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“Electronic Research Demonstration Project”

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submitted by:

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Introduction

This is the final report for the Department of Energy (DOE) funded cooperative agreement "Electronic Research Demonstration Project (DE-FC02-92ER35180)" for the period August, 1994 - July, 1998. The goal of the project, referred to as NewERA, was to demonstrate the use of open standards for electronic commerce to support research administration, otherwise referred to as Electronic Research Administration (ERA).

The NewERA demonstration project provided a means to test interagency standards developed within the Federal Grant Electronic Commerce Committee, a group comprised of federal granting agencies. The NewERA program was initiated by DOE and it became a vital piece of the entire federal effort, as evidenced in the committee's "EC Project Plan" of May, 1996 (and revised in May, 1997).

NewERA was comprised of three separate, but related ERA activities in preaward administration, postaward administration and secure Internet commerce:

- (1) The initial cooperative agreement from ER/DOE focused on transmitting grant applications electronically from grant applicants to agencies using a public standard.
- (2) The Office of Naval Research, in 1995, awarded supplemental funds to NewERA to assist with the expansion of their ERA effort in postaward administration for electronic funds transfer (EFT).
- (3) Finally, beginning in 1997, the Federal Government Information Technology Services (GITS) Board - Security Champion - awarded additional funds to leverage the use of the NewERA testbed for demonstrating secure transmissions over the Internet as one of thirteen Key Recovery Demonstration Projects (KRDP).

The goal of NewERA was to demonstrate an open standard implementation of ERA using electronic data interchange (EDI), e-mail and Internet transaction security between grant applicants and DOE, along with the other participating agencies.

1.0 Submitting Grant Applications Electronically

In an effort to demonstrate an alternative to the current environment for grants administration, the NewERA project pursued the following objectives and activities:

1. facilitating the NewERA Task Force;
2. demonstrating the technical feasibility of ERA using electronic data interchange (EDI) as the open standard;
3. assessing business process reengineering (BPR) to support a new technical environment;

4. supporting demonstration centers in ERA preparation;
5. assisting DOE with internal ERA preparation and coordination with university and agency partners; and
6. disseminating progress and results to the research administration profession.

1.1 NewERA Task Force

RAMS-FIE was charged with facilitating the NewERA Task Force as a primary task, including recruiting participants, planning meetings (facilities, logistics, travel) and developing the agendas and activities to support program goals.

Originally mandated to include only four university partners (also referred to as Demonstration Centers), the NewERA Task Force soon expanded, out of interest and necessity. A key finding was that the original university participants rejected the idea of organizing their systems and personnel to interact electronically with only one agency. Coordinating with other agencies was a key critical success factor, as well as a powerful incentive to participate.

RAMS-FIE, in conjunction with DOE, then recruited other agencies and grantee organizations into the demonstration. Consequently, DOE was able to leverage greater investment, support and participation in NewERA. University participants cited this as critical to obtaining support for their own development and reorganization efforts (see University final reports in Appendix C). They also noted the benefits of being able to work cooperatively with peer institutions as an important benefit.

At various times in the project, up to ten grantee organizations participated (Baylor College of Medicine, Duke University, Florida A&M University, Fred Hutchinson Cancer Research Institute, Massachusetts Institute of Technology, North Carolina State University/GAMS (Grant Application Management System - in partnership with IBM), Pennsylvania State University, University of California - Los Angeles and University of Notre Dame). In addition, as many as five other agencies besides DOE participated as well (National Institutes of Health; Office of Naval Research; Air Force Office of Scientific; Army Research Office; and the Army Medical Research Acquisition Activity). Each organization had approximately 3 active members participating in the Task Force, generally comprised of representatives from sponsored programs, department research administration, and technical support.

RAMS-FIE facilitated 9 meetings of the full NewERA Task force, along with 3 separate meetings for the Programmers' Workgroup. Proceedings, documentation and other support were made available through the listserv (univ-l) and restricted project web page (<http://web.fie.com/web/era/restrict>).

1.2 Demonstrating the Technical Feasibility of ERA Using Electronic Data Interchange (EDI)

The success of ERA, according to NewERA Task Force participants, would depend on the availability of supporting systems, a standard agency implementation, and minimizing changes to the faculty/researcher work environment. While an EDI standard was evolving (i.e. transaction set 194), grantee organizations and agencies alike lacked automated systems to support ERA. At the same time, information technology personnel in the Task Force lacked knowledge and experience with EDI, Portable Document Format (PDF) and MIME communications. In fact, at the time, all EDI communications were transmitted through Value Added Networks (VANs), not through the Internet.

The key finding here was that it became absolutely necessary to provide prototype software for testing, and to develop EDI literacy for technical personnel. Thus, early in the project, the NewERA Task Force chartered the Technical Subcommittee.

RAMS-FIE created a prototype demonstration for conducting initial tests using commercial-off-the-shelf (COTS) software (DOS-based Cost Proposal System, Telink translator and Sendmail). The goal was to provide a homogenous proof of concept test to:

- create and store research application data electronically;
- map and translate the data into 194 format;
- transmit the file in a MIME email message;
- receive and acknowledge the email message using EDI rules.

In September of 1995, the Fred Hutchinson Cancer Research Center became the first Task Force participant to successfully submit a 194 test to DOE. Subsequent transmissions were received by Pennsylvania State University, Duke, MIT and Notre Dame to further validate the proof of concept test.

Later the next year, there were several universities and agencies that were ready to begin testing the transmission and receipt of data from their own systems. Thus, the Technical Subcommittee became the Programmers' Workgroup (PWG), created to facilitate heterogeneous testing between university and agency partners. This provided a robust forum for compliance and interoperability testing. Equally important, this was the first-ever multi-agency cooperative testing venture in research administration with grantee organizations.

The PWG was comprised of representatives from: Duke University, North Carolina State/GAMS consortium, Pennsylvania State University, Department of Energy, National Institutes of Health, Office of Naval Research, and RAMS-FIE, serving as chair. In addition, Florida A&M University participated in testing, but was not an active participant in the PWG.

The PWG focused on facilitating member participation in testing by:

- hosting separate meetings for programmers and technical support personnel to support EDI literacy and technical training;
- facilitating a collaborative work web site (http://edihost.fie.com/cgi-shl/_addcomments.pl?topics/test/);
- providing database mapping support documentation for relating agency forms to database fields, flat file positioning and 194 transaction set translation (Appendix A-1);
- creating an implementation convention for transaction set 841 - designated to incorporate PDF into EDI for transmission of scientific proposal content (Appendix A-2);
- developing, documenting and coordinating a test plan for creating and transmitting control proposals (Appendix A-3); and
- providing continuous feedback through regular progress reports (see Appendix A-4 for the final progress report number 7 - reports 1-6 located at <http://web.fie.com/web/era/restrict/>).

The test plan developed is a scaleable and replicable model. Transactions were initially exchanged between pairs of universities and agencies. At each successive stage, new data were added, documented and validated. Through this phased approach, the PWG completed transmissions for testing the full capabilities of TS 194 and TS 841 (with embedded PDF file containing scientific content). The PWG thus established the importance and utility of using control data to verify compliance and interoperability of university and agency systems. NewERA participants therefore demonstrated the use of EDI, PDF and MIME as enablers of ERA for submitting and processing grant applications.

As a followup activity, the project director reported all issues to the Federal Grant Electronic Commerce Committee for resolution and refinement of TS 194. This was important in moving from theory (developing EDI transaction sets) toward implementation (actually sending EDI transaction sets).

1.3 Business Process Reengineering - The Business Issues Subcommittee

The goal of ERA is not to layer new technology over pre-existing inefficiencies in research administration business models. Implementing ERA, and EDI, will necessarily require fundamental changes in business practices. The key finding here was the necessity to address business issues, which had been neglected in the scramble to understand and test the technology to support ERA.

The NewERA Task Force therefore chartered the Business Issues Subcommittee (BIS) to define business issues, and to make recommendations where possible. BIS membership included at least one representative from each participating agency and

demonstration center, as well as the Project Director from RAMS-FIE, who served as chair.

The BIS focused on: performance and benchmark measurements; requirements for transmitting proposal text electronically; trading partner agreements; and personnel impacts of ERA.

1.3.1 Performance and Benchmark Measurements

As cited in the feasibility study mentioned previously, research administrators recognized the need for change, and were receptive to process improvement. However, benchmark and performance measurements had never been established to define the business case for ERA, and to demonstrate future productivity improvements following any ERA implementation.

To provide answers, NewERA demonstration centers participated in a benchmark study, initiated by the National Science Foundation (NSF), and later co-funded by DOE and NIH, that examined the burden and costs related to current practices. (Another example of how the NewERA project leveraged further funds and greater participation beyond the initial DOE allocation.)

Most strikingly, the study found an inverse relationship between proposal unit cost and number of proposals submitted, where universities that submitted more proposals also had higher proposal unit costs (see "The NSF's FastLane System Baseline Data Collection - Cross Case Report, November, 1996. Cosmos Corporation, <http://www.nsf.gov/pubs/1997/ccrpt96/start.htm>).

Measurement, through this benchmark study, provided significant insight into the costs and burden associated with research administration. The study further illustrated the significance of organizational structure, and thus provided guidance on ERA reengineering issues.

1.3.2 Electronic Transmission of Proposal Content

As originally developed, TS 194 defined only the administrative elements of a grant application and did not accommodate the most important component to any grant application: the scientific narrative. A subcommittee of the BIS therefore undertook a study to define requirements for the electronic transmission of proposal content, which became the basis for testing PDF embedded within TS 841 through the PWG. The final report described user requirements and issues for the creation, submission, receipt and review of the scientific narrative (Appendix B-1).

1.3.3 Trading Partner Agreements

Historically, companies conducting business electronically through EDI exchange Trading Partner Agreements to define electronic business operations. Another subcommittee of the BIS evaluated trading partner agreements in industry, and within the federal government, and created a final report on trading issues that will require definition when conducting grants administration business electronically (Appendix B-2).

1.3.4 Personnel Impacts of ERA

The implementation of ERA will have a profound effect on the nature of work for research administrators. Redundant, non-value added tasks will diminish, and the personnel currently performing those tasks will have to be retrained, transferred or otherwise discontinued. A subcommittee of the BIS sought to explore the personnel impacts of ERA, and highlighted issues for the first time ever regarding change management for technical innovation in research administration. This report later served as a foundation for a masters' thesis (Appendix B-3).

1.4 Demonstration Center Facilitation

In a pre-solicitation participation letter, demonstration centers were asked to commit resources to the NewERA project, including appointing representatives to the Task Force. In addition, demonstration centers were expected to ultimately adopt ERA conventions as demonstrated by NewERA. The key finding here was that the member organizations, despite appointing leaders, lacked any background for organizing electronic commerce reengineering at their institutions.

Initially, the NewERA project conducted special sessions that focused exclusively on education issues such as: EDI literacy training (the first in the research administration profession); and reviews of developing transaction sets to support research administration (the only input obtained from the user community by the Federal Grant Electronic Commerce Committee).

However, while the NewERA Task Force would serve as an educational and testing forum, ultimately, the reengineering work would have to be carried out at each individual site. A number of the centers created their own internal work groups, or task force, with representatives linked to the NewERA Task Force.

RAMS-FIE conducted site visits to most centers, and worked extensively with some campus groups, making multiple site visits to Pennsylvania State University, Florida A&M and MIT. RAMS-FIE also conducted conference calls with every

center prior to each task force meeting. In addition, as noted earlier in the section on benchmark and performance measures, each demonstration center received a workflow and performance analysis for their preaward administration processes through the Cosmos study.

As a deliverable, each demonstration site was charged with developing an implementation guide, a standard requirement for organizations conducting business through EDI. Within the guide, demonstration centers were expected to: analyze current business and technical environments; identify non-value added functions and procedures; describe reengineering goals; conduct a cost/benefit analysis; develop a needs analysis; and create an implementation schedule.

RAMS-FIE developed the "User's Guide for ERA" as a reference manual for developing implementation guidelines at the demonstration centers and agencies (Appendix C-1).

Six of the demonstration centers (Pennsylvania State University, MIT, Duke, UCLA, Fred Hutchinson Cancer Center, North Carolina State University) have submitted to RAMS-FIE at least one draft, a positive sign that the helped to initiate business reengineering processes at the demonstration centers.

In fact, several campuses explained that the NewERA project had a profound effect on campus commitment to investments in management and supporting systems. For example:

- MIT commenced an enormous project to develop their Electronic Proposal System, "whose development in large measure can be credited to the efforts of NewERA (MIT Final Report - Appendix C-2)."
- Pennsylvania State University explained that NewERA "refined our understanding of ERA and how it could be applied to the University (Pennsylvania State University Final Report - Appendix C-3)."
- Notre Dame credited NewERA for the creation of their "Excellence in Service" team, charged with integrating EDI efforts on campus (Notre Dame Final Report - Appendix C-4).
- And UCLA claimed that their participation in NewERA made ERA a primary development issue, and contributed to the creation of R-Net, designed to support ERA at UCLA (UCLA Final Report - Appendix C-5).

1.5 Assisting DOE in ERA Preparation

In addition to coordinating demonstration center participation and testing with DOE, RAMS-FIE assisted DOE's ERA internal preparation efforts for ERA. The major task was to support DOE in the standards development process. The key finding here was that grants administration required a unique transaction set to

support the electronic submission of a grant application, as well as new/modified implementation conventions to support other exchanges of business data.

RAMS-FIE has assisted DOE's participation in the Federal Grant Electronic Commerce Committee, charged with developing and/or modifying EDI transaction sets for ERA. This required identifying DOE's data requirements for each business transaction, and then mapping DOE's data to the appropriate implementation convention for the transaction set, and, where necessary, producing a DOE-specific implementation guide. As a final step, RAMS-FIE solicited feedback on agency requirements through NewERA Task Force EDI training and update sessions. These procedures were followed for the following business documents:

- grant application (TS 194 - although earlier efforts focused on combining TS 251 and TS 843);
- grant proposal solicitation (TS 840);
- trading partner profile (TS 838);
- award notice (TS 850);
- technical specifications (TS 841);
- functional acknowledgment (TS 997).

As a general EDI implementation requirement, agencies specify their data requirements, and provide notation on the use of transaction sets, in an implementation guide. RAMS-FIE helped DOE to develop a draft implementation guide for TS 194, the first to be produced by any agency for the use of EDI in research administration (Appendix D-1). RAMS-FIE also created TS 194 implementation guides for NIH and ONR.

Also, within the testing protocol requirements, each agency was charged with developing a "Quick Reference Guide" to specify system environment, contacts, key implementation issues, and EDI specific instructions (e.g. ISA/GS segments). DOE, with guidance from RAMS-FIE, was the first to produce a this guide to support the testing program (Appendix D-2). ONR and NIH also produced guides.

Finally, whenever requested, RAMS-FIE participated in internal planning and/or outreach sessions with DOE's Energy Research program.

1.6 Dissemination and Outreach Efforts

Transferring the NewERA experience into actual implementation essentially requires transforming the entire research administration profession. A key finding was that research administrators at grantee organizations and agencies alike lacked the conceptual understanding for implementing a standards-based electronic commerce program. Yet, without the support of the profession, the lessons learned

in NewERA would not take hold beyond the actual participants. Dissemination and outreach efforts were therefore paramount to ERA becoming a reality.

As noted earlier, outreach efforts to federal agencies actually resulted in five additional organizations participating in NewERA. RAMS-FIE also made presentations to other federal agencies and groups such as: Office of Management and Budget, the Vice President's National Performance Review and Budget, the Office of Science and Technology Policy and the National Grants Management Association.

However, informing grantee personnel was equally important to the future of ERA. As such, RAMS-FIE, often in conjunction with NewERA Task Force members, participated in over 50 workshops and panel presentations to groups such as: the National Council of University Research Administrators, the Society of Research Administrators, Federal Demonstration Partnership, SPEEDE/ExPRESS, Data Interchange Standards Association, and the Office of Federal Programs (Appendix E-1).

RAMS-FIE, in support of the Society of Research Administrators, coordinated 3 special regional meetings on ERA, EDI and electronic commerce reengineering. Over 450 people throughout the nation were trained at these meetings.

In addition to the presentations and workshops, RAMS-FIE maintained a listserv (era-l@majordomo.fedix.fie.com) and web site (<http://web.fie.com/web/era>) to keep the research administration profession informed about the project's progress. In fact, the listerv became a primary resource for research administrators, with over 100 linkages from other web pages to the NewERA site.

Project personnel from RAMS-FIE, at times in collaboration with Task Force members, also published six articles and book chapters, including:

1. Killoren, Robert and Robert Unger. "Planning for ERA." draft - pending publication in *Research Management Review*, by the National Council of University Research Administrators. (Appendix E-2)
2. Unger, Robert. "NewERA: A Demonstration in Electronic Commerce Reengineering." *Transforming Higher Education: Strategies, Design and Implementation*, College and University Personnel Association, Washington, DC, to be published in a book Summer, 1998 by the College and University Personnel Association. (Appendix E-3)
3. Norris, Julie and Robert Unger. "Establishing Electronic Research Support in Preaward Administration at MIT: The Role of Discovery." *Transforming Higher Education: Strategies, Design and Implementation*, Washington, DC, to be published in a book Summer, 1998 by the College and University Personnel Association. (Appendix E-4)
4. Robertson, Lawrie and Robert Unger. "Reducing Risky E-Mail: There's No Such Thing as Privacy." *Journal of Registry Management*, August, 1996. (Appendix E-5)
5. Unger, Robert and Joe Bass. "Electronic Data Interchange (EDI) in Higher Education." (released on the internet at <http://web.fie.com/web/era/edi-ed21.htm>) July, 1998 (updated from initial release in February, 1997). (Appendix E-6)

6. Killoren, Robert and Robert Unger. "Improving the University-Agency Interface through Electronic Commerce." *National Grants Management Journal*, spring, 1996. (Appendix E-7)

Also, as recognition of the interest in NewERA, there were at least 15 articles written that contained references to, and even featured, activities from this project. Some of the publications include: *Chronicle of Higher Education*, *The Scientist*, *Science*, *Electronic Public Information Newsletter*, *EDI Insider*, *Federal Grants and Contracts Weekly* and others (Appendix E-8).

Finally, it is interesting to note that the NewERA project spawned two academic papers, including a masters' thesis entitled, "The Impact of Technology on Personnel in Research Administration in Higher Education," by Mary Lee Moore, a member of the NewERA Task Force.

2.0 Electronic Invoicing and Electronic Funds Transfer

The Office of Naval Research (ONR), a NewERA project participant, had been demonstrating the use of EDI for invoice submission and for payment via Electronic Funds Transfer (EFT). As a supplement to the NewERA demonstration, ONR funded RAMS-FIE to assist with the expansion of their electronic funds transfer (EFT) initiative. This was a natural progression of the preaward grant application ERA effort into postaward administration, as both agencies and universities would benefit from integrating EDI into other research administration functions. Furthermore, the Federal Grant Electronic Commerce Committee had begun developing interagency EDI standards for postaward administration based on the ONR model.

At the time the additional funding was made, the ONR EDI/EFT system was operational in nine institutions, only 18% of all vouchers were processed electronically. ONR had targeted 67 research institutions for its EDI/EFT program as stated in the ONR 24, "EDI/EFT Readiness Plan." These institutions represented 75% of all annual ONR vouchers processed, as of May 1996, to educational and nonprofit institutions. The objective for providing funding to NewERA was to expand the number of operational institutions through participant recruitment efforts, information dissemination, training and participant counseling and assistance.

As a result of efforts by RAMS-FIE, by July, 1998, ONR increased participation for the EDI/EFT project by nearly 700%. The ONR EDI/EFT system has become operational in 62 sites (see list of sites in Appendix F). Now, 63.25% of ONR's vouchers are processed electronically. There has been positive feedback from other agencies who are considering adopting ONR's model.

In addition to the benefits for ONR, university participants cited these advantages to participating in the EDI/EFT initiative:

- Low cost - Electronic Data Interchange (EDI)/EFT (electronic funds transfer) is fairly cheap and easy to establish. EDI/EFT eliminates low value-added tasks better performed by computers.
- Improved expenditure rates - By shortening the time between costs incurred and actual payment, agencies improve their performance expenditure rates.
- Security - EDI/EFT provides enhanced security compare to paper vouchers.
- Accurate accounting - Automatic synchronization between the agencies accounts and that of the payment office eliminates costly and time-consuming reconciliations.
- Error reduction - Since the projects inception, error rates on invoices have been reduced from 30% to less than 2%.
- Faster payments - Grantee organizations receive payments within 7 days of electronic invoice submission, compared to over 60 days for paper submission.

3.0 Internet Transaction Security Testing

Security is a business issue often cited as a requirement for ERA, particularly by faculty and researches who believe that proposals contain sensitive data. The important question is how does the electronic context of security differ from the paper understanding? Security is actually a broad term encompassing several elements, pneumatically noted as P.A.I.N. (privacy, authentication, integrity, non-repudiation).

In the paper world of grants, an authorizing official authenticates an application by signing a form. Privacy is maintained by sealing an envelope for delivery by an overnight delivery service. So long as the envelope is not opened, there is presumably no threat to the integrity of the document. Delivery services can prove delivery (non-repudiation of receipt) by requiring a signature from the recipient.

The NewERA project served as a testbed for demonstrating the electronic transaction security for transmitting EDI files over the Internet. In 1997, the Interagency Working Group on Cryptography Policy, under the Key Recovery Demonstration Project (KRDP), provided additional funds to NewERA to demonstrate a prototype environment to satisfy security needs for the research community. The focus is on securing transactions rather than securing the Internet.

The goal of the funding was to test and demonstrate various methodologies and technologies for providing emergency access to encrypted data, based on Internet transport protocols for e-mail. The finding here was that, again, universities and

agencies alike lacked any experience with key recovery technology. Therefore, RAMS-FIE, in partnership with security vendors, developed a prototype environment, EZ_ERA32, to test security features for research administration data.

3.1 EZ_ERA32 and the Key Recovery Demonstration Project (KRDP)

EZ_ERA32 was prototype software that allowed the extraction of grant application data from user productivity tools such as Microsoft Excel and Word. The extracted data was then processed to generate a standard TS194 transaction set which was encrypted. The software also provided functionality for public-private signature keys, public-private exchange keys, and CSR generation as well as other configuration utilities (email configuration, establishment of trading partner relationships and exchange key storage, etc.) that allowed the exchange of secure EDI transactions to occur. In the absence of a commercial product that provided the complete set of security functionality, EZ_ERA32 was developed as the glue to tie together the different commercially available components. This effort was part of the KRDP Pilot which demonstrated how security and key recovery could be utilized in an electronic research administration environment. Based on the EZ_ERA32 prototype, participants in research institutions were able to submit grant applications to DOE in a secure manner.

EZ_ERA32 utilized the Microsoft Crypto API, the Trusted Information Systems (TIS) Recover-Key International Cryptographic Provider v3.0 (CSP) and RecoverKey Client software, along with commercially available KRA and CA services to provide a complete, secure electronic commerce environment. Note: Since the pilot project, Trusted Information Systems has been acquired by Network Associates (NA) and functions under the name TIS Labs. The production version of the Recover-Key software is now released under the name CryptALL.

Research applications may contain sensitive data, may involve considerable amounts of money, and can contain valuable intellectual property. Therefore, investigators are very concerned about the security of electronic transmissions. Failure to address security will inhibit widespread adoption of Electronic Research Administration and Electronic Data Interchange (EDI). The requirements for cryptography include:

- **Confidentiality**: A confidentiality service to prevent the disclosure of information to unauthorized parties by means of strong encryption.
- **Integrity**: Providing cryptographic based integrity by means of message hashing to prevent undetected and unauthorized modifications of the information.
- **Authentication and non-repudiation**: A user authentication service to provide verification of the sending identity by means of digital signature and the use of signature certificates.

- Key Recovery: Providing a means of retrieving a session key for the purposes of re-acquiring plaintext information from the ciphertext files in the event that the original decrypting key is no longer available.

3.2 Partnering Vendors of Commercial Software and Services

Wherever possible, COTS products and services were utilized for the ERA project. The participating companies cooperated to provide the various security elements as described below.

Certificate Authority (CA): VeriSign provided Certificate Authority (CA) services. A Web interface developed by VeriSign provided a site into which a user would paste a CSR (Certificate Signing Request) generated by the EZ_ERA32 software. An EDI Certificate containing the public signature key was signed using the RSA algorithm and returned to the trading partner as a standard PKCS-7 file where it was stored by the EZ_ERA32 application. This certificate was then included within the encrypted package sent to a recipient so the recipient could verify the identity of the sender and the integrity of the received EDI transaction. (NOTE: Posting and management of CRL lists for their EDI certificates were not available from VeriSign during this project so that this functionality was not implemented in the EZ_ERA32 software.)

Key Recovery Agent (KRA): A Key Recovery Center (KRC) turnkey system developed by TIS Labs was operated by SourceKey, the KRA. Requests for plaintext retrieval, whether from individual registered users or authorized law enforcement officials, must satisfy the procedures and rules of the designated KRA before a retrieval can be accomplished. Only authorized personnel can request a file recovery. In the case of a user-initiated request, authorized personnel must register with the KRA prior to the process of encrypting data. In the case of an override account, Law Enforcement officials must present valid legal documents to the KRC in order to have an override account created. Either type of recovery, "user" or "override", could be requested from the Recovery menu option in EZ_ERA32. Once the name of the file to be decrypted had been entered, the software automatically established a modem connection to the KRC and initiated the process of challenge/response that must be successfully completed before the session key could be returned to the EZ_ERA32 software. All communications between the client and the KRC are encrypted. The KRC does not store (escrow) session keys, user keys, or user message files. Only an encrypted session key is returned to the client software where it is used to retrieve the plaintext data.

TIS Labs CryptALLProduct: CryptALL provides interfaces, dynamic link libraries, utilities, and sample code which can be utilized by application software to integrate the encryption and recovery capability into their products. The Client software runs on the application machine and also provides an interface for configuration and

registration with a Key Recovery Center (KRC). The software includes the Cryptographic Service Provider (CSP) module used for key generation and by the encryption/decryption processes of application software.

The System Architecture diagram below illustrates the relationship of EZ_ERA32 and the COTS services and software.

Figure 1 System Architecture

3.3 KRDP Activities

3.3.1 Video

On August 13, 1997 a team from Romano Associates filmed a video of the Department of Energy's key recovery pilot project. Participants interviewed for the project included the DOE personnel, RAMS-FIE staff, and representatives of the vendor partners (VeriSign, Trusted Information Systems, and SourceKey). Excerpts from this video were later used for the half-hour long video for the KRDP project as a whole.

3.3.2 Presentations and Demos

On November 5, 1997, a day-long KRDP conference was held in Washington, D.C. Representatives of all 13 of the KRDP projects manned booths that described their projects and demonstrated their software, where possible. The DOE KRDP project demonstrated the EZ_ERA32 system, the only completely functional systems to be available at that time. In addition, participants in this project presented a panel on the DOE KRDP pilot. Participants included a representative from DOE, two from RAMS-FIE, and a representative from each of the vendor partners. A copy of the PowerPoint presentation can be found at:

<http://web.fie.com/web/era/krdppanl/sld001.htm>

3.3.3 NIST Evaluation

In November, 1997 a team from NIST and Cygnacom evaluated and tested the security features, in particular key recovery functionality, implemented within the EZ_ERA32 system. The TIS Labs key recovery functionality passed all tests performed.

3.4 DOE Pilot Project Test Activities

Five research institutions Pennsylvania State University, University of California, Los Angeles, University of Notre Dame, Fred Hutchinson Cancer Research Center, and Massachusetts Institute of Technology (without Key Recovery), one government agency (Energy Research of Department of Energy), and RAMS-FIE participated in field testing the EZ_ERA32 system. Tests included the installation and configuration of the software, key generation, obtaining an EDI certificate from VeriSign. Once configured, participants were asked to submit several 194 and 841 transaction sets, some encrypted and others in plain text, to DOE and were to receive 997 confirmation messages. Participants were also asked to perform several recoveries of encrypted files by making requests to the KRA.

Software was sent to the participants on Friday, December 5, 1997. Because of different academic schedules and the holiday season, schools were given considerable time to install and set up their systems. Most had done so by January and testing was performed in February and March. In addition, the KRA was forced to relocate their operations center causing some down time for key recovery testing.

Findings:

1. Implementation of security functionality requires a whole new set of software setup and configuration. Many pieces must be set up (key generation, exchange partner agreements, obtaining a certificate, registration with a KRA, etc.) to create a complete environment. A basic understanding of how each of the security features works and what is required and necessary to get a system operational.
2. Participants indicated that they found the install and configuration moderately difficult to do. Since the system must be maintained over time, this suggests that basic training for operations personnel is highly desirable. Educated and qualified support for operations personnel who must perform these tasks is critical.
3. It takes time to install and setup security features since a number of different features must be configured (keys, certificates, trading partner relationships, key recovery center certificate and accounts). Operations personnel must be provided with sufficient time to perform these tasks.
4. Interoperability problems still remain. Certificates obtained by users on a MS Exchange mail system loaded into the EZ_ERA32 system with no problems. However, Eudora did not process attachments in the same way so that these users encountered problems. The CA has been notified of the problem.
5. Once installed and correctly configured, the security functionality was fairly invisible to the end-users. Encrypted messages were successfully sent and acknowledgments received. For those who attempted to perform recoveries, if the KRC was available, they were able to do so.

Associated Documents

1. PreTest Questionnaire prepared for NIST for the purposes of evaluating the implementation of key recovery in the EZ_ERA32 (Appendix G-1)
2. Implementation Plan prepared for KRDP (Appendix G-2)
3. System Administrators Users Guide for EZ_ERA32 (Appendix G-3)
4. Research Administrators Users Guide for EZ_ERA32 (Appendix G-4)

CONCLUSION

Where can ERA make a difference? The NewERA Task Force has established the viability of using EDI as the open standard for the transmission of grant applications to federal agencies. Similarly, through the ONR EDI/EFT effort, the implementation and effectiveness of using EDI and EFT in postaward administration is firmly established. Finally, a viable solution to Internet transaction security has been demonstrated.

The challenge remains, however, to couple business process reengineering with technology. ERA will provide the greatest benefits when exchanges of information, as well as overall information requirements, are minimized. Agencies and grantees alike must eliminate non-value added processes within their own business environments, as well as those between one another. The alternative is to live with electronic inefficiencies in the place of paper ones.

Furthermore, ERA must be adopted and integrated across administrative units and throughout the research administration process (award notification, progress reporting, financial reporting, payment requests, cash transactions, personnel administration, peer review, status checking and other related functions). Only when ERA is tightly integrated to the entire research administration enterprise will the anticipated benefits of ERA be realized. EDI is one piece of the puzzle.

The NewERA demonstration project has achieved notable successes in: education; standards development and review; testing; and research. However, institutions, both grantees and agencies, must make the necessary investments in order for ERA to prosper.

It is incumbent upon federal policy makers to codify the experience of NewERA to achieve all the expected benefits such as:

- more efficient and timely proposal submissions;
- improved data management capabilities;
- reduction in rekeying of data;
- reduced administrative time;
- decreased copying and mailing costs; and
- substantial paper savings.