
WESTINGHOUSE ELECTRIC COMPANY MONROEVILLE, PENNSYLVANIA

NORTH AMERICAN EXCELLENCE AWARDS: IMAGING, SILVER

OVERVIEW

Westinghouse Electric Company (WELCO) is a diversified company comprising various engineering, manufacturing, and service organizations. The company provides a wide range of primarily nuclear related products and services, including nuclear fuel, instrumentation and control for nuclear plants, inspection, maintenance and repair services for nuclear plants, new plant design and the effective management of nuclear and defense-related sites for the U.S. government. Headquartered in Monroeville, Pennsylvania, WELCO conducts business globally, providing its products and services to a significant number of the world's more than 400 operating nuclear power plants.

The use of imaging technologies between Westinghouse and these plants is innovative in that it contributes to ensuring nuclear safety for plants in Asia, Eastern and Central Europe and in the Americas.

WELCO's Information Delivery System

To provide effective service to customers, Westinghouse engineers needed to quickly access original design information. Prior to the implementation of the Information Delivery System, ten million pages of critical design documents existed on paper and microfilm. One study estimated that engineers spent fifteen to forty percent of their time finding and retrieving this information. Westinghouse proposed to reduce this search and retrieval time to one or two percent by implementing a document-imaging and workflow system integrated with existing document databases and networks.

A rigorous functional specification was delivered and provided to several vendors for evaluation. Because of a plan to increase system capacity to support thousands of users, FileNet Corporation was selected for its enterprise-wide capability and ability to handle high capacity applications.

Application Profile

The Information Delivery System (IDS^{See} Information Delivery System) manages historical documentation and supports the development of nuclear plant design. It integrates FileNet's optical document-imaging hardware and WorkFlo® Business System software with

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a BasisPlus document database and Sherpa Corporation's work process management software. IDS now supports 2,000 users on-line. Document search and retrieval is one of the major functions of IDS. Users search the document database based on any combination of 30 indexing fields such as author, data, subject, plant, system and component. Once located, documents are displayed on the engineer's PC or UNIX workstation.

All engineering documents are now scanned and indexed on the FileNet document-imaging system. The images, along with the original native file format, are stored on optical disk for archiving. Conversion of existing files from microfilm is done on a selected basis, as required.

Two major programs are dependent on the use of the FileNet system and IDS. In one major application, a group of twelve U.S. utility companies with Westinghouse-designed plants have formed a working group to retrofit their design information into IDS so that engineering and plant safety-related documents can be freely exchanged between remote sites.

Benefits

IDS and FileNet's document-imaging and retrieval system enable Westinghouse engineers to immediately access important design information. In addition, Westinghouse's utility partners are able to conduct safer, more efficient operations at existing nuclear stations in the U.S.

Another major application links Westinghouse U.S. and European design facilities to support the Temelin project. The Temelin nuclear plant, located in the Czech Republic, is the first Soviet-designed reactor to upgrade plant safety and use western-supplied technology and fuel. In late 1992, Westinghouse won the contract to supply fuel and a new instrumentation and control system for the then partially completed plant.

To support this project, a combination of satellite links, fiber optics, and local area networks are used to connect Westinghouse design engineers in Pennsylvania, the European Design Center in Brussels, Belgium, and the Czech Republic. The Westinghouse offices in Brussels and at Temelin have an IDS node that is a replica of the one in Pennsylvania. The three systems are synchronized daily, downloading documents and information so that engineers on both continents have immediate access to the same documents. Each day more than 1,000 pages of information and drawings are transferred between the three sites, allowing engineers to view the latest version of any document.

Business Results and Benefits

FileNet's document-imaging and WorkFlo solution enabled Westinghouse to implement IDS. In addition to increased productivity among engineers, Westinghouse divisions have realized many other benefits. These include:

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- Payback for IDS was realized in **2.4 years** versus the original expectation of four years.
- The potential exists for IDS to be marketed directly to Westinghouse utility customers, thereby generating new revenue.
- Fast document access saves an average of 30 minutes per document display. This results in 750 hours per month saved in engineers' time to retrieve documents—a \$400,000 per year savings.
- Immediate access to design information by Westinghouse and its utility partners enhances the safe and efficient operations of existing nuclear power stations in the U.S.
- The FileNet Optical Storage and Retrieval (OSAR®) system provides for disaster recovery with back-up copies of optical disks stored off-site. This satisfies NRC (Nuclear Regulatory Commission) requirements for long-term records storage and has eliminated the need for antiquated microfilm system equipment.
- For the Temelin project, Westinghouse saved several weeks by eliminating the time spent waiting for revised documentation between engineers at remote sites.
- Engineers' workloads are now more evenly distributed across physical boundaries, minimizing the impact of downsizing.
- Concurrent work processing technology is enabling Westinghouse engineers to develop designs in geographically independent locations with customers and suppliers. Database technology is enabling Westinghouse to reference massive quantities of information and easily retrieve it. Optical disk technology is enabling the company to store all documents compactly at a fraction of the hard copy cost, thus eliminating duplication, mailing and time lag costs. Communications technology is also allowing Westinghouse to take advantage of time zones so that work can be accomplished on a project over a larger portion of the 24-hour period. Such leading-edge technologies as electronic signature applications, electronic files storage and retrieval, internet applications and portable document software are also embedded. All of these technologies are tied together and utilized as part of the Information Delivery System.

THE SYSTEM APPLICATION.

Nearly 2,000 Westinghouse employees, plus a number of Westinghouse customers, use the Information Delivery System to reduce the search time for documents and to archive completed work in accordance with Nuclear Regulatory Commission requirements. This function of the system provides two main benefits: 1) Increasing the re-use of archived information to improve the quality and efficiency of current work, and 2) reducing search and retrieval time for archived information. Time and dollar savings associated with document searches are tracked monthly. Savings associated with the use of IDS were estimated at \$1.51 million for 1996.

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The Information Delivery System provides for the electronic management of both historical and current nuclear power plant design information. This is implemented through a detailed document database, optical imaging hardware and software, full text search of selected documents, and configuration and work process management software.

One of the major features of the Information Delivery System is the user's ability to search the document database to find archived information that supports day-to-day operations. Each document in the document database can be searched on up to 30 fields such as author, date, and subject, in addition to fields for plant, system, component, and topical area. Full text search is also available for selected documents. Once documents of interest are identified, the images can be viewed on either a PC or a workstation at an engineer's desk.

Many employees and customers also use the on-line document management features of the application to share electronic drawings and documents on current projects within their work groups. This part of the application has changed the nature of relationships with customers and with "sister divisions" throughout Westinghouse. Very small pieces of a work scope can now be instantly routed to the person who is most qualified or most readily available to perform that work. In one of its most advanced customer relationships, Westinghouse has reached the point where the customer now does work that was traditionally performed by Westinghouse and conversely, Westinghouse does work that was traditionally performed by the customer.

Another function of the Information Delivery System is work process management and document revision control. This function provides on-line access to all revisions of documents. Users from any location can share work folders electronically and design automated review and approval cycles for product documents. The appropriate application software can automatically be launched (such as word processing, spreadsheet, or CAD applications) to allow the user to work on a given file. Access to the most current version of any document is guaranteed, unless an earlier version is specifically requested.

The electronic folder system allows a project manager to easily attach sample calculations, previous examples, specific procedures and other information to work requests so that less experienced engineers (or engineers from another company) can work effectively on a project.

THE KEY MOTIVATIONS BEHIND THE SYSTEM

The entire electric energy industry, and particularly the nuclear segment of that industry, is at a crossroads. Electric utilities are entering a competitive environment for the first time. Ultimately, this will have a positive effect on industry and consumer prices for electricity nationwide. As part of the transition, utilities are facing dramatic needs to reduce costs and downsize their organizations.

The Information Delivery System is part of the solution needed to meet these changes in the utility industry. By allowing work to be shared instantly across organizational and

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physical boundaries, it becomes possible to load level engineering work across several organizations to minimize the impact of downsizing in any one organization. It also becomes possible for vendors and utilities to work together in new ways to take cost out of the system. This has become apparent in the Westinghouse partnership with one of its customers where engineering cost savings of \$500,000 in six months were attributed to a new working relationship using the Information Delivery System.

THE CURRENT SYSTEM CONFIGURATION

Information technology is at the heart of the Information Delivery System. The system incorporates database technology, optical disk technology, engineering drawing control technology, sophisticated communications technology utilizing satellites, concurrent work processing technology and product data management technology. Westinghouse had wanted to develop such a document management system for the past 20 years and it is only now that the technology is available to accomplish this goal.

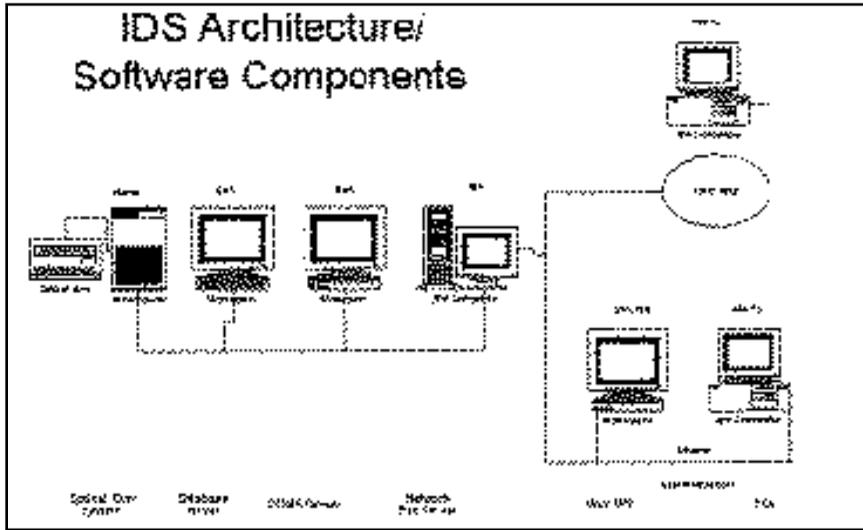
System Configuration

The system was developed with a combination of off-the-shelf software and hardware, and customized modifications to that software as a client/server environment. Client workstations consist of about 1,200 PCs and about 100 Sun OS UNIX workstations. The PC environment is running either Windows 3.1 on a Novell network or Windows NT. The client software includes an in-house application written using Uniface 4GL software that accesses a BasisPlus database running on a Sun server and FileNet Image Display for Windows on the PCs. The Unix clients use image display software supplied by Cotek.

The FileNet system supports four scanners, four printers and two plotters. One of the scanners is a Formtek large document scanner. Two of the printers, one scanner and one plotter are located at remote sites.

The file storage consists of a 96-platter FileNet optical disk jukebox and the database server storage is on a 64GB RAID tower.

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IMPACT TO THE COMPANY

The Information Delivery System couples a document database with optical imaging technology for the storage and retrieval of archived documentation, as well as the creation, routing, review, and electronic approval of documents, including drawings. Aside from the workflow and budgetary advantages of IDS, its implementation has allowed Westinghouse to accomplish more with fewer employees.

IDS has been successfully implemented and used in Westinghouse for over four years. Currently, nearly users of over 630,000 documents reap the benefits of the innovative use of this technology. With an average growth rate of about 4,500 documents per week, continued implementation of IDS is highly important. As the culture evolves from paper-based to electronic-based documents and processes, greater efficiency and cost savings will be realized. Improved productivity and process cycle times will, in the long-term, also reduce the number of employees required to perform certain tasks.

COST SAVINGS

IDS was developed and implemented as an internal cost-reduction initiative with a positive impact on productivity. Use of IDS dramatically improves access to information needed to support day-to-day business operations and meet contractual commitments. Additional savings are realized through cycle-time reductions resulting from the use of the electronic workflow. For example, in the first half of 1996, one Westinghouse division realized a 50 percent reduction in the cycle time required to generate calc notes by reengineering the process to include electronic workflow and file storage capabilities. The time saved positively impacts direct product cost, resulting in improved operating profits. Lower costs will allow a reduction in process to gain market share and increase sales volume.

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Savings associated with the use of the IDS Document Database were estimated at \$1.51 million for 1996, which exceeded the year-end goal of \$1.5 million. It is noteworthy that the use of electronic workflow contributed to half of the savings realized in the second quarter of 1996. This is indicative of the potential savings to be gained with further implementation of electronic workflow, coupled with associated process reengineering. (Note: Savings are based on recorded measurable system parameters used in formulas based on the conservative estimates of time savings by using IDS.)

PRODUCTIVITY IMPROVEMENTS

Enabling Technology

Listed below are the benefits/advantages of the enabling technology of IDS:

- a. Scanning/electronic storage replaces microfilming of documents.
- b. On-line searchable database fields are providing for rapid retrieval of documents.
- c. Document images can be displayed on PCs and/or workstations.
- d. Information can be made available in several electronic formats (i.e., document images and/or native electronic files that can be used to generate new documents).
- e. Use of electronic workflow capabilities enables process reengineering initiatives.
- f. Documents are easily available and retrievable throughout the entire document life cycle (i.e., create, use, store, retrieve, destroy).
- g. The system is approved by the NRC for the long-term storage of records.
- h. Electronic storage of records reduces the need for file space, as well as the cost of storing hard copy records at the Westinghouse Corporate Records Center.
- i. IDS accommodates the need to reduce process costs through reduction in resource requirements.

COMPETITIVE ADVANTAGE GAINED

The potential exists for the system to be directly marketed and sold to Westinghouse utility customers. A more likely avenue for revenue generation will be through the enhancements that the system can directly add to many products and services. Examples include the ability to work on-line with customers and other major projects similar to the Temelin initiative.

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Specifically, in 1997 one division used the enabling technology of IDS to further sales to customers of its calc note system. In addition, plans are in place to provide documents indexing and scanning services to a mini-group comprised of four utility companies.

THE IMPLEMENTATION PROCESS AND METHODOLOGY

Westinghouse has reengineered the total records and document management process by building a component of IDS which identifies all document categories as applicable to records requirements. This Document Management Directory provides an electronic consolidation and standardization of records flow schedules and links current record policies and retention practices with an optical disk-based storage and retrieval system. It also provides a reference link to legacy systems. In addition, the directory links the policy to the requirements that direct the practice, and eliminates the need for a written or paper manual or policy. This system provides several benefits over the previous system:

- All documents are referenced using standard terminology.
- All documents are managed and controlled using consistent criteria.
- All employees will have access to the directory, thereby making their records requirements easier to implement.
- Computer-managed disposition notices make document disposition consistent for all users.
- The culture of the organization is making a positive transition to more effective and efficient document management.

Westinghouse has implemented a small number of pilot programs that currently use the electronic folder system for day-to-day work. This has been very successful, particularly in those cases where a customer is connected to the system. The most important part of planning for the future is to grow the use of the electronic folder system to encompass the vast majority of WELCO's work.

Planned enhancements to the application include the integration of electronic approval technology, as well as increased electronic workflow functionality.

Critical Obstacles

The critical obstacles to overcome during the implementation of the Information Delivery System were human and cultural issues. Several technical problems were encountered, but these were easily solved compared to the "people issues." These included:

- Unwillingness by part of the user population to accept a new way of performing their day-to-day work.

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- Low tolerance to system start-up problems such as slow response time and system downtime.
- Comfort with paper documents as opposed to electronic documents. This includes a feeling of loss of control as paper documents are eliminated.
- Resistance by part of the user population to the short-term inefficiencies associated with training and first times use of the system.

Overcoming these obstacles has been a carrot-and-stick operation. Some users were simply told that the system is the only acceptable way of doing certain kinds of work. In other cases, champions were selected to learn and use the new system, thereby setting an example for their work groups. Two four-hour training courses are offered to all employees and are strongly encouraged by management. Ongoing help and “hand-holding” is offered by the technical groups responsible for the rollout of the system.

THE OVERALL TECHNOLOGICAL AND BUSINESS INNOVATION

IDS has helped move Westinghouse Electric Company from paper and microfilm based to imaging-based work procedures. The culture of the engineering organization has moved from pencil and paper to PC, Unix workstations and optical images. The engineering process has, in some cases, been improved to take advantage of imaging technology. Engineers can now perform computer analysis and output files on the PCs and save the files to optical disk. Previously, the computer analysis files were output to microfiche, reviewed by engineers on microfiche readers and then stored as part of a paper copy of the calculation note. The optical imaging technology has helped to improve this process and significantly reduce the time required to complete a calculation.

The facilitation of document transfer across departmental lines and far-flung geographic locations has also aided in ensuring greater safety at Westinghouse's nuclear plants. Since the disaster at Chernobyl, the Nuclear Regulatory Commission has put increasing pressure on U.S. plant operators to reengineer their safety operations. Westinghouse has also been a leader in transferring those safety improvements to Eastern European plants.

Westinghouse is now looking at ways to utilize the technology to make further improvements in work processing. The implementation of optical imaging has forced the engineering culture to move toward a truly “less paper” environment.