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C. W. Jordan
W. A. Niven
R. E. Cavitt
J. M. Taylor
F. Alford
M. J. Mauvais
F. E. Warren
S. S. Taylor
D. L. Vickers
R. L. Weaver

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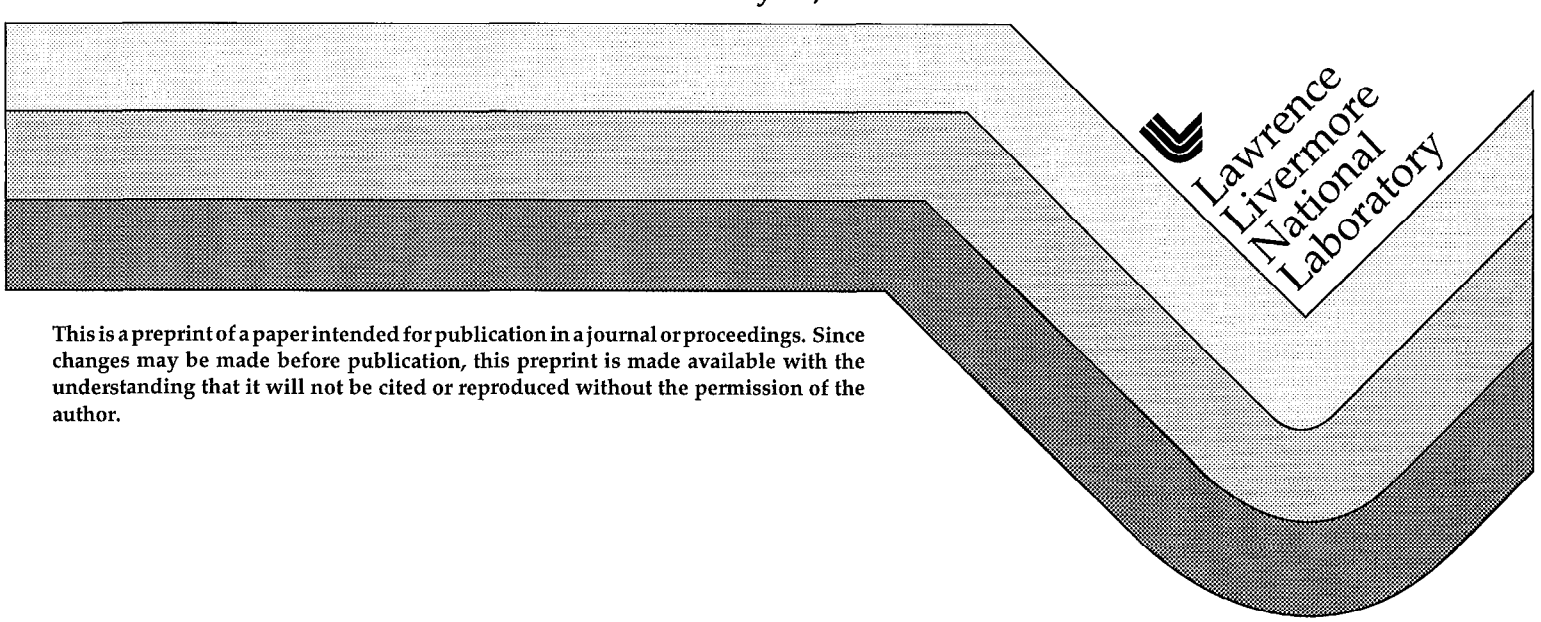

Zephyr: "A Secure Internet Process to Streamline Engineering"

C.W. Jordan,W. A. Niven , R.E. Cavitt, J. M. Taylor
Electronics Engineering, Lawrence Livermore National Laboratory

Francine Alford, M. J. Mauvais
Administrative Information Systems, Lawrence Livermore National Laboratory

F. E. Warren, S. S. Taylor,
Computation Directorate, Lawrence Livermore National Laboratory

D. L. Vickers
Technical Information Systems, Lawrence Livermore National Laboratory

R. L. Weaver
Procurement & Material Management, Lawrence Livermore National Laboratory

Abstract: *Lawrence Livermore National Laboratory (LLNL) is implementing an Internet-based process pilot called "Zephyr" to streamline engineering and commerce using the internet. Major benefits have accrued by using Zephyr in facilitating industrial collaboration, speeding the engineering development cycle, reducing procurement time, and lowering overall costs. Programs at LLNL are potentializing the efficiencies introduced since implementing Zephyr. Zephyr's pilot functionality is undergoing full integration with Business Systems, Finance, and Vendors to support major programs at the Laboratory.*

Introduction: The Pilot Project

Zephyr is a paperless, distributed web-workflow approach that streamlines the procurement of fabricated parts and assemblies. It electronically links all the steps in the engineering and procurement process including concept, collaborative design, approval, solicitation, supplier selection, award, technical data transfer, shipment, delivery, receipt, invoicing, and payment.

The actual development of Zephyr received over four years of funding through the Department of Energy (DOE). However, its success draws on contributions from a decade of work funded by the Department of Defense (DoD).

Projects that have contributed to its success include Lawrence Berkeley National Laboratory's Web-based computer-aided design system, the DoD's Air Force-administered Computer-Aided Acquisition and Logistics Support Program (CALS) (ref. 1), the Air Force's Government Acquisition Through Electronic Commerce (GATEC) System, (ref. 2), and the Department of Commerce (DOC) Technology Reinvestment Program's CommerceNet.

Zephyr was developed by LLNL's Engineering Directorate in partnership with the Laboratory's Administrative Information Systems, Procurement, and Computation departments. Zephyr can move "design concepts" 60-90% faster than previous paper-based approaches from engineering design release, through contract award, to product delivery and payment. Zephyr links people in Laboratory programs, engineering, and procurement to pre-qualified small and medium enterprises (SME's) across the nation or internationally in a practical, simple, secure way.

Procurements of fabricated parts and assemblies are now done up to 90% faster, from initial request to delivery.

All the process steps are conducted via a World Wide Web browser (Netscape or Internet Explorer) and e-mail. These steps are secure, that is firewalled, encrypted, password-protected and provide information on a need to know basis.

Zephyr's web-based workflow process moves projects from the traditional paperwork path toward interoperable systems which share a common browser technology. The Lab's programs benefit from a compressed time-frame for engineering deliverables by assuring valid designs, minimizing schedule impact, and reaching project goals sooner.

Zephyr was recently the subject of a case study by the UC Berkeley Fisher Center for Information Technology (ref.12); recognized by the Department of Defense US Navy as a "Best Manufacturing Practice" (Winter 1997); by the Department of Energy as a "Best Practice for Procurement and Material" (Fall 1996); A Coopers & Lybrand Consulting, Report (August 1996) and through a CALS-CommerceNet pilot has received G7 endorsement as a candidate for world-wide trade and commerce (Fall 1995). Our homepage can be found at http//:zephyr.llnl.gov.

Description

Zephyr began as a pilot concept system called CERPS (Concurrent Engineering Rapid Prototyping System). CERPS (ref. 3), networked LLNL's engineering and business systems linking them to multiple commercial and government partners to speed all aspects of the engineering development cycle independent of geographic location (fig. 1).

Zephyr (ref. 4), improved upon CERPS by integrating engineering processes related to solicitation, collaboration, design, procurement, payment, fabrication, testing, and evaluation into interoperable systems. Interoperable processes are both precursive and critical to seeking industrial partnerships, developing engineering concepts, securing goods or services, and assuring product quality.

Model: Zephyr Pilot System

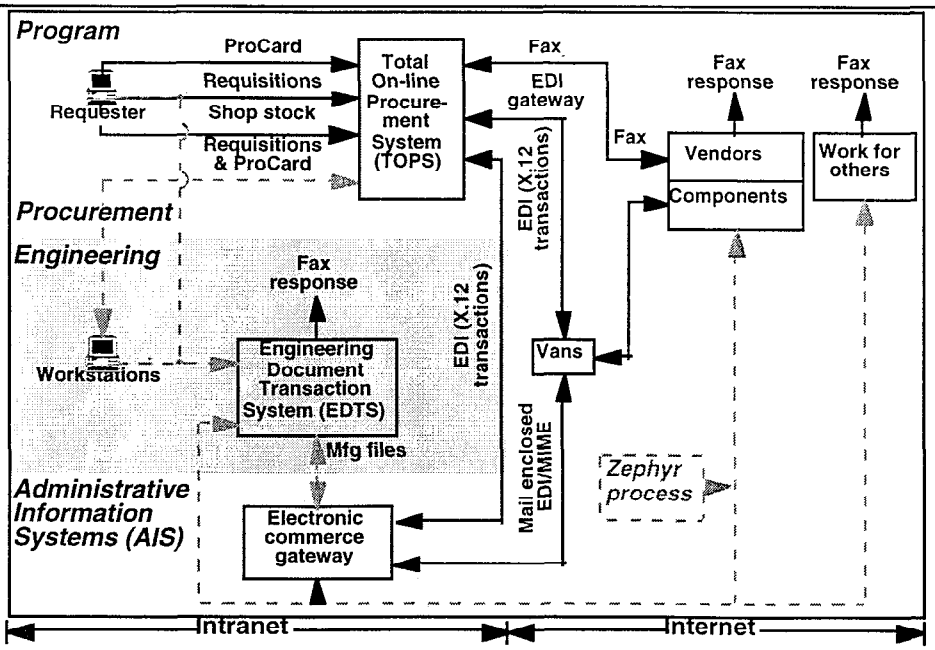

Fig. 1

With centralized, sharable data sources, and Zephyr's web-workflow process (fig.2), people in LLNL's programmatic organizations, engineering, procurement, finance, and development partners are assured of accurate and timely information. Interoperable systems integration (fig.3) (ref. 5), plus web-workflow facilitate rapid procurement and delivery cycles while meeting all DOE purchasing requirements at the Laboratory.

Model: Zephyr Web-based Workflow

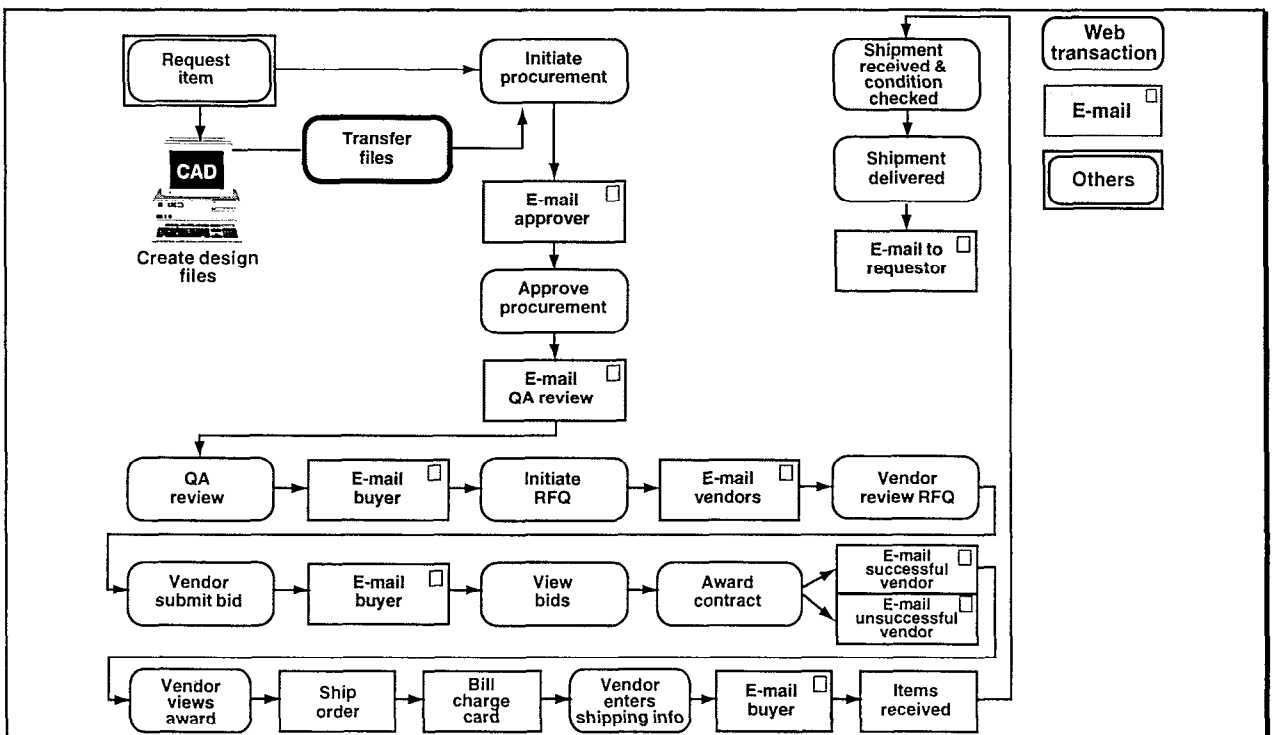

Fig. 2. Zephyr's e-mail driven workflow process speeds engineering procurements by communicating with users. Using e-mail to make "announcements" and "secure forms" to record all transactions takes advantage of strengths offered by both technologies. Approval, Review, Bid-Quote, Award, Payment, and Delivery announcement using e-mail are simple and inexpensive. Netscape's RSA secured forms provide transactional activity while protecting business sensitive information.

Security

Zephyr's daily operations and computer security are dependent upon administrative and technical systems expertise within LLNL's Administrative Information Systems (AIS). AIS is responsible for LLNL's Business Systems and as a course of normal operations protects critical business sensitive and proprietary information to assure the Laboratory's mission.

Operational security risk must be well articulated before responsible business activity can commence. Risk assessment, by trusted independent third parties, assures operators and users of commerce websites of the integrity of a particular service. A graded approach to computer security, matching security expense with security risk, allows affordable operations in known risk environments.

Model: Interoperable Secure Hub

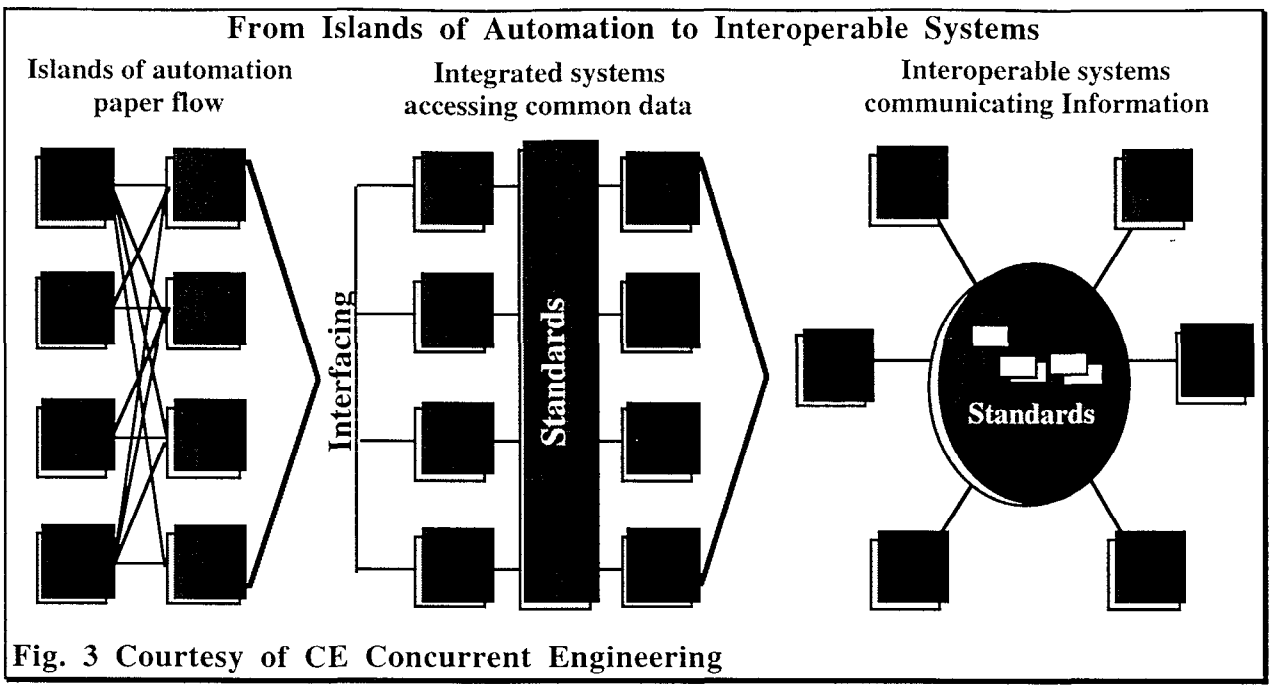

Fig. 3 Courtesy of CE Concurrent Engineering

Firewalls, intrusion monitoring, user name-password, encryption, and "need to know" access to information are common technical elements of a secure operation. However, in and of themselves, "technical solutions" may foster but do not assure website security.

The combination of robust Administrative Security Plans coupled with properly applied "technical solutions" (solutions which are an integral part of daily operations) provide consistent and well understood limits to computer security risk when properly maintained.

Host-client network architectures, like Zephyr, require vigorous risk assessment prior to establishing operations and constant review as new technologies emerge through the course of on-going operations (fig. 4).

Model: Interoperable Systems A Secure Hub

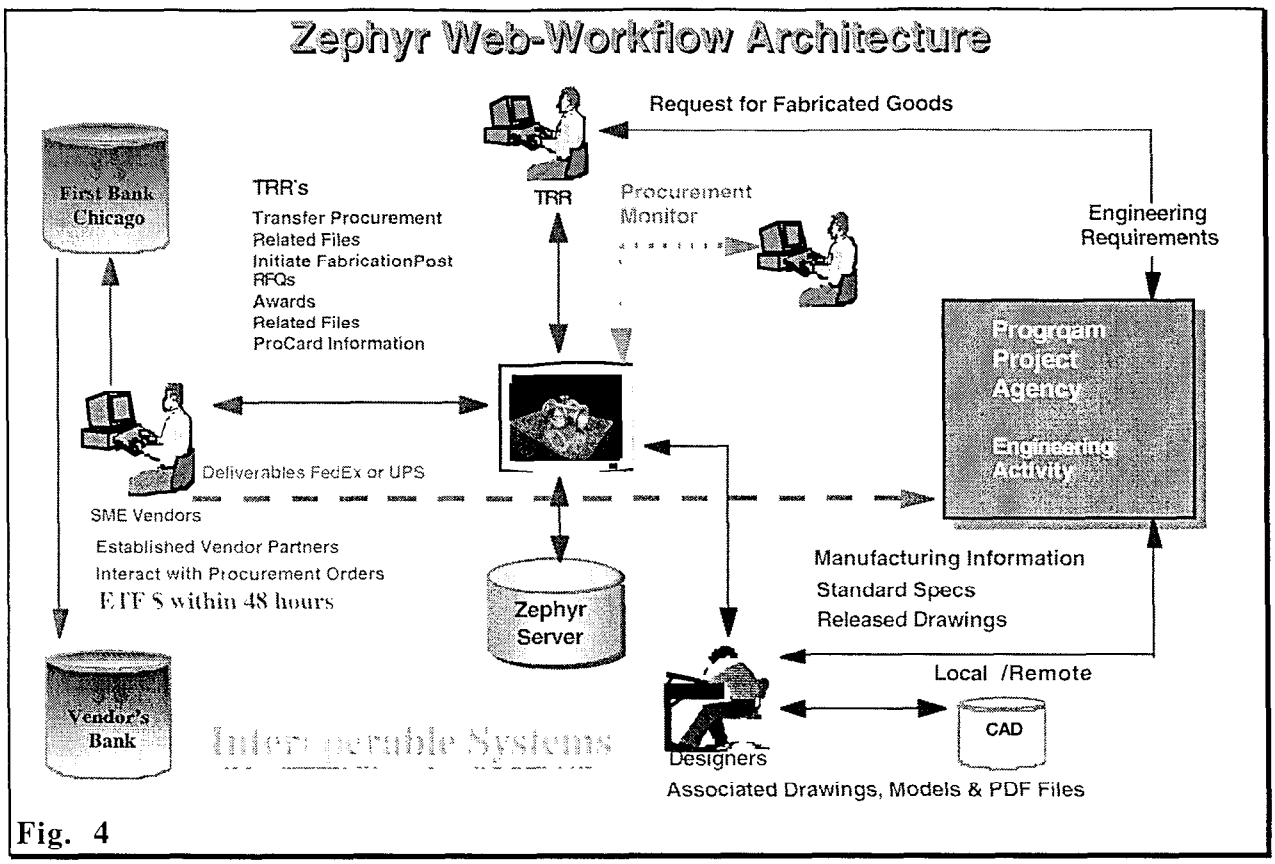

Fig. 4

Zephyr does not use technologies such as conventional file transfer protocol (ftp), X-Windows, and anonymous log-in. Using these protocols, in unprotected environments like the Internet, are an invitation to computer security intrusions and misuse.

Developing a secure host, in a client-host architecture, is the keystone for web security. Browser technology, like Netscape's Commerce Server, and protocol restrictions are important elements in reducing host-client risk associated with conventional file transfer protocols.

Solicitation

Solicitation involving potential contractors is an initial step in many engineering projects. The solicitation process defines legal, technical, and environmental requirements necessary to accomplish project goals while developing a proposal leading to contract award.

Communicating information such as terms and conditions, contract iteration, specifications which contain technical information including engineering reports, and "blue prints" are common. Traditional processes communicate and protect information but are bound by non-value added delays inherent in paper printing, mailing, reviewing, and iteration during the solicitation phase of a project.

Secure web servers eliminate non-value added processes while protecting proprietary contractor information. Sharing project proposal specifications with selected contractors in a simple "download" format like Adobe Acrobat's portable document format (pdf) can expedite the solicitation phase of engineering projects. More importantly, electronic solicitation establishes

file exchange techniques for project collaboration as a business practice once a contract is awarded.

In a recent solicitation, LLNL's National Ignition Facility (NIF) Program awarded a contact for NIF's Target Chamber Assembly by simply posting technical specifications to selected contractors using the Internet. Such postings allow potential Contractors consistent "on-demand" information, regarding specifications and changes, while maintaining a single informational source.

Another DOE National Laboratory, Oak Ridge National Laboratory (ORNL) has implemented a robust Solicitation Management Server (SMS) to expedite engineering solicitations using the Internet-World Wide Web. In pilot demonstrations involving 300 solicitations, ORNL's Procurement Division reports a 20-80% reduction in cycle time with the procurement functions that SMS facilitates. Los Alamos National Laboratory (LANL), a user of SMS, estimates as much as 50% cost savings over similar paper processes (ref. 6).

SMS enables buyers to assemble a solicitation from solicitation specific templates and existing standard files. The solicitation-specific files are easily uploaded while the standard files are only linked in at the time the solicitation is viewed by the buyer to ensure current information.

SMS provides a means for the buyer to submit the solicitation for approval and/or review to selected persons. Once vendors are selected the buyer can post a solicitation to the pre-selected vendors. Posting the solicitation notifies vendors by e-mail and grants the vendors access to view the solicitation's homepage on the Web. The homepage viewed by a vendor is again dynamically generated ensuring current data.

Vendors are able to ask questions and view answered questions from the homepage. Access to the homepage is limited to only selected vendors and buyers. The buyer can monitor the progress of the solicitation throughout the entire process.

SMS is easy to use which accounts for it's rapid acceptance in a Procurement department over 100 strong. SMS has demonstrated the creation of solicitations in minutes, live, over telephone lines at national conferences. It requires no formal training for buyers , and after being shown basic steps, even non-computer users are comfortable using it. Most importantly SMS saves projects time and money.

Collaboration

Collaboration among engineering teams is a critical element in meeting project deliverables, schedules, and minimizing costs. Small teams typically located "on-site" at engineering projects require accurate and timely information for changes in specifications, drawings, CAD models, tooling files, computer software, and many other "critical path" items (fig. 5).

Traditionally, teams gathered at engineering reviews exchanged information across the table by marking up drawings, project schedules, and specifications. The communications were both immediate and interpersonal. Engineering disciplines have performed tasks effectively this way for hundreds of years. It worked because all the information, technology, and decision makers were "at hand". However, when information, technology, and decision makers were not "at hand" schedules protracted, cost increased, and re-work dominated the process. Many times projects became intractable and simply failed.

Today engineering information, industrial technology, and decision makers are not always "at hand". In fact, these critical engineering elements are tending to be more globally distributed.

Model: Zephyr Collaboration

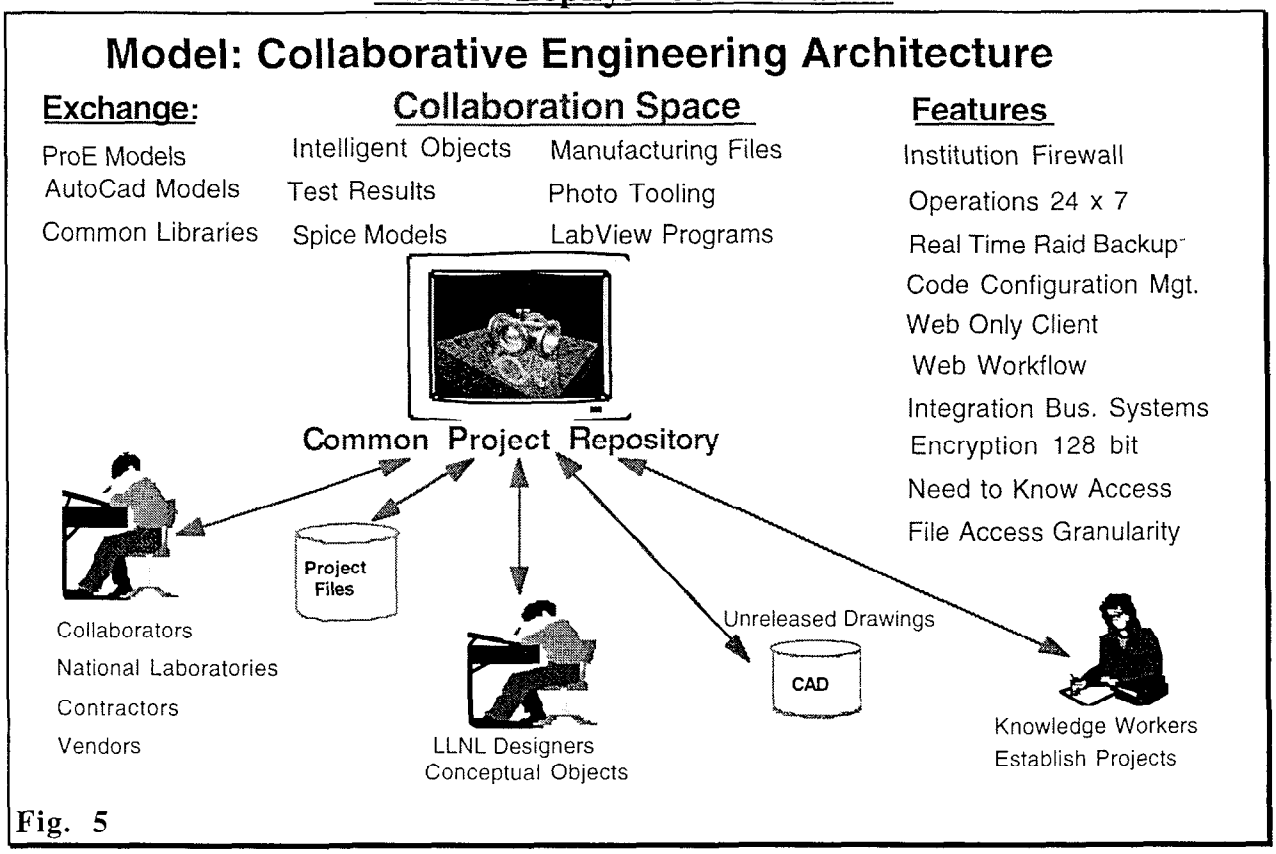

Fig. 5

It is common, to design a product in one country, produce the product in another, and deliver product on a global basis. Automobiles, aircraft, and many consumer goods are excellent examples. Engineering and commerce on the Internet speeds the engineering process by "virtually" providing critical engineering elements in forms intended for immediate use (ref. 7).

Zephyr-based collaboration is important to several nationally and internationally distributed engineering teams. However, it is critical to LLNL's Advanced Radiation Machine (ARM) Project. ARM is developing a new generation of linear induction accelerators. It shares engineering information between LLNL, Bechtel's North Las Vegas, Nevada Facility, and Allied Signal's Kansas City Plant in Kansas City, Missouri.

Vital paperless engineering information such as project schedules, CAD drawings, base-line performance-design, common design libraries, object-oriented design tools, 3D Models, integrated circuit design specifications and testing data are exchanged in seconds (fig.6).

Example: Paperless Engineering Information

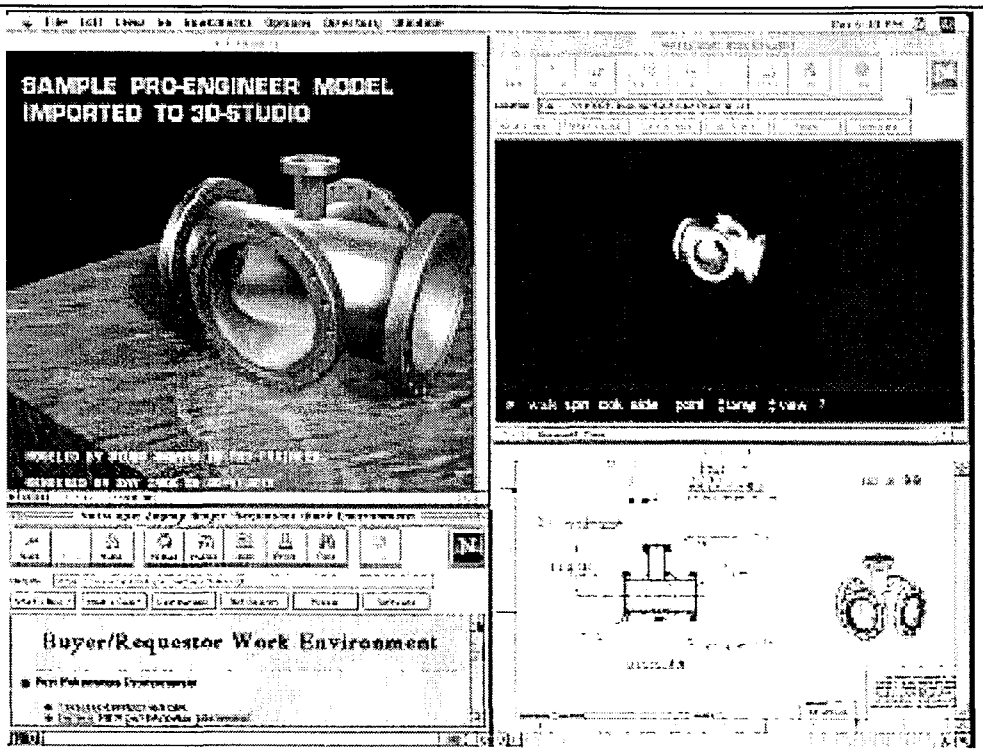

Fig. 6

Engineering teams share current information and knowledge using interoperable systems. Decision makers collaborate and concur within minutes and hours instead of weeks and months. Projects are better able to avoid unnecessary risk, stay within budget, and meet scheduled delivery dates.

ARM's Project Engineer stated that "without such a capability this project could not be accomplished within the allocated project time and budget". Similar stories of "collaborative value" have been documented between LLNL, other DOE National Laboratories, and Industrial Partners (national and international) in the development of high-performance optics, state of the art laser amplifiers, and massive power conditioning systems.

Procurement

Once engineering teams release a design for manufacturing, engineering services that meet specified requirements must be provided. Zephyr's procurement workflow process is initiated upon a user request to procure engineering goods or services. Soon after engineering design release, a buyer prepares an electronic request for quotation (RFQ) package.

Then Zephyr's procurement web-workflow process e-mails a vendor announcement indicating the presence of the RFQ in a secure section of the Zephyr World Wide Web "home page." After the announcement, all solicitations, quotations, awards, technical data exchanges (manufacturing files, drawings, and specifications), payments, delivery tracking, and record-keeping are provided for by Zephyr's workflow process. At all transactional levels, the benefits of compressed cycle time, ease of use, and secure business information are realized (ref. 8).

Payment

In keeping with Zephyr's mission to streamline the engineering procurement cycle, we have employed the use of the

LLNL's corporate purchasing card (Procard) as our primary payment mechanism to round out the procurement cycle.

Procard — a Mastercard purchasing card provided to LLNL by First National Bank of Chicago — solidifies the Zephyr contractor partnership by expediting payment (in most cases electronic funds transfer) to the contractor's bank, usually within 48 hours from product shipment.

First National Bank of Chicago's Mastercard was chosen because of it's world-wide acceptance, ease of payment processing, and enhanced point-of-sale reporting capabilities.

Manufacturers are interested in developing new ways of providing engineering goods and services to LLNL. Procard prompt payment, typically 1 to 2 days, and potential new business with Zephyr's competitive edge are clearly attractive manufacturer benefits.

In a series of pilot procurements, Zephyr's procurement officer purchased non-standard optical components using Zephyr's paperless bid-quote process and Procard. The bid package, request for quote, and award-process cycle took less than 5 days as opposed to longer cycle times associated with paper-based processes.

Because of Procard's prompt payment, our procurement officer negotiated "same as cash" discounts amounting to $120,000 in just two months. Zephyr's workflow process allows rapid accrual of such savings.

Zephyr's primary payment mechanism is First National Bank of Chicago's Procard. However, existing purchase and blanket orders are well understood payment mechanisms which are easily accommodated by Zephyr's web-based processes.

Implementation

One of Zephyr's early project milestones was a project review at the first meeting of the Lab's Engineering and Commerce on the Internet (ECI) Working Group. This working group consisted of representatives from Engineering, Procurement, Administrative Information Systems, Computation, and Technical Information Systems.

The ECI Working Group reached an agreement to promote Internet-based approaches to lower LLNL's cost of doing business. Such corporate-wide "working group" agreements are critical to implementing institutional cultural change.

However, technology alone will not assure complex engineering-business cycle reductions in time or cost. Administrative change must precede and complement "technical" implementation. Without such congruity, many excellent technical solutions fail to reach potential and eventually default to the "time honored" techniques of avoidance or misuse (ref 9).

Zephyr has been in constant operation since its inception as a prototype in March 1995, providing immediate access to a wide variety of vendors in many locations across the country.

Metrics

In 1995 and 1996 Engineering dramatically saved time in a series of prototypical manufacturing procurements. For example, Internet-based procurement of an assembly fixture in 5.5 days was 90% faster than traditional (paper-based) cycle times.

In other tests, prototype printed circuit boards were purchased in less than 2 days, again 90% faster cycle times.

Such transactions represent procurements of less than $5,000 per order but are 80% of the volume of custom manufactured items in Electronics Engineering (ref. 10).

In 1997-98, the metrics established in prior years remains valid. Engineering's use of Zephyr in LLNL's Electronics Manufacturing Group has allowed wide-access to manufacturing and procurement through out the Laboratory while providing on-line access to industrial partners and vendors using the Internet-WWW.

In 1997, we initiated collaborative on-line engineering teams sharing current information and knowledge using interoperable systems. Decision makers now collaborate and decide within hours instead of months. Projects using such collaborative techniques avoid unnecessary design risk and adverse budgets impacts while meeting delivery dates.

In 1998, we conducted our third Industrial Partnering - Procard Vendor Outreach Program.

Furthering our goal to develop meaningful partnering relationships with our vendors, the Laboratory initiated an annual Procard Symposium and Trade Show event.

Procard vendors are invited to attend a 2- 3 hour training presentation in a business meeting forum to learn about the evolution and changes within the Laboratory's new Procard low-value purchasing model. As incentive to attend this training session, participating vendors are also allowed to host a table in a trade show environment to demonstrate new product offerings and distribute catalogs to LLNL customers.

This event is extremely well attended and is currently receiving national recognition as one of the most innovative Vendor Outreach Programs throughout the Federal complex. Approximately 250 vendors participate with over 2500 Laboratory personnel visiting the trade show. As added incentive, cardholders also formally recognize "outstanding vendor performance" during the morning symposium by providing partnership awards to those vendors who consistently provide their Laboratory customers with outstanding service throughout the year.

Genesis: Enterprise Integration Engineering-Procurement

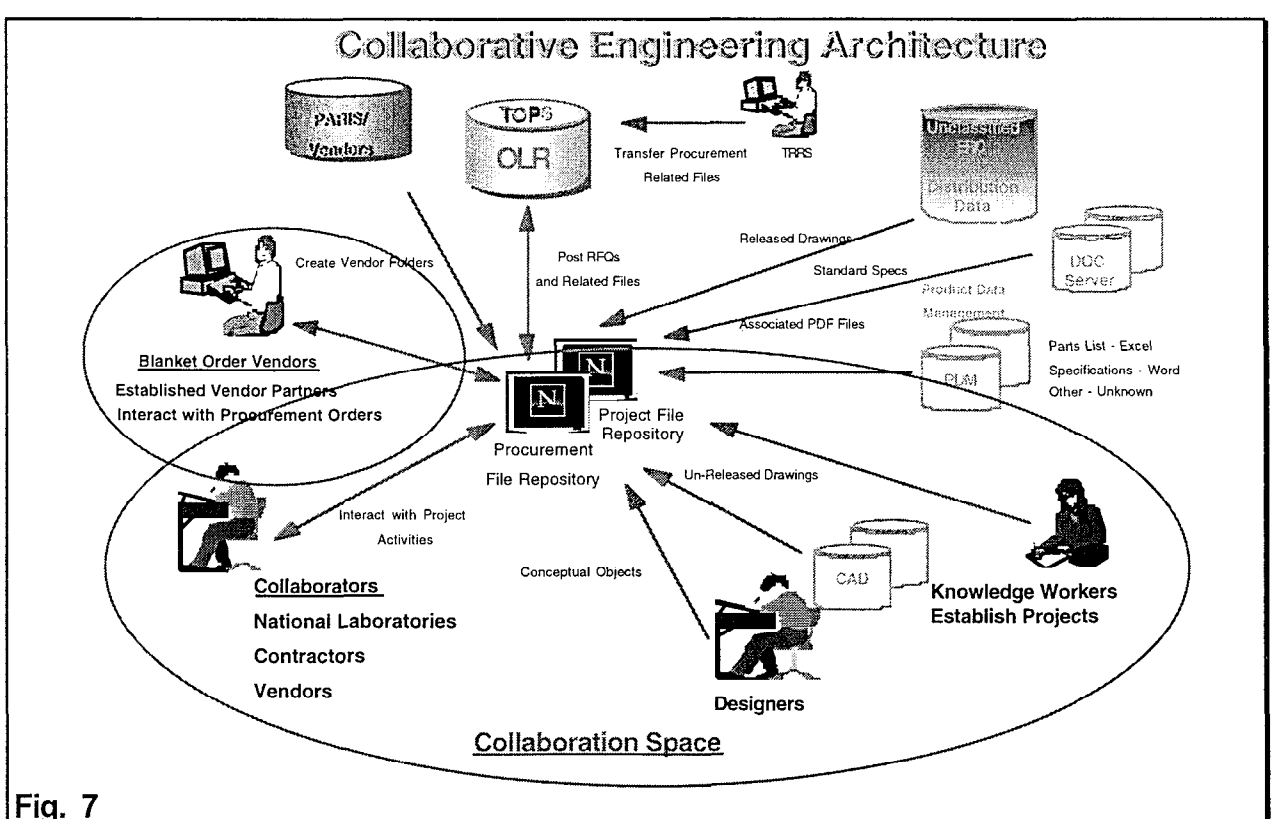

Fig. 7

Future Development:

LLNL Engineering and Administrative Information Systems (AIS) are developing a CITIS (Contractor Integrated Technical Information Service) like web-based document server to support Engineering development and procurements called LIAM (Livermore Information and Methods).

A major goal of the LIAM system is to provide "need to know" control and access on an individual or at group level to paperless documents such as electronic drawings, CAD files and models during the design phase of Engineering projects. Activities include check in/out provisions with file management features, document distribution to local and remote plotters/printers, retrieve/view/transfer of CAD data (2D and 3D), collaboration, forms, search of metadata, access to translators, and review and markup (in a future phase of the pilot).

LIAM will contain web links and access to actual CAD drawings, documents on the topics of Engineering Standards, Engineering Specifications, Vendor Resources, Training Opportunities, Laboratory Resources, Bulletins and critical software applications.

Information will be collected from various resources to complete the content of the pilot system. Documents will be stored in a document management system operated by AIS and will provide upload, download, access control, and revision control for the documents.

In the future, upon approval and release for procurement, LIAM Documents will be electronically attached to blanket order or bid-quote procurements using a web-based workflow model using lessons learned from Zephyr's pilot project (fig.7).

DOE Complex

The DOE Nuclear Weapons Complex (NWC), with LLNL participation, is developing new strategies for operations that automate traditional engineering and business processes in a classified working environment, while significantly reducing cycle time and costs.

DOE's Public Key Infrastructure (PKI) Working Group will orchestrate a PKI solution that spans five DOE sites. This solution will enable secure, authenticated exchange of e-mail, technical data, electronic forms, and other information required to conduct complex engineering and business processes over the Internet.

It is anticipated that PKI work, developed within the Nuclear Weapons complex, will "spin-off" into unclassified engineering projects allowing commercial businesses to take advantage of this technology (ref 11).

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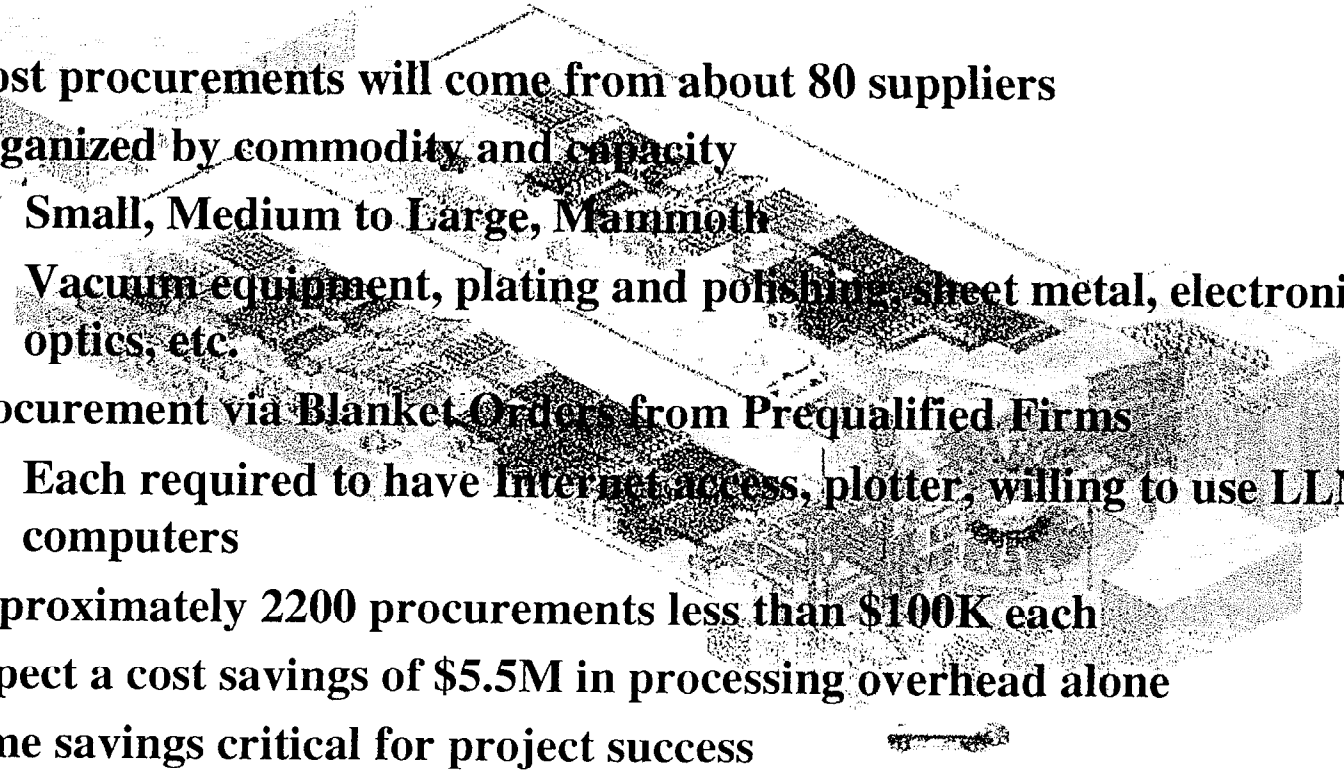
Where we're going...

Procurement & Material

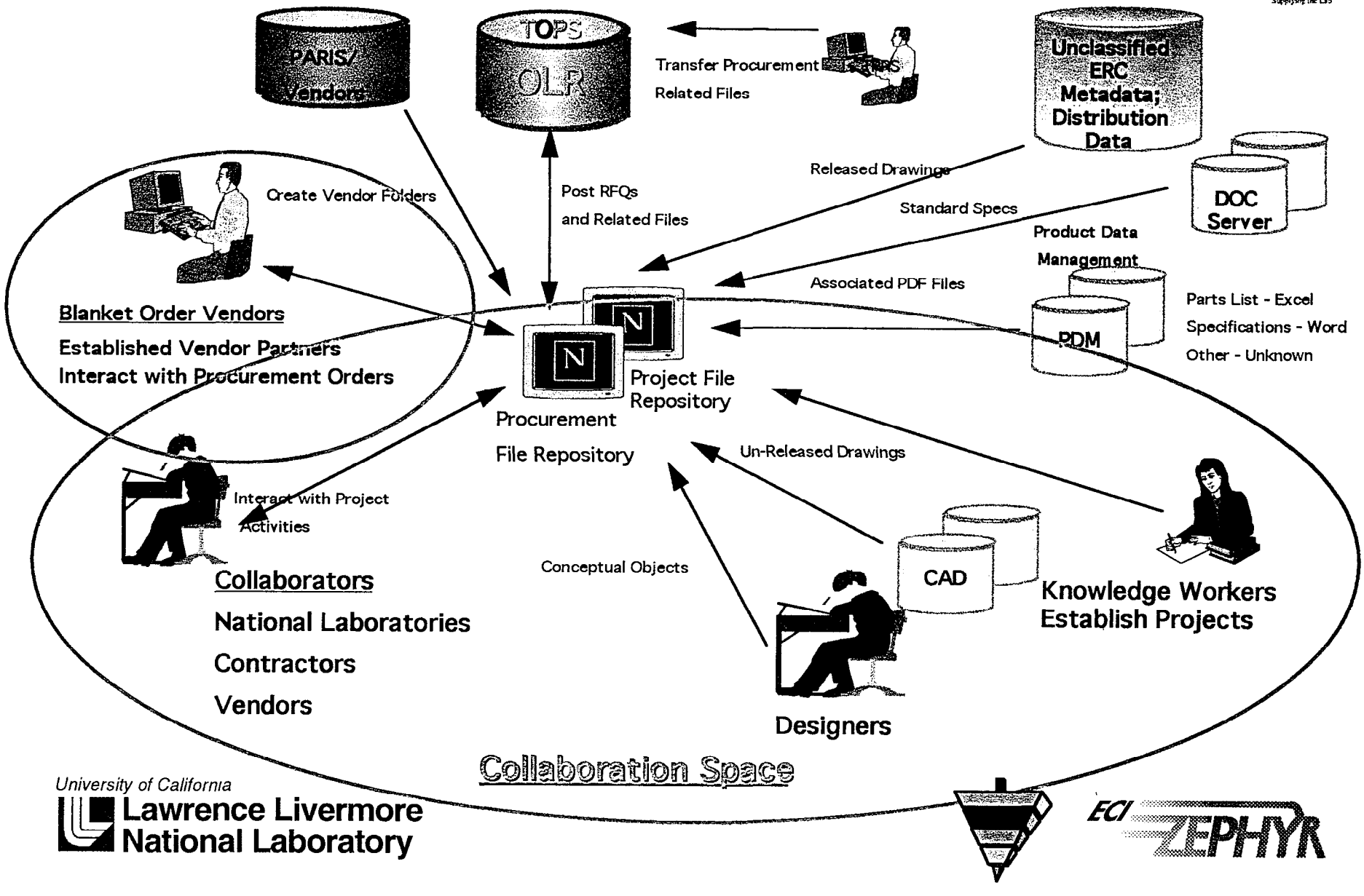
National Ignition Facility - $1.2B Project Uses EC for Supply Chain



- Most procurements will come from about 80 suppliers
- Organized by commodity and capacity
  - Small, Medium to Large, Mammoth
  - Vacuum equipment, plating and polishing, sheet metal, electronics, optics, etc.
- Procurement via Blanket Orders from Prequalified Firms
  - Each required to have Internet access, plotter, willing to use LLNL computers
- Approximately 2200 procurements less than $100K each
- Expect a cost savings of $5.5M in processing overhead alone
- Time savings critical for project success

Where we're going...

Model: Integrated Engineering-Procurement



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ECI ZEPHYR

Where we're going...

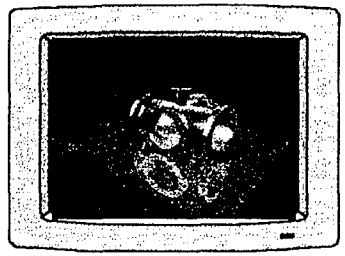
Model: Collaborative Engineering Architecture

Exchange

ProE Models
AutoCad Models
Common Libraries

Collaboration Space

Intelligent Objects
Test Results
Spice Models
Manufacturing Files
Photo Tooling
LabView Programs



Common Project Repository

Project Files

Collaborators:
National Laboratories
Contractors
Vendors

LLNL Designers
Conceptual Objects

Unreleased Drawings

CAD

Knowledge Workers
Establish Projects

Features

Institution Firewall
Operations 24 x 7
Real Time Raid Backup
Code Configuration Mgt.
Web Only Client
Web Workflow
Integration Bus. Systems
Encryption 128 bit
Need to Know Access
File Access Granularity

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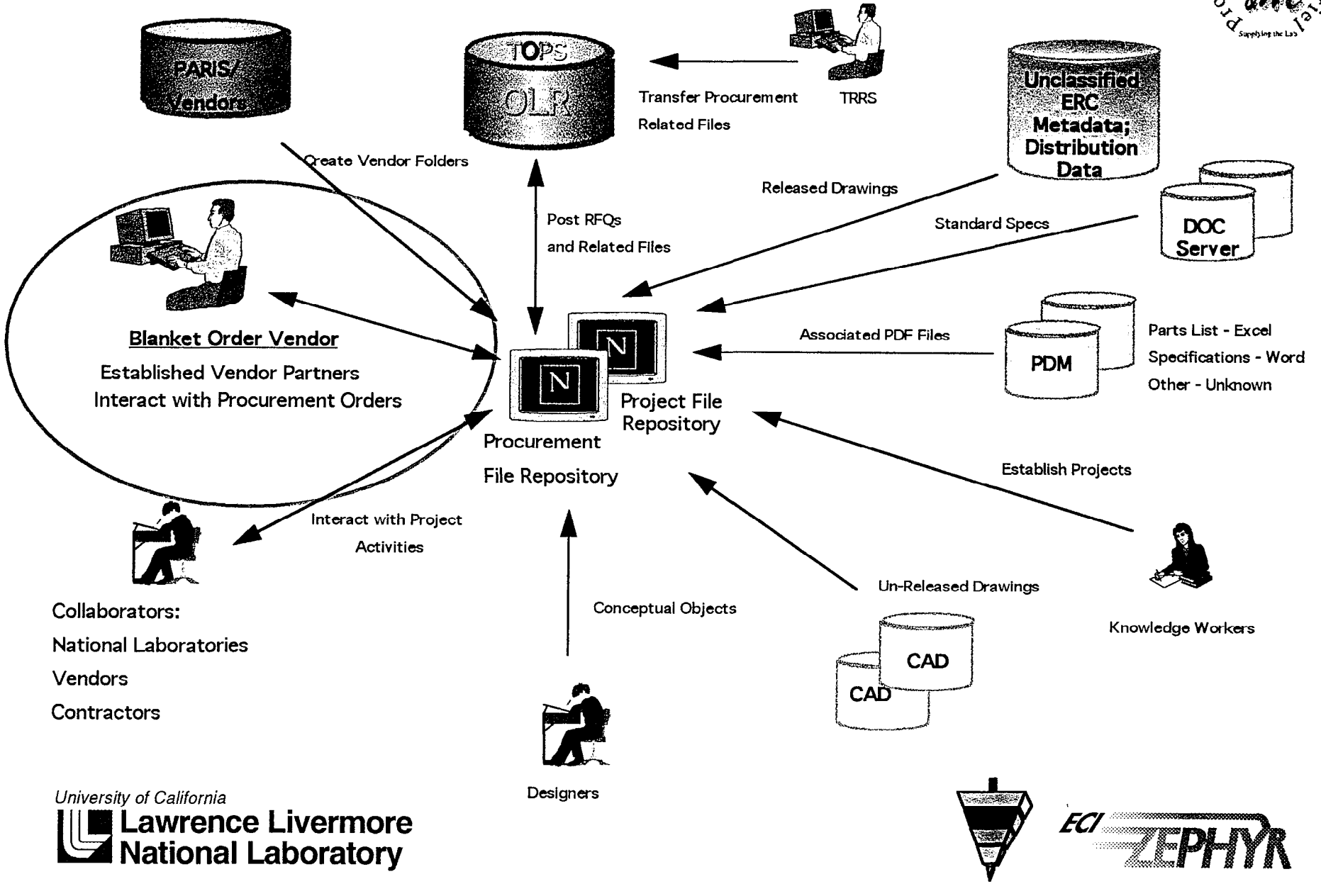
ECI ZEPHYR

Where we're going...

Model: Procurement Architecture



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ECI ZEPHYR

Where we're going...

Procurement Sources of Data

- Engineering Records Center
- Technical Release Representatives
- TOPS On-line Requisition System
- PARIS (Procurement System)

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ECI ZEPHYR

Engineering Sources of Data

- Engineering Records Center
- Engineering Document Servers
- Product Data Management Systems
- Designers and CAD Systems

Common Requirements

- Provide an Institutional infrastructure that supports **collaborative engineering** and the **procurement lifecycle**
  - Change Control
    - Check In/Out
    - Automatic Revision
  - Search/Retrieve
  - Secure - 128 Bit Encryption
  - Workflow to Insure Integrity of Engineering Processes
  - Distributed Administration of Access Control
  - File Exchange of Various Engineering File Formats
  - Customizable Attributes

Engineering Procurement Pilot Objective

- Implement an Institutional secure paperless workflow capability for Requesters, Buyers, and On-line Vendors that supports engineering procurement Job Orders.

Where we're going...

Collaborative Engineering Pilot Objective

- Implement a secure project-based repository to support engineering design and archiving for use by designers and engineers from various National Laboratories, Vendors, and Contractors.

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ECI ZEPHYR

Procurement & Material P&M Supplying the Lab

Working Group - Objectives

- Determine Abstract Requirements
- Define Document Management Architecture
- Research Solutions
- Learn From Pilots
- Report Findings
- Develop Institutional Document Management Strategy

Agents of Change

- Participants
  - Administrative Information Systems
  - Computations
  - Engineering/Engineering Records Center
  - Procurement & Materiel/Information Management Division
  - Laboratory Site/Plant Engineering & Construction
  - Laser Programs/NIF
  - Technical Information Department

Procurement & Material P&M Supplying the Lab

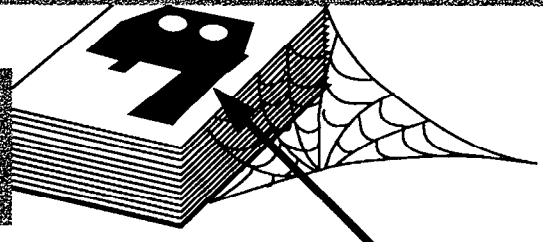
Enterprise Integration

Where we're going...

Where we are

An actual example shows dramatic time savings

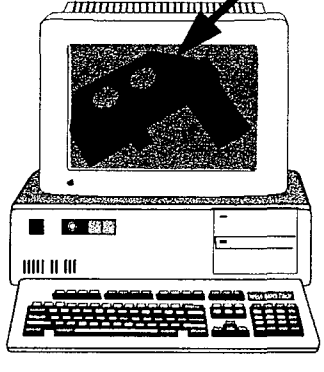
Traditional example (paper)



Delivered assembly fixture for Heavy-Ion Fusion Program (July 1995) → 56 days

< $5K procurements

Zephyr example (paperless)



Delivered same assembly (August 1995) → 5.5 days

90% time reduction

"SMEs deliver the results"

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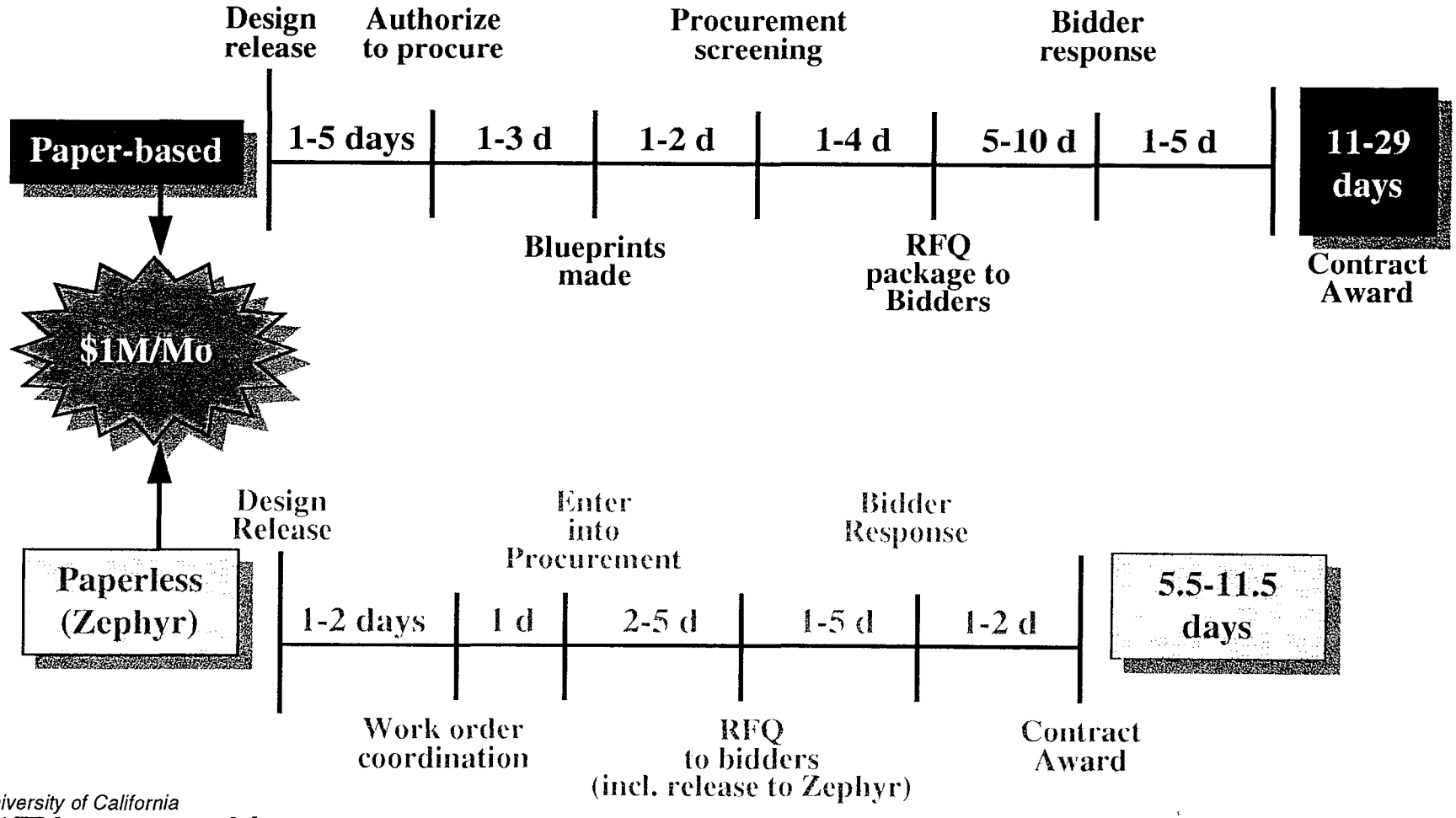
Where we are

The "design release-through-contract award" cycle can be substantially cut using Web-based workflow



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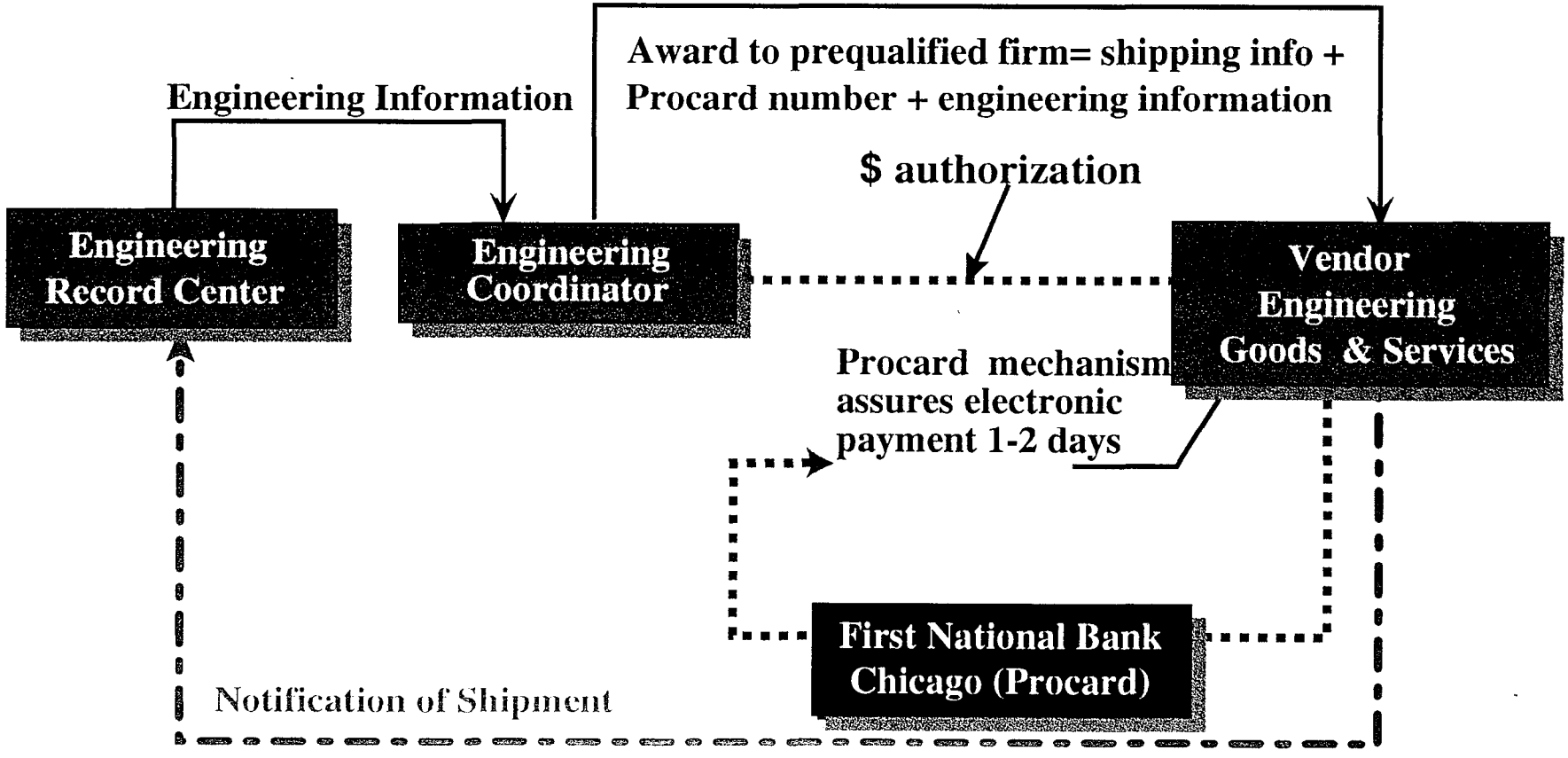
Where we are

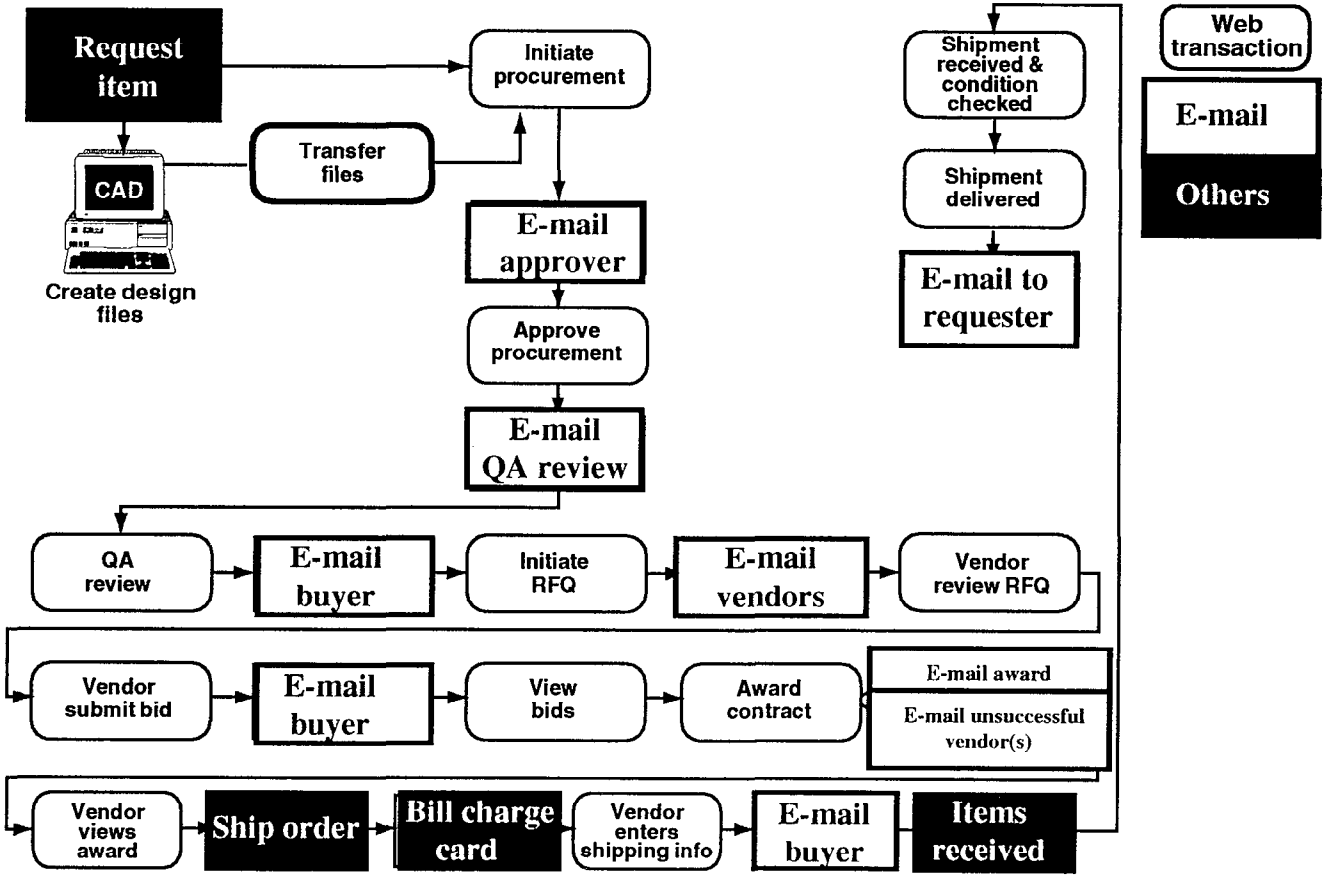
Paperless process

Engineering and Procurement provide the electronic way to eliminate paper steps

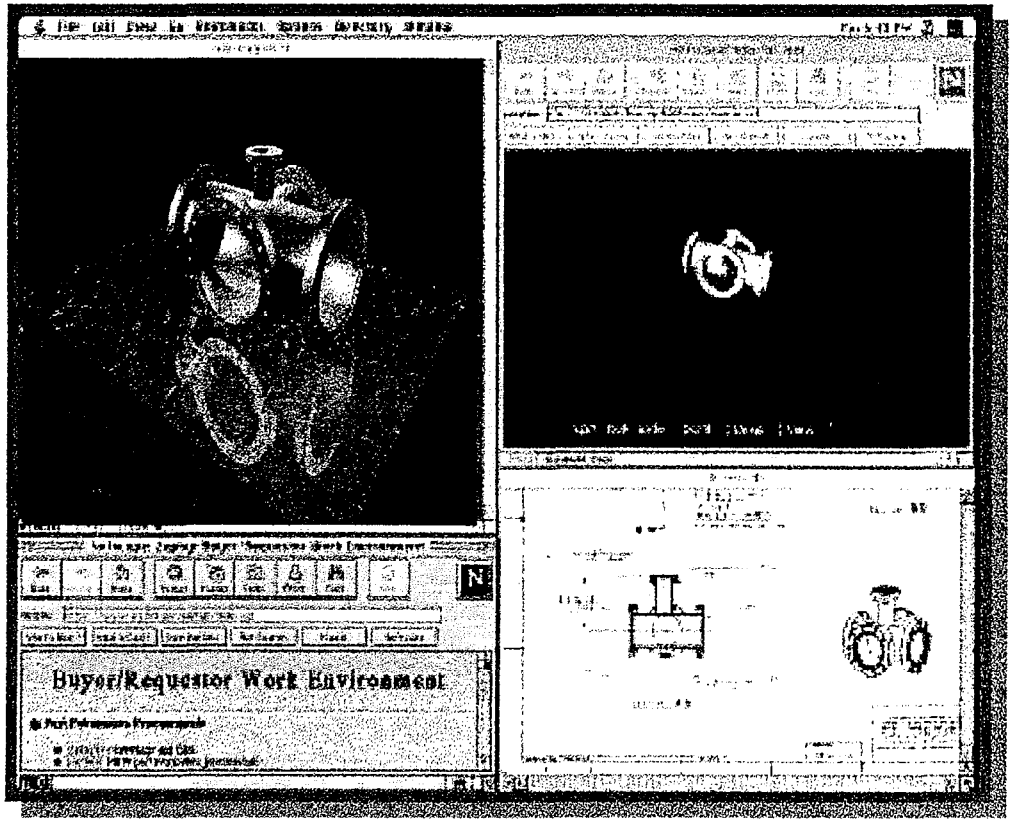


Where we are

Model: Web-based "transactions and e-mail"



Examples: Paperless Engineering Information

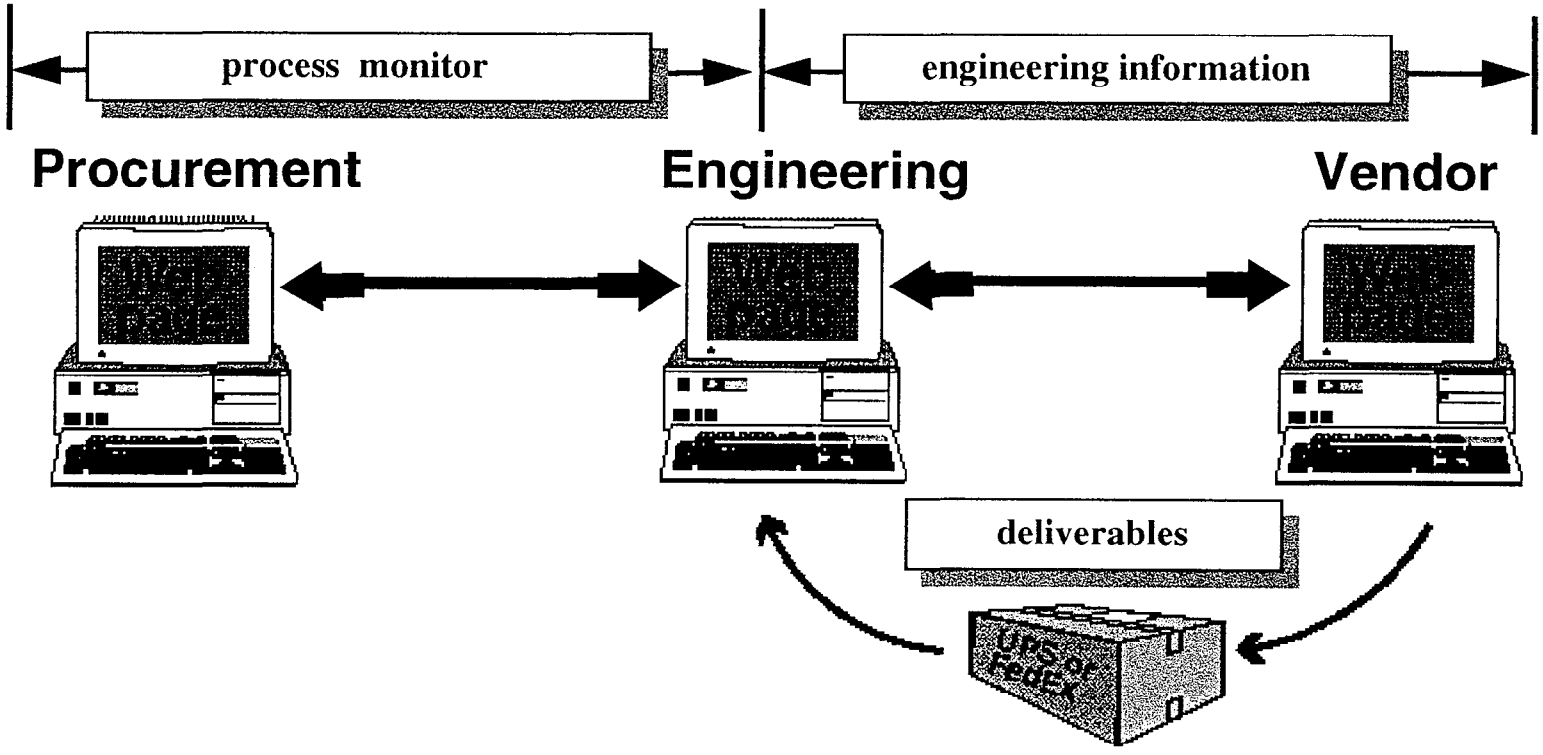


- Computer Aided Design
  - _3D solid models
  - _2D plots or "drawings"
  - _Virtual reality "views"
  - _Model-based "animation's"
- Manufacturing files
  - _CNC instructions
  - _StereoLithography
  - _Photo-tooling "gerber plots"
- MicroSoft Office Applications
  - _Word
  - _Excel
  - _PowerPoint
- Object-oriented design tools
  - _Spice
  - _MicroCap

Where we are

Solution Result

Zephyr's Web-based workflow process eliminates procurement paper delays



Deliverables 60-90% Faster

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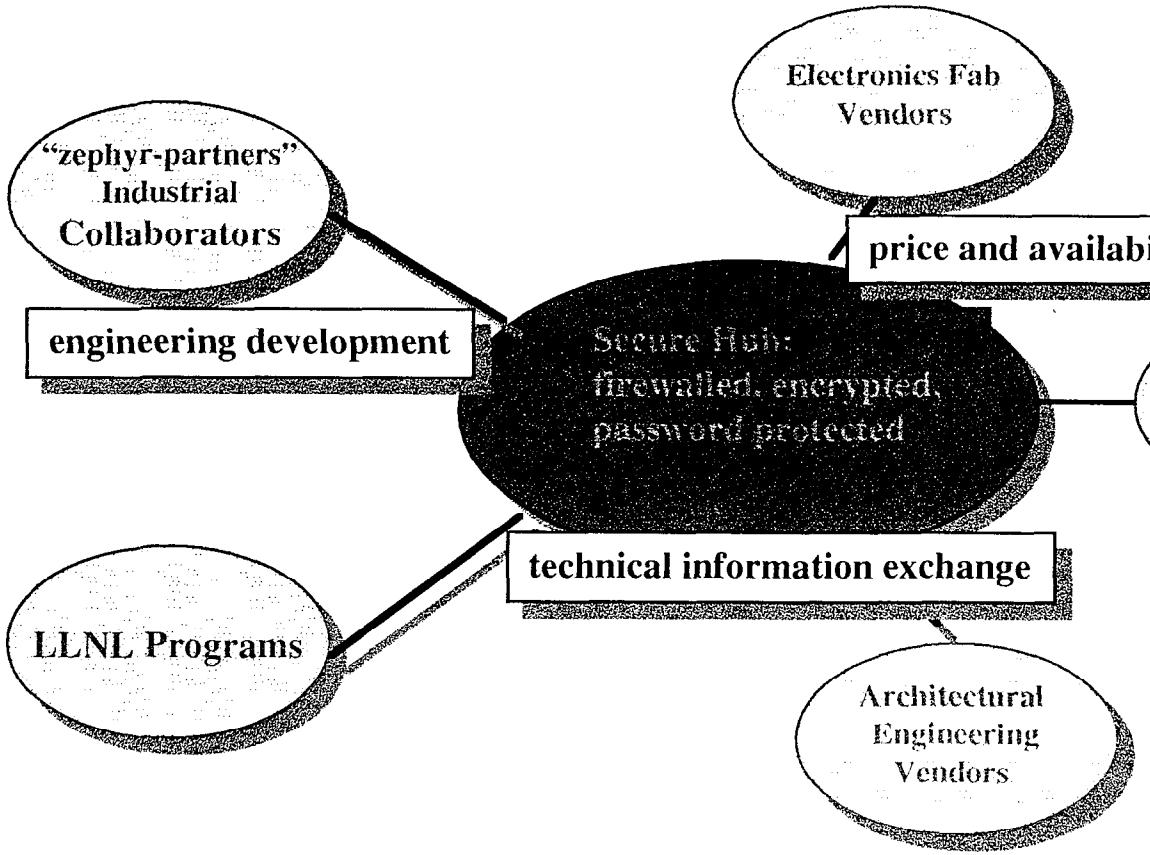
Where we are

Model: Integrates LLNL, Collaborators, and Vendors



SME Benefits:

- Equal access to large organizations
- Paid faster (improved cash flow)
- Easier to do business with large organizations
- More business opportunities

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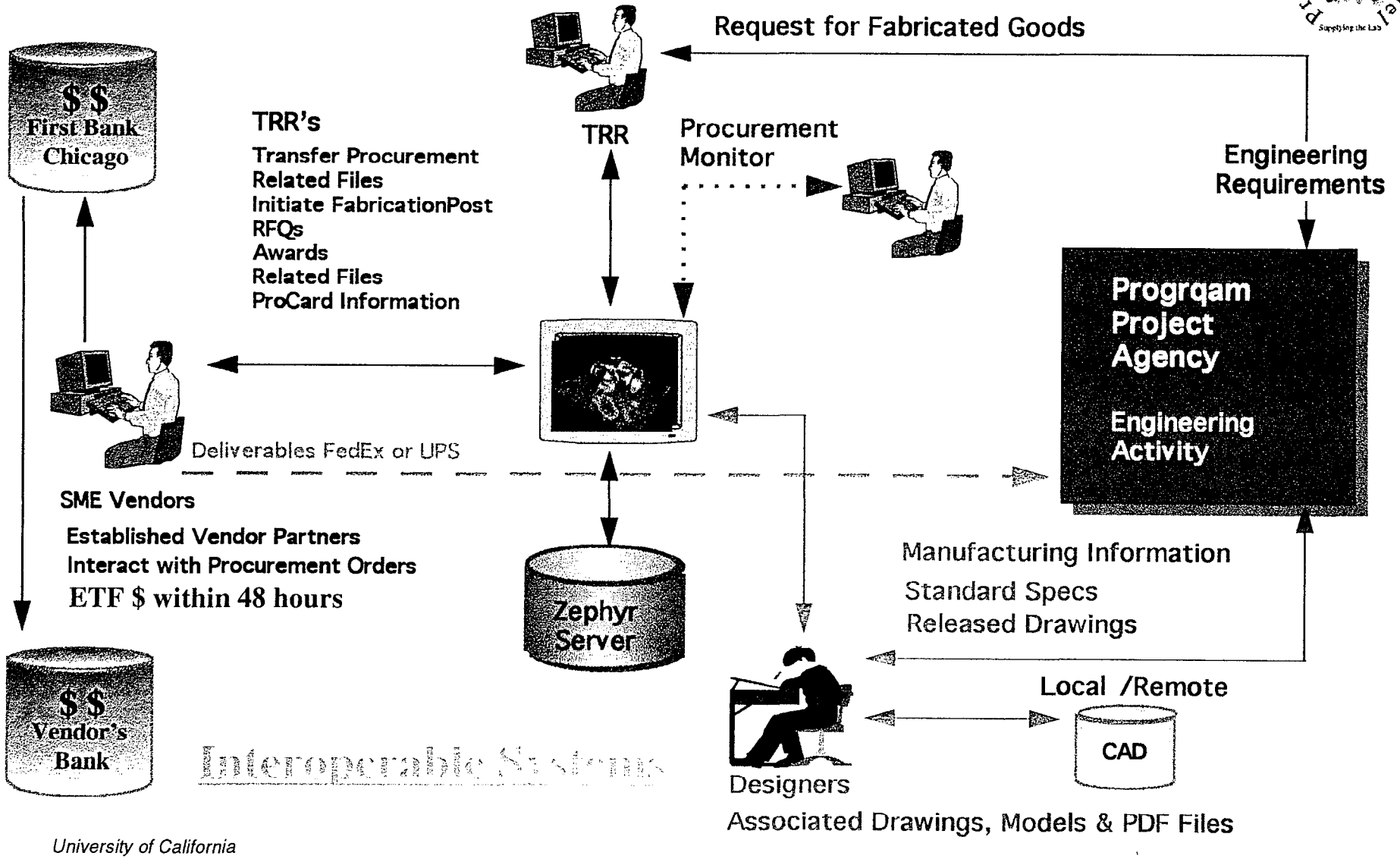
Where we are

Model: Web-Workflow Architecture



Interoperable Systems

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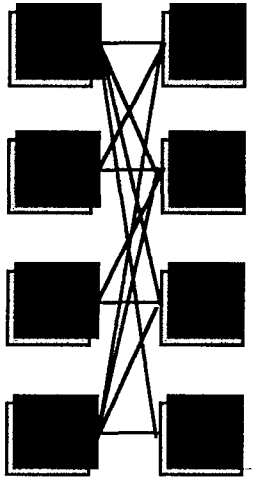
Where we've been

Solution Concept

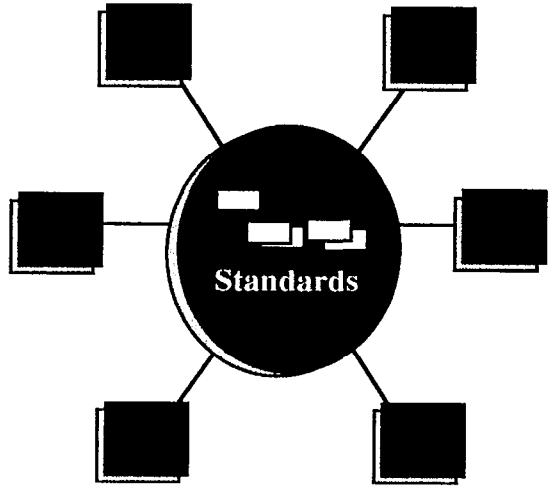
From Islands of Automation to Interoperable Systems

Islands of automation
paper flow



Transition Path

Interoperable systems
communicating Information



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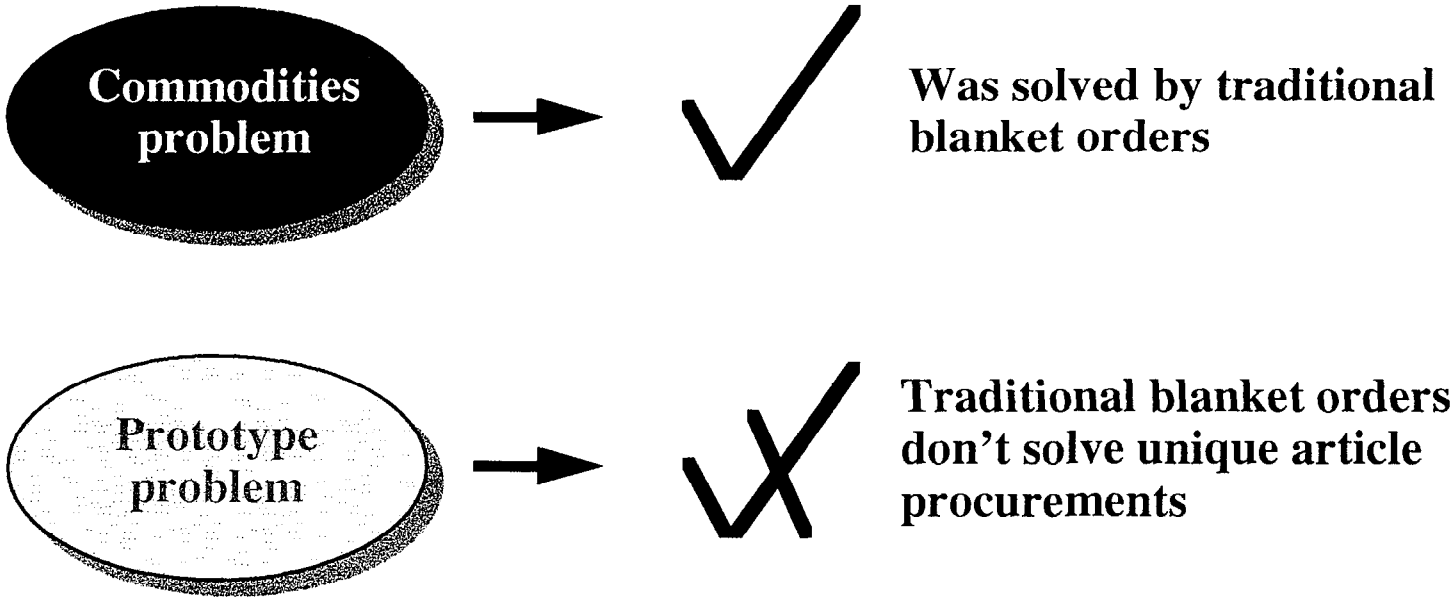
More problems

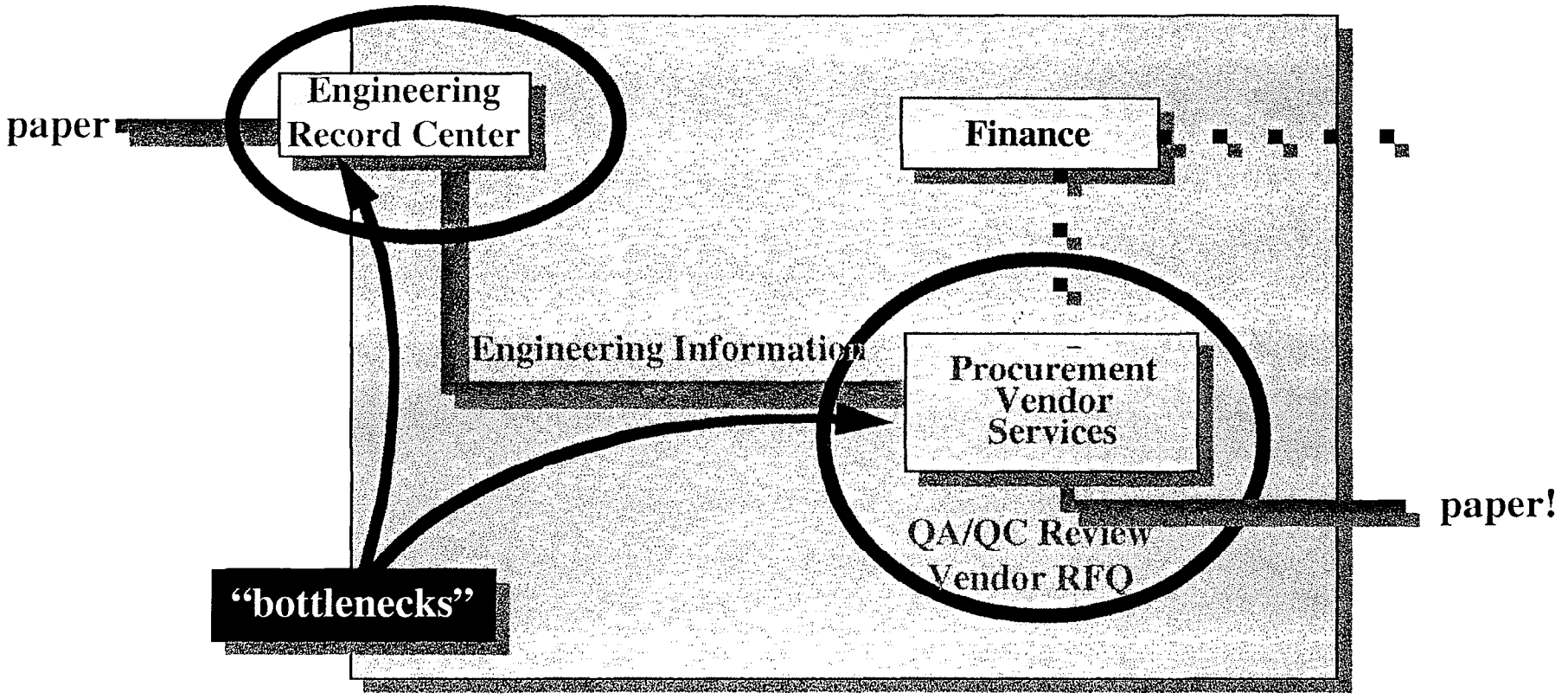
The acquisition process for prototypes was costly and had too long a cycle time



Where we've been

The problems

Our traditional deliverables path contained "bottlenecks" and was a maze of paper delays



Includes major time-consuming paper-based steps

Critical Issues in Web Commerce

- Security
  - Attacks on computers are probable
  - Proprietary information must be protected
  - Requires an active on-going defense
- Administration
  - System reliability is central to business use
- Computer Interoperability

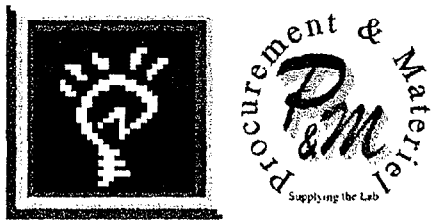
Internet/Intranet Business Transactions

- Faster, Cheaper, Smarter
- Elimination of Paper Cost and Delays
- Competitive Advantage
  - Fast response to customers
  - Rapid payment
- Global Commerce
  - No barriers to entry for remote vendors
  - No time zone problems

EC History at LLNL

- **1991 - Logistics Information Network (LINK)**
  - Important role in Desert Storm, still in use
- **1993 - GATEC at Wright-Patterson AFB**
  - Rapid procurement of commodity items using EDI and VANs
- **1995 - LLNL/BofA Internet Bill Paying**
  - $200M annually via the Internet, 200 vendors paid
- **1995-98 Zephyr**

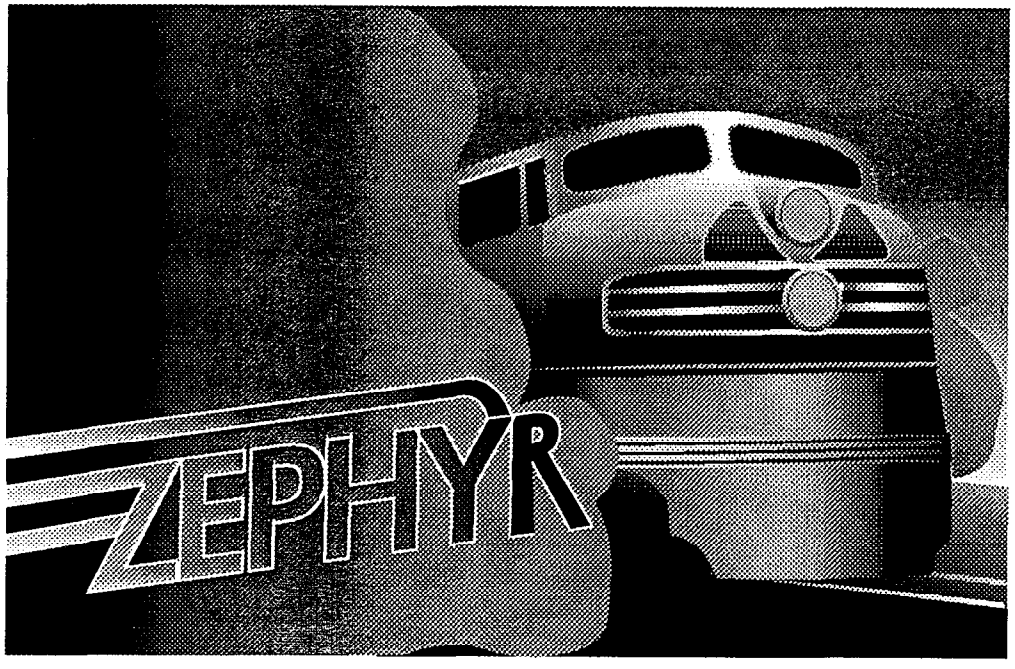
Navy Best Manufacturing Practice



DOE Best Practice

Where we've been

A Secure Internet Process to Streamline Engineering



- Web-based Zephyr speeds procurement by 60-90%
- Secure paperless workflow enables the process
- Levels the playing field for vendors regardless of size or location

http://zephyr.llnl.gov/

Outline: The Tracks to Enterprise Integration

- Where we've been
- Where we are
- Where we're going...

A Secure Internet Process to Streamline Engineering

Cecil Jordan, Electronics Engineering
Lawrence Livermore National Laboratory
Livermore, California 94550

CALS Expo International & 21st Century Commerce 1998
Global Business Solutions for the New Millennium
Long Beach Convention Center
Long Beach, California
October 26-29, 1998

Barriers to Change

- Corporate Culture
  - Is the new embraced or suppressed?
- Entrenched paper-based practices
  - They have been approved
  - They are safe and reliable
- Human nature
  - Change requires effort and overcoming fear

Keys to Success

- Senior executive champion
- Key supporters in functional areas
- Person by person approach
- Effective middle management network
- Excellent business case (reduced cycle-times)
- Working pilot system generating metrics
- A strong business driver

Case Study: Zephyr Pilot Rapid Procurement System

- Driven by business need (shorten procurement time)
- Newly available technology
- Visionary leader with a mission
- Pressure to out-source fabrications

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