inc. clients include reseller partners, manufacturing firms, utilities, state and local government, and architectural firms that require raster enabled solutions.

Mr. Wilson can be reached at:

Open Archive Systems, Inc.
63 Range Road, Suite 202
Windham, NH 03087
603-890-9980 Fax: 603-890-9986
e-mail: dwilson@openarchive.com
www.openarchive.com