

The Engineering Aperture Card: *Still Active, Still Vital*



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Executive Summary

There has been a rebirth of interest and enthusiasm in microfilm as companies continue to use microfilm aperture cards as their long term archival solution for wide format drawings. Immediately after World War II when a company called Film'N File (later changed to Filmsort, Inc and ultimately acquired by 3M), first tried to introduce aperture cards, and hardly anyone could come up with a use for them.

Now decades later, the aperture card continues to be the long-term archival solution of choice. It continues to have a storage shelf life of over 100 years where magnetic, CD-ROM, and other digital storage media's have a maximum shelf life of 7 - 25 years.

This paper explores the need for a long-term archival engineering drawing solution (microfilm aperture cards) and the collaboration with digital media's. The linking together of disparate sources of product data and presenting this information in a form that is relevant and accessible to every stakeholder in the product life cycle.

In the beginning

The aperture card was created in 1943 as a means to capture all photographs of strategic military value and make them available on request to Army and Navy intelligence. In time the aperture card gained it's own level of data capture with holerith holes being added to capture digital data while also providing title information.

By early 1957 in many government agencies and industrial company's, highly advanced systems utilizing aperture cards had evolved for managing and filing engineering drawings. Those systems, for all practical purposes, eliminated reproducible tracings and blueprints from the engineering drawing production and distribution cycle. Tracings and blueprints were replaced by aperture cards because government and industry people had decided cards were more economical and efficient than paper for information management.

In the 60's aperture cards became international. As in the United States, the first sales were for engineering drawing applications, but today public records, medical, government/defense and other information also are being preserved on aperture cards.

Today, that same comment now applies to digital systems where microfilm aperture cards continue to be the right choice for archiving drawings and documents as the best long-term storage solution.

Implementing Technological Change

Sometimes all a company needs is a good crisis to foster the acceptance of new technology. Suddenly there would be an urgent need for a real-time company wide archival system embracing all of their manufacturing sites product drawings. Management would then begin to review where the state-of-the-information management industry stands right now, and where it is rapidly heading. What was learned from 9/11 about having a good archival system to reach out to when disaster hits, still rings in many company CIO's ears. One of the unsung benefits of emerging archival technologies is how Aperture Film-Based-Imaging systems have continued to breathe new life into securing engineering drawings. The Engineering Aperture Card is "Still Active and Very Vital" and will continue to be the industries best archival solution.



CAD (Computer Aided Design)

The first primitive computer-aided-design (CAD) systems appeared in the 1950's with the automotive and aerospace manufacturers. Much of the engineering documentation was still created on drawing boards in the drafting department, but CAD systems were rapidly gaining momentum as engineers and designers became familiar with the abilities of CAD systems. CAD system output to electrostatic plotters was faster and more legible. Smaller size copies (even smaller original documents) were acceptable. Design graphics that were off loaded on magnetic tape and stored in a tape library could be reloaded to the CAD system for revisions. Clearly CAD was and still is a faster and more efficient distribution tool for moving drawings throughout the network. So, management started to believe that CAD would replace their existing micrographic systems, when the thing they needed to understand was how both could survive together. CAD systems were made to improve the drafting and design processes, while Microfilm aperture card systems became the archival distribution media along side the CAD system. The CAD system still has a limited storage life for all magnetic, optical, and tape media's. Aperture cards continue to be the least expensive and most efficient method for filming, duplicating and archiving engineering drawings.

When aperture card systems do not exist in companies, one should investigate a local service bureau or equipment manufacturer to review how their services can provide the missing micrographic solution. In-house equipment, like the Quintek 4400 plotter can be purchased as a direct link to the existing CAD system producing aperture cards on the fly. The service bureau's can also provide other services for all drawings that are either active or inactive filed away in drawing files. They can also provide back file conversions from paper or film into an electronic format, through hard copy scanning.

What micrographics continues to bring to the table is the most economical, on-line storage of engineering drawings over any other media. It is not meant to compete with the CAD systems in the speed those systems provide in creating, changing and distributing drawings.

Film vs Digital

In today's rapidly changing communications world, micrographics plays an important role as a competitive and high-tech information management technology. This is not surprising though, because the leaders in the micrographics industry have worked to develop a base of advanced technology that assures micrographics a prominent position in engineering drawings and documentation for decades to come. Especially when one takes a long look at it's place for being today's best archival media and still the best solution for being there during and after a major disaster.

Over two decades of experience with digital technologies has proven there are some parts of the document lifecycle where the digital solution is not effective. Microfilm is still cheaper, faster and more reliable than digital storage systems. Microfilm is rated to last 100 - 500 years compared to a maximum 25 years lifespan for CD-ROM and other digital media. Digital media content cannot be determined without substantial specialized technology that routinely becomes quickly outdated. Digital archival technology requires



constant, expensive migration to keep up with technology or it becomes useless. Microfilm is human-readable and therefore never becomes outdated, making microfilm the best solution for long term storage.

Of course, there are also benefits associated with permanent digital storage, including high-speed retrieval, electronic data transmission and communication, speed of drawings and faster initial drawing release. These are the same benefits so long associated with microfilm, but digital storage needs to take it a step further and so the search for permanent digital storage has continued.

Many industries are required to archive critical data in human-readable form, i.e.; Aerospace & Defense, Banking, Life Sciences, Utilities and AEC (Architectural Engineering and Construction) to name a few. A recent example of the benefits of microfilm over digital came about when the U.S. Census Bureau decided to continue using microfilm rather than digital imaging to preserve the U.S. census report. Some of the reasons for staying with microfilm were the ongoing expenses of migrating with each digital technology, the risk of losing critical data during such migrations, and the advantage of human-readable formats with a lifespan of 100 years or more.

35mm Aperture Cards – Very much alive!

In the early 80's, processor camera's had become faster and more sophisticated, thus allowing high speed filming and indexing of drawings onto aperture cards. The new systems provided faster initial drawing release, together with much improved flexibility of the distribution media. Many companies still distribute paper prints or duplicate aperture cards depending on the requirements of their end users. Contrary to the predictions of many engineers, CAD did not mean the end of 35mm micrographics. Throughout the world, the major microfilm vendors still see growth in their 35mm business.

The output of CAD is digital, and this has led to much speculation as to the possibilities of storing information permanently in this format. Those designers who predicted the demise of 35mm microfilm when CAD became dominant assumed all drawings would be stored magnetically on floppy disks, hard disks, optical disks, or optical/magnetic tape. However, microfilm has remained the document storage medium because of the unsuitability of magnetic media for long-term storage of digital information. Not only is this form of storage expensive when compared to microfilm, but also the image is apt to deteriorate over time and must be refreshed on a regular basis to compete with microfilm. Microfilm's other significant advantage is its compatibility. The aperture card can be viewed and/or have prints created on every 35mm micro system currently in use in the world today.

To date, almost all aperture card imaging systems have been associated with large CAD installations. The first approach used, with some installations dating back over two decades, was to adapt commercially available graphic COM (Computer On Microfilm) systems. These COM systems recorded onto 35mm film, not directly onto aperture cards. The film required processing, mounting and punching just as if it had been exposed in a

camera system. While the image quality was excellent, this early approach was too expensive and cumbersome for wide spread use.



In the late 80's the industry saw the introduction of direct aperture card imaging systems, utilizing a vector laser imaging technology. Aperture cards, containing unexposed film, were imaged, developed, printed, and punched. Aside from laser imaging, the process was very similar to that of a processor camera.

Aperture Card Archival Systems

Companies accessing digital data from either a DMS (Document Management System) or CAD system, for drawing management and distribution, can now automatically generate a back-up copy of each image released on the network and create a permanent copy for long-term archival. Companies currently using aperture cards for drawing management, distribution, long-term storage, and disaster recovery situations, have dramatically improved operational efficiency. They have reduced costs by eliminating the conventional conversion process, by producing aperture cards directly from CAD or a DMS system because:

- Aperture cards are available in a few minutes instead of a few days
- Paper copies (small and large quantities) can be produced quickly with standard reader and printer equipment.
- Aperture card duplicates can be produced directly from the masters with diazo or viscular duplication equipment.
- The improved time to market accelerates the availability of engineering drawing data to the decision makers.

It provides an immediate and permanent archival media for years to come.

Document Management Systems

The definition of a Document Management System (DMS) can vary widely, ranging from a simple, central storage repository all the way to an all-encompassing interconnected system of scanning, data processing, archiving, retrieval, and workflow product. Depending on the industry and what application a company is trying to address, you will be introduced to "systems" that are better known as: Enterprise Content Management (ECM), Knowledge Management (KM), Product Data Management (PDM), and Product Life Cycle Management (PLM). For the purposes of this document, the term DMS will be used; a definition based on the market of electronic document management applications.

A Document Management System manages the production, access and distribution of electronic documents across an organization. Many of these documents are created elsewhere in the organization and are electronically deposited into the central DMS for global access and/or distribution. Key features include document creation, metadata (document property) management, access and revision of these documents, and security of documents and their repositories.

Many systems will also maintain simple relationships between documents, such as parent-child and rendition relationships. Many organizations maintain and track mission-critical documents in a DMS. A single DMS across an enterprise is ideal, but commonly seen is a business with multiple DMS implementations within strategic departments. These document management systems also allow a business to manage, access, and maintain versions of documents that are part of the critical process. The majority of DMS users are the authors of single-format documents contained in that system. For purposes of this document one of those databases, that feeds the DMS with technical drawings, is CAD. These drawings are delivered to the DMS as raster or vector data files and maintained and controlled by the DMS for all users. These drawings can also become related to other data within the DMS such as parts lists, vendor part numbers, Bills of Materials, financial information, drawing to drawing relationships, and ECO's (Engineering Change Orders).



Another generic term used for the type of data that is maintained by a document management system is digital. CAD drawings are electronically stored within the DMS for user access or for networking to other systems that convert the digital images into another media.

Film-based microfilm systems meet a document management system at the point where business needs dictate the creation of a long-term archival media.


While the document management system always maintains control over source documents and renditions, the film-based imaging systems manage the archival structure and associated properties. The ability of these two systems to be integrated allows organizations to focus on their core competencies, not the mechanics of how to combine digital with microfilm. The interface can be connected to the user system directly via corporate networks. It is compatible with a wide range of file formats, which are automatically retrieved from the user, converted to raster format and imaged.

Why Film-Based-Imaging?

Economical Digital Imaging (CAD and DMS) are now mature collaborative technologies that are widely available. There are some parts of the document lifecycle where Microfilm remains the most efficient and economical solution over digital.

Just as digital imaging has progressed technologically, so has film-based imaging. Quintek's aperture card plotter produces hardcopy on chemical free "dry silver" microfilm directly from all popular file formats with no impact on the environment. An Aperture Card is a piece of 35mm film within an IBM-style punch card. They are human-readable and are easy to automatically sort and duplicate. They also have a written description across the top of the card for easy filing and recognition.

The plotter is a self-contained tabletop device used to generate complete card media from CAD and digital imaging systems. The system operates automatically without the need for operator intervention, performing self-diagnostic tests and automatically plots image files either on-line, or from ones that have been queued.



The universal interface is based on the IBM compatible PC platform and functions to provide a link between the operator, user system and the Aperture card Plotter. The interface can be connected to the user system directly via corporate networks. It is also compatible with a wide range of file formats, which are automatically retrieved from the user, converted to raster format and imaged with Quintek's patented technology.

The Quintek system has the capability to integrate with a number of document management systems. Understand that a DMS is not a requirement, for the Quintek system, as users can also integrate directly from CAD to store all their drawings as a shared file system. Like CAD, the DMS interface is a natural fit with the Quintek system. This then becomes an efficient and integrated long-term archival solution for any company with complex engineering drawings. See Figure I to see how these three technologies can collaborate together across most companies.

Microfilm is "future-proof" because it is human readable and certified by the American national Standards Institute (ANSI) to have a 500 plus year lifespan. For archive documents, film-based media remain superior. Film-based archival already has a massive installed base of billions of documents accumulated over more than 50 years of use.

It is anticipated that film-based imaging, driven by archival will be a growth market. The volume of archived paper and digital records will continue to increase for a number of reasons, including:

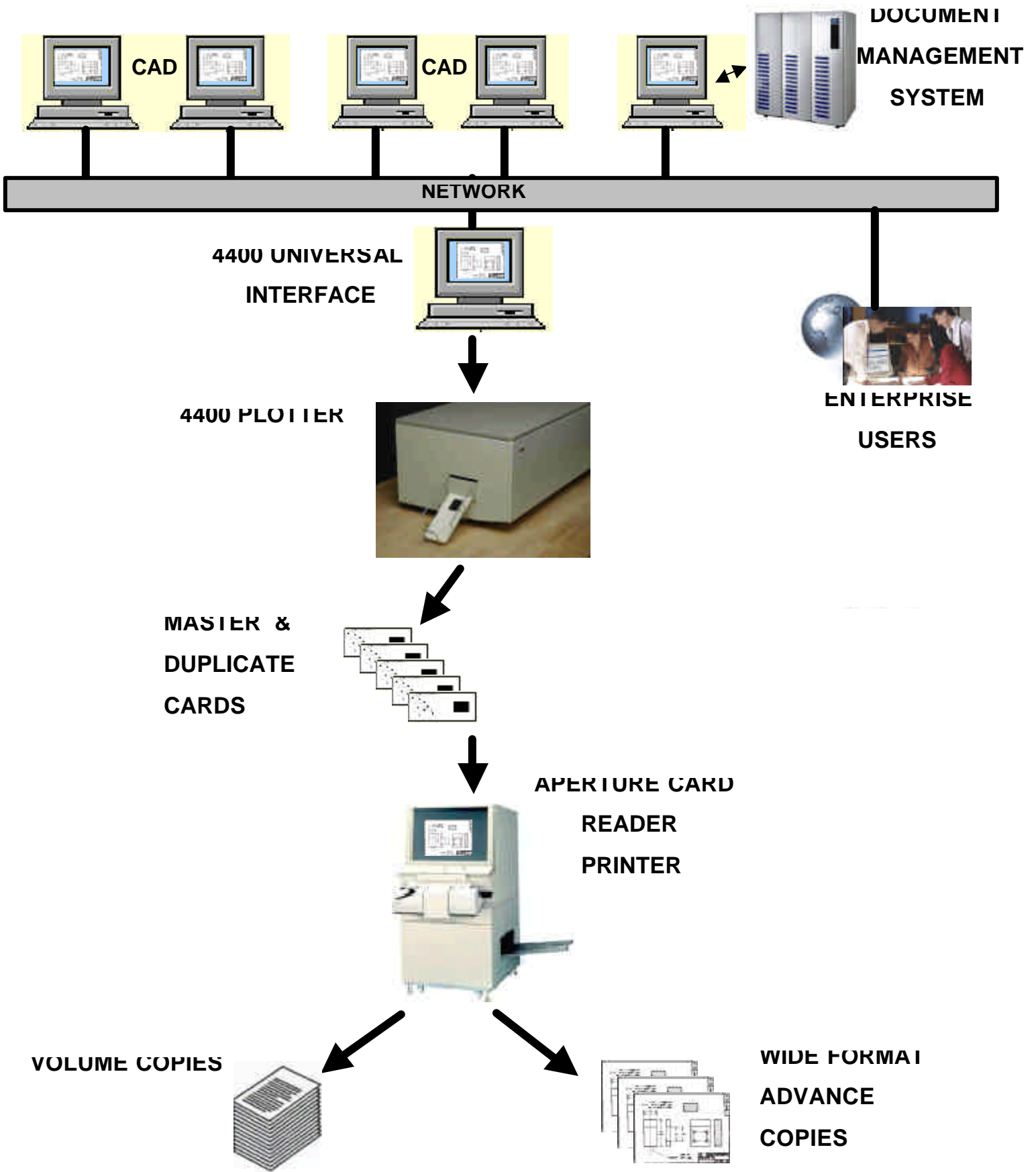
- The rapid growth of inexpensive document producing technologies such as fax, desktop publishing software and desktop printing
- The continued proliferation of data processing technologies such as personal computers and networks
- Regulatory requirements
- Concerns over possible future litigation and the resulting increases in volume and holding periods of documentation
- The high cost of reviewing records and deciding whether to retain or destroy them
- The failure of many entities to adopt or follow policies on records destruction
- Audit requirements to keep back-up copies of certain records in off-site locations.

Despite the growth of new "paperless" technologies, such as the Internet and E-mail, it is believed that archived information remains predominately film and paper-based. Rather than eliminate paper, digital technology has created the need for more archival.

Film-based imaging market is now entering a new growth phase. Changes in this market caused by new digital technologies have created new opportunities. By enabling the creation of microfilm directly from digital files, Quintek products marry modern digital technologies to the proven best practices of microfilm archival.

The future of this marketplace is in hybrid systems, which bridges the gap between these two technologies.

(FIGURE I)



The Quintek Q4400 supplements current digital distribution systems because:

- The aperture card media is not subject to data loss thru media degradation or technical obsolescence.
- Distribution can be accomplished using conventional delivery methods or electronic delivery to the user can be accomplished using Quintek's Web Shuttle distribution system.
- The Q4400 provides access by bridging the digital distribution to the archival domain.



Patented Film-Based Imaging Technology (For existing aperture card users)

Aperture Card Production: Utilizing the latest laser recording technology with a single desktop unit

Benefits: Quintek's Q4400 Aperture Card System will eliminate your aperture card production headaches, while reducing costs.

- Saving 2000-4000 square feet of dedicated and consumptive facility space
- Displaces aged equipment and its costly maintenance
- Reduction of labor intensive manual processing

Eliminating all chemicals required for wet film processing

- Waste disposal storage and handling expenses
- Employee health related issues
- Compliance with hazardous material government regulatory policies and inspections

Providing a direct connection to any CAD/CAM and imaging system

- No software application development
- Compliant with standard and custom header and file formats
- Transparently converts distinct data formats into raster format for laser image recording

Summary

Finally, companies need a technical solution that can merge with their existing systems and thus accomplish two tasks: manage engineering drawings and be able to purge electronically. There is good reason for CAD, DMS and Film Based Imaging products to work together and this paper has hit on the majority of those reasons. These products together provide fast access, control and security. For companies seeking compliance and being prepared for any type of disaster gives them the ability to maintain and control their technical drawings from a single location and in some cases multiple locations.

The most recent depressed economy and several company budget constraints will drive enterprises of all kinds to focus on their core competencies. This focus will, lead enterprises to seek operational efficiencies through more extensive exploitation of departmental technologies, increased application integration, standardized processes and the use of specialized service providers. The increasing popularity of hybrid systems, combining the best features of micrographics and electronic imaging, has created a demand for equipment to link the two technologies. This paper has examined methods of converting digital formats, including raster graphics, to micro-images for 35mm aperture

card archival storage. It provides advantages for established storage life, freedom from technological obsolescence and the security and preparation for any future disaster.



We have also examined the Quintek system which uses the latest laser technology to provide the long-term archival of CAD and imaging media in a chemical free environment. It automates the aperture card production process, which saves space, time, and most importantly... money. The portable self-contained tabletop package fits well into an office for the archival of engineering drawings.

Glossary

AEC – Architecture, Engineering & Construction

CAD – Computer Aided Design

CALS – Continuous Acquisition and Life Cycle Support

CAM – Computer Automated Manufacturing

CD-ROM – Compact Disk- Read Only Memory

CIO – Chief Information Officer

COM – Computer On Microfilm

DMS – Document Management System

ECM – Enterprise Content Management

EDM – Enterprise Document Management

EDMICS – Engineering Data Management Information Control System

FDA – Food & Drug Association

ISO – International Standard Organization

KMS – Knowledge Management

OSHA – Occupational Safety & Health Administration

PDM – Product Data Management

PLM – Product Life Cycle Management

About Quintek

Quintek is the only manufacturer of a chemical-free desktop microfilm solution. The company currently sells hardware, software and services for printing wide format drawings such as blueprints and CAD files (Computer Aided Design), directly to microfilm. Quintek does business in the Content and Document Management services market, forecast by IDC Research to grow to \$2.4 billion by 2006 at a combined growth rate of 44%. Quintek presently targets the Aerospace & Defense and AEC industries, while looking at the High Tech, Life Sciences, and other industries, that need to stay compliant with government standards like; CALS, EDMICS, ISO, OSHA, and FDA policies.

About EDM Consultants

EDM Consultants provides fresh insights into the future of Technical Information Management and the computing and networking and implications for users in the industry. Ed LoTurco has spent 30 years in the technical document management arena, including data base management systems (EDM/PDM/PLM), CAD/CAM systems, micrographics, and industry marketing, for both domestic and international clients.

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