

MICROFICHE DIGITIZATION AND PROCESS IMPROVEMENT

FOR CAL POLY SENIOR PROJECTS

by

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## **Abstract**

This project addresses the need to digitize Senior Projects available on microfiche at the Cal Poly Robert E. Kennedy Library. Microfiche is an outdated document archival medium and is unfamiliar to most students, making Senior Project research inconvenient and frustrating to students. To make this process easier and more accessible to students, the University Library should consider digitizing its Senior Project collection and improving the current system in the mean time.

The Six Sigma DMAIC method was used to discover root cause problems of the current system, define performance metrics, and to develop data driven solutions for improving the current system of viewing and saving Senior Projects on microfiche. From this analysis, a new User Guide and visual aids were designed to help students navigate the microfiche reader machines and scanning software. Digitization opportunities were also analyzed in this study by examining student usage and Senior Project usage by year, contacting vendors for quotes, and investigating in-house digitization through digitization on demand. Based on the various alternatives, it was recommended to digitize Senior Projects in-house through a process called digitization on demand – where Senior Projects on microfiche are scanned and uploaded to the University Library’s digital Senior Project database (DigitalCommons@CalPoly) as students use the Senior Projects. This is the most affordable alternative, and will help immediately digitize frequently used Senior Projects, as well as give the University Library a much clearer idea of its digitization challenges and requirements for future digitization purposes.

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## Introduction

Each year, hundreds of students at Cal Poly submit their Senior Projects to the Robert E. Kennedy Library. This university requirement is unique to Cal Poly, encouraging students to work individually or collaboratively on a capstone project that showcases the knowledge and skills they have learned in their specific major. When doing research for their Senior Project, many students often reference past Senior Projects to gain valuable information that may be helpful to their own Senior Project. Unfortunately however, most Senior Projects at Cal Poly are only viewable by microfiche – small photographic film cards containing miniaturized documents. Specialized microfiche reader machines located in the University Library are required to view the film, forcing students to visit the University Library any time they wish to view a Senior Project available on microfiche. In addition, the current process for viewing and saving pages from a Senior Project can be a painful and frustrating process for new users, often deterring students from using the machines at all.

It wasn't until November, 2009 that the University Library finally implemented an online database for newly submitted Senior Projects. Students can now submit a digital copy of their Senior Project to the University Library, which is viewable to the public through the DigitalCommons@CalPoly. While this is helpful for viewing recently submitted Senior Projects, the vast majority of Senior Projects are still only viewable via microfiche. The goal of this study is to improve the current process for viewing and saving Senior Projects on microfiche by applying Industrial Engineering tools and methodology, as well as to investigate the possibility of digitizing Cal Poly's entire Senior Project collection.

# Background

## *Motivation for Project*

My original Senior Project had nothing to do with viewing Senior Projects on microfiche. However, after using the ancient microform machines in the reference room in the University Library for my own research, I quickly encountered a number of frustrations with the process, and decided that as an Industrial Engineer, I could make this process more efficient. It was also a project that would help future students at Cal Poly when they conduct research for their Senior Projects, which is why I decided to change projects.



Room

## *Cal Poly Senior Project History*



Over 85,000 Senior Projects have been submitted through the Robert E. Library since students first began submitting Senior Projects to Cal Poly in 1942. In order to store and preserve these documents for years to come, minimize storage space, as well as make them easily accessible to the students and public, the university elected to archive Senior Projects via microfiche – small photographic film cards containing miniaturized documents. Since its inception at Cal Poly in the 1960's, microfiche has been an effective archival method and is still currently in use today. Refer to Table 2- Appendix A for a complete timeline.



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## DigitalCommons@CalPoly

The DigitalCommons@CalPoly was established in November 2009, giving students the opportunity to view and submit Senior Projects digitally. This was a major step forward by Cal Poly, giving students the opportunity to reference past Senior Projects from the comfort of their home. In this new process, students still use the library's PolyCAT database to browse Senior Projects like before, except now students can easily download a PDF version of the Senior Project they are interested in online.

<p><b>Viewing Senior Projects Using the Microform Readers</b></p> 	<p><b>Viewing Senior Projects Using the DigitalCommons@CalPoly</b></p> 
1. Search the PolyCAT database for a Senior Project of interest	1. Search the PolyCAT database for a Senior Project of interest
2. Copy down the reference number for the Senior Project of interest	2. Download Senior Project of interest (PDF format)
3. Visit the Reference Room located on the 1 <sup>st</sup> floor of the Robert E. Kennedy Library	
4. Locate the Senior Project of interest in the Senior Project file cabinets	
5. Follow the User Guide to use the microform machines	
6. View, save, or print pages of the Senior Project (convert to PDF if desired)	



### ***Academic Senate Resolution – Senior Projects***

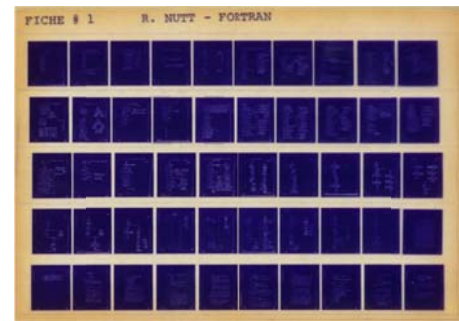
In April 2011 the Academic Senate at Cal Poly made a number of changes to Senior Projects requirements and how they are submitted, in what was called the “Academic Senate Resolution to Update the Campus Administrative Manual Senior Project Section.” Prior to this Resolution, all academic departments were required to submit a copy of each Senior Project to the University Library to be copied to Microfiche and stored with the Library’s collection. The associated changes in the resolution can be found in Appendix A.

The current bylaw allows each academic department to determine whether or not they will submit a copy of each Senior Project to the library. For example, the Industrial and Manufacturing Engineering Department still requires students to submit a copy of their Senior Project to the library as part of their Senior Project requirements, while the Materials Engineering Department recently elected not to require students to do so. This has had a large impact on the number of Senior Projects submitted to the Robert E. Kennedy Library and thus decreased the amount of content available for student and public use. Because of this resolution, the content available for digital use on the DigitalCommons@CalPoly will vary greatly by department. While some departments may have a large quantity of Senior Projects available on the DigitalCommons@CalPoly (because it is a requirement), other departments may have zero content available on the DigitalCommons@CalPoly, forcing them to use past Senior Projects on microfiche as a solution to their research needs.

# Literature Review

## *What is Microfiche?*

Microfiche was once a popular form of document preservation and way to store multiple pages from a document on a small photographic film card. A microfiche card is typically 4" x 5" and contains printed information in a size too small to be seen by the naked eye (Kaminsky). Depending on the microfiche type and reduction ratio, a single card can store well over 98 pages. The life expectancy of a microfiche card can be over 500 years (depending on how well it is taken care of) making microfiche a suitable archival format for lengthy documents and print material.



A microform reader is required to physically view the microfiche card. The reader itself is essentially a light and magnifying lens that then projects the image onto a screen (ehow.com). Images can then be scrolled through and even enlarged. Users can also adjust the brightness or focus level to view the image more clearly. Most microform readers can also sync with computer software for scanning, saving, and printing capability. The image quality that results is thus dependent on the microfiche condition and quality, as the quality and features of the microform reader. While the significance of microfiche technology could be seen over 50 years ago, microfiche is quickly becoming obsolete due to the ease and simplicity of digital storage mediums such as PDFs. Documents can now be stored in a universally accessible format via the internet (if desired), making institutions and organizations rethink the way they store and preserve information.

## ***Brief History of Microfilm***

The first practical use of commercial microfilm was developed by a New York City banker, George McCarthy, in the 1920s. He was issued a patent in 1925 for his Checkograph machine, which was designed to make permanent film copies of all bank records (Heritage Microfilm). By WWII, microphotography was being used extensively by the military for regular military mail and espionage. After the war, the idea of using microforms for active information systems and preservation of material was proposed. Microforms quickly became an important form of document preservation by the government, libraries, and a variety of other institutions. In the 1970's, microform technology made great advancements in film, readers, viewers, and reader-printers. Microfiche had now become a popular and cost effective alternative for print material storage and preservation. In the 1980's Kodak introduced a polyester-based microfilm, which quickly became the new standard. This new material was shown to accurately preserve images for over 500 years in aging simulation lab testing, making microform a valuable archival medium for years to come despite the advances in digital storage technology still be a valuable and well used form archival for years to come.

## ***Microfiche Applications***

Before digital documentation became a trusted and reliable medium, microform was the only viable way to preserve large documents such as newspapers and have it available to the general public. Libraries commonly carry microfiche or microfilm documents such as newspapers, but their applications extend to a variety of industries including:

- **Local and State Government**
  - Libraries and museum archives

- Voter registration documents
- Student records
- **Banks and Credit Unions**
  - Applications, loan files, signature cards, checks, member files
- **Commercial**
  - Accounts payable, accounts receivable, human resource files
- **Engineering and manufacturing**
  - Plans and maps
- **Hospitals / healthcare facilities**
  - Medical records
- **Insurance**
  - Policy membership files, life insurance files, property files

Storing back issues of newspapers, magazines, and genealogy records in libraries is a common practice (Wong). Archiving inactive files in large organizations such as banks is also a popular use of microfiche. At universities, most technical reports and dissertations can be found in microfiche.

The military has also been active involved in documenting information on microfiche until recently. In 2002, the Army announced that it was saying good-bye to the microfiche system. “After years of service, the microfiche system used by personnel units and soldiers to keep tabs on their careers is going the way of the dinosaur and dodo bird. The online Official Military Personnel File will completely replace the old microfiche system by next year” (Army To Boot Out Microfiche, 2002).

## ***Advantages and Disadvantages of Microfiche***

### **Advantages**

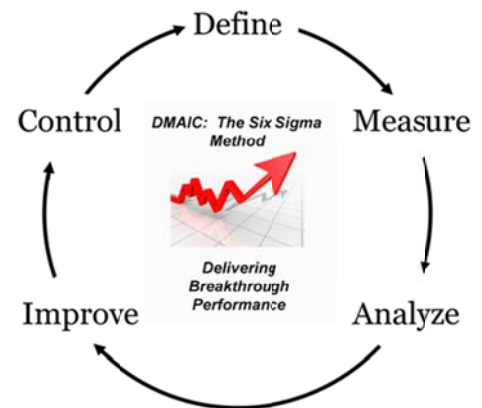
- Storing lengthy documents on a small film card
  - An immense library of information can be contained in the size of a shoebox
- Relatively inexpensive
- Longest life of any physical storage medium (>500 years)
- Reference works can be kept readily accessible
- Greatly reduces the amount of paper used

### **Disadvantages**

- Specialized equipment required for use
- Time consuming process to view, scan, save or print
- Film is susceptible to scratches and other damage, making it difficult to read
- Microfiche cards may only be reviewed one user at a time
- Limited accessibility due to company/library hours
- Records management/tracking can be difficult
- Microfiche is only available in black and white
- Microform machines require frequent and costly maintenance (lens, bulbs, etc.)

## DMAIC Analysis for the Current System

DMAIC is a basic component of the Six Sigma Methodology and is a business management strategy to improve work processes, often by eliminating defects or reducing variation. While more commonly used in a manufacturing setting to improve efficiency and eliminate defects, the same methodology can be used to systematically improve almost any system. The DMAIC methodology consists of a five-step improvement process including: Define, Measure, Analyze, Improve, and Control. By following the DMAIC methodology, businesses can discover root causes to their problems, define performance metrics, and develop data driven solutions based on facts rather than hunches or guesses. The DMAIC approach may not always be the best Six Sigma methodology to implement when approaching a problem, but given the right type of problem with sufficient time and resources, the DMAIC method can be a great tool to improve a system.



### DMAIC Method

- **Define:** identify the issue causing decreased customer satisfaction
- **Measure:** collect data from the process
- **Analyze:** study the process and data for clues to what is going on
- **Improve:** act on the data to change the process for improvement
- **Control:** monitor the system to sustain the gains

## *Define*

Defining the problem and indentifying the issues causing decreased customer satisfaction was the first step in this analysis. It was also important to define the critical customer and stakeholder requirements, and to document the processes involved for viewing and saving a Senior Project on microfiche. This was completed through student observations, becoming an expert at the machines, and interviewing library staff who are directly involved with Senior Projects at the University Library.

Student observations were conducted in the Reference Room of the Robert E. Kennedy Library throughout winter and spring quarter in 2011, and were necessary to understand how students use the microform machines and what problems they frequently encounter. From this research, the following issues were discovered:

- The process to view/scan/save Senior Projects is confusing and time consuming
- Students prefer to ask the Research Help Desk for help than look in the manual
- The User Guide is outdated and fails to describe key instructions
- The newer microform machine is much harder to use, but has superior image quality
- The image quality for certain Senior Projects is very poor
- The “Email Images” button in the software does not work
- Viewing multiple scanned pages in one file is confusing

Various library staff also provided helpful information aiding in the define process including background information of the DigitalCommons@CalPoly, a rough timeline of the history of Senior Projects at Cal Poly (Table 1 – Appendix A), and how Research Help Desk employees are trained on the microform machines.

## Measure

### Pareto Analysis

A survey was created for the Research Help desk employees to determine which problems students encounter the most when using the microform machines. A Pareto analysis was then conducted using the data collected from all 8 employees. Students frequently visit the Research Help Desk for help regarding Senior Projects in the reference room, making the staff experts at which challenges students commonly face when using the microform machines. From the Pareto Analysis below, it was apparent that the 2 biggest problems include “Emailing” and “Error 20088: TWAIN device was not ready.” Together they make up 50% of the problems faced by students. This data is extremely significant, as it highlights opportunities to improve the current system.

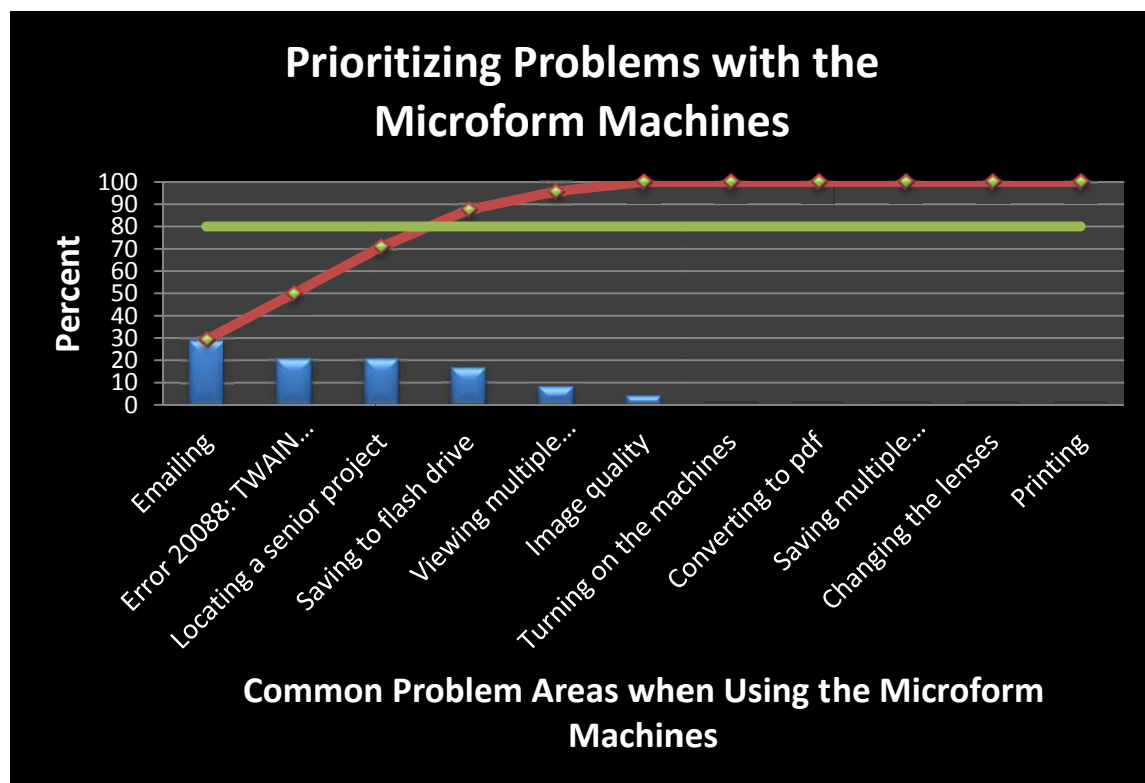


Figure 5: Research Help Desk Employee Survey and Pareto Analysis



## *Analyze*

Analyzing the current process and measuring performance metrics helps gain a better understanding of the system, opening the door to discover root causes to the problem at hand. For this project, it was important to investigate why students were struggling to view and save Senior Projects on microfiche. This was done by looking into the content and format of the User Guide, and by further analyzing the two biggest problems identified in the Pareto analysis from the previous section.

### **User Guide Content and Format**

The microform User Guide is an effective and commonly used resource for viewing and saving Senior Projects, and has the potential to make the entire process far less painful if written properly. A thorough analysis of the User Guide was conducted to determine what improvements (if any) could be made. It was first necessary to understand who wrote the manual, and how long ago to gain background information on the current User Guide. By meeting with University Library staff, it was discovered that Nikki DeMerville from Collection Management had written the User Guide in 2008, inspired to write the User Guide herself after seeing how inefficient the process was. Before 2008, there wasn't even a User Guide at all. Staff at the Research Help Desk had a "cheat sheet" for using the machines, and would often help students use the machines when attempting to view or save a specific Senior Project. This was an incredibly wasteful process for the University Library staff. Since the User Guide was adopted, the manual has been very helpful to both the students and staff, and is even part of the training program for new staff at the Research Help Desk. Unfortunately however, there were no stakeholders in this project, and Nikki's User Guide was adopted almost without

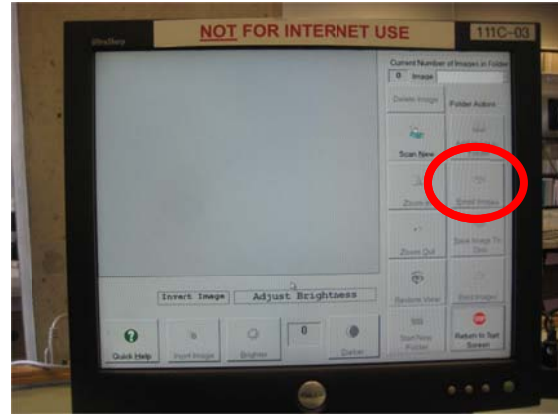
question or review. Technical writing principles and instruction manual techniques are required to properly write a User Guide, and may have been overlooked due to the desire to input a User Guide as quickly as possible to lessen the load on University Library staff.

A thorough investigation of the content and formatting of the User Guide showed that there was lots of opportunity for improvement. Inconsistencies in the formatting, style, tense, structure, and picture locations were prevalent throughout the guide. In addition, much of the page content was unnecessary, outdated, or not prioritized/weighted the way it should have been. For example, students in today's world do not typically save documents to CD's anymore (flash drives, email, and Dropbox are more common); yet two pages in the User Guide were dedicated to explaining this functionality. A single page was also dedicated to uploading files to the Cal Poly Zimbra Briefcase (an email document storage system similar to Dropbox). While the University may have been pushing this technology in 2008, it is no longer used by students, and is thus taking up space in the User Guide with irrelevant information. Some of the website links in the User Guide were also outdated. For example, Cal Poly's Campus Dining website address changed since 2008, making the link for adding money to a student's Poly Card invaluable. As evidenced from the statements above, a newly updated and professional User Guide would greatly improve a user's ability to navigate the microfilm machines.

## **Emailing Images**

The number one problem identified in the Pareto analysis was that students had difficulty emailing the files of scanned images to themselves. Analysis of this process was conducted to determine the root cause of why it was such a prevalent issue.

After scanning images using the microfilm reader software, students can then email the file to themselves if they desire. The User Guide located next to the microfilm machines has a section dedicated to “EMAILING IMAGES” to address this common practice. While the User Guide defines the steps to properly email a file of scanned images (using their own email account within the web browser), it leaves ambiguity for a very common mistake made by students, which only seem intuitive by nature – to click on the “Email Images” button located within the software.



Upon investigation, it was discovered that the “Email Images” button does not actually work. By clicking on the button, a customized screen pops up, prompting users to enter their email address and click send. Unfortunately, this functionality (using Outlook Express) no longer works, and fails to email the scanned images/file to the email address entered in the text box. After clicking send, users will see a pop up message saying: “There has been an error Sending your message. Please either try again or contact your Customer Support.” Further messages pop up upon closing that message box, further confusing the user even more as the new screen fails to successfully send the desired document to their email address. At this point, many users approach the Research Help Desk for assistance, or look to the manual for help. The manual addresses this problem; however, the information regarding this problem is located at the very bottom of the page within the “EMAILING IMAGES” section, making it easy to miss when quickly scanning the User Guide as a reference. In addition, many users simply do not look at the User Guide first, because it seems obvious that after scanning the images, the

next step would be to click the “Email Images” button if they desire to email themselves the a scanned image file. Only after encountering the problem do they seek additional resources.

While the warning for emailing images should probably be at the top of the page, the real problem and issue is why the “Email Images” button doesn’t work properly. By meeting with Tommy DeMoville from the Library Information Technology department, it was discovered that this functionality had been lost years ago when transitioning to new computers and updating the scanning software. When asked if this could be fixed easily, Mr. DeMoville responded that it would be impossible to fix this problem without making changes to the entire software again, which may not work with the old microfilm reader machines due to specialized reader equipment and technology specific to those machines. Unfortunately, this meant that the root cause to the problem could not be fixed unless the University Library risked purchasing new software that may not even work with the microform reader machines they currently have. At this point in time, this is not something the University Library is interested in pursuing. While the root cause to the problem of emailing images could not be properly addressed and resolved, there was still a large opportunity to address this problem and is addressed in the next section.

### **Error 20088: TWAIN device was not ready**

The second biggest problem identified from the Pareto analysis was when an error message appears on computer screen, prohibiting the user from scanning any pages. This error message reads: “TWAIN device was not ready.” Unless the user is an expert at the machines, it is almost impossible for them to solve the problem without approaching the Research Help Desk. The computer must be restarted (leaving the reader machine on) in order for the

software to work properly again. This problem is not addressed anywhere in the User Guide. However, there is a sticky note taped to the top right corner of the reader machines, which addresses this problem and how to troubleshoot it. This message can easily go unnoticed, as the error message appears on the



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computer monitor, not the reader machine. In addition, the reader machines are very large and propped up high, meaning the sticky note is located above eye level for most users, making it difficult to even notice. On top of that, the signage that addresses this problem is on a handwritten sticky note, taped onto the machines, making it appear unprofessional and insignificant. Users must actively scan their surroundings in order to discover a solution to this problem on their own. As a result, staff at the Research Help Desk frequently has to help students fix this problem. The root cause to this



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problem was never fully understood in the analysis, but appears to be a similar software issue that was addressed the previous section. As a result, steps were taken to improve the signage location, content, and display format.

## ***Improvement***

The collected data and User Guide analysis indicate a variety of improvements that can be made to enhance the user experience for viewing and saving Senior Projects. The results from the Pareto analysis drove the biggest changes for improvements in this study, by heavily addressing the email functionality and “Error 20088: TWAIN device was not ready” within the computer software. Design considerations were made to both the User Guide itself, as well as by creating visual aids located on the computer monitors to assist with the two most common problems students encounter when using the microform machines.

### **User Guide Design**

A new User Guide was designed to accommodate problems addressed in the analysis phase of this study. The biggest goal for the User Guide re-design was to better address the two biggest problems users face when user the microform machines in the User Guide: Emailing files and fixing the “Error 20088: TWAIN device was not ready.” The previous User Guide failed to properly address these issues, forcing students to ask the Research Help Desk for assistance, or leading students to give up using the machines entirely. The new User Guide will hopefully reduce the amount of questions students have for the Research Help Desk regarding how to use the microfilm machines.

When students wish to email a file of scanned images, they may refer to the “EMAILING IMAGES” section of the User Guide. Problems with the previous User Guide include:

- Poor location for the warning regarding the “Email Images” button which doesn’t work (the warning is at the bottom of the page)
- Too much information crammed on one page (lack of white space)

- Too busy (excessive bolding and “important” warnings)
- Issue regarding saved files containing all images not address (this problem is addressed in the “SAVING IMAGES TO USB” section, but not in the “EMAIL IMAGES” section)
- “Emailing Problems?” section not included (all other sections include a section at the end addressing problems related to that section; Ex. “Scanning Problems?”)

Solutions were taken to address each issue above. The warning for the “Email Images” button was moved to the top of the page, because clicking on this button is the biggest problem student’s encounter when using the microform machines, and thus should be the first thing users read when referencing how to email themselves a file in the User Guide. The EMAILING IMAGES section was expanded to two pages to increase the amount of white space on the pages, thus making it easier to read and navigate. The “Important” warnings located in the margins of the page were eliminated to reduce clutter; “Hints” were added to draw attention to important steps and tips for using the machines. A “Hint” was added to emphasize that the scanned image file contains all images (despite only displaying the first scanned image). A section at the end of the EMAILING IMAGES section was also added to address common problems users encounter when attempting to email a document. By making the adjustments addressed in this section, users can now easily learn how to email scanned files without having to ask for assistance.

Another problem that was important to address in the User Guide is when students encounter the error, “Error 20088: TWAIN device was not ready” when attempting to scan an image. This problem is not addressed in the previous user guide at all! A yellow sticky note attached to the reader machine is the only message for how to fix this problem, and often goes

unnoticed by most users. Thus, a goal for the new User Guide was to incorporate this problem and solution into the manual. This problem is addressed in two sections of the User Guide: the SCANNING IMAGES section and the FAQ section at the end of the manual. In the SCANNING IMAGES section this problem is addressed in the “Scanning Problems?” section, and is the first problem addressed. The title is also bolded to draw more attention to it. Detailed instructions are included to teach the user how they can fix the problem on their own. This will hopefully reduce traffic to the Research Help Desk. This problem is also addressed in the Frequently Asked Questions section of the manual in case students see the error before attempting to scan their first images, and thus flip to the FAQ for help. To help draw attention to this important issue, it is placed as the second question on the FAQ page. By properly addressing this issue in the User Guide, users will become less frustrated with the machines and can quickly and easily fix the problem by themselves.

Various changes to the structure, design, flow, and content were also made to enhance usability. Examples can be easily seen by comparing the previous and new User Guides in the Appendices. It is important to note however that the general design structure was used from the previous User Guide, as well as copied verbiage for specific sections that did not need adjustments. This decision was made based on the ease and simplicity of the previous User Guide structure. While the order and content needed adjusting, the sections, headings, and many of the pictures were still appropriate. This decision was also made in regards to presenting the new User Guide to the University Library staff. An updated User Guide compared to a completely new and redesigned User Guide would be easier to follow and to understand in regards to the changes that were made.



Each section of the User Guide was closely examined to search for improvements that could be made. Through this process it was determined that a few sections of the previous User Guide no longer needed to be included in the new manual, the ordering of the sections should be adjusted, and more questions should be added to the FAQ. The sections for saving images to a recordable CD and saving images to your Zimbra Briefcase were eliminated for the new User Guide based on the analysis in the “Analyze” section of the report, where these two sections were determined to be outdated and no longer used by students. This helped shorten the manual, and to focus the manual on only the critical areas of the process. The ordering of the sections was also adjusted to enhance the flow of the document.

- Previous Flow:

- How to View Microfiche → How to View Microfilm → Scanning Images → Printing Images → Saving Images to a USB Flash Drive → Saving Images to Recordable CD → Saving Images to Zimbra Briefcase → Emailing Images → Frequently Asked Questions → Changing the Lens

- New Flow:

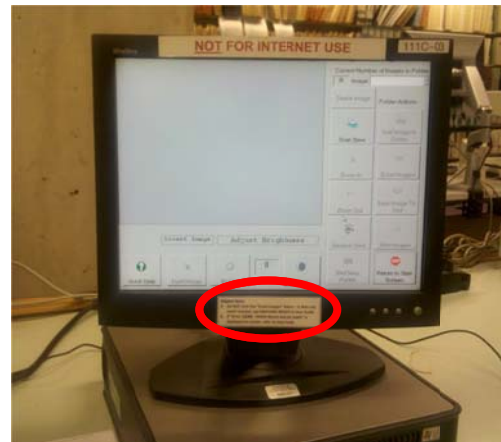
- How to View Microfiche → How to View Microfilm → Scanning Images → Saving Images to a USB Flash Drive → Emailing Images → Printing Images → Changing the Lens → Frequently Asked Questions

It was also apparent that the previous User Guide did not address all the questions and problems that users encounter. By prioritizing problems discovered throughout the define process of this report, additional questions were added to the FAQ section of the User Guide.

General considerations for the entire User Guide were also taken into account. For example, pictures in the new manual are all located on the hand side of the page, rather than randomly placed and sized throughout the document. The new User Guide was also written in a manner to encourage users to play around with the machines, and to explore the manual for how to use the machines. For more examples on changes that were made to the new User Guide, refer to the Appendix B (previous User Guide) and Appendix C (new User Guide).

## Visual Aid on Computer Monitors

A visual aid featuring two “Helpful Hints” (emailing images and fixing the “Error 20088: TWAIN device was not ready”) was placed on each computer monitor to further assist users when navigating the microform machines. The goal of this aid was to inform users of common problems when using the machines, prior to actually encountering them. By placing the visual aid in an ergonomic location on the monitor (eye level, centered), users are drawn to the card and will likely read how to handle the two most commonly identified problems encountered by students. This makes users self-sufficient and more independent for the entire Senior Project viewing and saving process.



or

### Helpful Hints:

1. Do NOT click the “Email Images” button – it does not work! Instead, see EMAILING IMAGES in User Guide
2. If “Error 20088: TWAIN device was not ready” is displayed on screen, refer to User Guide

## ***Control***

After implementing the new User Guide and visual aids, it will be necessary to monitor the system to ensure stability of the implemented improvements. This will be difficult to monitor, but can be done effectively by monitoring the amount and type questions asked to the Research Help Desk employees. If the amount of students who approach the Research Help Desk for assistance decreases, it would suggest that the User Guide and visual aids were a success and in fact help students figure out solutions to their questions on their own. However, if students begin asking new questions that are not addressed in the user Guide, or have difficulty using specific sections of the manual, adjustments to the new User Guide may be needed. This is a very critical step in the DMAIC method, and should not be overlooked by the University Library. In order to sustain long term benefits from this project, the process needs to be monitored, and updates to the User Guide will likely be required in the future.

## **Digitization Research**

Microfiche may have been the industry standard just twenty years ago, however, its heyday of being a primary archival source is gone (Kaminsky). In fact, most institutions carrying microfiche are now attempting to digitize their microfiche records (conversion to a digital form such as PDF). With digital archives, users can search, read, save, and print documents with the click of a mouse, and access them universally via the internet. Doing the same process with microfiche requires physically walking into a library or another location with a microfiche reader, using a reference guide to help search through file cabinets of documents to locate the microfiche you are looking for, and then using an ancient machine (most likely from the 1980's) to read the document. In today's digital world, digital documentation and archival is a superior method of data archiving and retrieval, and institutions still using or carrying microfiche records should seriously consider digitizing their records.

### ***Conversion Challenges and Solutions***

Digitizing microfiche archives is clearly desirable; however, converting outdated microfiche to today's preferred formats can prove to be problematic. The poor quality, inflexibility, and processing limitations of microfiche have rendered many digitized documents unusable given today's standards. Copyright infringement and security requirements must also be considered during the process depending on what is actually being digitized and how it will become available. Compliance regulations and precautions may also be required, further complicating the process and increasing the overall cost. The entire process for conversion to

digital format can be costly and time consuming, often deterring many companies from making the transformation.

State-of-the-art scanners and image enhancement software are enabling microfilm digitization companies to offer lower rates and deliver higher quality scans than ever before. Many digitization companies also offer a variety of services such as indexing, giving clients the ability to quickly search and retrieve desired records instantaneously. By removing the cumbersome manual search-and-retrieval process, digital microfilm conversion optimizes record retrieval and increases the productivity of your organization (BMI Imaging Systems).

Costs for digitization varies based on the needs and requirements of the organization, but can quickly become costly when high volumes of microfiche are involved. Despite the high costs of digitizing microfiche, many companies often yield savings from the conversion process due to increased productivity and accessibility of the documents. Each organization is unique, and should carefully consider their options before electing to digitize their entire microfiche collection.

### ***Advantages and Disadvantages of Digitizing Microfiche Records***

#### **Advantages**

- Record retrieval in seconds
- Universally accessible via the internet
- Accessible to multiple users at the same time
- Eliminates microform readers
  - Creates additional room space
  - Microfiche equipment and maintenance are no longer required

- Higher quality images potentially available

### **Disadvantages**

- Expensive
- Image quality may not meet standards
- Compliance requirements
- Copyright infringement

## **Digitizing Cal Poly's Senior Project Collection**

The Robert E. Kennedy Library should seriously consider digitizing its Senior Project collection to benefit its students, increase information accessibility to the public, and to continue moving toward modern record keeping practices. Establishing the DigitalCommons@CalPoly was a step in the right direction, but unfortunately only a small number of Senior Projects are available online, forcing students to continue using the ancient microform machines for research purposes. One of the unique features and bragging points of Cal Poly is its Senior Project Requirement; however, continuing to use and invest in microform technology is outrageous for a technical school like Cal Poly. Unfortunately, the cost to digitize Cal Poly's Senior Project collection remains high, and without a budget to fund such an expense. To determine if such an investment would be worth it for Cal Poly and to the Robert E. Kennedy Library, analysis of student usage and Senior Project usage by year was conducted. Multiple alternatives were also generated based on the financial capability of the University Library and vendor estimates.

### ***Student Usage***

Since the DigitalCommons@CalPoly began incorporating Senior Projects in November 2009, the Robert E. Kennedy Library has seen a drastic decrease in student usage of the Senior Projects on microfiche; this is most likely due to the student's ability to access past Senior Projects online through the DigitalCommons@CalPoly. This statement is based on data collected by the University Library staff, which includes the volume of Senior Projects that are re-filed in the reference room every month. There has been a significant drop-off in student

usage, from 4,212 Senior Project re-filed in fall 2005, to just 219 Senior Projects re-filed in fall 2010 (Table 1 – Appendix D). This would imply that as more and more Senior Projects are uploaded to the DigitalCommons@CalPoly each year, students will continue using the microform readers less and less. However, Senior Projects submitted prior to the establishment of the DigitalCommons@CalPoly are still only viewable by microfiche. In fact, as of March 2011, only 705 Senior Projects were available on the DigitalCommons@CalPoly. This means that only 0.85% of the entire Senior Project collection was available for digital viewing. Thus, a large amount of information is still unavailable digitally, even as students continue to submit digital copies of their Senior Project in the future.

### ***Senior Project Usage by Year***

With the high costs of digitizing the entire collection of Senior Projects on microfiche, it was of interest to examine which years were being used most by the students to determine if there were any alternatives to scanning the entire collection. From Table 2 – Appendix D we can see that students typically use recently submitted Senior Projects. In fact, from the sample, 40.7% of Senior Projects that needed to be re-filed are from 2000-2009, and 84.3% of Senior Projects that needed to be re-filed were from 1980-2009. A cheaper alternative to scanning the entire Senior Project collection is to digitize Senior Projects from 2000-2009. This would significantly reduce costs, and still provide benefit to students doing Senior Project research. The University Library would lose its discount on bulk digitization, but could make a significant impact immediately by simply digitizing Senior Projects from 2000-2009.



## ***Digitization Estimate and Alternatives***

The Robert E. Kennedy has a variety of alternatives for digitizing its Senior Project collection. Potential alternatives include digitizing the entire Senior Project collection, digitizing a specific time frame of Senior Projects (ex. 2000-2009), or digitizing Senior Projects in-house as they are used and need to be re-filed (digitization on demand). Each alternative has its own advantages and disadvantages and were carefully looked into for this study.

If the Robert E. Kennedy Library had enough funds to digitize the entire Senior Project collection, that would be the ideal alternative. Unfortunately however, this is not very realistic and looks like it will be many more years before the entire collection will be digitized (unless a large grant or donation is received). Regardless, gathering quotes from vendors was necessary to estimate of digitization costs and to understand the processes required for digitizing a collection of microfiche from the University Library.

The general estimate for digitizing a collection of microfiche is based on total volume of microfiche to be scanned, and the number of pages per microfiche document (additional costs for enhanced quality, indexing, and special requests are also available). This price can range from \$0.02-\$0.20 per page based on the total volume. It was first necessary to calculate the number of Senior Projects available on microfiche. This was done by sorting through each year of Senior Projects in the file cabinets located in the reference room of the University Library. A breakdown of this data can be found in Table 1 – Appendix E, which displays the number of Senior Projects submitted each year from 1942-2009. 83,145 total Senior Projects on microfiche were calculated. Table 2 – Appendix E is also useful for analyzing Senior Project volume from specific time frames (Ex. 13,583 Senior Projects were submitted from 2000-2009).

## **Statistical Sampling – Average # of Pages per Senior Project**

Statistical sampling and analysis was conducted to determine the average number of pages per Senior Project for cost estimation purposes. Obtaining an accurate and true mean is critical for cost estimation because it determines the rate per page, which ultimately affects the final cost. Vendor estimates are primarily based on how many total scanned pages are required; making the average number of pages and total volume of microfiche scanned critical for creating an accurate estimate.

Tables were generated within excel to determine how an incorrect mean for average number of pages affects would affect the total cost (Table 1 and 2 – Appendix G). The results show that there are significant price increases when underestimating the population mean. Obtaining an accurate page per microfiche mean is especially significant when scanning larger volumes. For example, if the estimated population mean is 51 pages and the actual population mean turns out to be 66 pages (after scanning all the Senior Projects), the cost for digitization would go up \$59,241 dollars. This price increase goes down as the estimated population mean approaches the actual population mean. Because the University Library is interested in eventually digitizing its entire collection, estimating the average number of pages per Senior Project accurately is very important for obtaining an accurate estimate.

It was first necessary to sample a small group of Senior Projects to estimate the standard deviation, which could then be used to calculate the sample size necessary to estimate the population mean with a specific confidence interval. This was done by sampling 50 random Senior Projects. A random number generator was used to select the 50 Senior Projects from the population of 83,145 Senior Projects. Senior Projects were then manually

located, and the number of pages on each Senior Project was recorded. This data and supporting Minitab results can be found in Appendix H. The data yielded the following results:

Sample Size	50
Mean	41.44
Standard Deviation	19.46

The sample standard deviation from above could then be used to calculate the sample size necessary to calculate the estimated population mean with a desired confidence interval.

The sample size depends on the desired confidence interval and the width (# of pages away from the mean), and can be calculated using the following equation:

$$n = \left( 2 * Z_{\frac{\alpha}{2}} * \frac{\sigma}{w} \right)^2$$

Due to the long amount of time it takes to locate and record the number of pages for each Senior Project, the sample size had to be a feasible number to collect data for, yet maintain a high confidence interval with strong page accuracy. The following table was created to select an appropriate sample size:

Confidence Interval	Page Accuracy					
	1	2	3	5	7	10
99%	10086	2522	1121	403	206	101
95%	5821	1455	647	233	119	58
90%	4100	1025	456	164	84	41
68%	1515	379	168	61	31	15

While it is desired to estimate the population mean to within 2-3 pages, it was not feasible to sample more than 400 Senior Projects for this study; it simply takes too long to create the sample, locate the microfiche, and record the number of pages per Senior Project. It was also desired to estimate the mean with high confidence; thus a confidence interval of 95% was chosen for this study. A sample of 233 was then selected to estimate the population mean to

within 5 pages with 95% confidence. The new sample was conducted the same way as before, using a random number generator to select 233 Senior Projects. The sample yielded the following results:

Sample Size	233
Mean	50.97
Standard Deviation	30.71

Sample data and Minitab results can be found in Appendix I. Vendors could now be approached using this new sample mean for the average number of pages per Senior Project.

## Vendor Estimates

Vendor estimates for digitizing a collection of microfiche are primarily based on total volume and the number of pages per microfiche document; additional costs for indexing, enhanced resolution, and transportation costs also typically apply. Two vendors were approached in this study to gather an estimate of digitization costs. Criteria for vendor candidates included the following:

- Located within California
- Capable of completing the project in under 10 weeks (over summer break)
- Strong reputation (Association for Information and Image Management Member)
- Advanced indexing compatible with the Robert E. Kennedy Library
- High image resolution

Royal Imaging Inc. (Los Angeles) and BMI Imaging Systems Inc (Sunnyvale, CA) were selected based on the above requirements. Based on the information and requirements provided to them, they provided quotes for scanning the entire Senior Project collection, as well as just Senior Projects from 2000-2009. A summary of their quotes are listed in the table below:

# of Senior Projects	Royal Imaging Inc.	BMI Imaging Systems Inc.
83,145	\$211,000.00	\$140,000.00
13,583	\$45,000.00	\$34,000.00

Table 1: Vendor Quote Comparison

It is important to note that these quotes are not the end cost for digitizing the Senior Projects. The University Library has additional compliance requirements that are not accounted for in the vendor quotes. The University Library must also devote time and resources for creating metadata and uploading the new PDF versions of Senior Projects to the DigitalCommons@CalPoly. This is very costly due to the nature of what is required. However, for the purpose of this study, those costs were not accounted for because the exact requirements have not yet been defined by the University Library.

## Digitization on Demand

Digitizing the entire Senior Project collection (or even just the last 10 years) will be very expensive, and is a cost the University Library cannot currently afford. Another option to consider however is digitizing Senior Projects on demand; that is, as Senior Projects are used and need to be re-filed, University Library staff would create a PDF versions of those Senior Project (in-house; using the current machines), and upload the Senior Projects to the DigitalCommons@CalPoly. In this way, frequently used Senior Projects would quickly become available in digital format. This is a much more affordable solution, and would have an immediate impact that would become more valuable over time.

Digitization on demand is a feasible opportunity for the University Library. Students are viewing Senior Projects less and less on microfiche – preferring to instead view Senior Projects online at the DigitalCommons@CalPoly. The decreased usage makes it possible for digitization

on demand, as only 40-150 Senior Projects are being viewed per month currently, as compared to the 400-2,000 that used to be viewed per month before the DigitalCommons@CalPoly was established. This smaller number is much more manageable and can be managed by the University Library. The average time to scan and create a PDF of a Senior Project takes 15 minutes once familiar with the machines, and if an average of 80 Senior Projects need to be re-filed every month, 20 man-hours would be required for this task every month. The University Library would need to train part-time employees for this job, but at \$10/hour, the rough cost per month is only \$200 (see Table 1 – Appendix J). This is a much more affordable price for the University Library, and would also benefit students seeking a part-time job on campus.

Aside from the reduced costs for digitization on demand, by starting to digitize Senior Projects in-house, the University Library will gain a better understanding of the digitization process, and may discover further requirements for vendors that were not originally considered. The Senior Projects at Cal Poly range over a 67 year period, and thus have a lot of variation in the condition and format of the microfiche. By scanning Senior Projects in-house, the University Library will know more about its collection, and how to better define digitization requirements to vendors in the future if the University Library elects to eventually digitize its entire collection. This will result in cost and time savings for the University Library, and should thus be seriously considered to minimize error and ensure quality of the scanning process.

## **Summary & Conclusions**

The Robert E. Kennedy Library transitioned to digital Senior Project submission through the DigitalCommons@CalPoly, and will begin retrofitting past Senior Projects on microfiche to digital format once it has the resources to do so. Until then, the University Library should continue monitoring its current system through re-filing data, and make updates to the User Guide as the reference room is remodeled and computer hardware are upgraded. The University Library should also commence digitizing Senior Projects in-house as they are used by students and need to be re-filed. This is the most affordable alternative to digitizing the entire Senior Project collection, which may cost well over \$200,000 total. Digitizing Senior Projects on demand also helps immediately digitize frequently used Senior Projects, and will prepare the University Library to digitize its entire Senior Project collection in the future. This will result in cost and time savings for the University Library, and should thus be seriously considered to minimize error and ensure quality of the scanning process.

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- What is Microfiche. Ehow. [http://www.ehow.com/about\\_4615977\\_what-is-microfiche.html](http://www.ehow.com/about_4615977_what-is-microfiche.html)
- Where DMAIC Applies. DMAIC Tools. <http://www.dmaictools.com/>



## Appendices

### *Appendix A: Academic Senate Resolution & Senior Project Timeline at Cal Poly*

#### 211.44 Library Copy

~~One copy of each Senior Project will be sent by the academic department to the University Library where it will be copied to microfiche. A microfiche copy of the project will become a part of the Library's collection where it will be available for public use. One copy of each microfiche project will also be deposited in the University archives.~~

The academic department may send one copy of each senior project to the University Library where it will be reproduced on microfiche or in an electronic format. A microfiche or electronic copy of the project will become part of the Library's archival collection where it will be available for public use. Archival copies of Senior Projects will be available either on microfiche or in an electronic format.

**Table 1** – Senior Project Timeline at Cal Poly

1942	First Senior Projects are submitted at Cal Poly
1960's	University Library implements microfiche cards and reader machines (only viewing/printing; coin operated)
1985	University Library converts old paper copies of Senior Projects to microfiche (1942-1960's)
1980's - 1990's	University Library purchases 4 Minolta MS 6000 machines
April 2001	Academic Senate Resolution makes it optional for departments to submit a copy of Senior Projects to the University Library
2008	University Library purchases the ST200X Series Viewer (tosses out 2 Minolta MS 6000 machines)
2008	Library Staff writes a User Guide for the Minolta MS 6000 machines
November 2009	The DigitalCommons@CalPoly is established
June 2011	New User Guide and Signage for Microfiche Readers

## ***Appendix B: Previous User Guide***

See Following Pages.

# HELP!

## HOW DO I USE THE MICROFORM READERS?



## Frequently Asked Questions

**Q.** What's the difference between microfiche and microfilm?

**A.** Microfiche is in the form of a transparent card. Microfilm comes on a reel. Both formats contain scanned pages of information, and our readers can handle either one.

**Q.** What do I do with the microfiche/microfilm when I'm done with it?

**A.** Put it back in its envelope or box and put it in the appropriate basket (the large baskets for microfilm, or the small basket atop the cabinet for microfiche). Library staff will re-file the microfiche or microfilm.

**Q.** What if the microfiche/microfilm is unreadable and/or I can't get a decent printout?

**A.** Talk to the library staff at the Reference Desk. They can help you to identify possible other sources for the material.

**Q.** I'm not a member of the Cal Poly Community. Can I still use the microfiche/microfilm?

**A.** Yes! You can view the microfiche and microfilm, and you can save pages or email them to yourself or others. However, you will *not* be able to print pages on any of the campus printers due to payment restrictions (but if you save or email them, you can print them elsewhere).

**Q.** My images were saved as a TIFF file. Can I open it on my home computer?

**A.** Yes. How it opens depends on what kind of computer you have and what software is installed.

### ***Windows PC***

- In most cases, the TIFF file will open in Microsoft Office Document Imaging.
- PCs running Windows XP will be able to open the TIFF file in Windows Picture and Fax Viewer.
- PCs running Vista will be able to open the TIFF file using Windows Photo Gallery.

### ***Macintosh***

- In most cases, the TIFF file will open in Preview.

**Q.** Can I convert this TIFF file into a PDF?

**A.** Yes! Here's how:

1. Save your images to a USB flash drive (see **SAVING TO USB FLASH DRIVE**).
2. Go to any computer and find your file on the USB flash drive. **DO NOT OPEN IT**.
3. Right click on your file and select ***Convert to Adobe PDF***.
4. Your file will open in Adobe Acrobat Professional.
5. ***Save*** your new PDF with whatever name you choose.

**Q.** I've read this entire manual and I still have questions. What can I do?

**A.** Go to the Reference Desk. The person on duty there will be glad to assist you!

## How to View Microfiche

1. If the microform reader is asleep (the light is off), press the green **START** button on the front.
2. Pull out the drawer so the top plate of glass opens upward.
3. Place your microfiche face down between the plates of glass.



4. Push the drawer back in. Your microfiche should display on the screen.
5. Move the drawer back and forth to view individual pages on the microfiche.
6. If you plan to save or print pages, scan and add to your folder as you go (see SCANNING IMAGES TO SAVE OR PRINT).
7. When you are finished, return the fiche to its envelope and place it in the basket.



## Viewing Problems?

Display is tilted or upside down.

- Turn the knob on the reader until display looks right.

Display is too light or dark.

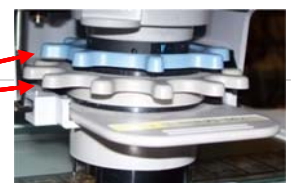
- Use the adjustment buttons on the display to make it lighter or darker.
- Note: Old or poor quality microfiche may be too light or dark despite adjustment.

Display is too large or too small.

- Change the lens in the reader (see CHANGING THE LENS for directions).
- The number 1 lens gives the smallest view; the number 3 lens gives the largest.

Display is out of focus.

- Turn the rings on the lens until the display is in focus.

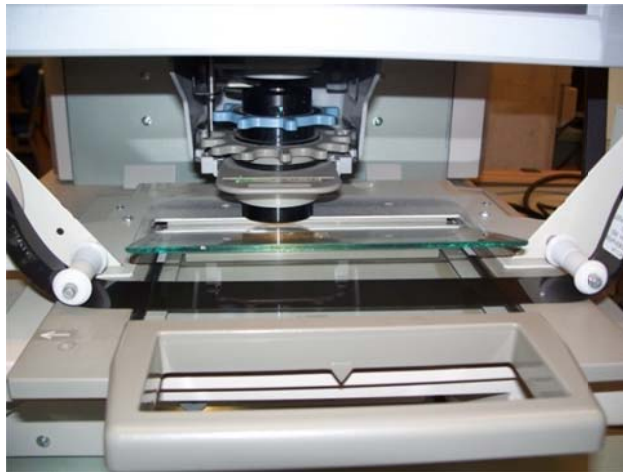


## How to View Microfilm

1. If the microform reader is asleep (the light is off), press the green **START** button on the front.
2. Pull out the drawer so the top plate of glass opens upward.
3. Push your reel of microfilm onto the left-hand side of the machine, so that the film comes over the top of the reel.



4. Thread the film under the left-hand roller, *between* the plates of glass, and under the right-hand roller.

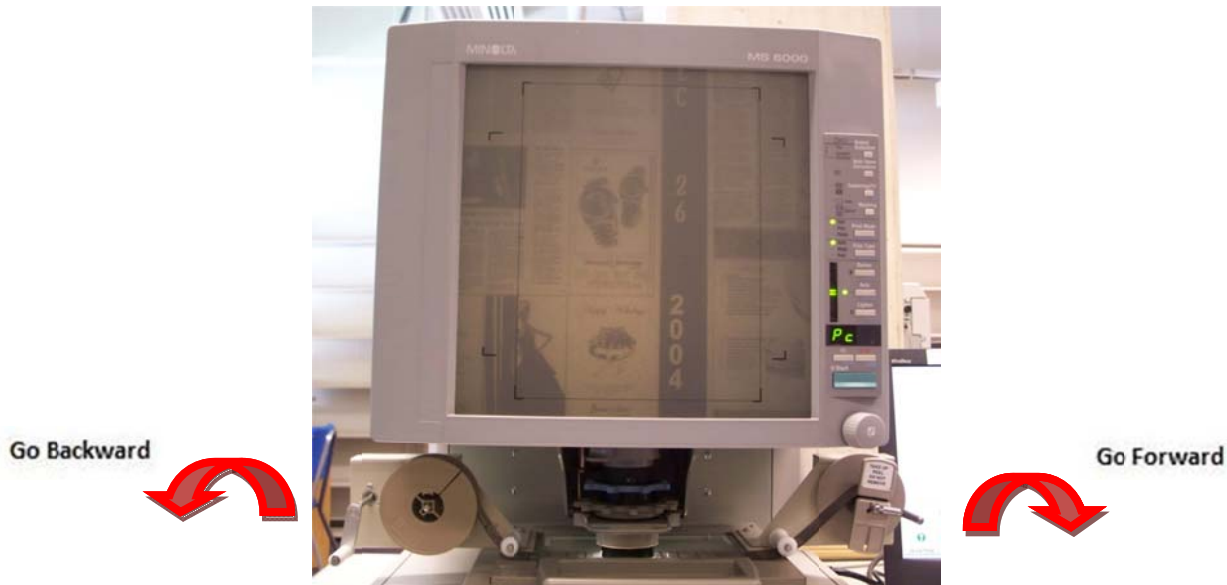


5. Tuck the end of the film into the slot in the take-up reel on the right-hand side.



6. Push the drawer back in.

7. Turn the crank on the right-hand side to wind your film forward. Many reels of film include visual clues such as the month along the side of the display to help you find your place.



8. If you plan to save or print pages, scan and add to your folder as you go (see SCANNING IMAGES TO SAVE OR PRINT).
9. When you are finished, use the crank on the left-hand side to rewind your reel of film. Return the reel to its box and place it in the basket to be re-filed.



## Viewing Problems?

Display is tilted or upside down.

- Turn the knob on the reader until display looks right.



Display is too light or dark.

- Use the adjustment buttons on the display to make it lighter or darker.
- Note: Old or poor quality microfilm may be too light or dark despite adjustment.



Display is too large or too small.

- Change the lens in the reader (see CHANGING THE LENS for directions).
- The number 1 lens gives the smallest view; the number 3 lens gives the largest.

Display is out of focus.

- Turn the rings on the lens until the display is in focus.

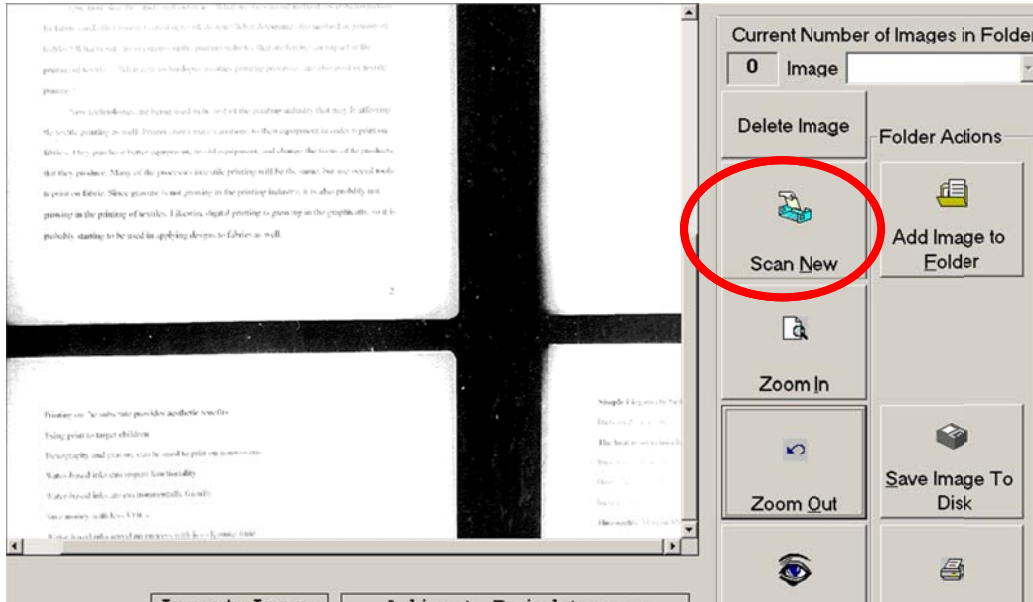


## SCANNING IMAGES

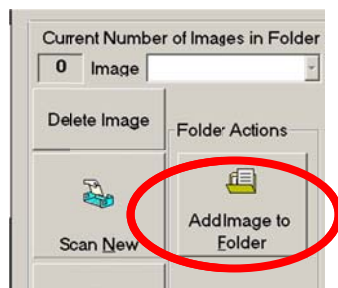


Before you can print or save pages, you **MUST** scan them and **add them to your folder**.

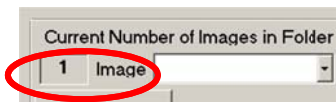
1. Use the mouse to click anywhere on the computer screen to start the scanning software.
2. Line up each image (or page) on the microform reader within the 8 ½" x 11" lines on the screen.
3. Click on the "Scan New" button on the computer monitor.



4. Click the "**Add Image to Folder**" button. **Each** scanned image **must** be added to this folder in order for you to print or save it.



5. Repeat for each image you want to print or save. *Note that the image count increases each time you add to the folder.* Finish scanning all images *before* printing or saving or you will end up with duplicate pages.

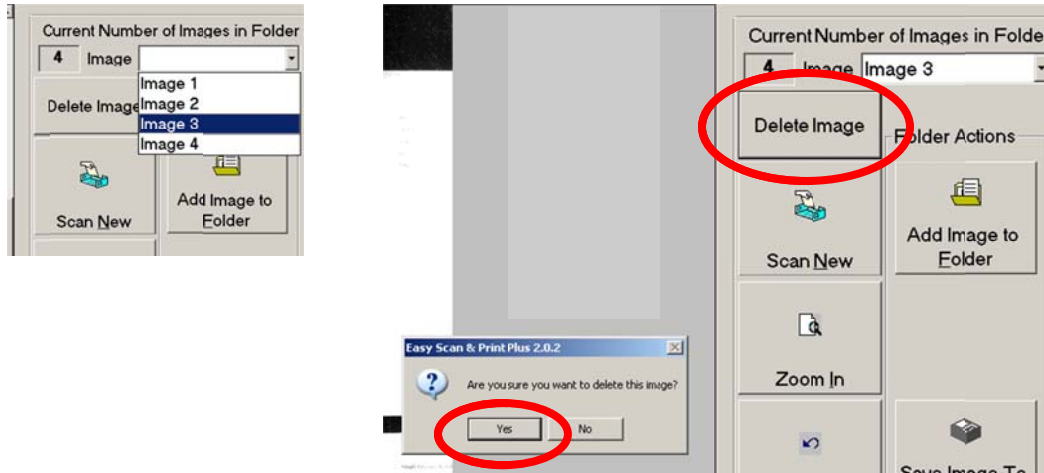




## Scanning Problems?

How do I delete an image I saved?

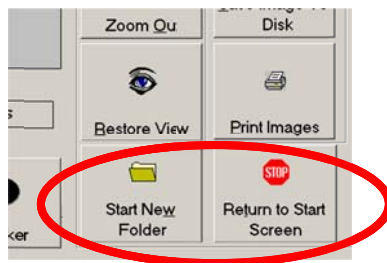
- Go back through the saved images until you find the one you want to get rid of. Click the Delete button, then click the Yes button.



The last person walked away and left their saved images in the folder.  
(or) I don't want to leave my images for someone else to look at.

**How do I clear the folder?**

- Click either Start New Folder or Return to Start Screen.



What happens if I scan pages but don't add them to the folder?



- Images that are not added to the folder are overwritten by the next scan and cannot be retrieved.**

## PRINTING IMAGES

**Important!**



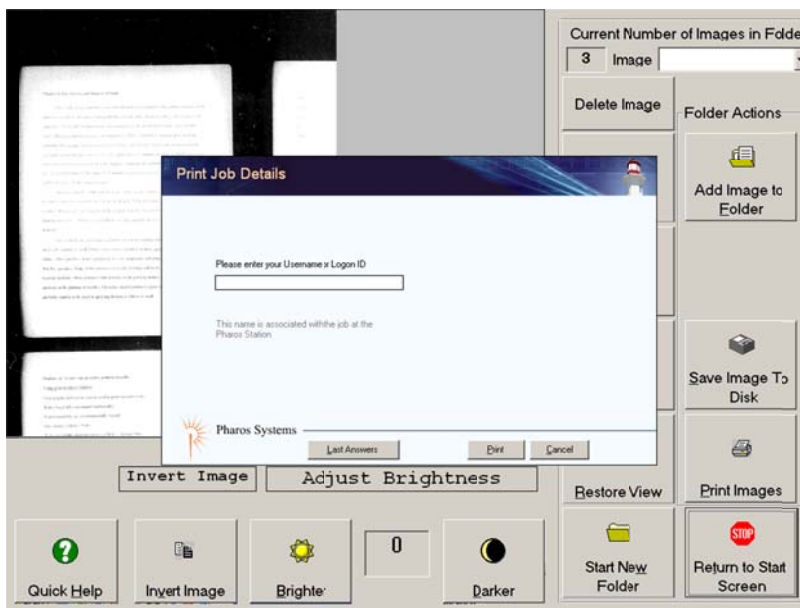
Did you scan and **add each image** to the folder?

1. Click the “Print Images” button.



2. Follow the prompts for the PolyCard printing system.

- UserID can be your name or whatever you will recognize.
- Printing costs 10 cents per page.
- You must pay with your PolyCard (campus ID).
- You must have money on your PolyCard.



3. Your pages will print at the print station located in the main Reference room.



## Printing Problems?

My printout is so light or dark I can't read it.

- Use the adjustment buttons on the display to make it lighter or darker.
- Note: Old or poor quality microfilm may be too light or dark despite adjustment.



I tried adjusting it, and my printout is still impossible to read.

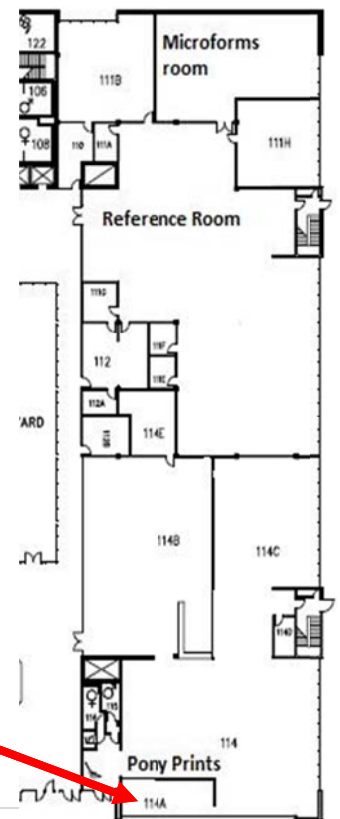
- Talk to the library staff at the Reference Desk. They can help you to identify possible other sources for the material.
- If you can read the pages on the screen, try saving them instead of printing them. This may allow you to capture the images in a way that will still let you use them later.

I don't have enough/any money on my PolyCard.

- You can add money to your PolyCard in the following ways:
  - Call 756-5939 if you have a Visa, MasterCard, or Discover card.
  - Visit the Campus Express Club page and click "Add Value Now" (<http://www.cpfoundation.org/express/>) (requires credit card).
  - Visit the Lighthouse in person.

I don't have a PolyCard, but I still need to print this right now.

- You can save it to a flash drive or CD-ROM and take it to Pony Prints at the front of the Library. For a small extra fee, they will print it for you.



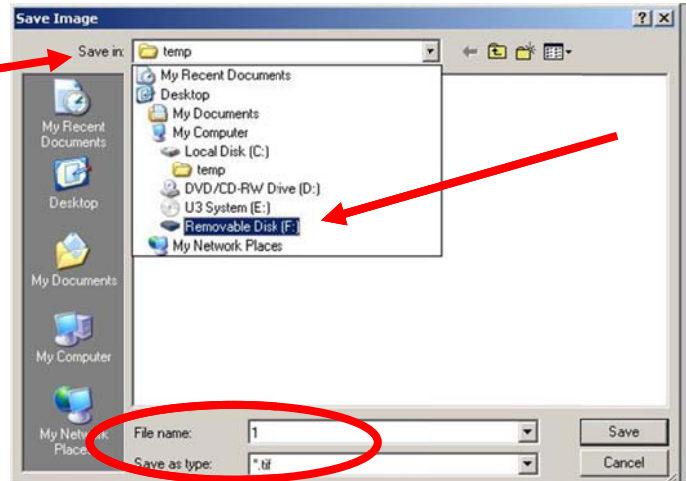
## SAVING IMAGES TO A USB FLASH DRIVE

**Important!**



**Did you scan and add each image to the folder?**

1. Insert your USB flash drive into the front of the computer.
2. Click on the “Save Image to Disk” button. This will open the **temp** folder.
3. Click on the arrow in the “Save In” box and choose **Removable Disk** from the dropdown menu. This will open your flash drive.



4. Click in the File name box and name your file (the default file name will be 1.tif unless you rename it). Click the save button. This file will contain all images.
5. To safely remove your USB drive:
  - a. Press the Windows key on the keyboard
  - b. **Left-click** the green arrow icon in the system tray (do not rapidly double-click)
  - c. Click on “Safely remove USB Mass Storage Device – Drive (F:)” and remove your drive.
  - d. A small message will pop up, informing you that it’s safe to remove your drive.

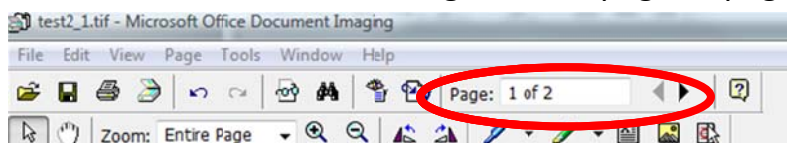
## Flash Drive Problems?

I saved a lot of images. Why is there only one file?

- All the images are stored together in one TIFF file.

I opened the file on another computer and I only see my first page.

- Look for a page number and a pair of arrows in your image viewing program. Use the arrows to navigate from page to page in your file.



I opened the file in the Reference Room and it opened in PhotoShop. I need a less complicated way to view it.

- Right click on your file and select Open with... Microsoft Office Document Imaging, Windows Picture and Fax Viewer, or Windows Photo Gallery.


## SAVING IMAGES TO YOUR ZIMBRA BRIEFCASE

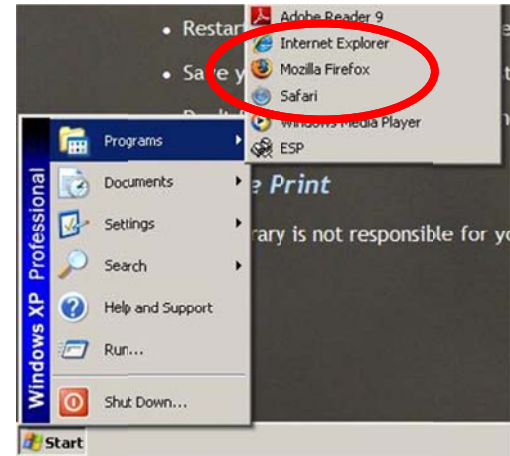
**Important!**



Did you scan and **add each image** to the folder?

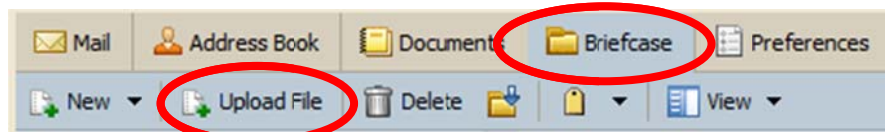


1. Click on the “Save Image to Disk” button. This will open the **temp folder**.
2. Click in the File name box and name your file (the default file name will be 1.tif unless you rename it). Click the save button. This file will contain all images.
3. Press the Windows  key on the keyboard
4. Click Start, then go to Programs and select a web browser.



5. Start the web browser and go to the Cal Poly Portal (my.calpoly.edu).
6. Log in and click the Go button next to Zimbra email.
  - a. *Note: This will work even if you have your Cal Poly email forwarded to another account.*

7. Click the Briefcase tab.



8. Click Upload File.
9. Click Browse or Choose File; the **temp folder** will open.
10. Click on your file; then click OK.
11. Your file will be accessible from any place you can log into the Cal Poly Portal.
12. **BE SURE TO LOG OUT AND CLOSE THE WEB BROWSER WHEN YOU ARE FINISHED.**

### Briefcase Problems?

I put a lot of files in my briefcase. Will that affect my quota?

- Briefcase files DO count against your email quota, and the TIFF files generated by microform scanning usually exceed 1MB in size. The status bar beneath your name in the Zimbra client will indicate how much of your quota you are using.

I saved a lot of images. Why is there only one file?

- All the images are stored together in one TIFF file.

I opened the file on another computer and I only see my first page.

- Look for a page number and a pair of arrows in your image viewing program. Use the arrows to navigate from page to page in your file.

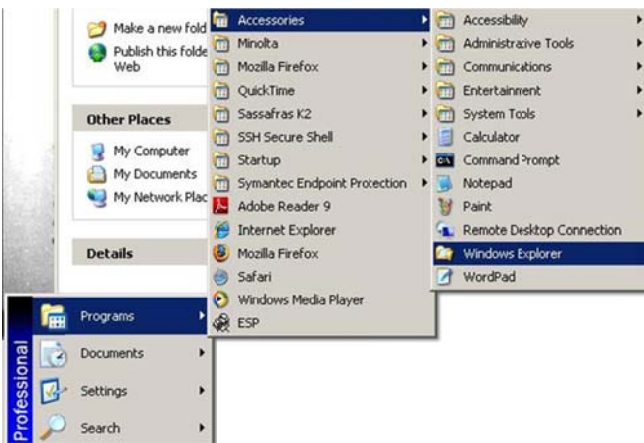
## SAVING IMAGES TO RECORDABLE CD

**Important!**



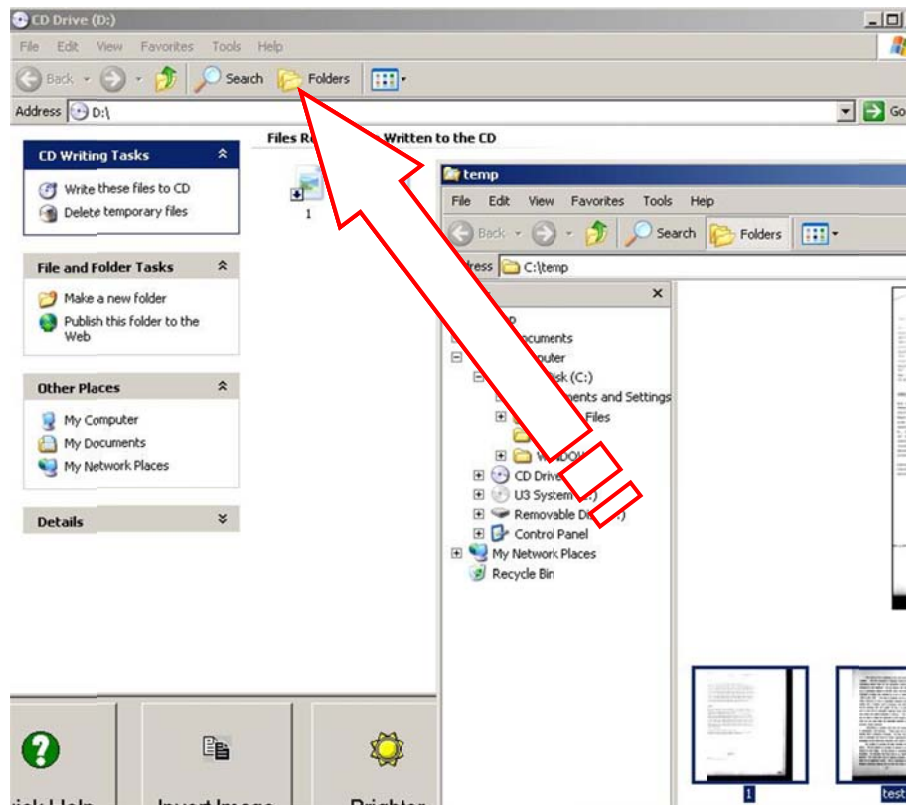
Did you scan and **add each image** to the folder?

1. Click on the “Save Image to Disk” button. This will open the **temp folder**.
2. Click in the File name box and name your file (the default file name will be 1.tif unless you rename it). Click the save button. This file will contain all images.
3. Put your recordable CD in the CD/DVD drive.
4. Click “Open writable CD folder using Windows Explorer” from the popup window. This will open the **CD Drive (D:)** window.



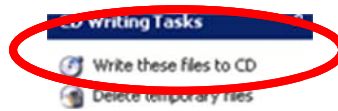
5. Go to **Start**, then **Programs**, then **Accessories**, and choose **Windows Explorer** from the menu. This will open the **temp folder**.

6. Drag your files to the CD Drive window.





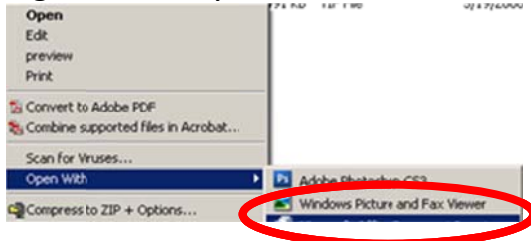
7. Close the temp folder window.
8. Click on Write these files to CD.
9. Name your CD if desired.



10. Click Next. The CD Writing Wizard writes to the CD.
11. The CD drawer opens when the disk is done. Click Finish.
12. If you want to check to be sure your file is there, put the disk back into the drive.
13. Click OK on "Open folder to view files using Windows Explorer".



14. Right click on your file and select Open with... Windows Picture and Fax Viewer.



15. If your file looks OK, you are finished. Close the window and eject your CD.

## ***CD-R Problems?***

I saved a lot of images. Why is there only one file?

- All the images are stored together in one TIFF file.

I opened the file on another computer and I only see my first page.

- Look for a page number and a pair of arrows in your image viewing program. Use the arrows to navigate from page to page in your file.




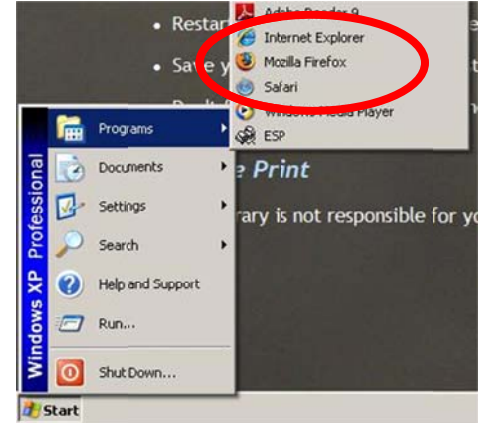
## Important!

## EMAILING IMAGES

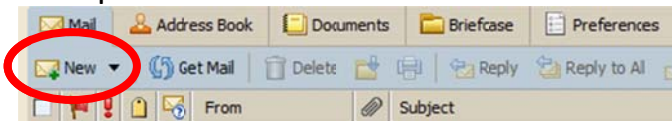


Did you scan and **add each image** to the folder?

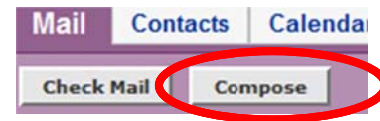
1. Click on the “Save Image to Disk” button. This will open the **temp folder**.
2. Click in the File name box and name your file (the default file name will be 1.tif unless you rename it). Click the save button. This file will contain all images.
3. Press the Windows  key on the keyboard
4. Click Start, then go to Programs and select a web browser.
5. Start the web browser and go to your web email page (Cal Poly Portal, Yahoo!, Charter.net, etc.).
6. Log in to your email account.
7. Compose a new email message to yourself or whoever needs the images.



Examples:



Cal Poly

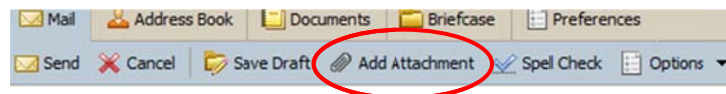


Yahoo!

8. Hit the button to Add Attachments (this will vary according to email program).

Examples:

Cal Poly



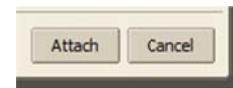
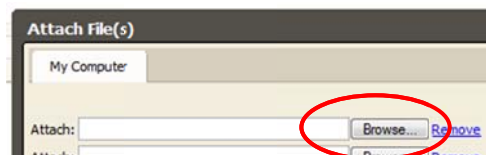
Yahoo!



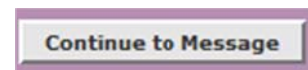
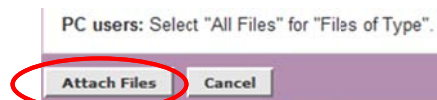
9. Hit the Browse button to navigate to your file on the USB flash drive (remember, the filename will end with .tif) and follow the prompts to attach it to your email.

Examples:

Cal Poly



Yahoo!



10. Hit the send button.

11. **BE SURE TO LOG OUT AND CLOSE THE WEB BROWSER WHEN YOU ARE FINISHED.**

The scanning software may display a button to “Email Images.” **DO NOT USE IT—IT WILL NOT WORK.** The computer must be **REBOOTED** if this button is pressed—YOUR SCANNED FILES WILL BE LOST.

## Important!





## CHANGING THE LENS

You may need to change to a different lens in order to properly view, save, or print your microfiche or microfilm.

There are three kinds of lenses:



- Type 1-- images appear ***smaller*** (often useful for newspaper microfilm)
- Type 2-- average
- Type 3-- images appear ***larger*** (often useful for microfiche).

Lenses are stored on top of the blue Senior Project cabinets. Please return the old lens to the storage area when you exchange it for a new one.

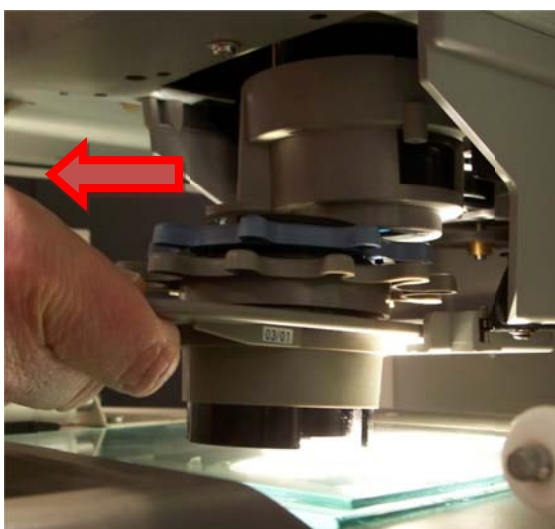


### Instructions

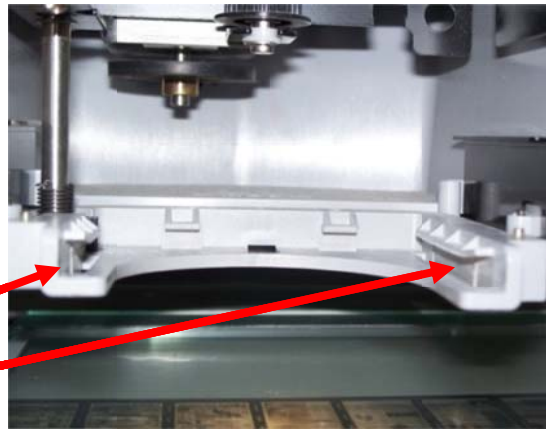
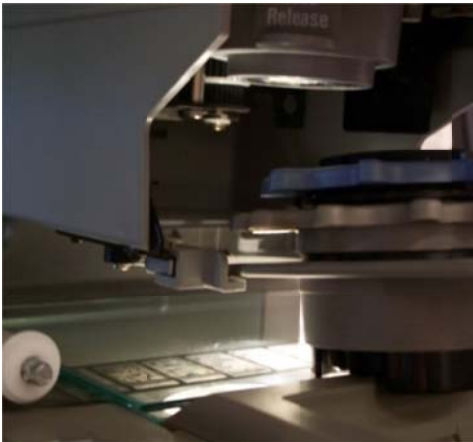
1. Push up on the lens release.



2. Pull the old lens straight out.



3. Push the new lens in until it clicks into place. Be sure to get it into the tracks on both sides

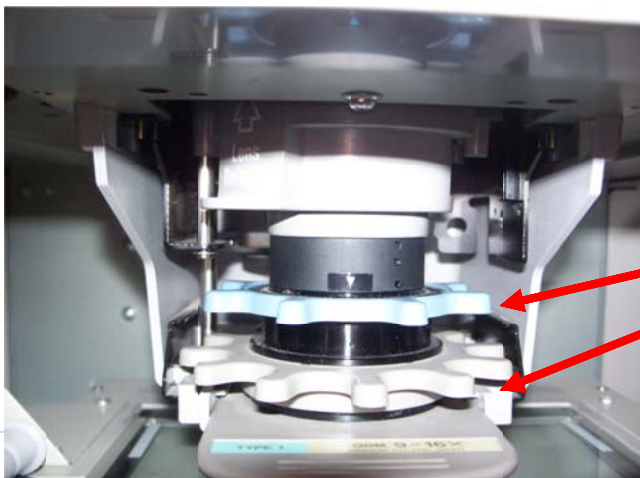


4. The lens release unit should then come down on its own to meet the top of the lens. If it does not, and you do not have a readable display, go to the Reference Desk for assistance.
5. Pull out the Brightness Select Lever and slide it to a position appropriate for the type of lens loaded in the machine. The lever should click into position.



*Note: Brightness on the screen is uneven if the brightness select lever is not placed in a position corresponding to the type of the lens being used.*

6. It should look like this when you are finished. Turn the rings to bring your page into focus.



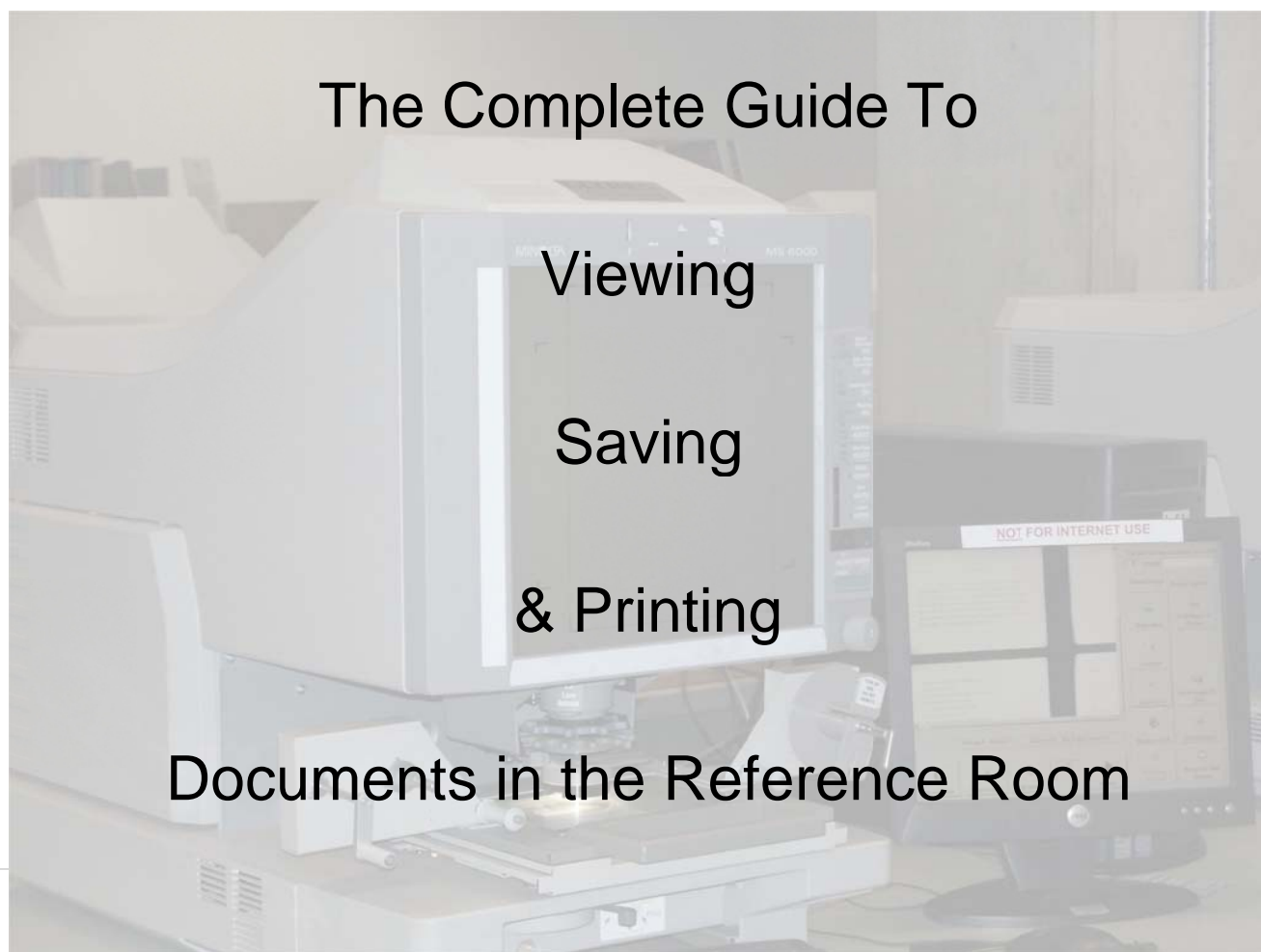
## ***Appendix C: New User Guide***

See Following Pages.

# USER GUIDE

## HOW TO USE THE MICROFORM READERS

FOR MICROFICHE OR MICROFILM



The Complete Guide To

Viewing

Saving

& Printing

Documents in the Reference Room

## How to View Microfiche

1. If the microform reader is turned off (screen is grey, not yellow), press the **On/Off switch** on the side of the right side of the microform viewer.



2. Pull out the drawer so the top plate of glass opens upward.
3. Place your microfiche **face down** between the plates of glass.



4. Push the drawer back in. Your microfiche should display on the screen.
5. Move the drawer back and forth to view individual pages on the microfiche.
6. If you plan to save or print pages, see SCANNING IMAGES for directions.
7. When finished, please return the microfiche in its envelope to the basket on top the blue Senior Project file cabinets.



## Viewing Problems?

Image is tilted or upside down

- To align image, rotate knob on the reader until it fits within the 8 ½" x 11" lines on the screen



Display is too light or dark

- To adjust the brightness, use the adjustment buttons on the display  
**Hint:** Old or poor quality microfiche may be too light or dark despite adjustment.



Display is too large or too small

- To **zoom** in or out, rotate the blue ring on the lens
- You may need to change the lens in the reader for enhanced viewing (see CHANGING THE LENS for directions)

Zoom  
Focus



Display is out of focus

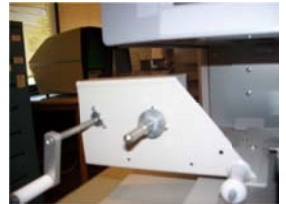
- To **focus**, rotate the white ring on the lens

## How to View Microfilm

1. If the microform reader is turned off (screen is grey, not yellow), press the **On/Off switch** on the side of the right side of the microform viewer.



2. Pull out the drawer so the top plate of glass opens upward.
3. Push your reel of microfilm onto the left-hand side of the machine, so that the film comes over the top of the reel.



4. Thread the film under the left-hand roller, **between** the plates of glass, and under the right-hand roller.



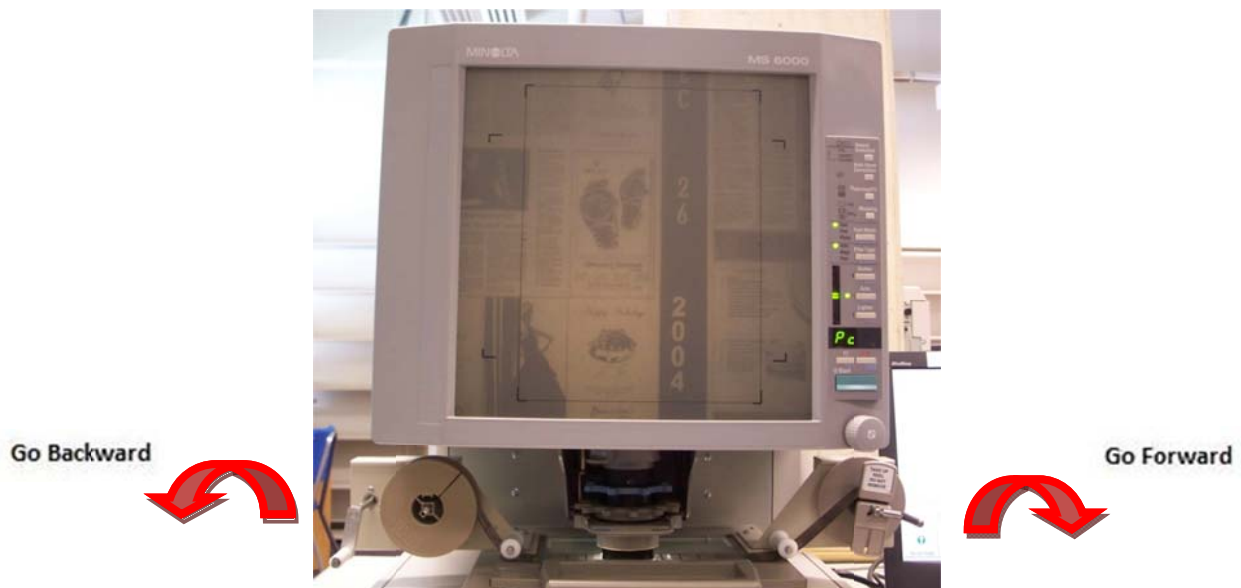
5. Tuck the end of the film into the slot in the take-up reel on the right-hand side.



6. Push the drawer back in.



7. Turn the crank on the left or right side to wind your film backwards and forwards.
- Note:** the right machine has electronic functionality for viewing. Many reels of film include visual clues such as the month along the side of the display to help you find your place.



8. If you plan to save or print pages, see SCANNING IMAGES for directions.
9. When you are finished, use the crank on the left-hand side to rewind your reel of film. Return the reel to its box and place it in the basket to be re-filed.

### Viewing Problems?

Image is tilted or upside down

- To align image, rotate knob on the reader until it fits within the 8 ½" x 11" lines on the screen



Display is too light or dark

- To adjust the brightness, use the adjustment buttons on the display
- Hint:** Old or poor quality microfiche may be too light or dark despite adjustment.



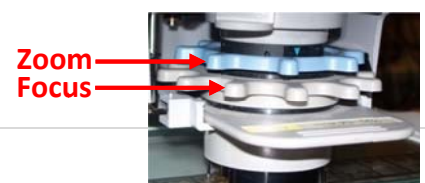
Display is too large or too small

- To **zoom** in or out, rotate the blue ring on the lens
- You may need to change the lens in the reader for enhanced viewing (see CHANGING THE LENS for directions)



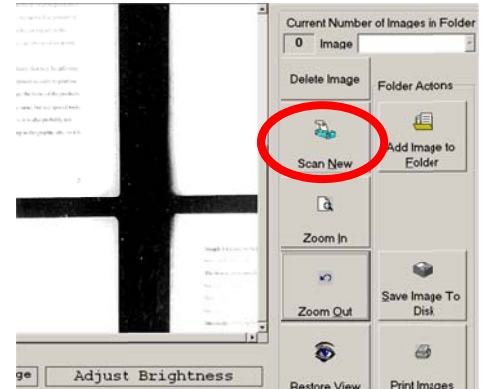
Display is out of focus

- To **focus**, rotate the white ring on the lens



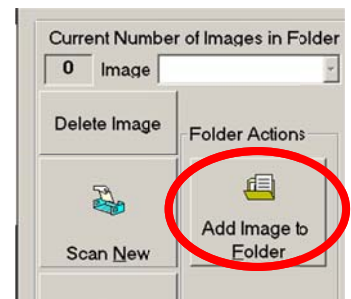
## SCANNING IMAGES

1. Use the mouse to click anywhere on the computer screen to start the scanning software.
2. Line up each image (or page) on the microform reader within the 8 ½" x 11" lines on the screen.
3. Click on the "Scan New" button on the computer monitor.



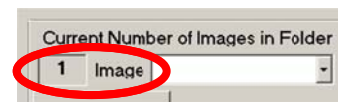
4. Click the "Add Image to Folder" button.

**Hint:** Each scanned image must be added to this folder in order for you to print or save it. Images that are not added to the folder are overwritten by the next scan and **cannot** be retrieved.



5. Repeat for each image you want to print or save.

**Hint:** The image count increases each time you add to the folder. Finish scanning all images **before** printing or saving or you will end up with duplicate pages.





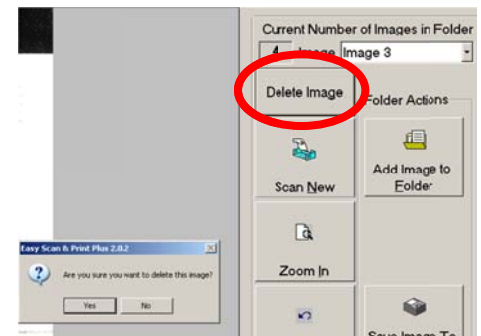
## Scanning Problems?

### Error 20088: TWAIN device was not ready

- Leave the microform reader on and then restart the computer
  - Do this by holding the power button for 5 seconds to turn off, and then pressing the power button again to turn on
  - The computer will automatically open the scanning software once turned on again, and you may begin scanning. If problems persist, please report to the Research Help Desk just outside the reference room

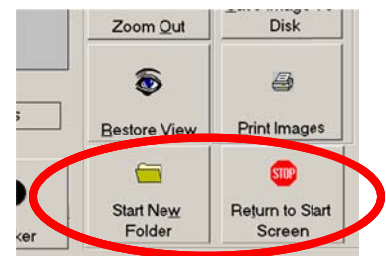
### Deleting an image

- Go back through the saved images until you find the one you want to get rid of. Click the “Delete Image” button, and then click the “Yes” button



### Clearing the folder

- Click either “Start New Folder” or “Return to Start Screen”

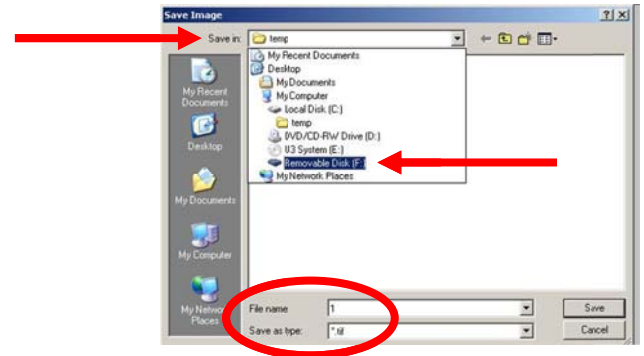


## SAVING IMAGES TO A USB/FLASH DRIVE

1. Insert your USB flash drive into the front of the computer.
2. Click on the “Save Image to Disk” button. This will open the temp folder.



3. Click on the arrow in the “Save In” box and select your USB from the dropdown menu. This will open your flash drive.



4. Rename the file then click the save button

**Hint:** This file contains all images (Despite only displaying the first scanned image). To view multiple images in the saved file, look for a page number and pair of arrows in the image viewing program. Use the arrows to navigate from page to page in your file.



5. To safely remove your USB drive:
  - a. Press the **Windows** key on the keyboard
  - b. Left-click the green arrow icon in the system tray (do not rapidly double-click)
  - c. Click on “Safely remove USB Mass Storage Device” and remove your drive
  - d. A small message will pop up, informing you that it’s safe to remove your drive

## USB Flash Drive Problems?

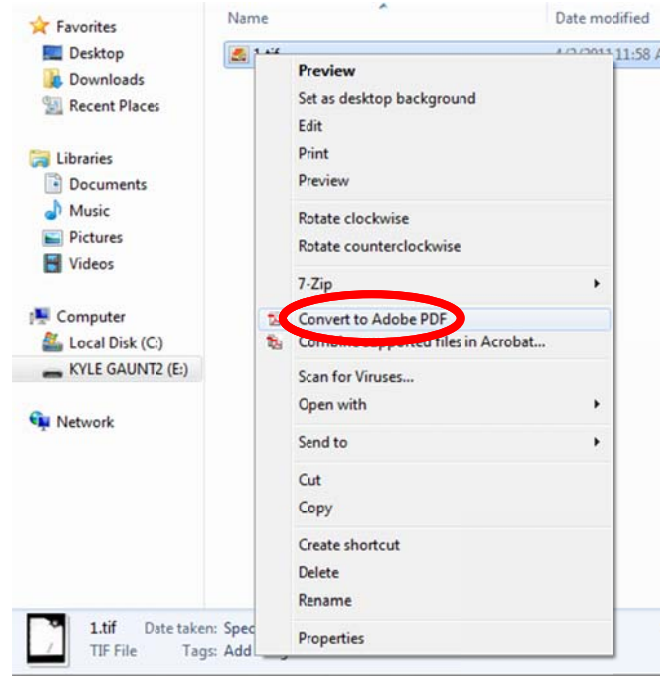
### Viewing all images in one file

- All the images are stored together in one TIF file (see next page to convert to PDF)
- Look for a page number and a pair of arrows in your image viewing program. Use the arrows to navigate from page to page in your file

**Hint:** It’s easier to navigate the images/pages in PDF format

## Convert File to a PDF

1. Save your images to a USB flash drive (see SAVING TO USB FLASH DRIVE).
2. Go to any library computer (not in the reference room) and find your file on the USB flash drive. **Do NOT open it.**
3. Right click on your file and select **Convert to Adobe PDF**.



4. Your file will open in Adobe Acrobat Professional.
5. Save your new PDF with whatever name you choose.

## EMAILING IMAGES



**Do NOT use the “Email Images” button – it will not work!**

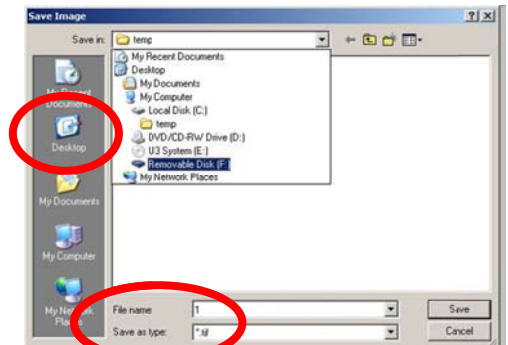
You must access your personal email account and attach your files (see instructions below)


1. Click on the “**Save Image to Disk**” button. This will open the temp folder.

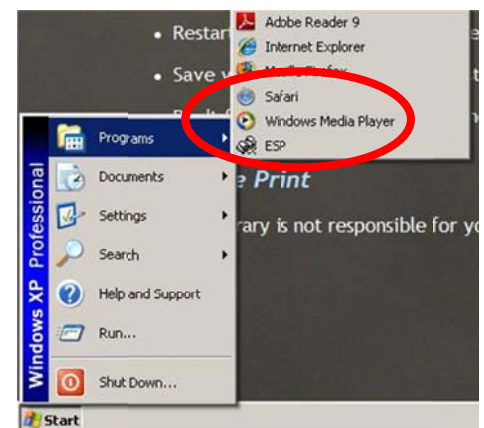


2. Rename the file and save it on the **desktop**.

- **Hint:** This file contains all images (Despite only displaying the first scanned image). To view multiple images in the saved file, look for a page number and pair of arrows in the image viewing program. Use the arrows to navigate from page to page in your file.



3. Press the **Windows**  key on the keyboard.
4. Click Start, then go to Programs and select a **web browser**.

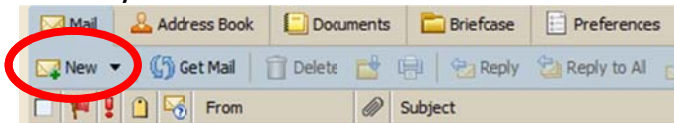


5. Start the web browser and go to your web email page (Cal Poly Portal, Gmail, Yahoo!, Charter.net, etc.)
6. Log in to your email account.

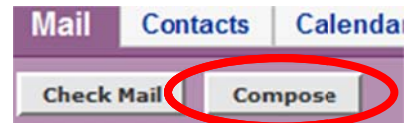
7. Compose a new email message to yourself or whoever needs the images.

Examples:

Cal Poly



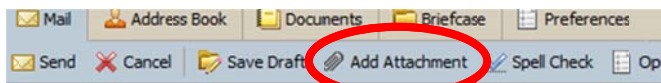
Yahoo!



8. Click the button to **Add Attachments** (this will vary according to email program).

Examples:

Cal Poly



Yahoo!



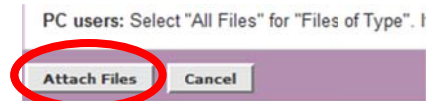
9. Click the “Browse” button to navigate to your file on the USB flash drive and follow the prompts to attach it to your email.

Examples:

Cal Poly



Yahoo!



10. Click the send button.

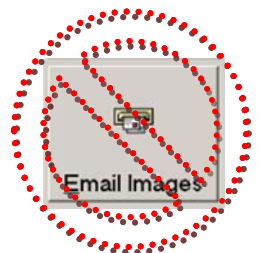
11. Log out and close the web browser when you are finished.

12. **Delete the file/s you saved on the Desktop.**


## Emailing Problems?

Email button doesn't work

- Do NOT click the “Email Images” button – it does not work!
- The computer must be rebooted if this button is pressed and your scanned files will be lost!



Accessing email

- Press the Windows  key on the keyboard
- Click Start, then go to Programs and select a web browser
- Start the web browser and go to your web email page

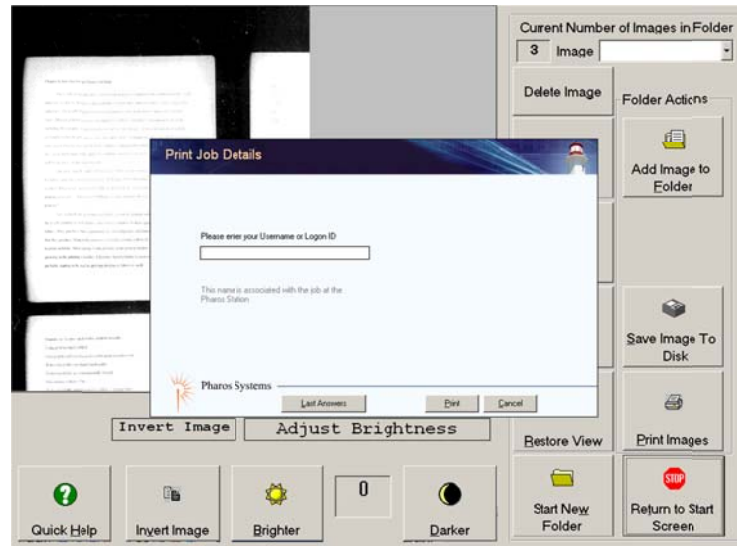
# PRINTING IMAGES

1. Click the “Print Images” button.

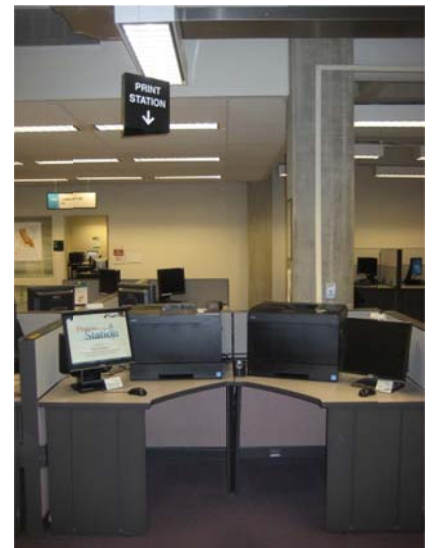


2. Follow the prompts for the PolyCard printing system.

- UserID can be your name or whatever you will recognize
- Printing costs \$.10 per page
- You must pay with your PolyCard (campus ID)
- You must have Campus Express money on your PolyCard



3. Your pages will print at the Print Station located in the main reference room.



## Printing Problems?

Printout is too light or too dark

- To adjust the brightness, use the adjustment buttons on the display  
**Note:** Old or poor quality microfiche may be too light or dark despite adjustment.

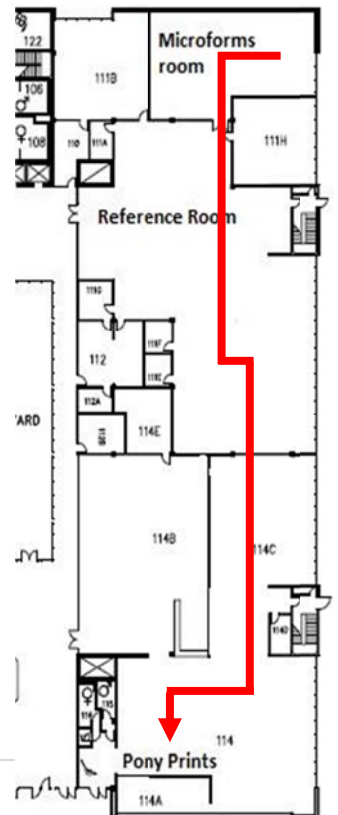
Printout is still impossible to read after making brightness adjustments

- Talk to the library staff at the **Research Help Desk**. They can help you to identify possible other sources for the material
- Try using the **newer microform machine** in the reference room. It has better image quality but is more difficult to use



Using your **PolyCard**

- You can add money to your PolyCard in the following ways:
  - a. Call 756-5939 if you have a Visa, MasterCard, or Discover card
  - b. Visit the Campus Express Club page and click “Add Value Now”  
<http://www.calpolydining.com/campusexpress/> (requires credit card)
  - c. Pay at the Customer Service office (Building 19)
- If you **don't have a PolyCard** and would like to print, save the file to a flash drive or email it to yourself, then go to Pony Prints at the front of the Library and pay to have it printed





## CHANGING THE LENS

**Hint:** You may need to change to a different lens in order to properly view, save, or print your microfiche or microfilm

There are **three kinds of lenses**:

- Type 1—Viewing smaller images (typically microfilm)
- Type 2— Average
- Type 3— Viewing larger images (typically microfiche)



### Lenses Storage

- Lenses are stored on top of the blue Senior Project file cabinets. Please return the old lens to the storage area when you exchange it for a new one



### Instructions

1. Push up on the lens release.

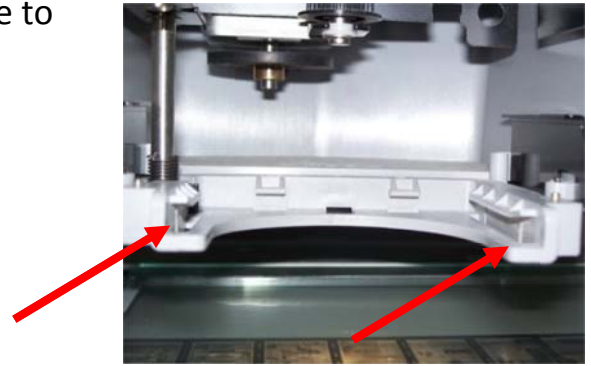


2. Pull the old lens straight out.





3. Push the new lens in until it clicks into place. Be sure to get it into the tracks on both sides.



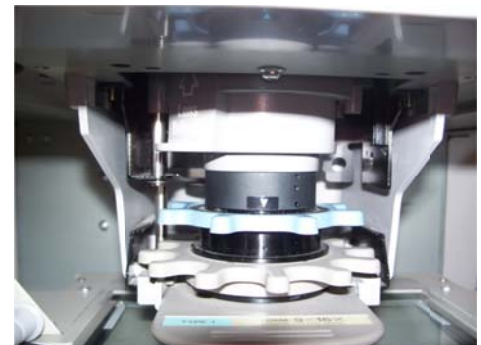
4. The lens release unit should then come down on its own to meet the top of the lens. If it does not, and you do not have a readable display, go to the Research Help Desk for assistance.

5. Pull out the brightness select lever and slide it to a position appropriate for the type of lens loaded in the machine. The lever should click into position.

**Hint:** Brightness on the screen is uneven if the brightness select lever is not placed in a position corresponding to the type of the lens being used.



6. The lens should look like this when you are finished. Turn the rings to bring your page into focus.



## Frequently Asked Questions

**Q. The computer shows “Error 20088: TWAIN device was not ready.” How can I fix this?**

A. Leave the microform reader on and then restart the computer.

- Do this by holding the power button for 5 seconds to turn off, and then pressing the power button again to turn on
- The computer will automatically open the scanning software once turned on again, and you may begin scanning. If problems persist, please report to the Research Help Desk just outside the reference room

**Q. The email button isn’t working. How do I email my file?**

A. Do NOT use the “Email Images” button – it will not work! You must access your personal email account and attach your files (see EMAILING IMAGES).

**Q. I opened the file and I can only see my first page? Where are the other pages?**

A. Look for a page number and a pair of arrows in your image viewing program. Use the arrows to navigate from page to page in your file (note: it is easier to navigate in PDF format).

**Q. I saved a lot of images. Why is there only one file?**

A. All the images are stored together in one TIFF file (see below to convert to PDF).

**Q. Can I convert the TIFF file into a PDF?**

A. Yes! Here’s how:

6. Save your images to a USB flash drive (see SAVING TO USB FLASH DRIVE)
7. Go to any library computer and find your file on the USB flash drive. Do not open it
8. Right click on your file and select Convert to Adobe PDF
9. Your file will open in Adobe Acrobat Professional
10. Save your new PDF with whatever name you choose

**Q. What if the microfiche/microfilm is unreadable and/or I can’t get a decent printout?**

A. Talk to the library staff at the Research Help Desk. They can help you to identify possible other sources for the material.

**Q. What do I do with the microfiche/microfilm when I’m done with it?**

A. Put it back in its envelope or box and put it in the appropriate basket (the large baskets for microfilm, or the small basket atop the blue file cabinet for microfiche). Library staff will re-file the microfiche or microfilm.

**Q. My images were saved as a TIFF file. Can I open it on my home computer?**

A. Yes. How it opens depends on the type of computer you have and what software is installed.

Windows PC

- In most cases, the TIFF file will open in Microsoft Office Document Imaging
- PCs running Windows XP will be able to open the TIFF file in Windows Picture and Fax Viewer
- PCs running Vista or Window 7 will be able to open the TIFF file using Windows Photo Gallery

Macintosh

- In most cases, the TIFF file will open in Preview

**Q. What's the difference between microfiche and microfilm?**

A. Microfiche is in the form of a transparent card. Microfilm comes on a reel. Both formats contain scanned pages of information, and our readers can handle either one.

**Q. I'm not a member of the Cal Poly Community. Can I still use the microfiche/microfilm?**

A. Yes! You can view the microfiche and microfilm, and you can save pages or email them to yourself or others. However, you will not be able to print pages on any of the campus printers due to payment restrictions (but if you save or email them, you can print them elsewhere).

**Q. How can I receive additional assistance if I still have questions?**

A. Go to the Research Help Desk. The person on duty there will be glad to assist you!

## *Appendix D: Senior Project Usage*

**Table 1 – Senior Project Re-Filing History: Fall 2005 vs. Fall 2010**

Fall 2005		Fall 2010	
Monthly Total	# of Senior Projects	Monthly Total	# of Senior Projects
Sept.	1108	Sept.	109
Oct.	1854	Oct.	31
Nov.	891	Nov.	44
Dec.	361	Dec.	35
<b>Total</b>	<b>4214</b>	<b>Total</b>	<b>219</b>

**Table 2 – Senior Project Usage Breakdown by Year**

Year Range	Count	%
2000-2009	44	40.7%
1990-1999	23	21.3%
1980-1989	24	22.2%
1970-1979	7	6.5%
1960-1969	3	2.8%
1950-1959	6	5.6%
1942-1949	1	0.9%
Total	108	

**Table 3 – Senior Project Re-Filing History: 2005-2006**

Date	# of Senior Projects	Date	# of Senior Projects	Date	# of Senior Projects
09/26/05	128	01/18/06	12	04/20/06	118
09/28/05	55	01/25/06	165	04/23/06	78
10/02/05	128	01/31/06	363	04/27/06	77
10/03/05	66	02/04/06	34	04/30/06	186
10/06/05	72	02/06/06	54	05/02/06	208
10/10/05	175	02/08/06	41	05/07/06	185
10/11/05	88	02/09/06	33	05/10/06	145
10/13/05	15	02/14/06	26	05/11/06	45
10/17/05	328	02/16/06	45	05/16/06	244
10/19/05	456	02/21/06	54	05/17/06	155
10/20/05	43	02/23/06	42	05/21/06	245
10/24/05	156	02/24/06	54	05/24/06	98
10/27/05	199	02/26/06	28	05/28/06	45
10/31/05	128	02/28/06	167	05/29/06	8
11/03/05	58	02/28/06	98	05/30/06	85
11/08/05	61	03/02/06	254	05/31/06	18
11/10/05	56	03/06/06	328	06/01/06	145
11/14/05	40	03/08/06	156	06/04/06	85
11/15/05	16	03/09/06	136	06/08/06	125
11/21/05	256	03/10/06	78	06/20/06	225
11/22/05	248	03/13/06	154	06/25/06	201
11/28/05	156	03/15/06	48	06/26/06	19
12/01/05	18	03/20/06	288	07/10/06	6
12/04/05	118	03/26/06	35	07/14/06	33
12/06/05	65	03/29/06	75	07/18/06	14
12/07/05	78	04/02/06	88	07/25/06	45
12/08/05	76	04/04/06	75	08/04/06	144
12/15/05	6	04/06/06	215	09/08/06	38
01/05/06	4	04/10/06	208	09/13/06	25
01/08/06	75	04/11/06	196	08/14/06	77
01/10/06	7	04/13/06	29	08/21/06	45
01/12/06	33	04/16/06	25	09/20/06	13
01/17/06	128	04/19/06	123	<b>Total</b>	<b>10443</b>

## Appendix E: Senior Project Volume by Year

**Table 1** – # of Senior Projects on Microfiche in the Reference Room

Year	# of Senior Projects	Year	# of Senior Projects	Year	# of Senior Projects
1942	26	1965	909	1988	1899
1943	20	1966	1016	1989	1742
1944	5	1967	1069	1990	1585
1945	4	1968	1218	1991	2318
1946	21	1969	1322	1992	2363
1947	62	1970	1162	1993	2186
1948	95	1971	2007	1994	1820
1949	182	1972	2049	1995	1730
1950	443	1973	1688	1996	1652
1951	471	1974	1648	1997	1774
1952	370	1975	1666	1998	1492
1953	357	1976	1511	1999	1746
1954	274	1977	2056	2000	1705
1955	325	1978	2079	2001	1846
1956	405	1979	1954	2002	1804
1957	458	1980	1847	2003	1577
1958	571	1981	1657	2004	1375
1959	631	1982	2349	2005	1480
1960	640	1983	2118	2006	1278
1961	592	1984	1782	2007	999
1962	650	1985	2160	2008	856
1963	672	1986	2000	2009	663
1964	831	1987	1883		

**Table 2** – Summary of Senior Project Volume on Microfiche

Year	# of Senior Projects
<b>Total</b>	<b>83,145</b>
2000-2009	13,583
1990-2009	32,249
1975-2009	60,952

## Appendix G: Page Accuracy Impact for Cost Estimates

**Table 1 – Page Accuracy Variation for the Entire Senior Project Collection (83,145)**

<b>Cost to Digitize</b>									
				<b>Avg. # of Pages</b>					
<b>Cost Per Page</b>	36	41	46	48	51	54	56	61	66
\$ 0.0475	\$ 142,178	\$ 161,925	\$ 181,672	\$ 189,571	\$ 201,419	\$ 213,267	\$ 221,166	\$ 240,913	\$ 260,660
<b>Difference from Actual Cost</b>									
				<b>Avg. # of Pages</b>					
<b>Cost Per Page</b>	36	41	46	48	51	54	56	61	66
\$ 0.0475	\$ 59,241	\$ 39,494	\$ 19,747	\$ 11,848	\$ -	\$ (11,848)	\$ (19,747)	\$ (39,494)	\$ (59,241)

**Table 2 – Page Accuracy Variation for Senior Projects from 2000-2009 (13,583)**

<b>Cost to Digitize</b>									
				<b>Avg. # of Pages</b>					
<b>Cost Per Page</b>	36	41	46	48	51	54	56	61	66
\$ 0.0625	\$ 30,562	\$ 34,806	\$ 39,051	\$ 40,749	\$ 43,296	\$ 45,843	\$ 47,541	\$ 51,785	\$ 56,030
<b>Difference from Actual Cost</b>									
				<b>Avg. # of Pages</b>					
<b>Cost Per Page</b>	36	41	46	48	51	54	56	61	66
\$ 0.0625	\$ 12,734	\$ 8,489	\$ 4,245	\$ 2,547	\$ -	\$ (2,547)	\$ (4,245)	\$ (8,489)	\$ (12,734)

## Appendix H: Sample #1: Calculating the Mean # of Pages per Senior Project

**Table 1** – Senior Project Sample to Calculate the Standard Deviation

Sample #	Randomly Gen. #	Reference #	# of Pages	Sample #	Randomly Gen. #	Reference #	# of Pages
1	42,241	85-1029	36	27	53,584	91-1103	40
2	29,143	78-1717	30	28	76,036	03-1119	38
3	45,656	87-0284	64	29	47,605	88-0350	55
4	44,487	86-1115	17	30	54,306	91-1825	52
5	55,061	92-0262	41	31	8,543	65-438	21
6	40,077	84-0647	71	32	69,007	99-1191	43
7	2,921	56-0266	24	33	43,010	85-1798	36
8	52,759	91-0278	40	34	81,678	08-0052	27
9	2,948	56-0293	30	35	69,519	99-1703	30
10	74,530	02-1417	8	36	28	43-0002	68
11	76,024	03-1107	36	37	7,535	64-0261	44
12	2,747	56-0092	38	38	22,531	75-0338	74
13	60,873	94-1525	40	39	75,221	03-0304	26
14	70,929	00-1367	31	40	31,252	79-1747	57
15	60,157	94-0809	27	41	55,271	90-0472	51
16	74,074	01-0961	50	42	77,915	05-0046	56
17	55,926	92-1127	42	43	29,452	78-2026	49
18	68,169	99-0353	24	44	23,556	75-1363	26
19	67,821	99-0005	32	45	15,405	71-0604	42
20	37,183	82-2220	22	46	3,775	58-0257	21
21	56,763	92-1964	23	47	15,595	71-0794	32
22	8,557	65-0452	39	48	73,131	02-0018	106
23	44,892	86-1520	40	49	51,745	90-0849	32
24	39,698	84-268	43	50	49,306	89-0152	90
25	16,176	71-1375	23			<b>Mean</b>	<b>41.44</b>
26	65,035	97-0485	85			Std. Dev.	19.46



**Table 2** – Stem and Leaf Plot: Avg. Number of Pages per Senior Project (Sample Size 50)

Stem	Leaf	Count
0	8	1
1	1	1
2	11233446677	11
3	0001222666889	13
4	00001223349	11
5	012567	6
6	48	2
7	14	2
8	5	1
9	0	1
10	6	1

N = 50

**Figure 1** – Histogram for Sample Size: 50

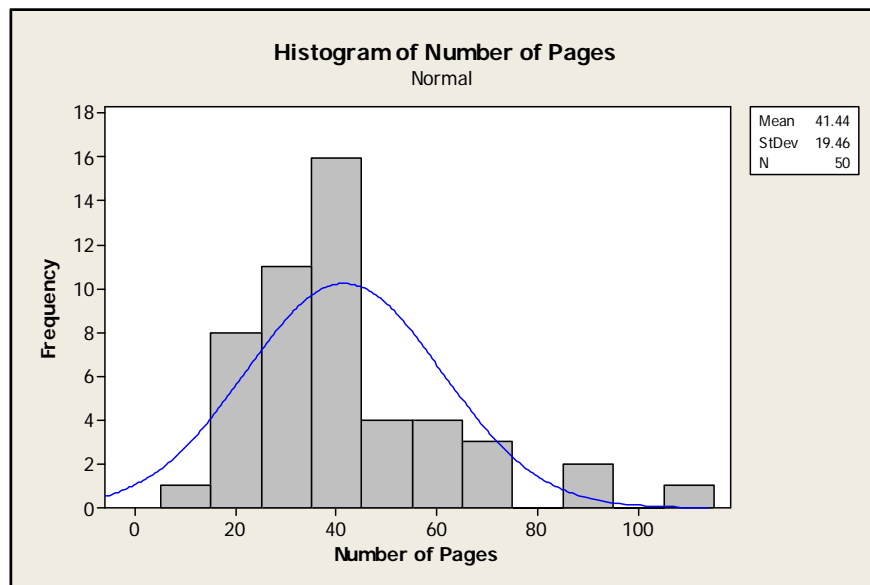
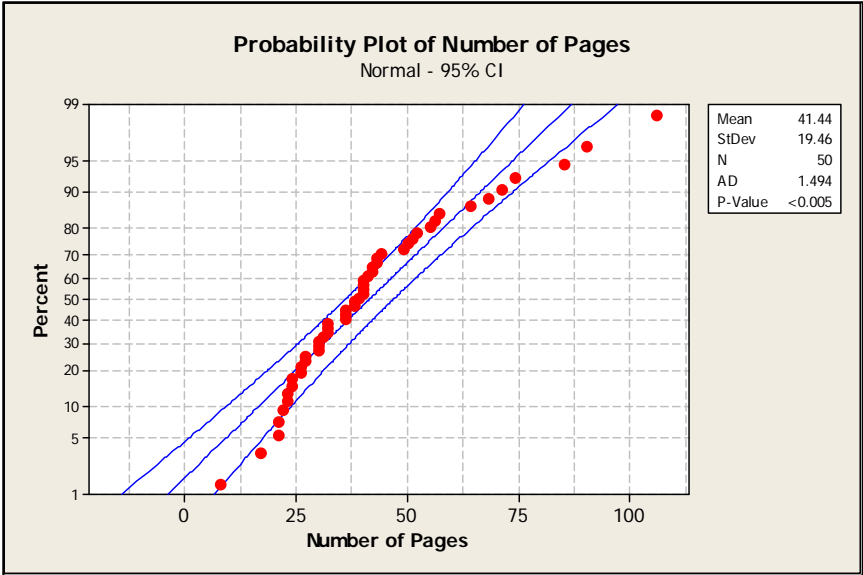


Figure 2 – Probability Plot for Sample Size: 50

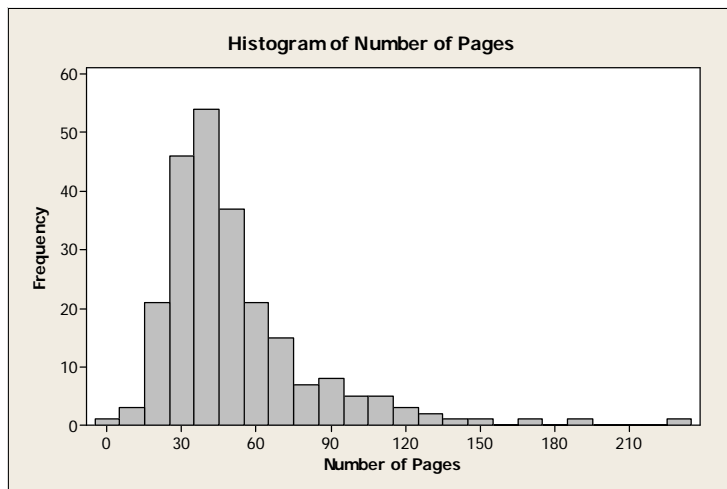


## Appendix I: Sample #2: Calculating the Mean # of Pages per Senior Project

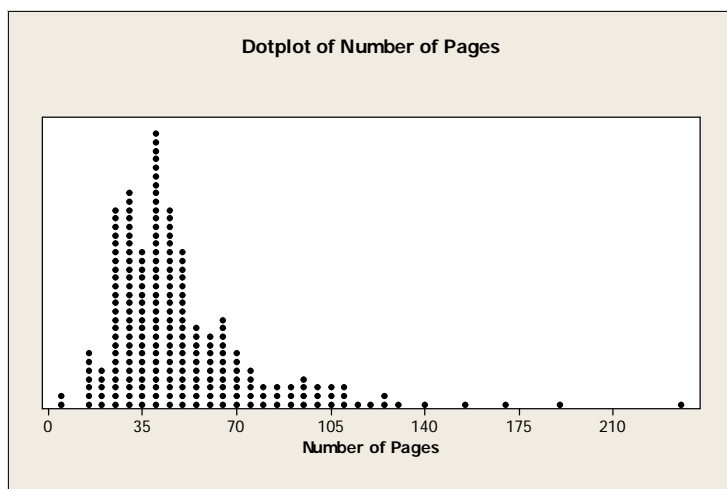
**Table 1** – Senior Project Sample to Estimate the # of Pages per Senior Project

Sample #	# of Pages	Sample #	# of Pages	Sample #	# of Pages	Sample #	# of Pages	Sample #	# of Pages
1	35	48	48	95	15	142	27	189	31
2	31	49	47	96	13	143	40	190	119
3	47	50	42	97	64	144	65	191	23
4	43	51	55	98	42	145	50	192	45
5	98	52	25	99	74	146	37	193	30
6	41	53	93	100	42	147	85	194	33
7	23	54	50	101	42	148	6	195	24
8	105	55	30	102	41	149	28	196	41
9	40	56	38	103	47	150	25	197	37
10	38	57	40	104	17	151	98	198	64
11	38	58	38	105	42	152	40	199	233
12	56	59	44	106	95	153	44	200	66
13	40	60	28	107	124	154	31	201	40
14	54	61	41	108	38	155	48	202	36
15	29	62	94	109	90	156	28	203	26
16	26	63	53	110	52	157	52	204	112
17	27	64	24	111	62	158	19	205	27
18	44	65	13	112	89	159	28	206	19
19	37	66	29	113	63	160	71	207	74
20	44	67	31	114	44	161	139	208	24
21	82	68	68	115	65	162	45	209	27
22	60	69	23	116	38	163	169	210	24
23	17	70	15	117	153	164	33	211	30
24	40	71	46	118	50	165	48	212	103
25	52	72	61	119	46	166	32	213	47
26	27	73	110	120	47	167	37	214	41
27	62	74	30	121	46	168	37	215	38
28	72	75	31	122	87	169	38	216	33
29	22	76	80	123	55	170	52	217	57
30	44	77	37	124	61	171	55	218	33
31	76	78	24	125	75	172	37	219	34
32	44	79	30	126	16	173	34	220	52
33	66	80	60	127	3	174	30	221	31
34	126	81	38	128	50	175	49	222	51
35	106	82	26	129	26	176	45	223	69
36	31	83	130	130	30	177	41	224	36
37	53	84	60	131	68	178	65	225	30
38	66	85	31	132	93	179	49	226	23
39	40	86	98	133	18	180	83	227	64
40	91	87	50	134	29	181	42	228	80
41	34	88	60	135	43	182	55	229	24
42	52	89	191	136	23	183	46	230	61
43	109	90	115	137	46	184	75	231	63
44	38	91	36	138	57	185	32	232	71
45	26	92	49	139	38	186	46	233	42
46	18	93	39	140	37	187	46	<b>Average 50.97</b>	
47	29	94	71	141	27	188	52	Std. Dev.	30.71

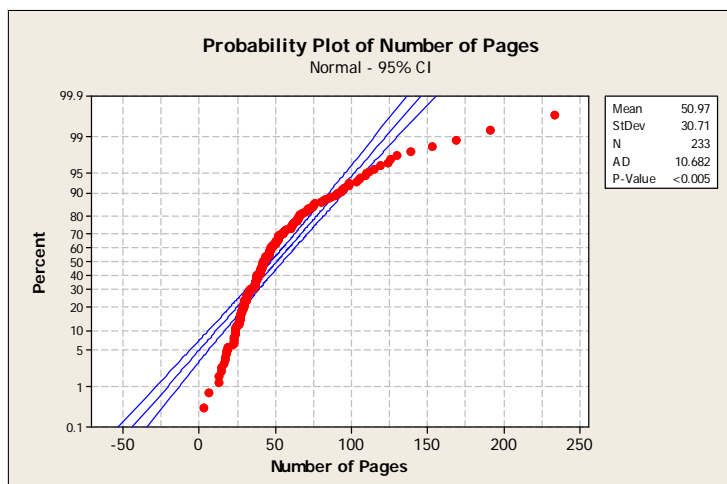
**Figure 1 – Histogram for Sample Size: 233**



**Figure 2 – Dotplot of Sample Size: 233**



**Figure 3 – Probability Plot for Sample Size: 233**



## ***Appendix J: Digitization Demand (In-House Estimate)***

Table 1 – In-House Digitization

Digitization on Demand	
# of senior projects digitized (per month)	80
Avg. # of pages per microfiche	42
Avg. time to digitize a senior project (hrs)	0.25
Total time to digitize senior projects (hrs)	20
Equivalent 8 hr days	2.5
Cost at \$10/hr	\$ 200

## ***Appendix K: Other Relevant Tables and Figures***

**Table 1:** – Number of Senior Project Submitted to the Robert E. Kennedy Library

<b>Year</b>	<b># of Senior Projects</b>
2001	1846
2002	1804
2003	1577
2004	1375
2005	1480
2006	1278
2007	999
2008	856

**Table 2** – College Department Breakdown of Senior Projects Available on the DigitalCommons@CalPoly

	<b>Count</b>	<b>Percentage</b>
<b>College of Agriculture</b>	158	22%
<b>College of Architecture &amp; Environmental Design</b>	1	0%
<b>Orfalea College of Business</b>	13	2%
<b>College of Engineering</b>	248	35%
<b>College of Liberal Arts</b>	230	33%
<b>College of Science and Mathematics</b>	55	8%
	705	