NISTIR 6715
January 2001

MSID's Virtual Library & Office Automation Continuous Improvement Projects

By

Sharon J. Kemmerer
Kristy D. Thompson

Table of Contents

Chapter 1: Continuous Improvement Projects

1.1 Introduction

This document provides status on the Virtual Library and Office Automation continuous improvement projects internal to the Manufacturing Systems Integration Division (MSID).[1] In a time of diminishing budgets and a strong awareness to improve how we do business, continuous improvement projects aim to improve performance of the daily operations within our public agency while reducing necessary manpower and other supporting expenditures. MSID works internally to improve its supporting operations so that it can continue to be effective in its pursuit of its mission to support industry. The two projects discussed in this document, automating the office and building a virtual library, are anticipated to provide cost savings in labor and to improve the performance of the MSID staff.

In general, both projects evolved out of a desire to improve information flow, communicate better through current technology application, maximize access to information for all staff while reducing their time to retrieve and process such information, and minimize recreating the same information two or more times. The Virtual Library project endeavors to use Internet access and Web technologies to make visible to the MSID staff the vast collection of references[2] purchased for professional use by individual staff members within the division. The Office Automation project applies more to the daily operations of the division and attempts to improve what information is accessible to staff, how a staff member accesses this information, and where such information is stored. Efforts have been ongoing for both of these projects over the last two years. During this time, we have had some successes, have made progress on both projects, and have also benefited from lessons learned. This document captures the essence of each initiative, states current progress, and reports the lessons learned thus far from both efforts.

Although "lessons learned" will be summarized as Chapter 4 of this document, one of the initial lessons learned is actually reflected in the rewriting of this document itself. Originally, both initiatives were approached more or less as one project in the writing of this document, where the Virtual Library was one element of the Office Automation project. What the authors did not anticipate was the magnitude of activities and independent efforts associated with the Virtual Library project. It became exceedingly difficult to write about both with one incorporated within the other; hence, this document reflects a second attempt to document both projects as separate and distinct in their purpose, function, and progress. The original written approach was as that shown in the Venn Diagram of Figure 1a. It is easier to address in one document both projects when thinking of them in the context of Figure 1b. The end result of such a lesson is that now each project will have a separate chapter devoted to the initiative and its status.

---

[1] MSID is one of five divisions of the Manufacturing Engineering Laboratory (MEL) at the National Institute of Standards and Technology (NIST) under the Department of Commerce. MSID promotes developing technologies and standards that lead to industrial implementation of information-intensive manufacturing systems. Such systems can be integrated into a national network of enterprises working together to make U.S. industry more productive. To accomplish its mission, MSID works closely with industry (both as individual companies and as consortia), other government agencies, standards bodies, and universities.

[2] "References" is used here to include technical books, training materials, video tapes created for or by industry on topics related to MSID in the areas of manufacturing, engineering, computer science, and management development. It will be used interchangeably with "resources" in the context of this paper.

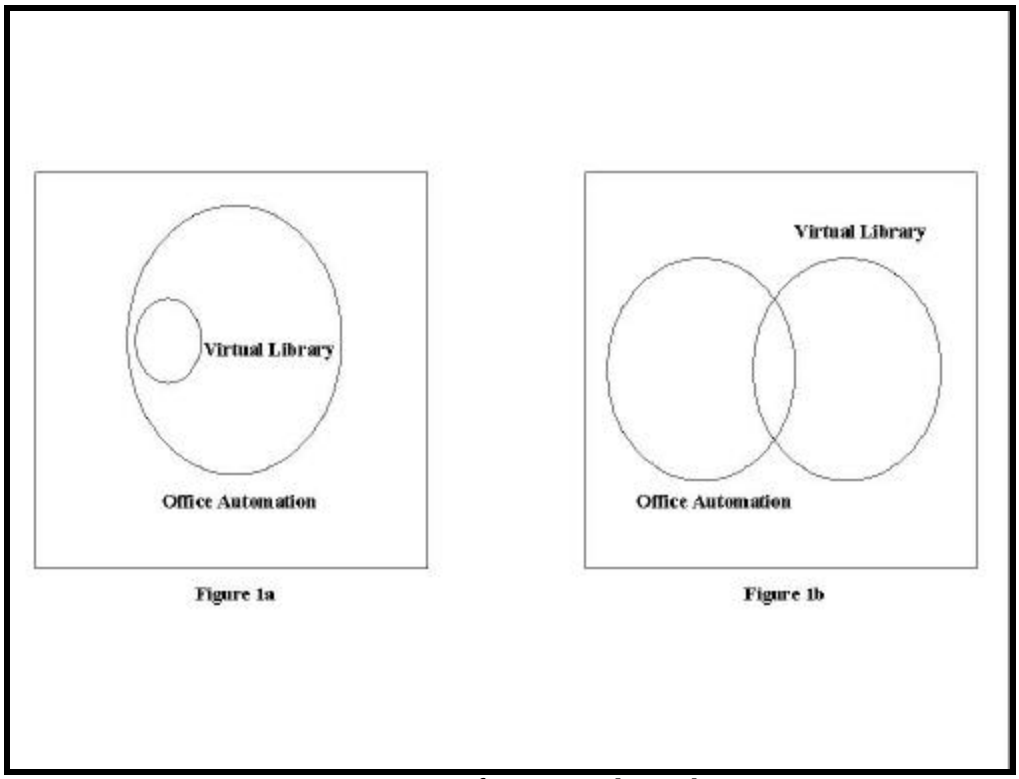

Figure 1: View of Project Relationships

Chapter 2 will address MSID's Virtual Library project, the older of the two. There were two reasons for the initiation of this project: to update the existing archives of the original MSID library, built almost a decade ago but out of date; and to leverage access to the most current resources being purchased by MSID staff through government bank card purchases. The result of this project will be a Web-accessible composite of hundreds of catalogued resources available on loan to any permanent or visiting staff of MSID.

Chapter 3 will address the Office Automation project. Over the years, MSID staff has become increasingly dependent upon read and write access to files through the MEL server-based network; however, a good mechanism has not been put into place to search and retrieve such files to use by other than the originator. Hence, staff may recreate information that already exists elsewhere on the server. This results in an inefficient use of manpower and of information. The Office Automation project attempts to make existing information more readily accessible to all staff, and enhance the digital archiving of information historically produced in hard copy only.

Chapter 4 discusses "lessons learned." Both initiatives attempt to bridge current practices and understanding with new ideas and technologies. As a result, there are experiences along the development cycle that serve as lessons learned. The lessons learned include those generic to both projects, as well as for each project individually. This chapter is divided into sections to distinguish these lessons.

Any mention of commercial products or services in this document is for example or information only; it does not imply recommendation or endorsement by the National Institute of Standards and Technology.

1.2 Audience for this Document

The intended audience for this document is the division staff of the Manufacturing Systems Integration Division. This document serves to provide explanatory information of completed activities, future activities, and

procedures for which the staff may benefit should they be inclined to want to use any of the services or technologies described in this paper.

Since continuous improvement is usually a goal of both the private and public sectors, this document may have a secondary audience for those interested in learning how MSID leveraged existing technologies to improve information sharing among its staff.

Chapter 2: Virtual Library

2.1 Project Description

For close to a decade, MSID has had its own library for use by the MSID staff. The NIST Research Library cataloged the references contained initially in the MSID library, and an individual was to use the barcode technology, available on a local computer, to check out/in the books when one wanted to borrow a resource. The positive characteristics of the existing library included the concept of integrating our activity with the central NIST library and using some sort of automatic check out/check in process for tracking who had what resource. However, several aspects made the library borrowing system fail over time:

- Lack of currency of the resources.
- The barcode technology was never implemented.
- Lack of security for the controlled borrowing of the references.
- Aging technology of the bar-coding software application.
- No procedures put in place to work with the NIST Research Library to catalog new resources on an ongoing basis.
- The necessity to physically go to the library room to review the resources and to check out any resources of interest.
- No centralized coordination of the library maintenance as a whole.

The Virtual Library continuous improvement project was born out of a desire to improve the MSID library:

- Quality, quantity, and timeliness of the resources.
- Procedures for accessing the resources.
- Process for borrowing the resources by MSID staff.
- Security of the resources for those who participate.

Before initiating the project, we considered lessons learned from the historical library project, and took into account the current distributed dispersion of such resources (located in individual staff offices across several buildings).

An additional dynamic that has been added to purchasing resources since the original MSID library was created is the use of bankcards. Today, those professional staff holding a government bankcard can make single purchases under $2500.00. This ability for quick purchase of resources has been a successful way of providing our division personnel with reference materials and other resources "on demand." The downside has been the isolated way in which such purchases can be made; thus, many across the division are unaware of the rich resources and reference materials purchased and maintained in staff offices.

2.2 Project Goal

Develop an MSID multi-media library that will maximize staff desk-side [virtual] access to such a library via an integrated Web interface, while retaining some level of propriety for those professionals and their workspace.

2.3 Project Objective

Provide MSID staff with more knowledge about its existing resources and make MSID more efficient in accessing such resources by January 1, 2001. The success of such results will be measured through an informal survey of division staff on the use and benefit of the virtual library interface.

2.4 Expected End State

The result of this project will be a Web-accessible composite of hundreds of catalogued resources available on loan to any permanent or visiting staff of MSID. Such a virtual library is expected to have the following impact:

- Fewer bankcard purchases within the division
- Fewer outside training purchases because of shared value in purchases
- Stronger leveraging of multi-disciplinary training tools by making the existence of the tools available centrally
- More complete library reference material by integrating existing beginner-through-advanced materials available from various staff within the division
- Easier identification of what reference material is less than complete topically by knowing what is available currently
- Efficiencies that come with being better informed
- Single-point access to a wealth of resources and reference materials distributed across the division
- An existing Web-based infrastructure to which other components can be integrated as they are identified

Besides time and dollar savings and improved quality, processes being put in place should benefit participating staff in two ways: an existence of a user-friendly library borrowing process the MSID staff uses routinely for their research and development; and a high level of comfort for those contributing their established resource libraries to the centralized loaner process. In general, a system that is reliable and staff is happy to use.

2.5 Completing the Project – A Phased Approach

Automating access to the resources is being addressed in a phased approach because of the complexity of the current environment. Various media formats, the continued proliferation of new resources available, and the distribution of many of the physical media across the division contribute to this complexity. Figure 2 shows a high level summary of the milestones for each of the phases. As shown, there are some continuous efforts across the phases, and the activities associated with a given phase may overlap as the next phase is already underway. Following Figure 2 is more detail associated with the actions and status for each of the three phases.

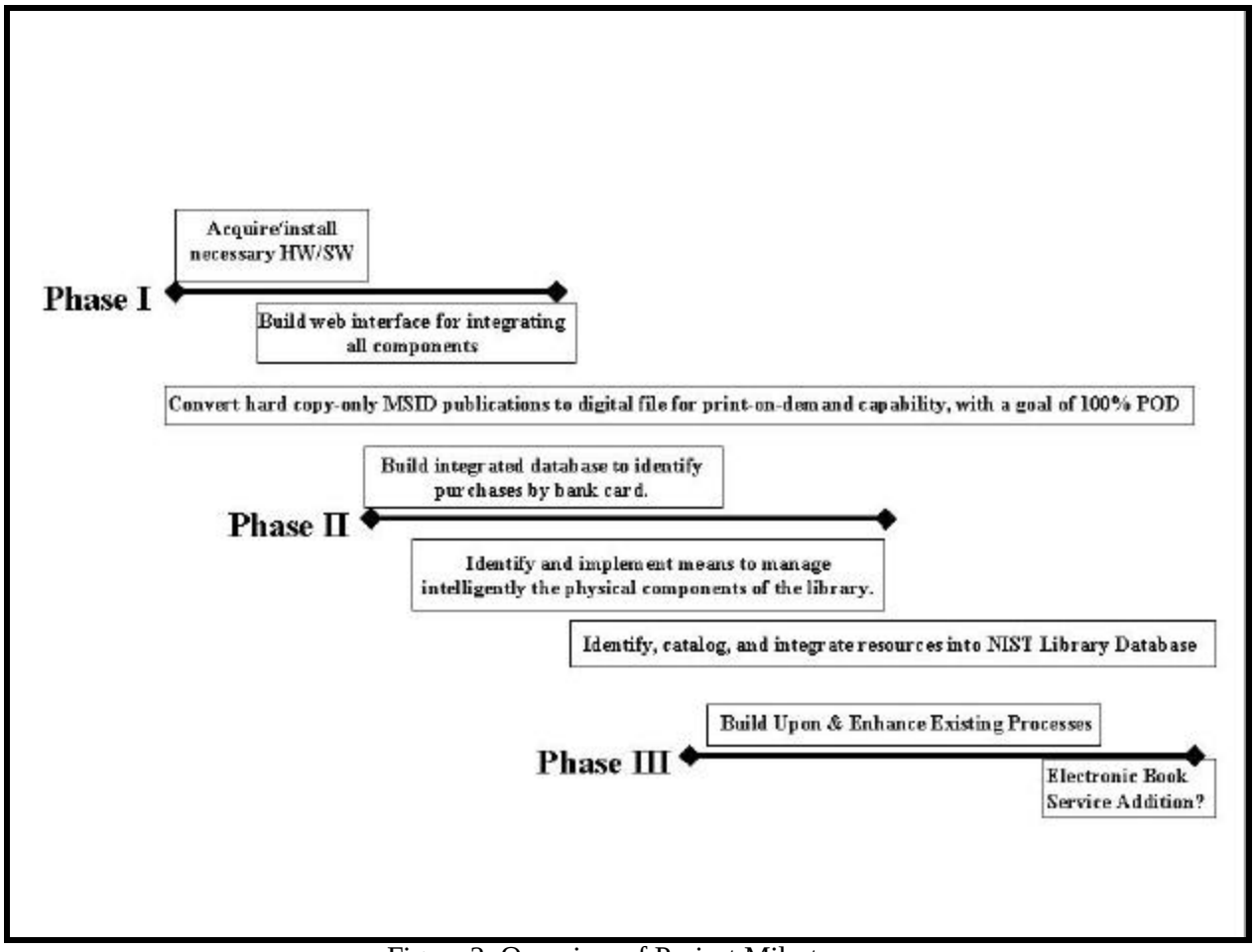

Figure 2: Overview of Project Milestones

2.5.1 Phase I

Phase I had a two-fold approach:

- Acquire and install necessary hardware and software for the library.
- Establish necessary links to existing components of the MSID Library. These components include:
  - MSID Digital Publications' Library
  - NIST Virtual Library
  - existing subscriptions
  - writing tools
  - other technical and administrative Websites within and external to MSID

2.5.2 Phase I Major Milestones

- Necessary hardware and software for the project is acquired and installed.
- A Web interface for integrating all the components has been built.
- Any necessary software tools for integrating the components into a Web environment have been employed.
- 100% of those hard-copy-only MSID publications (1999 to the most current) have been converted to digital file and accessible for print-on-demand (POD).

2.5.3 Status to Date, Phase I

Phase I was completed and operational for MSID staff in June of 2000. The initial Webpage design and content was based solely on those elements related to the virtual library. If an MSID user wanted to access the internal MSID Website for administrative or policy information, access to this site was a separate uniform resource

locator (url) from the virtual library. There were a few lessons learned from this approach, and these are captured in more detail in Chapter 4. To deal with these shortcomings, a revised Webpage was built that integrated at a single url, the administrative and policy information contained in the historical MSID internal Website with those elements of the virtual library. More information on this Website can be found under Chapter 3, as an office automation improvement milestone.

2.5.4 Phase II

Phase II introduced two new components of accessible information into the construction of the virtual library. The first was through credit card purchases and the individual empowerment to buy many resources in the form of books, audiotapes, and videotapes. Without a way to gather this purchase information centrally and make it available to all of the MSID staff, resources remain unknown across the division and there is a greater risk for unnecessary duplicate purchases. In 1999, a bankcard database structure was developed for individual use by those with credit card purchasing authorization in MSID. The database serves several purposes for the purchaser, one of which is the documentation of multi-media resource purchases for use by the Virtual Library. Figure 3 shows the intent of pulling together the information from the individual user databases into one consolidated database for the Library. Although the data entry is actually available in real time, it was not practical to use that information in real time for the Virtual Library project. There were several reasons for this:

- An entry in the database for a credit card purchase is not indicative of the resource actually being received from the company from which it is being purchased.
- Some amount of time must be allowed for the recipient of the resource to use it.
- Procedures and tools leveraged through the NIST Research Library were not conducive to being modified so that the MSID-specific database extractions could be appended.

For more details on these issues, please refer to Chapter 4 lessons learned for the Virtual Library.

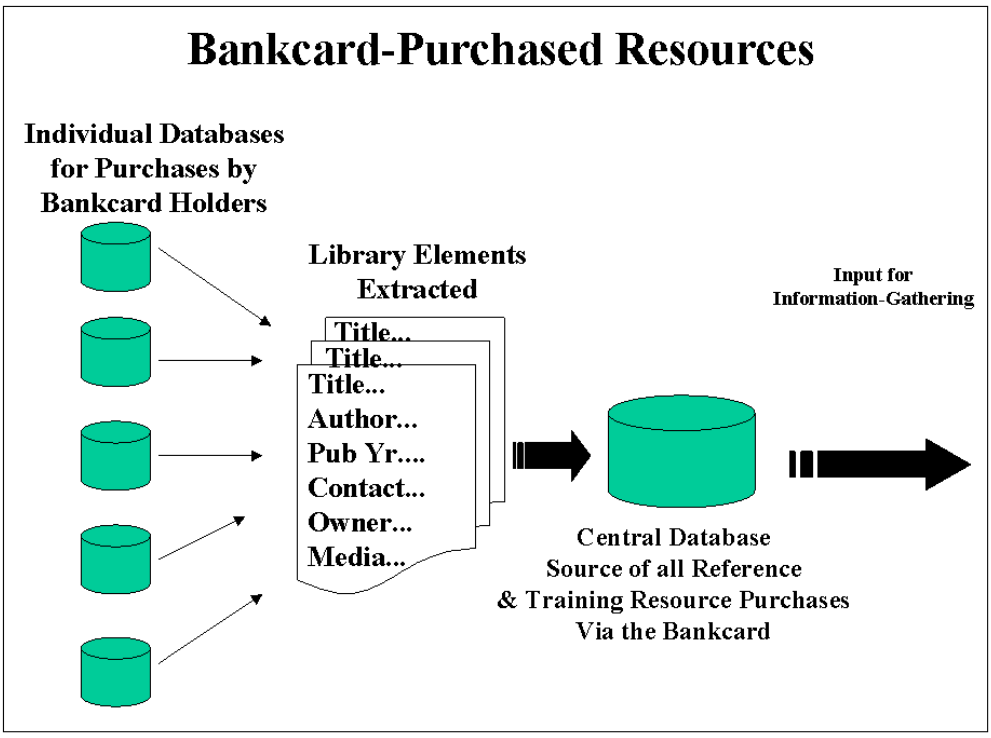

Figure 3: Bankcard-purchased resources

The second element of Phase II is to design a systematic way to identify and bring together the wealth of resources distributed across MSID and its physical space that spans across three buildings on the NIST campus.

In a very high level sense, Figure 4 indicates (by the stars) the dispersion of the staff offices and the potential for accessing existing resources virtually. Such remote access attempts to retain some level of propriety for those professionals and their workspace. The result of this process is what is termed the "virtual library" in this paper.

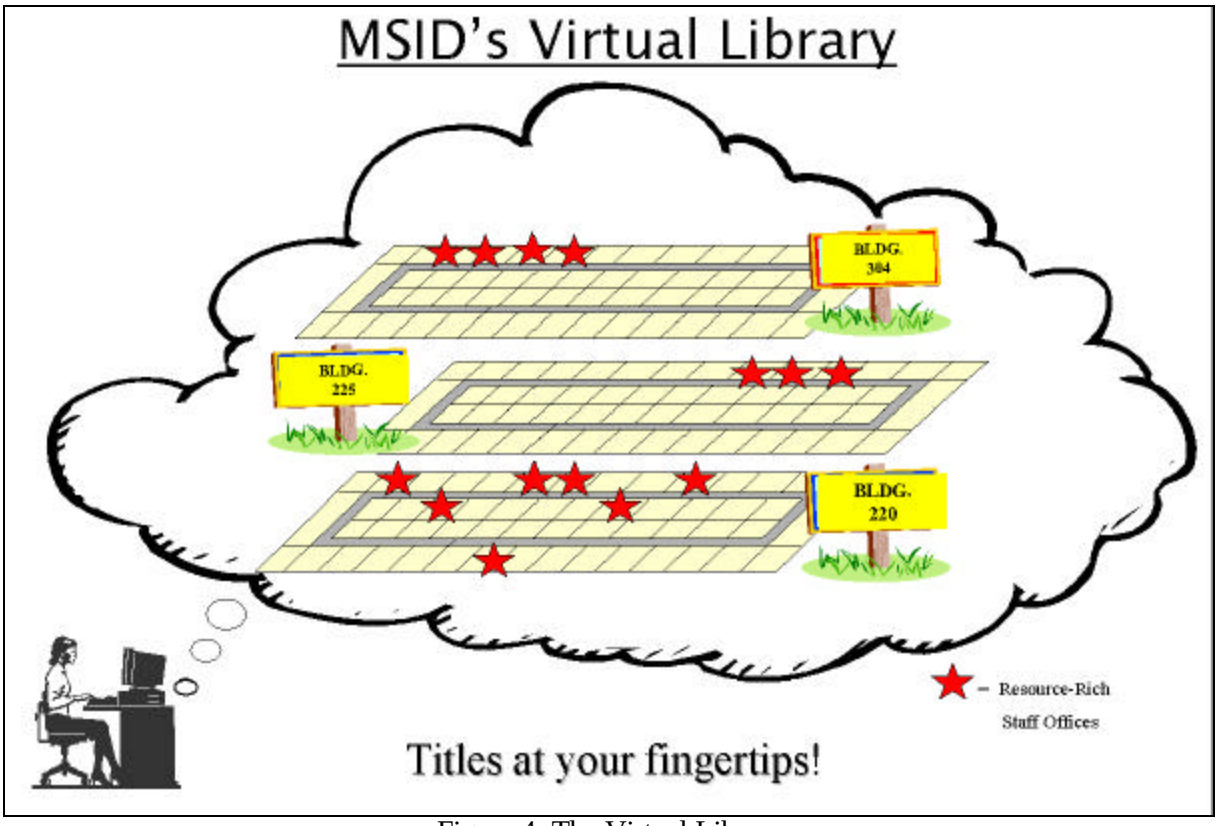

Figure 4: The Virtual Library

2.5.5 Phase II Major Milestones

- A database for extracting reference purchase information from the bankcard database as shown in Figure 3 above is built and integrated into the virtual library activities.
- A means for managing intelligently the physical components of the library is identified and implemented.
- A list and description of all available periodicals on the library Web page is provided on the virtual library or MSID homepage.
- 100% of those hard-copy-only MSID publications (1993-1998) have been converted to digital file and are accessible for print-on-demand (POD).

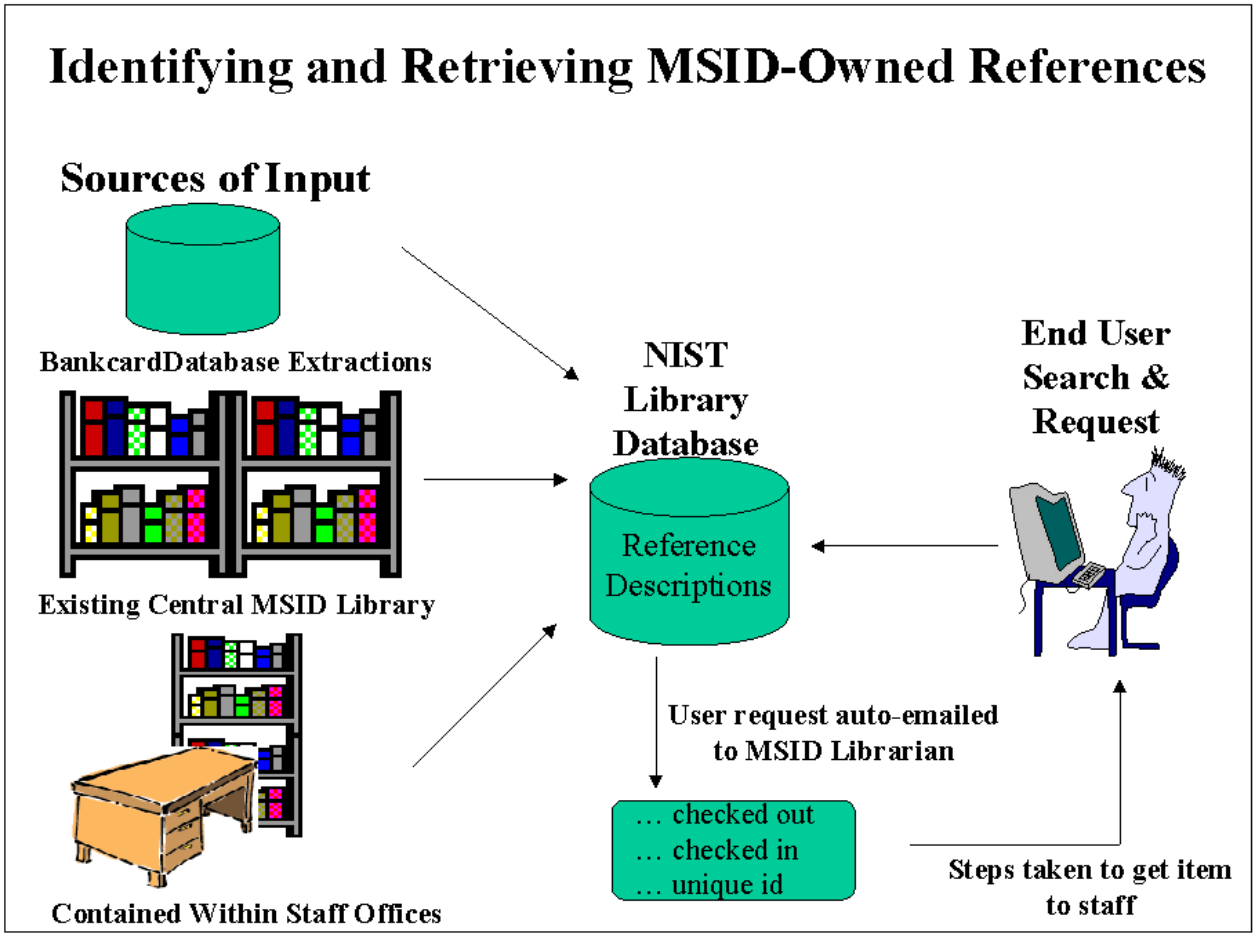

Figure 5: Identifying and Retrieving MSID Resources

2.5.6 Status to Date, Phase II

- The automated information extraction from the several databases into one, as described in Figure 3, has been developed. MSID now has a way to retrieve and review the reference materials purchased by credit card. Cardholders entering bankcard purchases of resources are able to enter the data once as a purchase without having to enter similar data for use in the virtual library.
- A formal relationship has been established with the NIST Research Library for cataloging our MSID publications. These cataloged references will be added to the library's online database, and are extractable for MSID's viewing. To preserve the privacy of those professional staff contributing their resources, the following naming convention has been established: MSID-[numeric][numeric][numeric]-[0 or 1]. "MSID" indicates in the NIST Research Library online database that such a resource is specific to our Division. The three numerics become an identification number assigned to each participating owner of said resources. This list of identifications is maintained by the MSID Librarian and accessible only to the secretarial staff responsible for distributing the resources on loan. "0" or "1" indicates the physical location of such a resource. "0" indicates physical storage in the central division library, located currently in Building 220, Room A152; "1" means its held by the owner physically in the owner's office.
- The historical print-on-demand process continues as the library staff converts hard copies of historical publications and saves them as portable document format (pdf) files. These files are then linked for access through our MSID publication database. It is important to note here that a separate initiative is ongoing at the laboratory level. MEL is establishing a laboratory-wide digital publication database that is a composite of all the division's existing databases. Our division representatives have played an integral role in this

laboratory initiative. Because MSID's publication system was well structured and already widely proven as a public resource, the MEL Publication Committee agreed the MSID system would serve as a template for the MEL system project. MSID staff coordinated efforts between NIST's Information Technology Laboratory (ITL) and the MEL Publication Committee's contractor to establish a means to have data transferred to the MEL system as it is currently provided to our local MSID publication system. Because of this effort, the MSID library is migrating to this integrated laboratory-wide database management and retrieval system. This paper does not cover this MEL initiative, but the migration may impact progress for delivering some of the MSID virtual library components to the staff.

- A procedure for using the library has been established. The following defines what is meant by "steps taken to get item to staff" found in Figure 5.
  - Accessed through the MSID Virtual Library under "MSID Physical Library," staff preview available MSID resources through the main Research Library online. If an item listed in the library seems of interest to a staffer, s/he will complete a short information form that includes providing his/her government identification number. Once completed, this is sent as an email to the MSID Librarian.
  - The secretary or designated librarian will respond to the request and retrieve the item for the user and enter this into the main NIST Research Library database. MSID has purchased a NIST ID card reader for this purpose, and will manage the tracking of borrowed books through a user's NIST ID number.
  - The owner of the book would receive an email letting him/her know that an item had been borrowed, which would include the borrowers name, date borrowed, and item borrowed.
  - The borrower would receive an email notification two weeks from the time of the loan that the borrowed item was due back and should be returned.
  - Upon the return of the item, the secretary or designated librarian would clear the system by noting in the main NIST database that the item had been returned. The resource would be made available for loan again. In the absence of a next loan, the resource is returned to the central library or the owner's office.
  - Updates to the data displayed through the Web interface will occur in real-time.
- If an employee who contributed library resources to the virtual library was to depart MSID but to remain an employee of NIST, it would be at the supervisor's discretion what resources would remain with the owner and what would remain in the library. If the employee leaves the government, at the supervisor's discretion, all government-purchased resources become the ownership of the MSID central library. Either of these processes will require the library administrator to alter the database.

In addition to the library process explained above, MSID staff are also able to visit the physical library, located in Building 220 Room A152, to review resources, or to carry out the loan process independently or with the librarian's assistance.

2.5.7 Phase III and Beyond

Phase III and beyond will include the continual processes of keeping the library information current, adding to the library with MSID staff resources, improving automated processes, and staying current with the supporting technologies.

2.5.8 Phase III Major Milestones

- All reference and training material located across MSID, from all interested staff, has been identified, marked, and incorporated into the database. Participation in the library and lending resources to the library is strictly voluntary for permanent employees. Only NIST resources (government property purchased with government funds) should be used in the library. In some cases it may be unclear whether the resource is government or personal (any resource purchased with personal funds or any resource purchased by government funds but personally marked with notations from its use, e.g., course materials). If there is doubt, we suggest the item not be included in the library.
- The MSID Librarian received formal training to ensure the library software can be administered properly within the division, as agreed to by the NIST Research Library in conjunction with contracted services.
- 100% of those hard-copy-only MSID publications remaining have been converted to digital file and accessible for print-on-demand (POD).

- An efficient process is developed for those resources purchased by credit card to transition smoothly into the virtual library. This process will include effective ways to identify, catalog, and make available the resource.
- A more automated approach (i.e., the Web) was re-investigated to handle the MSID staff borrowing process. The current process is designed to handle notification by email.
- The concept of acquiring and deploying the use of electronic books in the library has been evaluated and feasibility determined.

2.5.9 Status to Date, Phase III and Beyond

As of the writing of this paper, this project has not progressed to Phase III other than that some of the training of the MSID Librarian has begun. As mentioned in Phase II, a database to automatically extract credit card purchases of resources has been established, but issues associated with the efficient extraction and use of this information remain. Questions are still unanswered:

- How much time should be allowed for the new owner to use the resource before being asked to place the resource into the virtual library?
- What is established contractually with the NIST Research Llibrary to continue cataloging new MSID resources?
- What automated processes can be put in place to manage the transition of bankcard purchases to the virtual library?

Chapter 3: Office Automation

3.1 Project Description

In any work environment, there is always room to improve the office automation tools necessary to support daily operations. Over the years, MSID staff has become increasingly dependent upon read and write access to files through the MEL server-based network; however, a good mechanism has not been put into place to search and retrieve such files to use by other than the originator. Hence, staff may recreate information that already exists elsewhere on the server. This results in an inefficient use of manpower and of information. The Office Automation project attempts to make existing information more readily accessible to all staff, and enhance the digital archiving of information historically produced in hard copy only.

Our ultimate objectives for this project are many:

- To improve search, find, and retrieve capabilities of staff for all existing MSID-created files
- To leverage existing commercial off-the-shelf hardware and software applications for capturing historical, and the ongoing creation of, technical information
- To better track paperwork flow within MSID as the paperwork progresses from the originator through the appropriate signatures and ultimately to its completion

The MSID staff 's ability to access information effectively is impacted adversely by:

- Differences in workstation operating systems (PC, MacIntosh, Unix)
- Nature of the diverse media existing in training and reference materials (physical copy, digital, multi-software applications)
- Use of personal naming conventions for file storage and retrieval
- Existence of complex directories and subdirectories created by individuals and found under organization, technical, program, project, or administrative subjects
- Network permissions blocking information access for files appropriate to all staff
- Large fluctuation and change over of our technical staff (approximately 40% of MSID's staff) through the high use of guest researcher and other short-term (1-3 years) programs
- Dependency on, and the limitations of, MEL centralized administrative support

3.2 Project Goals

- To move MSID staff into a more digitally based mode of operation, by providing more automation of administrative functions.
- To broaden the all-round information base accessible to MSID staff by enhancing centralized storage and retrieval access and techniques.

3.3 Milestones

- A cost-effective software application was acquired that allows for the automatic searching of existing network files by key word search, independent of the file format or knowing its physical location.
- State-of-the-art network-compatible scanning equipment was purchased, installed, and operative.
- Solutions to resolve the issues identified under the general purpose of the project have been built.
- Network permission exclusion has been resolved for those files appropriate for all staff to have, at least, 'read' access.
- A document flow tracking system has been developed and deployed.

3.4 Expected End State

Automating more of the operations of MSID will accomplish several, perhaps independent but complementary, things:

- Ability to index MSID files on the network server through intelligent searches.
- Reduce or eliminate the recreation of technical work that already exists.
- Make written technical works previously only available in hard copy, available to the MSID staff and to the interested public via the Web.
- Allow capture, save, and retrieve of technical, administrative, procedural, or political hard copy information received from our laboratory, agency, or department.
- Allow capture, save, and retrieve of meeting notes.

3.5 Status to Date

A document-flow tracking system was established for use by the secretaries. Built as a Microsoft *Excel* spreadsheet, secretaries maintain information on each paperwork action as it progresses through the necessary signatures and steps for completion. So that interested MSID staff can follow the course of any of their paperwork, a read-only copy of the spreadsheet is placed in the MSID common directory every Friday.

As briefly mentioned in Chapter 2, a new internal MSID Webpage has been developed. This page incorporated the older policy and administrative information with the virtual library and other newly established, time-saving reference areas for MSID staff. Figure 6 shows this new main page.

Figure 6: MSID's Internal Website

The following provides a brief introduction of each subtopic on this main page. The general design of the page provides most of the administrative information on the left side, with those links associated with the virtual library on the right.

Inside or External MEL or NIST: Provides a direct link to the laboratory or agency internal or external Websites.

External MSID: This is a link to our public division page.

Admin. Tools: The Administrative Tools section has been built expressly for the secretaries; however, the technical staff should find several hotpoints of use here as well. It includes quick access to forms, zipcodes,

money converters, administrative procedures, and often-used purchasing sites to name a few. : This Web space, which is new, was part of the efforts associated with the office automation project.

Policies and Procedures: This Web space provides a shopping list of policies and procedures specific to our division. Such policies and procedures may be based on higher requirements established by MEL, NIST, or the Department of Commerce.

Writing Tools: This Web space, which is new, was part of the efforts associated with the office automation project. It offers sites that provide writing assistance for both the technical and administrative staff.

Reports: This section of the Web space is a sort of "catch all" for internal division information to inform staff, e.g., trip reports and MSID all-hands slides are posted here.

Groups: This section is an internal link to our group external Web pages. MEL is transitioning to programmatic management of its activities. As programs become a more prominent way to market and disseminate information, the group level pages may disappear eventually.

Autonomy: This link is to the free knowledge management search software that was being piloted by several in the division. Future renditions of this internal front page will no longer carry the Autonomy link.

Economic Data: This is a url to our SIMA page. Articles that present economic data to make a case for our technical and programmatic work are being accumulated here. This section is password accessible, but information on access is available through the SIMA Program Office or a group leader.

MSID Physical Library: This is the link to the NIST-cataloged references as described in Chapter 2. : This Web space, which is new, was part of the efforts associated with the office automation project.

MSID Publications: This is MSID's archival database of publications authored by past and present MSID staff.

Other Virtual Libraries: This url provides a collection of free magazine subscriptions and university, government, and commercial libraries and bookstores that are available. It also provides the link the to NIST Virtual Library

Other Mfg. Sites: These are Web sites focussed on manufacturing. Most of the urls are program initiatives within a university, consortia, or other government facility.

Staff/MELSA/Phone List: These provide access to our MSID personal staff pages, the MEL Systems Administration (MELSA) Web site for information and help request access, and the division phone list respectively.

To allow network capture, save, and retrieve of meeting notes, an electronic whiteboard was purchased and installed in MSID's conference room, Building 220, A114. This board allows pdf file storage, print-on-demand, and color retention of notes, when such a need to distinguish information by color is important.

Two state-of-the-art scanners were installed in the MSID library. The black and white scanner allows high volume, high-speed capture and save of documents as pdf files, duplex documents, and has Optical Character Recognition (OCR) capability. The second scanner is a color scanner for use when color retention of a publication is important; or for capture, save, and use of graphics for presentations.

An open house demonstration of the white board, scanners, and new Web site was held on May 24, 2000, to introduce the new equipment to all interested MSID staff and laboratory secretaries.

Autonomy's *Knowledge Update* software application was installed and piloted by MSID staff. This was a pilot run to find an appropriate software application that allowed automatic search and retrieve of existing Web and MSID network-shared information.

MSID worked with MELSA to change any staff's default permission to be MSID instead of to a particular group. This change occurred in the spring 2000. Files created before this time still retain the permission of the group under which an individual authored and saved; however, by applying the division level as default, many more will be able to read or write to files and directories previously inaccessible to them.

Last, the scanners mentioned above have been used extensively to copy the historical hard-copy-only staff publications. A primary goal of this activity is to make available, through the Web, a print-on-demand capability of all our division-authored resources for our internal staff and the general public, who accesses our publications through the MSID external Website. The conversion of hard copy resources was discussed in Chapter 2. Today, MSID support staff has to address manually a high volume of requests from around the world for MSID-authored publications. Table 1 provides a list of those countries from which we have received a request for our publications over the last two years. Table 2 shows the estimated volume of requests over this same period.

Algeria	Australia	Belgium	Brazil	Canada
China, PR	Denmark	Finland	France	Germany
Hungary	India	Ireland	Japan	Korea
Malaysia	Netherlands	Peru	Philippines	Portugal
Romania	Scotland	Singapore	Spain	Turkey
United Kingdom	United States	Yugoslavia		

Table 1: Country Requests for MSID Publications

MONTH	1999	2000	MONTH	1999	2000
January	Not available	11	**July**	21	4
February	4	12	**August**	12	3
March	6	23	**September**	30	15
April	3	18	**October**	38	17
May	3	15	**November**	13	18
June	19	5	**December**	12	12

Table 2: Volume of Requests of Hard Copy Reports

One metric of our success from the print-on-demand capability is to reduce the number of email requests from the public (Table 2 quantities). This would reduce our MSID labor requirement to respond to such traffic, and provide more real-time response to the requestor; thus a higher level of satisfaction. As noted in Table 2, for the most part, requests diminished through the year 2000 as we progressively digitized and made available more of our publications online. [3] Although gathering such information is not a fool-proof metric for indicating whether our audience is still desiring our publications and is now printing them on their own, it is one aspect that will be monitored. At a minimum, it may show trends so that we can better gauge the MSID resources required to be responsive to requests.

Although not specific to assessing the success of our print-on-demand direction, but perhaps at least an indicator suggesting we are going in the right direction, is unsolicited publicity of our external Webpage. In July 2000, the MSID division Webmaster received notice of the following: "The MEL Web page entitled 'Manufacturing Systems Integration Division' (url: http://www.mel.nist.gov/msid/) was selected as a Links2Go "Key Resource" on the topic of manufacturing. Every quarter, Links2Go samples millions of Web pages to determine which

[3] Where requests are higher in the first part of 2000, the authors believe this increase is due to our MSID url being on more search engines than in 1999.

pages are most heavily cited by Web page authors. The most popular pages are downloaded and automatically categorized by topic. At most, 50 of the pages related to a topic are selected as 'Key Resources.' Out of 50 pages selected as Key Resources for the Manufacturing topic, MSID's page ranked 38th. 'When Links2Go says your page is a Key Resource, we mean that your page is one of the most relevant pages related to a particular topic on the Web today, using an objective statistical measure applied to an extremely large data set.' Fewer than one page in one thousand will ever be selected as a Key Resource."

Chapter 4: Notable Oversights and Lessons Learned

Part of continuous improvement is continuous learning. This chapter summarizes the lessons learned from both the Virtual Library and Office Automation projects to date. There were some experiences that served as lessons learned from both projects, as well as some lessons learned while progressing through each project. The chapter is divided into sections to distinguish such lessons.

4.1 Lessons Applicable to Both Projects

4.1.1 Keep the Staff Informed

In 1999, NIST conducted an employee survey, the first of its kind in over ten years. As part of the process of reviewing the results by Division, an employee action plan was developed. During the Division discussion surrounding issues associated with policy and procedures, management learned of the lack of staff awareness regarding procedural issues. For instance, while staff complained about the WERB process, what was really at issue was independent of the process, e.g., "I do not know where my document is in the WERB process." In response to staff concerns, the document tracking system was developed (covered in section 3.5). This tool is a very convenient way for staff to view the progress of any logistical tasks carried out by their secretary, including all items in the WERB process.

4.1.2 Assume Management Has an Opinion

The Division Chief helped us refocus on what information was necessary to bring to the MSID staff that was not already readily available elsewhere. Originally, to "protect" the division chief from details of layout and content, the authors worked independently with general ideas received at the beginning of the assignment. Consequently, the authors went counter to the path the Division Chief wanted the authors to pursue. This missed direction was discovered as the authors unveiled to the Division Chief the final product and design for approval. Periodically sending the url as a draft for review to the Division Chief may have afforded more timely opportunity to discuss approach, strategy, and desired layout.

4.1.3 Integrate When Possible

With assistance from our Division Chief, we were able to develop an integrated web interface for our Virtual Library and internal Division homepage. The Division Chief recommended that we not include information that was already provided elsewhere on NIST Web pages; therefore, the interface was designed to provide our staff with internal information pertaining specifically to our Division. Prior to the integration, the Virtual Library Web page was viewed as a separate page from the internal Division homepage but was reachable via the internal Division Web page, as seen in Figures 7 and 8. Access to this level of a page would have required at least three clicks to retrieve information. First, the user would have needed to access the internal Division Web page, then continue to the library page. The third and subsequent clicks took the user to the actual library information desired. Upon completing the integration, the Virtual Library is now readily accessible from the front page of our internal Division homepage, as seen in Figure 6.

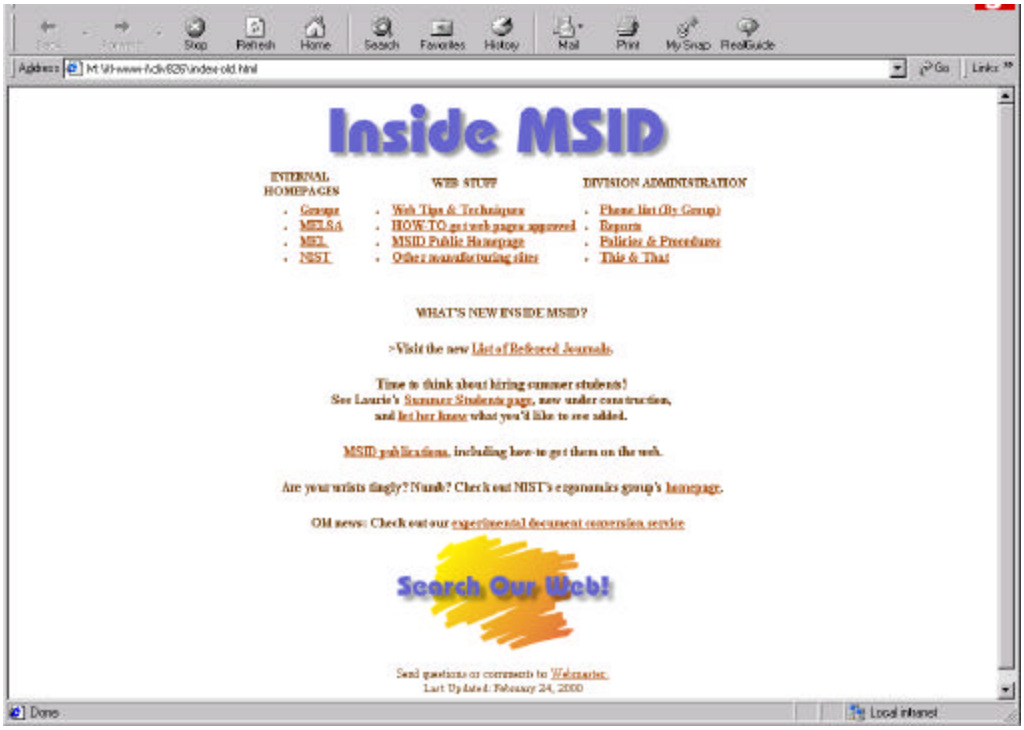

Figure 7: Original Internal MSID Page

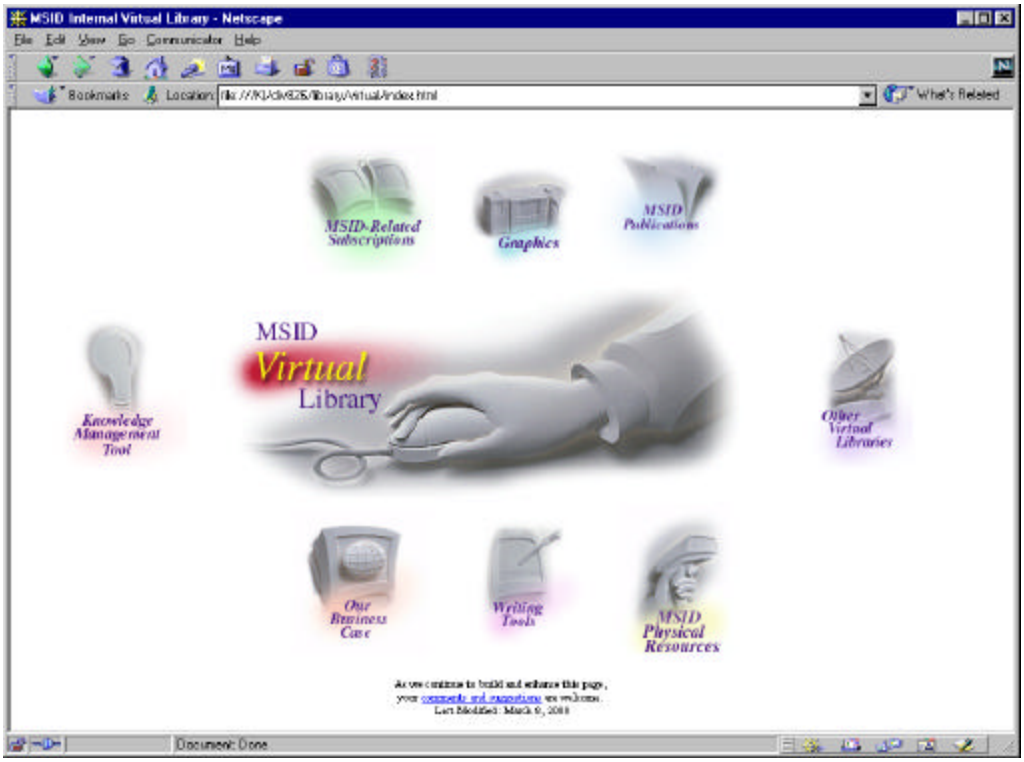

Figure 8: Original Virtual Library Look

4.2 Office Automation

4.2.1 Nothing Comes for Free

During the Federal Office Systems Exposition in the Spring of 1999, a Division staff member won a copy of a knowledge management software package. As part of this package award, the company worked with NIST to install the software on campus. Other services included by the company were:

- Marketing presentations to staff for a pilot of the software
- No-cost software administration training (valued at $1500) to ensure that the Division could support its own requirements
- One year of prompt technical support during the installation and pilot stage

After more than a year of installation, debugging, and technical issues' resolve, neither MEL staff nor the company technician was able to provide the fundamental access to the MSID network files. Nor were the MEL staff able to resolve the issues of the high overhead of continual maintenance, re-indexing, and space-hog management required of our trained software administrator. Less than three months into the pilot (which took 15 months to set up) MSID decided to abandon the application. An email to pilot participants stated, "Up to this point of the [software product] pilot, we have found many experienced problems with output, agent creation, and the application as a whole. We have also continued to deal with software installation and application issues on the administration side. Therefore, administrative support for this application has stopped. For those of you who wish to continue to use the application, it will remain on the server until August 1, 2000, at which point it will be removed." Because of the potential opportunity afforded by this application, research into other indexing and knowledge management software applications was not pursued, further delaying an integrating solution.

4.2.2 Technology is Only Good… When it Works

Our Division firmly believes and has been committed to the power of the Intranet. Rather than tuck files and information away on one's personal hard drive, our staff have been committed to making most information available via the network file servers managed by our central MEL system administrative support within the laboratory. Nevertheless, state-of-the-art equipment purchases can only be made, based on the level of capability and availability of the central administration support staff in getting such purchases up and running, and integrated into the Intranet. There have been several hardware devices available within the division that have provided, or could have provided, automated capability of hard copy digitization and preservation: scanner keyboard, network scanner/copier, and network copier.

The scanner keyboard became inoperative on at least one staff member's workstation. This was due to the inability of the central MEL system administration support staff to configure a profile allowing continual application growth on the system, with compatibility to the scanner keyboard technology. The network scanner/copier was initially an excellent tool when the software was compatible on the machines of the entire group leaders and secretarial staff (for those on PCs). Many hard-copy documents were scanned and distributed automatically via the group memberships selected on the scanner. Several problems did arise, most of which came from the inability of the MEL system support to technically support the application software as grouped with the newer hardware device. Membership lists had to be repopulated manually by our laboratory technical support as well. These problems, in combination with transient MEL system administration support staff, led to no one having the time or understanding to maintain the configuration to keep it running.

At the time the Division purchased the copier with optional scanning and network storage capability, the network scanner (mentioned in the previous paragraph) was operative; therefore, it was decided that this additional capability to allow scanning and network storage would not be purchased.

4.2.3 Transient Technology

Learning (and understanding) that technology does not always last forever was another lessons learned with our Division keyboard scanner. Using the ScanSoft, Inc.'s Paperport software application, several in the Division office tried a keyboard with a single page scanner. The readily available scanner provided a quick and easy way to scan and save digital files of existing hard-copy-only material. Since the pilot use of the keyboard was a success, more were encouraged to purchase the keyboard as well, particularly administrative support staff. Unfortunately, the company that made the keyboard stopped manufacturing and supporting the keyboard with the built-in scanner.

4.2.4 Designing Web Graphic Images

During the design of the new internal Division homepage (Figure 6), a great deal of effort was put forth to create a design using small graphics to reduce web page loading time. Using a variety of software applications including Adobe Photoshop, Adobe Illustrator, and Adobe Pagemill, all of the graphics were placed in one large file. Using the Adobe Photoshop image cutting tool, each small graphic used for the page icons was cut out of the large graphic and saved as individual files (separate images). The images were then indexed and pieced together using an HTML table structure. The outcome was splendid from a user's point of view. All images loaded very fast using Netscape Communicator and Internet Explorer. Since the page itself is new, this first year of deployment and use is resulting in several necessary modifications. The page should have been created as an image map, which would have allowed the graphic to be easily altered in the future. As it stands now, the images that are used on the page have been indexed and cannot be altered without re-indexing the entire page. Each necessary change would take a lot of time and effort, and require an enormous maintenance overhead for the long haul. It is necessary to redesign the page to incorporate image maps that will yield a more versatile and easily maintained Web page.

4.3 Virtual Library

4.3.1 Real-Time Access to Purchased Reference Materials

One precipitator of starting this virtual library project was noting how many reference and training resources were purchased monthly across the Division using individual bankcards. The initial idea was to extract relevant information pertaining to the purchase of books and training materials from the bankcard database. The information would then be provided to the Division staff in a real-time mode. However, this concept had several procedural glitches if the information was to be made available in real-time. The secretary populates the database at the time a purchase is being considered. Real-time visibility of such data input would provide information for, as yet, non-existent material.

A second glitch was associated with the reference material, once the material arrived. What is considered a fair time for the original purchaser to have the reference for personal professional use before making it generally available to staff? Moreover, even once the "owner" was ready to make the material generally available, most owners do not want anyone in the division just coming to their office to acquire the reference. The owners prefer this access be controlled through the secretary. Beyond these procedural glitches, having chosen to integrate with the NIST Central Library database made it impossible technically to merge the Division's bankcard data with the NIST Central Library database in real-time.

4.3.2 Single Point of Technical Capability

As previously explained in Chapter 2, we have defined a process using a Web interface, email, and scanning technology for borrowing materials from the library. In previous project meetings with the NIST Research Library technical staff, a program was to be developed to automate this process totally, allowing MSID staff to check out items of interest via a customized Web interface. Shortly after those meetings took place, the library staff member who had previously committed to developing the program retired from federal service. The library is attempting to replace this staff member with someone of equal technical skill and programming expertise capable of designing this type of application. Meanwhile, we will continue to use email as a means to

carry out our loan requests while reinvestigating in the future with the NIST Research Library new hire, a more automated approach to handle this task.

4.4 Summarizing These Lessons

As these two projects attempt to continuously improve the Division's operational environment, technical, procedural, and political challenges have been confronted. Rather than conclude the projects before achieving the intent of both efforts, the authors continue to leverage the above lessons learned and redirect the initiatives as necessary. It is believed both projects will result in improved information flow and better communication through applied state-of-the-art technology. Such results will provide staff with maximum access to information while reducing their time to retrieve and process such information. Such results will also minimize the need to recreate the same information two or more times.

The authors anticipate updating this document annually as both initiatives continue to progress.