Caterpillar RSSM Register

INFO 543 Design And Evaluation of User Interfaces
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An investigative review, redesign, and usability evaluation of the Request to Scrap Surplus Material (RSSM) Register application used at the Caterpillar Large Engine Center in Lafayette, Indiana.

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Spring 2008

Product Planning & Problem Space

Product

The Request to Scrap Surplus Material (RSSM) Register is an Internet application used to properly manage individual parts targeted for retirement at the Caterpillar Large Engine Center (LEC) in Lafayette, Indiana. Originally developed in 2002, the application does not currently adhere to a corporate-approved ColdFusion template adopted one year later (see screenshot).

The goal for this project is to re-engineer the Lafayette RSSM Register application by incorporating the following:

- Adoption of the corporate-approved ColdFusion template, producing a more common application layout to other applications used at the facility.
- Inclusion of user feedback message boxes and elimination of cryptic messages currently displayed upon application errors.
- Inclusion of user security measures, reducing risk of user errors based on assigned user roles and associated tasks.
- Redesign of data display pages, grouping part data in common categories, and table display consistencies for data reports.

Purpose and Market

The RSSM Register is a tool to proactively process the targeted retirement of obsolete parts to reduce the negative benefits of scrapping excess material. Analysts are aware of targeted parts in advance of retirement, such that on-hand quantities can be exhausted and/or work with engineering personnel to redesign obsolete parts into usable parts for future products. RSSM Coordinators assure targeted parts are being processed properly, and assist facilitation working with vendors and Caterpillar in-house organizations to reduce on-hand costs. RSSM Accounting Coordinators assure all parts to be scrapped are financially acceptable within a predetermined monthly allocation.

The RSSM Register was first introduced by the Lafayette facility in 2002, and has been replicated to seven (7) additional Caterpillar facilities in North America, with an additional 4-6 facilities demonstrating interest. The RSSM Register application was recognized as a 2004 Caterpillar Systems + Processes Division Outstanding application, and has accumulated a cost savings in excess of forty million ($40,000,000) dollars (US) across all facilities. While the application could be distributed to multiple industries, Caterpillar retains proprietary ownership of application code and customized processes.

Context

The application will be used in conjunction with daily activities among several user groups on a standard desktop or laptop PC. The redesigned application will continue to function as a ColdFusion application, with an upgraded Oracle 10g database interface. Some JavaScript functionality will be added to the redesigned application, complementing existing code.

Problem Space

The application was originally constructed without proper user administration. Thus, it is possible for procurement analysts to review part lists targeted for scrapping by RSSM Accounting Coordinators, and vice versa. This can lead to confusion between both groups, whereby a procurement analyst might accidentally complete a part from the RSSM Accounting Coordinator's part list. Proper definition of user roles should limit what access a user has available to him/her. A usability redesign could give RSSM Register users a clearer method for working their own parts lists without accidental interference to other user part lists.

The RSSM Register application was designed without the use of a consistent look and feel across all pages (fonts, colors, tables, etc.). Most pages also require users to scroll lengthy part lists, with "activity buttons" located at the bottom of the pages, whereas the same data and functionality can possibly be displayed on a single page. Navigation links along the top can also become confused as to where the user truly is within the application, leading to inconsistencies in traversing from page to page. After early application adoption by the Lafayette and Griffin, Georgia facilities, Caterpillar corporate design teams created a common ColdFusion application template to be used for new application, with current and replicated applications to be retrofitted at convenience. Most Lafayette-hosted ColdFusion applications use the template, but all RSSM Register applications do not at this time. For this project, only the Lafayette RSSM Register will be targeted for usability re-engineering, though interest in this product redesign has already spurned possible application retrofits for all facility RSSM Register applications. A usability redesign, in conjunction with integration of Caterpillar's ColdFusion application template, could provide all users with a more consistent and concise application look/feel, such that they can perform their required RSSM Register work more efficiently and with less confusion.

Requirements & Specifications

Requirements Questionnaire

In order to gain an accurate user representation, a requirements questionnaire was distributed. Questionnaire statements were devised specifically for the Lafayette RSSM Register user group, rather than the general public. Questions were categorized into subject areas for ease of data submission (by questionnaire participants) and data collection. All closed question responses were given proper Likert scale values to assist user attitude identification, and were similar in structure to annual Employee Opinion Survey questionnaire for user comfort. User responses constructed the "Voice Of Customer" wants, needs, domain, and attitudes. The survey and results are included in Appendix A.

User Profiles

An initial user profile was been generated to provide a perceived Lafayette RSSM Register application user background. This information was constructed on interactions between customer and IT representative over the last three (3) years.

User Characteristics	Description
Age & Work Experience	Users will range from 18-60+ years of age. Users will be employed by Caterpillar for 0-40 years. Users may be full- or part-time employees, and may be college interns learning business processes.
Sex	Users will consist of both male and female personnel.
Physical abilities/disabilities	Users may have no known physical limitations. Users may have minor physical limitations, such as eyesight or hearing.
Educational Background	Users may have no formal education for job role. Users may have secondary and/or post-secondary education backgrounds.
Computer / IT Experience	Users will have computer experience, including e-mail and Internet applications. Users may have limited or no experience in Information Technology methods.
Application Motivation	Users may have moderate to significant motivation using the RSSM Register to reduce Caterpillar waste and improve personal Short-Term Incentive Plan (i.e., yearly bonus) calculations.
Application Attitude	Users may have positive and/or negative attitude to RSSM Register, based on amount of RSSM Register work user must perform, ease of application usefulness vs. other Caterpillar web applications, and overall workload of user outside of RSSM Register.

Task Analysis

There are several different goals users can perform in the current Lafayette RSSM Register application, each of which having a unique set of tasks and activities. Below is a goal and task breakdown of the primary Procurement Analyst functionality in preparing the scrapping of parts within the facility. A graphical representation of this process is represented in Appendix B.

- Goal: Prepare an Individual Part for being Scrapped by the Facility
  - Task: Receive E-Mail Notification
  - Log Into RSSM Register Application
  - Open Part Detail Window
  - Notify Part Stores Controllers for Part Quantity confirmation
  - Update RSSM Register Part Information with Final Decision

Task Scenarios

Using the information gained from documenting the Task Analysis and the associated goals, tasks, and subtasks, an examination into possible task scenarios were prepared for end-to-end processing by a Procurement Analyst. Proper scenario construction allows development teams to focus on adopted processes and possible complications users may have while using the current application, in order to incorporate improved application usability. Two task scenario examples are provided in Appendix C. For confidentiality purposes, Caterpillar policies mentioned have been modified for description purposes only.

Contextual Inquiry

A brief interview and observation was performed with one of the primary Lafayette RSSM Register users prior to the start of reengineering the application. Appendix D demonstrates the questions asked while observing the user, and the responses he provided. Several excellent observations were made from this contextual inquiry, including the following:

- Information was not readily available to the user, or was not easily acquired from the displayed screens.
- Application could show incorrect data at times. Data accuracy was shaky at best.
- Adopted process the RSSM Register application was designed for has now been modified significantly, but the application has not been adjusted to support the new process.
- User had adopted his own methods for using the application that were not in the original application design.

Performance Testing

Three participants were asked to perform common tasks within the current Lafayette RSSM Register application. Requirements data were compiled referencing Quesenbery's Five Dimensions of Usability (2003): Effectiveness, Efficiency, Engaging, Ease of Use, and Error Tolerance

Performance testing of the current application was conducted in two phases. First, quantitative performance measurements for effectiveness, efficiency, and error tolerance were measured. Participants were given three common tasks, and instructed to read over each task for comprehension. The effectiveness metric was measured by the accuracy of each performed task. Any erroneous actions while performing the tasks are to be noted accordingly. The efficiency metric was measured by the length of time each participant requires to perform the full task. Starting and stopping points were documented for when task times were recorded. The error tolerance metric was measured by the number of errors each participant encountered during each task being conducted, and all errors were noted accordingly.

Second, qualitative performance measurements for engaging and ease of use dimensions were measured. After completing all application tasks, each participant was presented a short questionnaire to gather opinions regarding the current application's attractiveness (the design or aesthetics of the user interface itself) and learnability (the ease of learning the application's functionality for the user). All questionnaire statements were similar in structure to annual Employee Opinion Survey for user comfort, and followed a standard Caterpillar Likert scale with six selections.

Appendix E illustrates all documentation used and results gathered from the performance test on the original RSSM Register application.

Usability Requirements

Several usability goals and requirements were constructed in preparation for the RSSM Register reengineering project, including the following:

- Full implementation of the corporate-standardized ColdFusion Template.
  - Goal: Provide consistent look and feel across all Caterpillar ColdFusion web applications.
- Improved security features.
  - Goal: Users will only see application functionality available to their assigned user roles, designated with new user administration functionality.
- Improved acknowledgement of submitted functionality
  - Goal: Provide more intuitive messages, regardless of user's assigned job role.
- Improved table data displays
  - Goal: Display report data in same location and same column widths, regardless of report.
- Improved task performance
  - Goal: Meet or surpass a 20% improvement in task time performance – all tasks involved.
- Improved application aesthetics
  - Goal: Meet or surpass a 30% improvement in user acceptance

Design

Conceptual Design

Concrete Use Cases

Concrete use cases are detailed descriptions of individual tasks performed within the RSSM Register application. Proper documentation of concrete use cases assist in the identification of proper task objects, task attributes, and actions used to perform designated tasks. Five (5) concrete use cases were generated during the initial design phase, and are described in full within Appendix F.

Task Objects, Attributes, Actions

Each concrete use case was further deconstructed into individual task objects, attributes, and actions. Task objects are a specific piece of information with which the users interact with. Task attributes are associated properties of a task object which help describe the object and potential object owners. Actions are the desired activities performed on a task object.

Task Object	Attributes	Actions
Part	Part Number Part RSSM Decision ** Part Description ** Quantity On Hand ** Cost On Hand (** Appx. 25 other part attributes in database)	View Update Print
User (Procurement Analyst)	Last Name ** Caterpillar User ID ** Access rights	View Update Complete
User (RSSM Coordinator)	** Caterpillar User ID ** Access rights	View Update Complete Confirmation
User (Accounting Coordinator)	** Caterpillar User ID ** Access rights	View Update Complete

** These attributes were not directly included in concrete use cases, as details are either behind-the-scenes, or are too numerous to mention concisely

For the purposes of this project and study, the Part and User (Procurement Analyst) Task Objects were deemed most important in the application, so concentrated efforts were directed toward these two objects.

Content Diagram

A content diagram was created to establish initial relationships between objects and their associated connections, making use of the aforementioned task objects, attributes, and actions. The full content diagram for the proposed RSSM Register redesign is shown in Appendix G.

Architecture Schematic Design

In fairness, the RSSM Register is simple in intended design and purpose. There are only a limited number of functions available within the application, to which some are available to all users at all times, whereas others are only available to those with pre-established security rights within the application. In reviewing some "Voice Of Customer" notes from previous interviews, it was suggested more security be added into the application, such that functionalities can be controlled specifically via the security rights granted to an individual user's Caterpillar Web Security Identification Number.

In conjunction with the Content Diagram creation, a proposed Architecture Schematic was devised to address the initial menu hierarchy to be introduced with the reengineered RSSM Register application. This gives a designer a good base to work from regarding which roles each user group will have access to by color-coding user roles. The proposed Architecture Schematic can be found in Appendix H.

Human Action Cycle Model

A Human Action Cycle (HAC) is a conceptual tool used to understand steps a person (user) will perform during a specific activity within an application, from both cognitive and physical activity perspectives. Two goal-based HAC models, derived from the generated Menu Hierarchy description and Architecture Schematic diagram, were constructed to assist evaluation of the reengineered RSSM Register application's efficiency. These models are described further in Appendix I.

Static Prototype

Using the HAC models as a baseline for System Architecture, a Static Prototype was initiated. The prototype consisted of proposed ideas regarding interface design within the Lafayette RSSM Register main screen the primary users may select, if they have the proper access rights.

For this project, the RSSM Register was to integrate a corporate standard ColdFusion layout template, along with usability skills acquired during the reading assignments and class lectures. Screenshots demonstrated in Appendix K were, at the time, non-functional HTML page screenshots demonstrating basic access and functionality. For simplicity purposes, the access rights demonstrated were for Administrators (full-access). Standard Lafayette RSSM Register users will not have as much access, and therefore will not have as many selections within the left-hand navigation available for them.

Human Action Cycle Model Analysis

We can now attempt to expound more into the HAC model by asking critical questions in order to predict possible issues and/or identify supplementary requirements which could have been inadvertently omitted during the requirements and initial design phases. A further analysis of the developed HAC Models is located in Appendix J.

Dynamic Prototyping

Using the Static Prototype screens developed to better analyze the Human Action Cycle models, a dynamic prototype was developed. All Static Prototype screen mock-ups were incorporated, and the reengineered RSSM Register was expounded upon. Appendix K demonstrates some of the primary functionality screens incorporated into the fully-operational prototype.

Evaluation

Heuristic Inspections

After constructing an initial dynamic prototype, a detailed heuristic inspection was performed by three Caterpillar IT analysts, in order to thoroughly test the application prior to conducting the usability testing process. Each analyst was given a rigorous instruction manual, and was told to be specific with personal usability issues. Each issue found was to be categorized against a list of designated heuristic categories. A significant number of minor and major issues were discovered, with several of them being corrected before usability tests were conducted. All inspection submissions have been categorized and documented in Appendix L.

Usability Testing

The usability test was conducted after the heuristic inspection results were analyzed and several modifications were made to the initial dynamic prototype. Ten (10) usability tests were conducted over a 2+ week period: five (5) with the original RSSM Register application, and five (5) with the reengineered application. All ten test subjects were given a predetermined opening statement by the evaluator, to address the test purpose, and usability test instructions. All were made aware of the video/audio recording instruments, and were given a quick demonstration of the screen capturing software used for recording screen movements, in an effort to make the test subject comfortable with what was being recorded. Each test subject was given a list of three tasks to perform to the best of their abilities, ranging from a simple to more complex tasks.

Task	Full Task Description
Task #1	You have just received an e-mail from a colleague. She is working on possibly reselling a specific part back to Morton, and would like to know how many Finished On-Hand parts we currently have for Part # 251-4244, and how much each piece is.
Task #2	You have been notified Part # 289-0065 has now been loaded onto the RSSM Register application. Update the new entry, stating the part is to be scrapped for "Line of Sight – No Inventory", mark the part as reviewed, and note the Low-Dollar RSSM Form Number is #303468
Task #3	You are now playing the role of RSSM Coordinator. You have received permission to perform a final reconciliation on the three parts with the highest extended cost targeted for scrapping. Please perform this task.

Once the application usability test was completed, the test subject submitted a quick questionnaire to capture thoughts regarding the tested application. The user filled out the questionnaire while the evaluator rendered the video capture, as to minimize interference in filling out the questionnaire. Appendix M contains the raw data received from the Original and Revised Application Usability tests, a quick data comparison between the times recorded, and bar charts that demonstrate the time comparisons.

Requirements Evaluation

The data acquired from the usability tests demonstrate that application usability has been enhanced significantly. Quick investigations of each of the tasks among all test subjects show performance improvements ranging from 5% to 58%, but these are tempered with realization of two test subject (one for the original application, one for the revised) are newer consultants that did not have much experience in the application, and more importantly, the RSSM process. By removing outlier results and using the remaining four-person tests for each application, not only does the raw data calculate a task more focused improvement range (24%-50% improvement among all three tasks), but the raw task time savings becomes much more clear. For example, Task 3 was believed to be the most difficult of the tasks, yet when reviewing the non-outlier numbers, the task time average dropped from 158 seconds to 78 seconds, or approximately 2½ minutes to just over 1 minute. The average total task times for all users improved by 27.4%, and with the removal of the outlier numbers, the improvement jumps to 35.4%.

The post-test questionnaire results show similar improvements across most categories. All fourteen questionnaire statements were either unchanged or improved upon (ranging from 3.8% to 125%), with an overall application satisfaction rating increasing from a 5.4 average to 9.2 (a 70.4% improvement). Several raw comments & suggestions for the original and revised applications also demonstrate the test subjects enjoyed the reengineered interface, and look forward to this project continuing toward full implementation. Appendix M also contains the post-test questionnaire and compiled results for both the original and reengineered RSSM Register application.

Focus Group

A Focus Group discussion among several Caterpillar IT Analysts was conducted after all usability evaluations were conducted. From this discussion, a number of valuable topics were addressed, and a number of consensus problem / recommendations were agreed upon. A list of all discussion points are documented in Appendix N, with recommendations to concentrate on first listed in the next report section.

Final Recommendations

Overall, both the Heuristic Evaluation and the Prototype Usability Testing generated an appreciated number of suggestions and concerns to be addressed as the project moves forward later in the summer 2008 timeframe within a Caterpillar 6-Sigma project. The following two subsections outline the high-level recommendations to be considered.

From Heuristic Evaluation

Problem	Recommendation
Cryptic Error Messages received within User Administration	Disable "Submit" button if submission text box is blank. Repeat for all text boxes requiring submission (Cost Avoid Reasons, etc.)
Documentation file maintenance	Use a standardized file upload process, currently adopted in other Caterpillar ColdFusion applications.
Consistency of Navigation title link to the name of the corresponding screen title	Re-title all links along the new left-hand navigation to match the actual screen titles, and make screen titles more intuitive
Complex queries can cause timeouts	Work with local Oracle DBA on performing optimization study on current Oracle database. Optimize all queries within application itself.

From Prototype Usability Testing

Problem	Recommendation
Multiple drop-down selections, when only one or the other is needed	Disable opposite drop-down functionality in Part Detail screen if the other drop-down has been selected. Allow for reactivation, when necessary.
Add multiple sets of Submit/Reset buttons on submission pages	Add Submit/Reset buttons at both the top and bottom of submission lists. Add final confirmation of the number of parts being submitted.
Role definition and functionalities allowed for each role	Add links to similar pages if functionality is needed within a particular job role.
Re-order of main page	Swap locations of Part Search and Procurement Analyst functions. Consider creating two separate pages, one for each function, and creating a blank main page.

Appendices

Appendix A: Requirements Questionnaire & Results

Results are shown in **red**

General Information

Name of Participant	**Four participants total**				
Date	January 2008				
Age (Optional – demographic purposes only)	18-25 ☐ **(1)**	26-35 ☐ **(1)**	36-45 ☐ **(2)**	46-55 ☐	56+ ☐
Sex (Optional – demographic purposes only)	Male ☐ **(2)**		Female ☐ **(2)**		
Current Caterpillar Position Title					
Current Role within Lafayette RSSM Register	Procurement Analyst ☐ **(1)**	RSSM Coordinator ☐ **(1)**	RSSM Accountant ☐	Other (explain) **(2)** **(Intern)** **(Info Srvcs)**	

Professional Experience

How many full years have you worked at Caterpillar?

- ☐ 0-5 years **(1)**
- ☐ 6-10 years **(3)**
- ☐ 11-20 years
- ☐ Over 20 years

How many years have you worked in current position?

- ☐ 0-5 years **(3)**
- ☐ 6-10 years **(1)**
- ☐ 11-20 years
- ☐ Over 20 years

How many different positions have you held while employed with Caterpillar?

- ☐ 1-3 positions **(3)**
- ☐ 4-6 positions **(1)**
- ☐ 6-10 positions
- ☐ Over 10 positions

I am excited about my current position for 2008?

- ☐ Strongly Agree **(1)**
- ☐ Agree **(2)**
- ☐ Undecided **(1)**
- ☐ Disagree
- ☐ Strongly Disagree

Estimate how often you access the Lafayette RSSM Register application.

- ☐ Daily (5x / week) **(1)**
- ☐ Frequently (2-4x / week)
- ☐ Weekly (1x / week)
- ☐ Infrequently (2-3x / month) **(1)**
- ☐ Monthly (1x / month) **(2)**

Estimate the number of minutes you spend each time you work in the Lafayette RSSM Register.

- ☐ Usually under 15 minutes **(2)**
- ☐ Usually between 15-30 minutes **(1)**
- ☐ Usually between 30-60 minutes **(1)**
- ☐ Usually over 60 minutes

I understand the overall RSSM process adopted at the Lafayette facility.

- ☐ Strongly Agree **(2)**
- ☐ Agree **(2)**
- ☐ Neither Agree nor Disagree
- ☐ Disagree
- ☐ Strongly Disagree

I am satisfied in the overall RSSM process adopted at the Lafayette facility.

- ☐ Strongly Agree
- ☐ Agree **(2)**
- ☐ Neither Agree nor Disagree **(1)**
- ☐ Disagree **(1)**
- ☐ Strongly Disagree

I am satisfied in the current Lafayette RSSM Register and how it supports the adopted process.

- ☐ Strongly Agree
- ☐ Agree **(1)**
- ☐ Neither Agree nor Disagree **(2)**
- ☐ Disagree **(1)**
- ☐ Strongly Disagree

Computer Experience

In general, I am comfortable using a computer.

- ☐ Strongly Agree **(3)**
- ☐ Agree **(1)**
- ☐ Neither Agree nor Disagree
- ☐ Disagree
- ☐ Strongly Disagree

In general, I am comfortable using the Internet.

- ☐ Strongly Agree **(3)**
- ☐ Agree **(1)**
- ☐ Neither Agree nor Disagree
- ☐ Disagree
- ☐ Strongly Disagree

While at home, I enjoy and/or participate in the following activities while accessing the Internet (click all that apply).

- ☐ E-mail Access **(4)**
- ☐ Shopping online **(4)**
- ☐ Reading Local & National news **(4)**
- ☐ Gaming & Entertainment **(3)**
- ☐ Audio & Video review
- ☐ Discussion forums **(1)**
- ☐ Blog reviewing

While at home, how often do you (specifically) access the Internet (excluding e-mail)?

- ☐ No Internet access at home
- ☐ 1-3 hours / week **(2)**
- ☐ 4-8 hours / week
- ☐ 9-16 hours / week **(2)**
- ☐ More than 16 hours / week

While at work, how many Caterpillar-specific Internet applications do you use daily on average?

- ☐ 1-2 applications
- ☐ 3-5 applications **(3)**
- ☐ 6-8 applications **(1)**
- ☐ 9+ applications

While at work, how many Caterpillar-specific non-Internet applications do you use daily on average?

- ☐ 1-2 applications **(1)**
- ☐ 3-5 applications **(3)**
- ☐ 6-8 applications
- ☐ 9+ applications

If given a choice, I would prefer working on Caterpillar Internet applications.

- ☐ Strongly Agree **(1)**
- ☐ Agree **(2)**
- ☐ Neither Agree nor Disagree
- ☐ Disagree **(1)**
- ☐ Strongly Disagree

In general, I would appreciate a common look and feel to Caterpillar Internet applications.

- ☐ Strongly Agree **(3)**
- ☐ Agree **(1)**
- ☐ Neither Agree nor Disagree
- ☐ Disagree
- ☐ Strongly Disagree

Additional Comments

What functionalities within the Lafayette RSSM Register application do you believe need no improvements?

- All aspects could stand improvement
- Simplicity
- I think the email notice is good to make analysts know ahead of time

What functionalities within the Lafayette RSSM Register application do you believe need improving?

- Needs to be more mechanized and less paperwork.
- Layout & design
- Access, Look & feel, Better Administration access, Better reporting

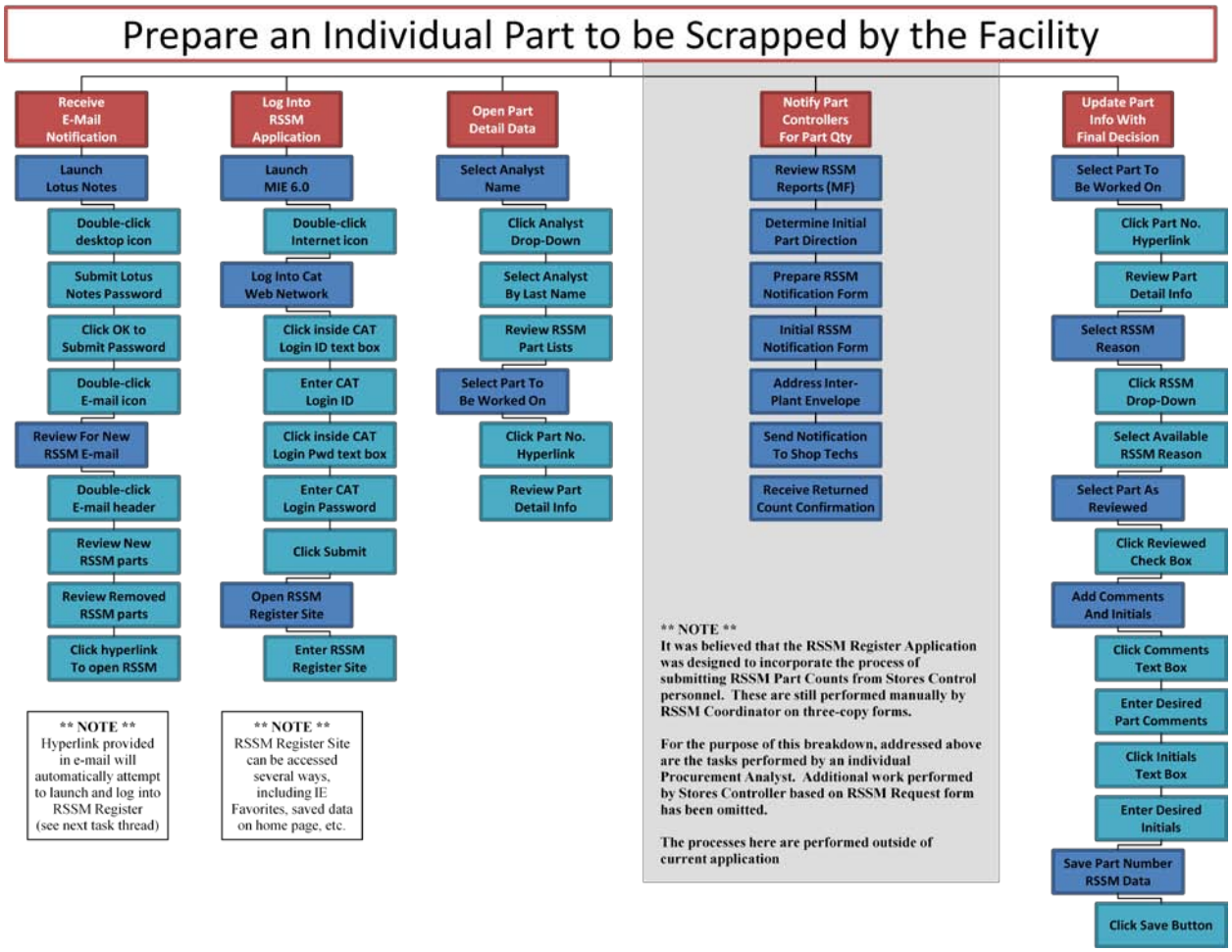
If you could pinpoint one improvement you feel is most needed within the Lafayette RSSM Register application, what would it be and why?

- Some parts are not dead any longer and there is no way to remove them from the database
- It would be nice for at least he RSSM Coordinator to be able to go to all the open items in one place instead of having to go into each analyst's list.
- Layout & design
- Probably the look and feel. The application does not follow Cat templates most apps follow. Makes it harder to support.

Any additional comments you may have?

- Good luck, David. Let me know if you need a test subject.

Appendix B: Task Analysis



Appendix C: Task Scenarios

These scenarios are believed accurate in regards to process. However, for confidentiality purposes, Caterpillar policies mentioned have been modified for description purposes only.

Task Scenario #1:

Robert is a fifteen (15) year employee with Caterpillar, and has spent time in both the Greater Peoria area, and at the engine facility in Griffin, Georgia. He has been with the Lafayette Large Engine Center for 6 years, within the Supply Chain Management area and Parts Procurement. Robert has been assigned as the responsible Procurement Analyst for over 1,500 individual piece parts within the facility, roughly 3-5% of all piece parts in total.

While checking his work e-mail first thing Tuesday morning, Robert notices he has received an e-mail automatically generated from the RSSM Register ColdFusion application. The e-mail states a specialized 2" galvanized bolt for a radiator is no longer going to be used for engines effective March 1st, 2008.

Robert proceeds to the Corporate RSSM Mainframe Report dropped off on his desk prior to his arrival, and notices the same part number is also referenced as changing part status to "targeted for retirement". The report states there are 586 bolts currently at the Lafayette facility, with no bolts located at the Caterpillar Logistics Center 2 miles away. The cost for each bolt is $1.75, meaning a total of $1025.50 of Caterpillar purchased parts are targeted for being thrown away unused.

Robert begins investigating how many engine orders are currently scheduled to start between Tuesday and March 1st, based on the radiator attachment group that consumes the bolt in question. This is performed outside of the RSSM Register application. After researching, Robert has found there are 36 engines scheduled to start with that radiator attachment group, each consuming 16 bolts per radiator. The last engine with the radiator group is scheduled for shipment on February 20th. There are no other radiator groups that can use this bolt, as it will be too small for use otherwise. By using basic calculations, Robert determines there will be a grand total of 10 bolts that will remain unconsumed at the Lafayette facility when the retirement effective date is reached, for a total of $17.50. Based on Caterpillar standards for cost avoidance and scrapping surplus, any part with a grand total under $25 at the time of retirement may be scrapped with no reservations.

Robert opens the Lafayette RSSM Register application, and selects his last name from the Analysts drop-down list. He is presented with a list of current parts that are candidates for retirement, and a list of parts that he has already processed and waiting for final reconciliation. Robert finds the part number in his Open Items list, and clicks on the hyperlinked part number. This brings him to the RSSM Part Detail page. This page displays part-specific information, including part vendor, on hand quantities (rough and finished), part cost per piece, etc. The page also allows Robert to enter information specific to the RSSM Register process. Based on his findings, he proceeds to the RSSM drop-down box, selects "Scrap", and marks the part as reviewed by checking the appropriate checkbox. In the comments box, he types the targeted ship date for the last engine to be shipped with this bolt, and types his initials in the provided initials box. Once all four objects have been populated to his liking, he clicks the Save button, which saves all of his submitted data to the database.

Over the next several days, Robert monitors the total on-hand quantities for the designated bolt. As each engine is built and consumes the bolts, the on-hand numbers in the Lafayette RSSM Register application are updated nightly. On February 15th, the last known engine with the radiator attachment group consuming the bolts starts the assembly process. The following workday, Robert notices the total on-hand quantity has now reached 10 parts in total.

Robert begins filling a RSSM Request Form, a 5"x8" form in triplicate (yellow on white on pink – with carbon paper), putting down the part number, total part quantity, individual cost per part, and total on hand cost. Other fields are filled in to assist Stores Controllers (personnel whom are knowledgeable on the physical receipt and location of individual piece parts) with confirming the total number of on-hand quantities for the 2" galvanized bolt. Once the form has been filled out, Robert prepares an Interplant mail envelope addressed to a specific Stores Controller, places the RSSM Request Form inside, and drops the envelope in a mail bin, which is picked up approximately four times per day.

Robert will continue monitoring for any fluctuations specific for the bolt, as on-hand quantities have been known to increase or decrease during this time of communication between the Procurement Analyst and the Stores Controller. On February 20th, the day the final engine shipped from the facility, Robert receives an Interplant mail from the Stores Controller. The Stores Controller has confirmed he has found 10 bolts on site, and has taken said bolts to an on-site disposal facility for scrapping.

Robert must now begin the final preparations for scrapping the part within the RSSM Register. He proceeds back to his Open Items list within RSSM Register, and finds the bolt. The bolt is now listed close to the top of his screen, as March 1st is coming closer. There are no changes reported from the Stores Controller, so he does not need to re-enter the Part Detail screen. All on-hand quantities and costs have been updated during the nightly batch process.

On March 1st, Robert notices the part number is no longer displayed in his list of Open Items, and is now displayed in his list of "Items Waiting Final Reconciliation". He then forwards the RSSM Request form to the Lafayette Accounting group for final reconciliation.

Task Scenario #2:

Keegan is a first-semester intern within the Lafayette Supply Chain group, and is currently working with the Procurement Analysts. She is a Junior at Purdue University, majoring in Business Marketing, and is very eager to become involved with business in general at a large corporation. She has been assigned to assist two Procurement Analysts with their RSSM Register work, as they are responsible for over 4,000 parts between the two of them.

On Monday while Keegan is in class, both Procurement Analysts are notified of several parts designated as retirement candidates, and forward their automatic e-mail notifications to her, as she can begin working on them Tuesday morning.

On Tuesday, Keegan starts processing the part numbers supplied to her within the Lafayette RSSM Register application. She has the ability within the application to enter both Procurement Analysts part lists by selecting their last name from the Analyst drop-down box provided on the RSSM Register home

page. Most of the parts she is assigned to work on will be scrapped as normal. However, one part in particular, an oil filter, stands out. There are 231 parts on-hand at the Caterpillar Logistics facility 2 miles away, and there is no required demand for these oil filters between Monday and the part retirement effective date of April 1st, 2008. Each filter costs $47.25, equating to over $10,900 dollars worth of purchased material would be thrown away, a significant amount of money in any company.

Keegan discusses possible options with the assigned Procurement Analyst. The analyst is busy working on other things at the moment, but suggests she might be able to contact the primary Caterpillar Logistics Distribution Center in Morton, IL to see if they have a need to store these particular oil filters for customer warranty claims and/or repair.

Keegan contacts a Caterpillar Logistics parts representative in Morton, and mentions the oil filters now marked as possible retirement candidates. The representative mentions their on-hand quantities for that particular part number is low. Over 13,000 Caterpillar engines worldwide were built with that particular oil filter, and while most have or can be retrofitted with newer parts, there are approximately 700 that must have that particular oil filter due to equipment clearances and EPA certifications. After further discussions with Cat Logistics purchasing management, they agree to transfer ownership of all 231 on-hand oil filters from the Lafayette facility to the Caterpillar Logistics Distribution Center for future warranty claims and/or repair.

Excited about the equipment transfer agreement, Keegan notifies the responsible Procurement Analyst of the news. She then opens the Lafayette RSSM Register application, and selects the assigned Procurement Analyst's last name from the Analysts drop-down list. She is presented with a list of current parts that are candidates for retirement, and a list of parts that he has already processed and waiting for final reconciliation. Keegan finds the oil filter part number in question in the Open Items list, and clicks on the hyperlinked part number, bringing her to the RSSM Part Detail page. This page displays part-specific information, including part vendor, on hand quantities (rough and finished), part cost per piece, etc. The page also allows Keegan to enter information specific to the RSSM Register process. Based on her discussions with Morton, she proceeds to the Cost Avoid drop-down box, selects "Transfer to Morton – 0 on hand", and marks the part as reviewed by checking the appropriate checkbox. In the comments box, she types the date she made contact with the Morton distribution center, and the contact name and phone number in Morton whom has agreed to the part transfer, and types her initials in the provided initials box. Once all four objects have been populated, she clicks the Save button, which saves all of his submitted data to the database.

Once Keegan has saved her initial data within the RSSM Register, she begins filling out the RSSM Request Form, putting down the part number, total part quantity, individual cost per part, and total on hand cost. She notes that all oil filters are to be shipped via standard freight to the Caterpillar Logistics Distribution Center, and the individual Logistics contact information. Other fields are filled in to assist Stores Controllers with confirming the total number of on-hand quantities. Once filled out, she prepares an Interplant mail envelope addressed to a specific Stores Controller at the local Cat Logistics facility, places the RSSM Request Form inside, and drops the envelope in a mail bin, which is picked up approximately four times per day.

Three days later, Keegan arrives at her desk to see an Interplant mail with her name on it from the local Cat Logistics facility. Inside, the Stores Controller has updated her RSSM Request form. Unfortunately, there was only 229 filters on-hand at the Logistics facility, but that information was relayed to local personnel to update on-hand quantities. An additional note on the RSSM Request form advises her to contact Morton to confirm shipment approval for the following Monday. Worried her transaction with Morton might be in jeopardy, Keegan turns on her computer, logs into the network, and heads out to the RSSM Register application straightaway. She selects the assigned Procurement Analyst's last name from the Analysts drop-down list for the oil filters. She is presented with a list of current parts that are candidates for retirement, and finds the oil filters entry. Upon clicking the hyperlinked part number, she notices the RSSM Register now reflects 229 oil filters on hand at the Logistics facility.

Somewhat relieved, she makes a call to her contact at the Caterpillar Logistics Distribution Center in Morton for the oil filters. She mentions to him the part quantity discrepancy, and would like to confirm they are still OK with accepting the oil filters. After a brief discussion with management, he confirms the oil filters are still welcome, and that a Monday shipment works well for them. Relieved, she contacts the local Logistics facility to approve of the Monday shipment of all 229 oil filters.

There are no additional changes necessary within the RSSM Register application for this part number. She has performed a Cost Avoidance process, rather than a RSSM (scrap) process, as she was able to determine a proper course-of-action for the excess oil filters without having to scrap the parts. On April 1st, 2008 (or the next time after April 1st she works at Cat), she notices the oil filter part has been moved from the list of Open Items for the Procurement Analyst assigned to the retired part number, and is now displayed in his list of "Items Waiting Final Reconciliation". She then forwards the finalized RSSM Request form to the Lafayette Accounting group for final reconciliation.

Appendix D: Contextual Inquiry Discussion

Interview Portion	Corresponding Response
Question 1	How does this application help you perform your job?
Answer	I use the application for reporting purposes than anything, comparing data against corporate RSSM reports (Mainframe) to assure accurate count numbers. The application does a good job of telling me when a part is scheduled to be retired, and I can plan accordingly.
Question 2	Does it provide you access to all of the necessary information to perform your job function?
Answer	No it does not. I still have to access part data from corporate databases (Mainframe) to cross-compare the numbers in RSSM. Most of the times, RSSM is correct. Sometimes, RSSM is incorrect. And if a part is designated as to be scrapped, but then the scrap indicator is removed (indicating an active part again), the part does not automatically leave the application, and there's no manual way of doing such.
Question 3	Do you perform certain tasks before, during, and after using the application that have an impact on the overall task of completing a part entry in RSSM?
Answer	Yes. I have to compare a corporate RSSM Report (Mainframe) generated once a month with the data that is in. While in the application, I have to fill out a RSSM Request form (2 different forms – one for parts under $XXXX in total cost, and one for parts over $XXXX total cost (cost numbers omitted). After processing the entry in the RSSM application, I have to send copies of the request form to a coordinator for confirmation, and she forwards the list onto accounting. I don't know what they do with the forms afterwards.
Question 4	How often do you review the RSSM Register for Open Items?
Answer	I review the Open Items report every day, but due to my time/job constraints, I am not able to process all of the parts in one setting. In order to be a proper RSSM Coordinator, a Full-Time Employee should be hired. However, we do not have that luxury at this time.
Question 5	In your opinion, what percentages of parts are being scrapped (RSSM'd) vs. cost avoided?
Answer	As of right now, we're scrapping every part we have. Again, I wish we could have a full-time employee to perform nothing but RSSM parts processing. This way, this person could actually try to cost avoid many of these parts by reselling them to the manufacturer, sell them to our parts distributor in Morton, IL, or re-engineer them into usable parts. Caterpillar would save more money in the long run than throwing money away each time we scrap an obsolete part.
Question 6	Are there different activities you must do between scrapping and cost avoiding a part?
Answer	There is no difference that I know within the application when performing cost avoidance on a part versus scrapping a part. At least I don't know of any.
Question 7	Given your experience with other web applications located here at Lafayette, do you think the navigation and layout is easy to understand.
Answer	While the RSSM Register application is relatively simple in nature, the application does differ quite a bit in regards to most of our other local applications, such as (Applications omitted). Is there a reason why it was designed this way, rather than like some others?

Question 8	Have you noticed any irregularities with the application itself (ie, error messages, cryptic messages displayed, etc.)? If so, how have you handled them or how have you worked around the issue?
Answer	I have not had any error messages displayed to me. I cannot recall the last error message I received in the application. The application itself seems to run pretty good, though every now and then, it can run a little slow.
Question 9	Is there functionality you would like to see the RSSM Register web application do that it currently does not now?
Answer	Yes. I would like to see the RSSM Request Form put into the application itself, so I can send the information to the Stores Controllers, who would get notified of new parts in their lists. Then, the Stores Controllers can do all their submissions in the application, and I get notified again that numbers match or do not match and I can process them accordingly. I'd also like to figure out if there's a way we can remove the parts that are no longer being retired from the RSSM Register. That is a big headache to pick of which parts I need to process, and which ones I don't.
Question 10	What part of this application takes the longest amount of time?
Answer	Probably the cross-compare I have to do between the RSSM Register application numbers and the numbers provided to me via the corporate RSSM report (Mainframe). Unfortunately, I'm not sure the local IT Department can do much about that. If you're looking for something in the application itself, perhaps being able to combine multiple Procurement Analysts into a single category so that I can process everyone's lists, instead of hopping around from list to list to list – that would help me out time-wise.
Question 11	What part of the process this application is to support takes the longest amount of time?
Answer	If you're talking about the process itself, then it is unquestionably the time between me sending the RSSM Request form to the Stores Controllers to the time I receive the RSSM Request form back from them. It could be well over 6-8 hours before it even arrives on their desks, and in a rare occasion, we have had them lost in transit both to and from my desk. If we can notify them within short order after I've filled out an online form, I would bet it would be received well with the Stores Controllers. However, they have probably never seen the RSSM Register application, though they would probably be on board with using it, I'd say. I'll have to talk to them about that.
Question 12	What are the one or two most difficult tasks to perform with the application?
Answer	To be honest, the application itself is pretty easy to work with. I think it's the lack of data it contains within the application, in comparison to the mainframe reports I get daily for scrapping parts, that's what makes the application difficult for me, but that may not be the fault of the application, but of the new process.
Question 13	What are the one or two most difficult tasks to perform with the RSSM process?
Answer	The RSSM Register process we have been using now for a while is still cumbersome, even for me. I have to fill out a pretty complex form for each individual part, based on some calculations I have to make. Then it's the waiting part between the Stores Controller and me when I send my RSSM Requests to them that really slow me down.
Question 14	Customer Walkthrough of application

Answer	Customer walkthrough of application demonstrated a few things: 1. Customer has shortcut to RSSM Register in his Favorites 2. Customer has no "special" functionality. He is just a Procurement Analyst. 3. Customer has become pretty adept at using the application, and knows where/how to get information rather quickly. He has been using the application now for several years. No noticeable artifacts are located around his desk, other than a stack of empty RSSM Register forms he fills out. 4. Customer does have set method of reviewing data between hardcopy mainframe report, three mainframe screens, and RSSM Register application. No true workarounds are being perceived at this time.
Question 15	Other thoughts, concerns, questions that might get brought up?
Answer	Work Environment of Interviewee: Office environment – Standard L-Shape Desk layout - Cubicle of 6 people & printer. 3 Cat employees – 2 interns. Noise: Light conversations throughout large room (telephone, personal). Oldies Radio station coming from ceiling speaker. Interviewee did not know of additional functionality available within RSSM Register. He was going to talk with his supervisor regarding access to that information, if possible. Interviewer demonstrated the functionality as an admin. User is quite comfortable working on the Internet, and shows same prowess working with Mainframe applications. It's believed he started his career working strictly with mainframe applications, and has migrated to using both platforms.

Appendix E: Task Performance and Survey

Task Descriptions and Measurement Points

Task #	Task Description
1	Launch the Lafayette RSSM Register application and find all RSSM-indicated parts for Procurement Analyst *John Smith**
2	Return to the Lafayette RSSM Register home page and perform a search for Part Number *137-2453**.
3	Select a RSSM Cause for the searched upon part number, add "Used for Test Purposes Only" as a comment, add your 3-character initials, submit the entry, and reconfirm all data.

* Note: For confidentiality purposes, analyst name and selected part number have been modified for documentation purposes only. Each participant was given the same analyst, but a different part number to search upon and modify.

Task #	Starting Point	Stopping Point
1	Lafayette RSSM application is launched (either via Favorites selection, Cat home page, or other noted launch mode)	Full list of John Smith's available RSSM Candidate parts is being displayed to the user.
2	User clicks the Internet Explorer "Back" button to return to the Lafayette RSSM Register home page	Part number 137-2453 has been successfully searched on, and part details are now being displayed to the user.
3	User begins selection of a RSSM Cause by clicking the drop-down box.	Part number 137-2453 has been successfully searched on, and *updated* part details are now being displayed to the user.

Task Performance Results

Task #		Participant 1 (*Frequent User*)	Participant 2 (*New Intern*)	Participant 3 (*Infrequent User*)	Avg.
1	Task Time (sec.)	10 sec.	16 sec.	13 sec.	**13 sec.**
	Task Finished? (Y/N)	Yes	Yes	Yes	**Yes**
	Comments	Knew where he was going due to his frequent application use.	Highlighted drop-down box, and started typing last name to scroll list faster. System does an automatic submission on change of the drop-down, so she went to wrong user w/o notice.	About selected his name rather than the requested name. Caught himself before selecting the wrong name – so a quick delay in name selection	
2	Task Time (sec.)	24 sec.	35 sec.	43 sec.	**34 sec.**
	Task Finished? (Y/N)	Yes	Yes	Yes	**Yes**
	Comments	Knew where he was going due to frequent application use. Fast typist – uses the numeric keypad rather than across the top of the standard alphabetic keyboard area. Was not watching key press actions using numeric keypad	Was more used to typing in a specific part number, rather than using procurement analyst drop-down section. Uses numeric keypad rather than across the top of the standard alphabetic keyboard area.	A little slower typing – mostly a hunt/peck typist (2-3 fingers mostly). Used standard numbers across alphabetic keyboard area. **ERROR MESSAGE: Part Number Not Found!** User typed special character (hyphen) in part number. Cat displays parts both ways in multiple reports, but usually stores data w/o hyphen. User returned to home page, entered part w/o hyphen, and found right part.	
3	Task Time (sec.)	25 sec.	31 sec.	27 sec.	**27.7 sec.**
	Task Finished? (Y/N)	Yes	Yes	Yes	**Yes**
	Comments	Noted to evaluator more time is usually spent on this screen, as analysts are switching between application, printed report, and mainframe number displays to confirm. Time measurement may not be true representation of time spent to complete full task. Needed to scroll window to see entry boxes.	Found no problems performing task. User did *not* have to scroll window – screen resolution was set at a small setting.	Studied part in question a little. Noted to evaluator more time is usually spent on this screen, as analysts are switching between application, printed report, and mainframe number displays to confirm. Needed to scroll window to see entry boxes.	

* Note: Performance test performed on development environment, with full debug on. Therefore, there may be slight performance degradation vs. production environment settings.

Questionnaire responses have been tabulated below. Scores have been assigned from 1 (Strongly Disagree) to 6 (Strongly Agree).

	Question	Usability Dimension	Participant 1	Participant 2	Participant 3	Average Response Score
1	Each of the tasks presented to me were easily understood.	Ease to Learn	Strong Agree (6)	Agree (5)	Agree (5)	**5.3**
2	The use of color used within the application was appropriate.	Engaging	Agree (5)	Agree (5)	Agree (5)	**5.0**
3	Information within the application pages are grouped appropriately.	Ease to Learn	Slight Agree (4)	Agree (5)	Slight Agree (4)	**4.3**
4	The application navigation was natural to follow.	Engaging	Agree (5)	Slight Agree (4)	Agree (5)	**4.7**
5	New employees can use this application with minimal training / assistance.	Ease to Learn	Slight Agree (4)	Slight Agree (4)	Slight Agree (4)	**4.0**
6	Color and application navigation were consistent throughout the site.	Engaging	Agree (5)	Agree (5)	Slight Agree (4)	**4.7**
7	I feel in control when I am using the application.	Engaging	Strong Agree (6)	Agree (5)	Agree (5)	**5.3**
8	The application labels and page headings were self-explanatory.	Ease to Learn	Agree (5)	Agree (5)	Agree (5)	**5.0**
9	It was necessary to scroll often to reach desired information.	Engaging	Strong Agree (6)	Slight Disagree (3)	Strong Agree (6)	**5.0**
10	The terminology used in the application is understandable throughout the site.	Ease to Learn	Agree (5)	Slight Agree (4)	Agree (5)	**4.7**
11	The text and graphics used in the application are presented in a visually pleasing manner.	Engaging	Agree (5)	Agree (5)	Agree (5)	**5.0**
12	The application pages seem to load quickly.	Engaging	Agree (5)	Agree (5)	Slight Agree (4)	**4.7**
13	Overall, I believe the current Lafayette RSSM Register application is easy to use.	Ease to Learn	Agree (5)	Agree (5)	Agree (5)	**5.0**

Appendix F: Concrete Use Cases

For the concrete use cases listed below, we assume the user has already launched the Lafayette RSSM Register application. By launching the application, the system has already verified the user is a Caterpillar employee. All concrete use cases will start the user from the primary home page. Entries highlighted in yellow indicate possible task objects. Entries highlighted in green indicate possible attributes to task objects.

Concrete Use Case #1: Search and Update Requested Part Number

User Action	System Response
Procurement Analyst ("User") enters a desired 6- or 7-character part number for the part	System displays part data for part number searched on.
User chooses a RSSM or Cost Avoid selection	System reflects tentative desired action for requested part number
User marks part number as reviewed	System reflects tentative desired action for requested part number
User adds optional comments to part number.	System reflects tentative desired action for requested part number
User submits information for saving	System saves all submitted information against specified part number System displays message box stating information was successfully saved. System returns order to Lafayette RSSM Register home page.

Concrete Use Case #2: Review all RSSM Candidate Part Numbers and Update Selected Part

User Action	System Response
Procurement Analyst ("User") selects his/her last name	List of all RSSM Candidate parts assigned to the selected Procurement Analyst are displayed.
User selects a desired part number	System displays part data for selected part number.
User chooses a RSSM or Cost Avoid selection	System reflects tentative desired action for requested part number
User marks part number as reviewed	System reflects tentative desired action for requested part number
User adds optional comments to part number.	System reflects tentative desired action for requested part number
User submits information for saving	System saves all submitted information against specified part number System displays message box stating information was successfully saved. System returns User to Lafayette RSSM Register home page.

Concrete Use Case #3: Reconcile part(s) from RSSM Register marked as Cost Avoided

User Action	System Response
Procurement Analyst ("User") opens the Cost Avoid Reconciliation screen	System displays list of all parts designated as Cost Avoided (i.e., alternatives other than scrapping have been found) that have reached their targeted retirement date.
User selects desired part(s) to complete out of RSSM Register as Cost Avoided	Each part selected now has checkbox
User submits selected parts as Cost Avoided.	System marks each part as Cost Avoided – Complete System displays message box stating parts were marked as Cost Avoided – Completed System returns User to the Cost Avoid Reconciliation screen

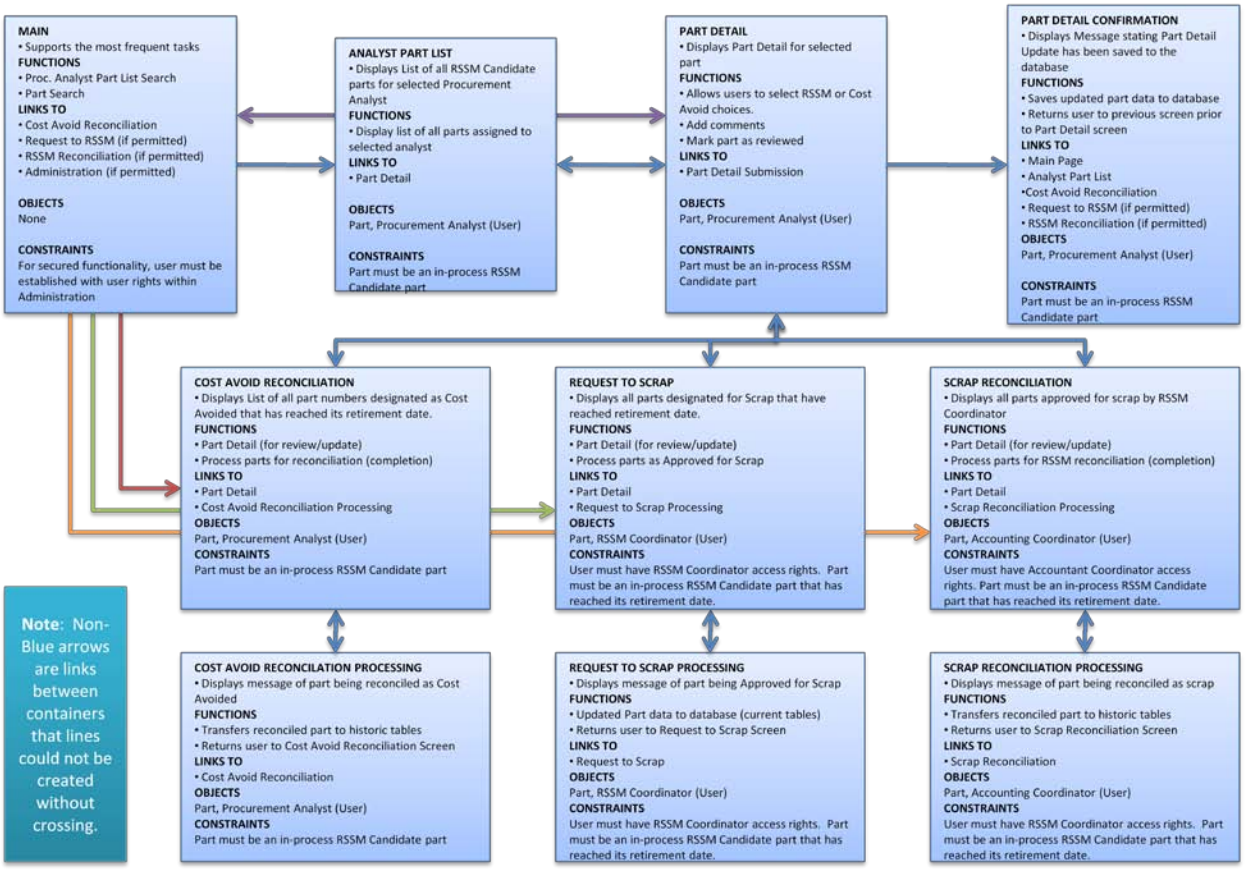
Concrete Use Case #4: Request to Scrap Surplus Material

User Action	System Response
RSSM Coordinator ("User") opens the Request to RSSM screen	System displays list of all parts designated for RSSM (i.e., part is to be scrapped) that have reached their targeted retirement date.
User selects desired part(s) to submit to Accounting personnel as finalized RSSM Candidates	Each part selected now has checkbox
User submits selected parts as finalized RSSM Candidates.	System marks each part as Approved for RSSM System displays message box stating parts were marked as Approved for RSSM System returns User to the Request to RSSM screen

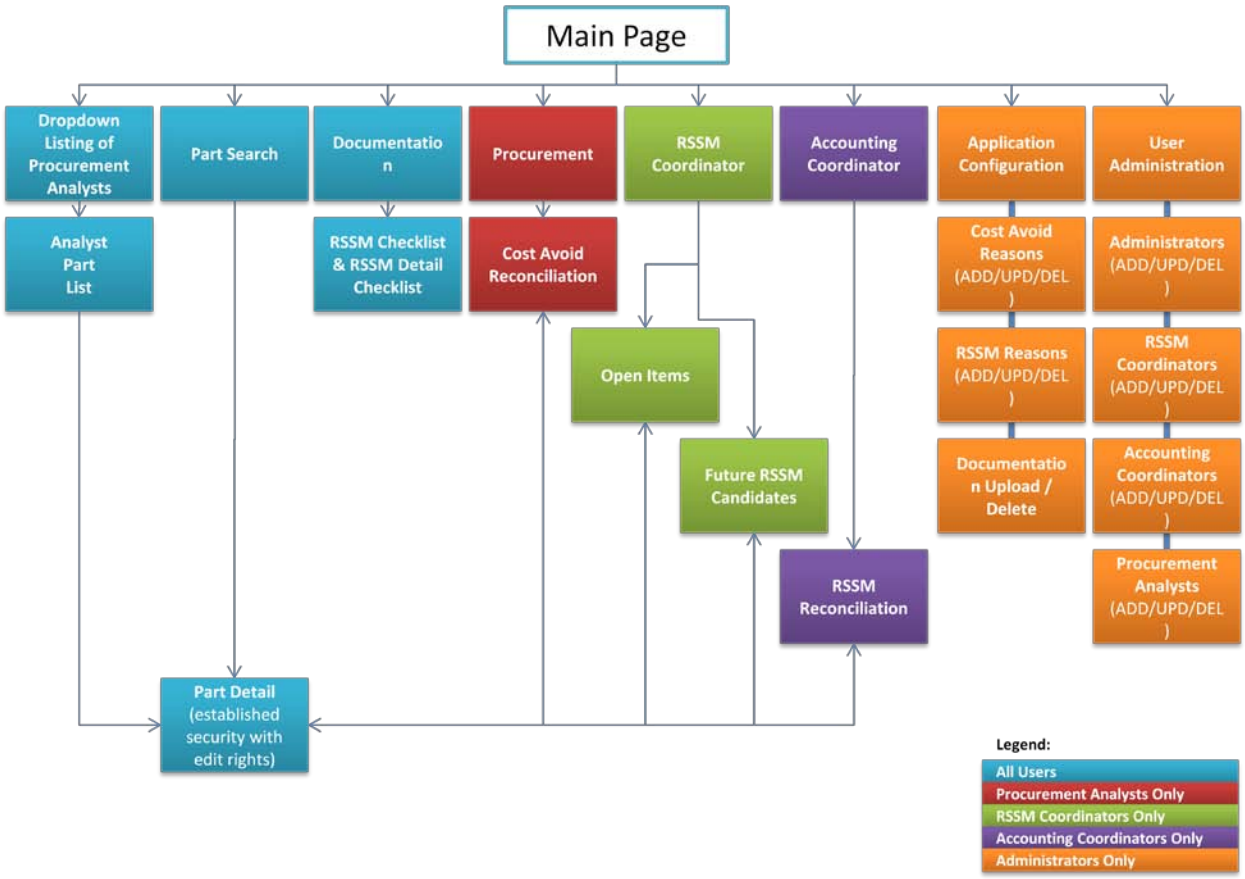
Concrete Use Case #5: Reconcile part(s) approved for Scrapping

User Action	System Response
Accounting Coordinator ("User") opens the RSSM Reconciliation screen	System displays list of all parts designated for RSSM (i.e., part is to be scrapped) that have reached their targeted retirement date.
User selects desired part(s) to submit to Accounting personnel as finalized RSSM Candidates	Each part selected now has checkbox
User submits selected parts as finalized RSSM.	System marks each part as Completed as RSSM parts System displays message box stating parts were marked as Completed as RSSM System returns User to the RSSM Reconciliation screen

Appendix G: Content Diagram



Appendix H: Architecture Schematic



Appendix I: Human Action Cycle Models

HAC #1: Review part details for a part within the Lafayette RSSM Register

HAC Step	Description
1. Goal	Review part details for a part within the Lafayette RSSM Register
2. Translate	Access the Lafayette RSSM Register. Search for a known Part Number. Review Part Number Information for desired data.
3. Plan	The user will access the Lafayette RSSM Register. Once there, the user will perform a part search using the Part Search function on the Main Page. Once the user has submitted the desired part number, he/she will review the part number data presented.
4. Execute	User opens the Lafayette RSSM Register Internet application. User clicks in the Text Box of the Part Search functionality on the Main Page, enters a known Part Number, and clicks Submit.
5. Perceive	User observes a new screen has opened within the Lafayette RSSM Register application. Application is now showing the Part Detail screen.
6. Interpret	User has not received an error message stating submitted part was not found. User reviews the Part Number section on the Part Detail screen to confirm he/she entered the correct part number, as he/she could have submitted an unwanted part number that exists within the Lafayette RSSM Register.
7. Compare	The user has confirmed he/she has submitted the correct part number, and may now review the remaining contents of the Part Detail screen for desired information on the part itself.

HAC #2: Review all Open Items Report within the Lafayette RSSM Register

HAC Step	Description
1. Goal	Review all Open Items Report within the Lafayette RSSM Register
2. Translate	Access the Lafayette RSSM Register. Expand the RSSM Coordinator navigation selection. Review the Open Items Report
3. Plan	The user knows he/she has RSSM Coordinator security rights to access the Open Items Report. The user will access the Lafayette RSSM Register. Once there, he/she will expand the RSSM Coordinator navigation selection, and choose the Open Items Report to review all open item part numbers.
4. Execute	User opens the Lafayette RSSM Register Internet application. User clicks the RSSM Coordinator navigation selection. User clicks on the Open Items Report hyperlink.
5. Perceive	User observes a new screen has opened within the Lafayette RSSM Register application. Application is now showing the Open Items screen.
6. Interpret	User has not received an error message stating he/she did not have proper access rights to the report. User reviews the heading of the presented screen to confirm the Open Items Report is now being displayed.
7. Compare	The user has confirmed he/she has successfully accessed the Open Items Report, and may now review the report content for desired information.

Appendix J: Human Action Cycle Model Analysis

HAC #1 Analysis: Review part details for a part within the Lafayette RSSM Register

HAC Step	Description	Questions	Initial Interpretation
1. Goal	Review part details for a part within the Lafayette RSSM Register	Do users have sufficient domain and task knowledge? Does UI help the users form these goals?	Yes. Users should already be familiar with the application, and will find the Part Search function in the middle of the main page.
2. Translate	Access the Lafayette RSSM Register. Search for known Part Number. Review Part Number Information for desired data.	Do users have sufficient domain and task knowledge? Does UI help the users form these goals?	Yes. Users should already be familiar with the application, and will find the Part Search function in the middle of the main page.
3. Plan	The user will access the Lafayette RSSM Register. Once there, the user will perform a part search using the Part Search function on the Main Page. Once the user has submitted the desired part number, he/she will review the part number data presented.	Do users have sufficient domain and task knowledge? Does the UI help the users formulate the action sequence?	Yes. Users should already be familiar with the application. The Part Search functionality will be one of two clearly-labeled options available to the user on the main page itself, rather than multiple options on the main page.
4. Execute	User opens the Lafayette RSSM Register Internet application. User clicks in Text Box of the Part Search functionality on the Main Page, enters a known Part Number, and clicks Submit.	Can typical users easily learn and use the UI? Do the actions provided by the system match those required by the users? Are the affordance and visibility of the actions good? Do the users have an accurate mental model of the system? Does the system support the development of an accurate mental model?	Yes. Users will now find the basic look/feel of application matches that of other ColdFusion applications used at the facility. The actions performed for this activity in the revised UI are identical to those in the current UI. A single text box and a Search button should give the user all he/she needs to perform the activity.
5. Perceive	User observes new screen open within Lafayette RSSM Register application. Application is now showing the Part Detail screen.	Can the users perceive the current state? Does UI provide the users with sufficient feedback about the effects of their actions?	Yes. The user is now displayed an updated, more compact, Part Detail page upon successfully finding the desired part number.
6. Interpret	User receives no error message stating submitted part was not found. User reviews the Part Number section on the Part Detail screen to confirm he/she entered the correct part number, as he/she could have submitted an unwanted part number.	Are the users able to make sense of the feedback? Does the UI provide enough feedback for this interpretation?	Yes. The new display will highlight the part number itself, and the associated detail. If the part is not found, a message will be displayed to the user. However, if user submits an incorrect part number, the user will not know until reviewing the returned information.
7. Compare	The user has confirmed he/she has submitted the correct part number, and may now review the remaining contents of the Part Detail screen for desired information on the part itself.	Can the users compare what happened with what they were trying to achieve?	Yes. The user should have an idea of which part he/she would like to find more information on from the Lafayette RSSM Register application. The information displayed is either the correct part number, or an incorrect (yet found) part number submitted in the Part Search.

HAC #2 Analysis: Review all Open Items Report within the Lafayette RSSM Register

HAC Step	Description	Questions	Initial Interpretation
1. Goal	Review all Open Items Report within the Lafayette RSSM Register	Do users have sufficient domain and task knowledge? Does UI help the users form these goals?	Yes. Users should already be familiar with the application, and will have user privileges to the Open Items report within the application.
2. Translate	Access the Lafayette RSSM Register. Expand the RSSM Coordinator navigation selection. Review the Open Items Report	Do users have sufficient domain and task knowledge? Does UI help the users form these goals?	Yes. Users should already be familiar with the application, and will have user privileges to the Open Items report within the application. The updated navigation selection specific to their role helps them understand what they have access rights to.
3. Plan	The user knows he/she has RSSM Coordinator security rights to access the Open Items Report. The user will access the Lafayette RSSM Register. Once there, he/she will expand the RSSM Coordinator navigation selection, and choose the Open Items Report to review all open item part numbers.	Do users have sufficient domain and task knowledge? Does the UI help the users formulate the action sequence?	Yes. Users should already be familiar with the application, and will have user privileges to the Open Items report within the application. The updated navigation selection specific to their role helps them understand what they have access rights to.
4. Execute	User opens the Lafayette RSSM Register Internet application. User clicks the RSSM Coordinator navigation selection. User clicks on the Open Items Report hyperlink.	Can typical users easily learn and use the UI? Do the actions provided by the system match those required by the users? Are the affordance and visibility of the actions good? Do the users have an accurate mental model of the system? Does the system support the development of an accurate mental model?	Yes. Users will now find the basic look/feel of application matches that of other ColdFusion applications used at the Lafayette facility. The actions performed for this activity in the revised UI are identical to those in the current UI. Users without the proper access rights will not notice the additional functionality exists, and therefore will not become confused with additional (unnecessary) functions.
5. Perceive	User observes a new screen has opened within the Lafayette RSSM Register application. Application is now showing the Open Items screen.	Can the users perceive the current state? Does the UI provide the users with sufficient feedback about the effects of their actions?	Yes. The user will now see the main page has been replaced. The user is now displayed an updated Open Items report. The display of this report should give the user ample feedback they have performed the task properly.
6. Interpret	User has not received an error message stating he/she did not have proper access rights to the report. User reviews the heading of the presented screen to confirm the Open Items Report is now being displayed.	Are the users able to make sense of the feedback? Does the UI provide enough feedback for this interpretation?	Yes. The report header clearly states Open Items report, with the default year being the current year. The display of this report should give the user ample feedback they have performed the task properly.
7. Compare	The user has confirmed he/she has successfully accessed the Open Items Report, and may now review the report content for desired information.	Can the users compare what happened with what they were trying to achieve?	Yes. The report header clearly states Open Items report, with the default year being the current year.

Appendix K: Static and Dynamic Prototype Screens

Image 1 shows a mock-up of the proposed main page redesign for the Lafayette RSSM Register application. Basic navigation is controlled by a navigation tree presented to the user along the left-hand side of the web site, and the two primary functions for most users presented in the primary frame of the application.

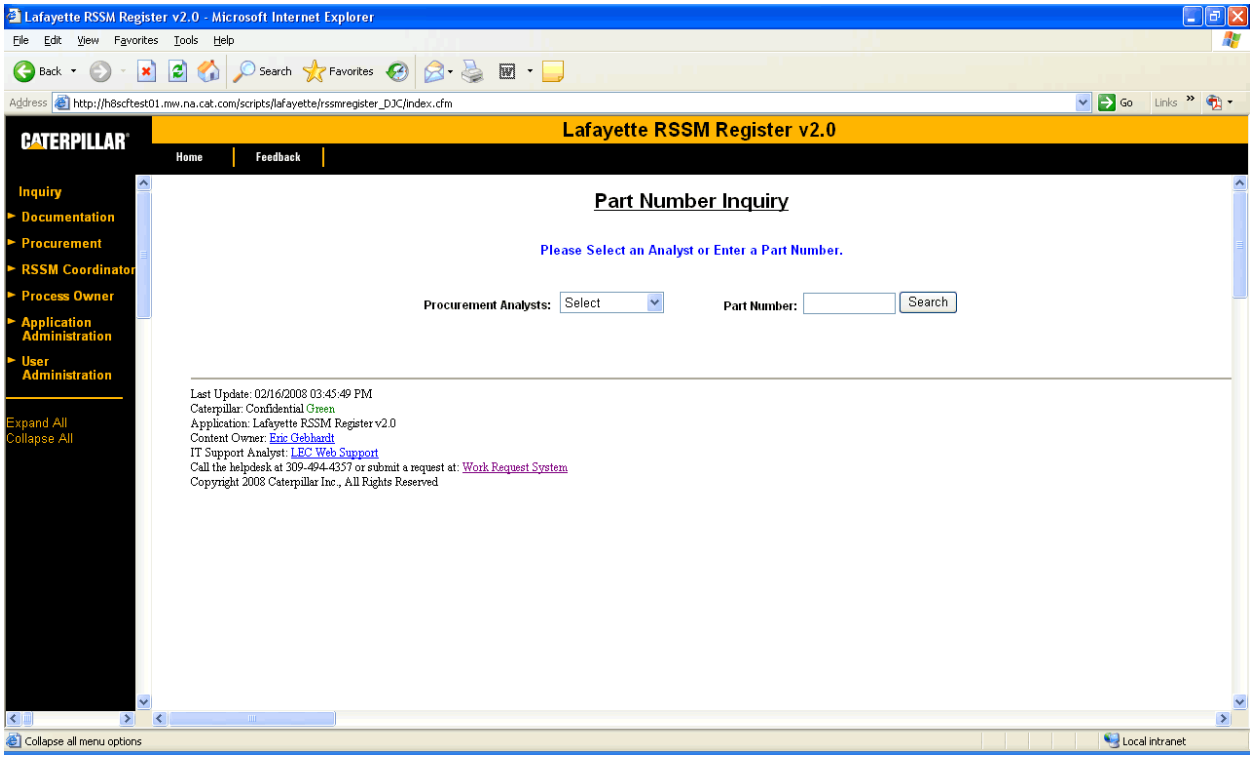


Image 1: Proposed Lafayette RSSM Register Main Page

Along the upper-left of the main page, and for every page within the application, the user is given links to return to the Home (Main) Page of the Lafayette RSSM Register application and to submit feedback to the IT Department regarding application functionality.

Image 2: Home & Feedback Links

The left-hand Navigation will be fully expandable and collapsible, based on the user's pre-established access rights. Images 3 and 4 demonstrate the fully collapsed and expanded navigation, leading the user to desired application functionality outside of the primary two functions within RSSM Register already on the home page.

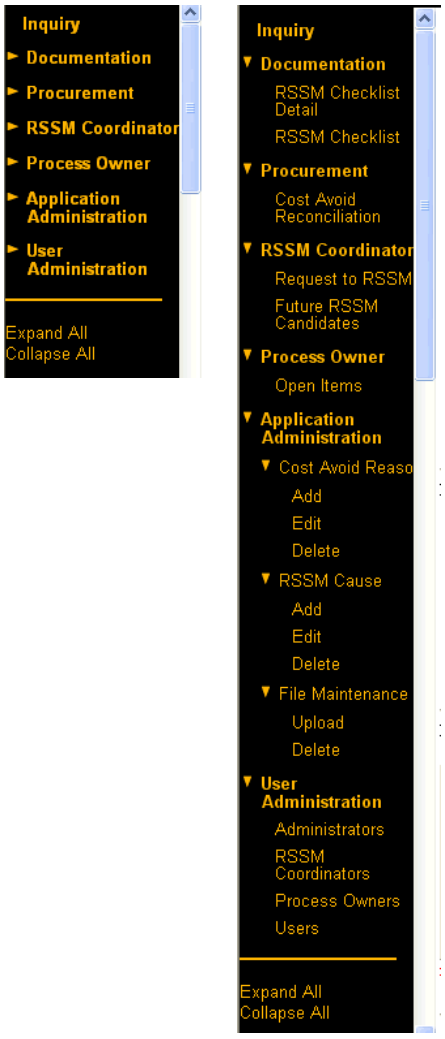


Image 3 and 4: Collapsed and Expanded Navigation Tree

Image 5 demonstrates the proposed reengineered Part Detail window, in which most decisions regarding the part will be made.

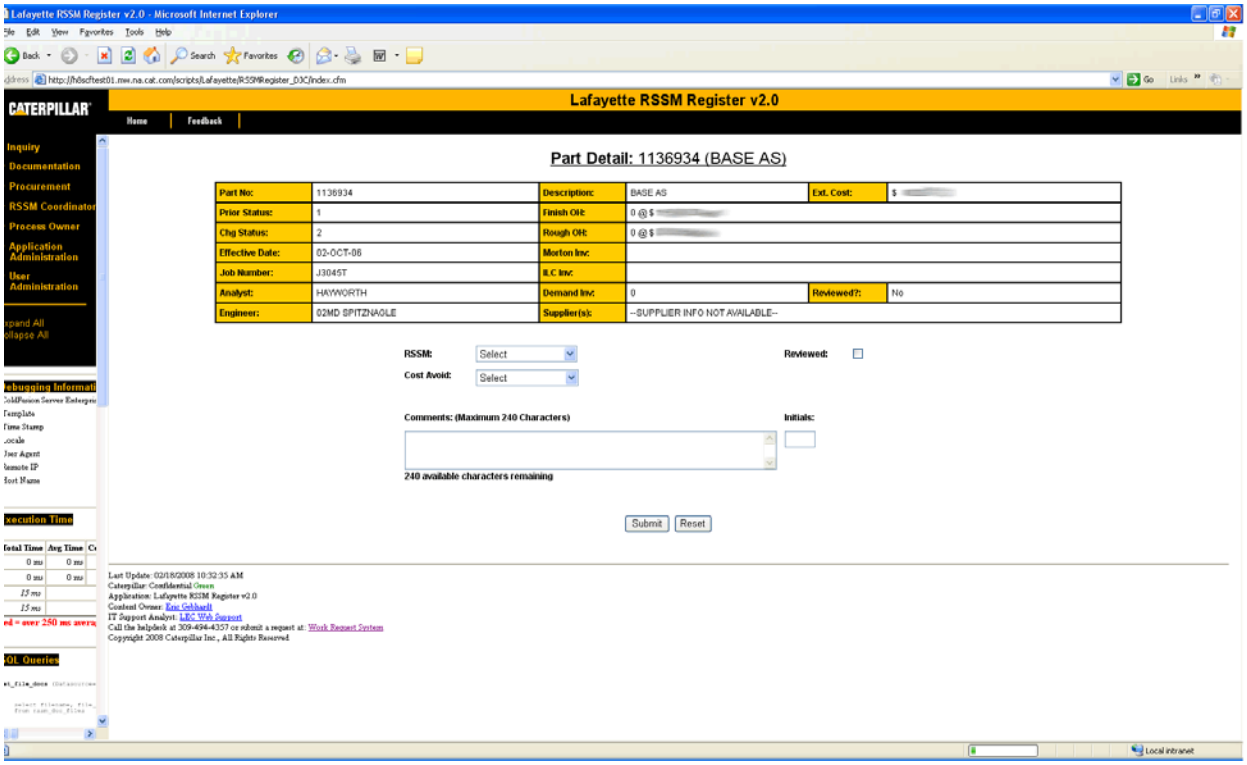


Image 5: Proposed Lafayette RSSM Register Part Detail Page

Images 6 and 7 are two demonstrations of proposed Lafayette RSSM Register message boxes.

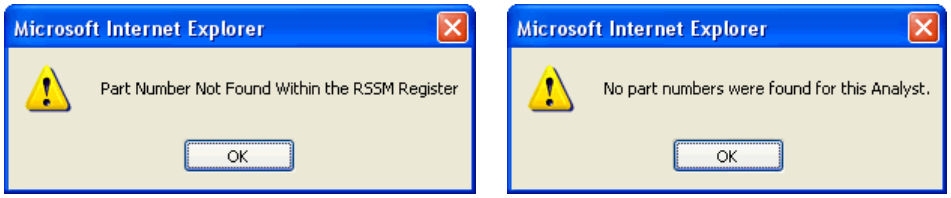
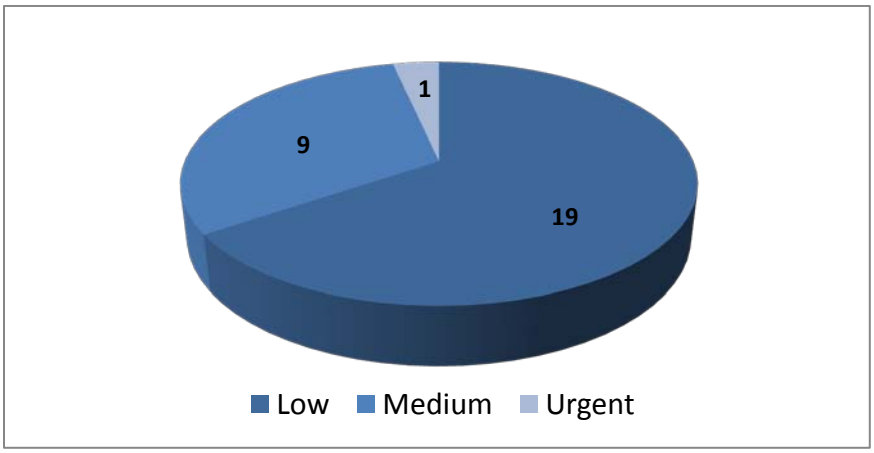


Image 6 and 7: Proposed Lafayette RSSM Register Message Boxes

Appendix L: Heuristic Inspection Feedback

Severity Ratings Summary Chart



Heuristics Feedback Form Results

Dimension	Eval #	Comments	Rating
Visibility of System Status	1	Analyst Part summary – No "breadcrumbs", no direction on what you can do next.	1. Low
	1	Part Detail – No "breadcrumbs". User can enter this page from multiple sources	1. Low
Match system with real world	1	Does the order of the links in the navigation represent the standard process flow?	1. Low
	2	Language used for the most part is appropriate	N/A
	2	"Request to RSSM" screen name does not lead one to know this is the RSSM Reconciliation screen. Rename screen?	2. Medium
	2	Reevaluate User Group names and who will be working with what functions. Rename group names?	1. Low
User Control & Freedom	2	Home button located at top of application – good	N/A
	2	Need to determine what screen resolution to develop at. My resolution is larger, and some columns show wrapped data.	1. Low
Consistency & Standards	1	Navigation says "Inquiry", whereas the screen name is "Part Number Inquiry"	1. Low
	1	Application / User Administration: Links should be consistent with page header title.	1. Low
	2	Month Listings on Future RSSM Candidates and Open Items reports: Lists begin with white line. Cost Avoid and Request to RSSM displays begin with grey line – be consistent in first line color	1. Low
	2	Comment initials are outdated – not required? Could this be retired and replaced with corporate data on user, so user no longer has initials entry?	1. Low
	3	Part Detail Screen: After adding comments of 240 characters, when you view that part again, the comments go past the page width requiring user to scroll right to see all comments and the submitted user initials and the Reviewed checkbox	2. Medium

Error Prevention	1	Users can enter a blank value on the following pages: Cost Avoid Reasons & RSSM Causes	2. Medium
	1	Users can click "Add Selected User" without selecting a name. Disable button?	2. Medium
	2	Blank entry on Admin functions show cryptic message. Should disable button if blank. At least an error message was shown.	2. Medium
	2	If a reason is selected on Part Detail, could other reason category drop-down be disabled until user clears selection?	1. Low
	3	On the Edit RSSM Causes screen, you can click the "Add RSSM Cause" button with nothing typed in the textbox. Database error is displayed – there was an error adding the selected user to the database. The error details information is good, but doesn't match the above error text.	2. Medium
Recognition, rather than Recall	2	"Request to RSSM" screen name does not lead one to know this is the RSSM Reconciliation screen. Rename screen?	2. Medium
	2	Reevaluate User Group names and who will be working with what functions. Rename group names?	1. Low
Flexibility & Efficiency of Use	1	Difficult to bookmark a single page. Should users be able to do this?	1. Low
	3	Feedback Form: If possible, could you already pre-populate the Name & Phone Number of the user?	1. Low
Helps User Recognize, Diagnose, & Recover from errors	1	Unhandled error when using "Request to RSSM" for Part # 2690586 – Investigate!	4. Urgent
	2	Error message when both RSSM and Cost Avoid selections are chosen & submitted: Error message wording could be simpler (see Part Detail screen)	2. Medium
Help & Documentation	2	Documentation on process controlled by user community – good	N/A
	2	Put minimal "Advice" information on both reconciliation screens to inform user on finality of submitting selected part number	1. Low
	3	Upload file "dxva_sig.txt": Received an unexpected error message: No data was received in the uploaded file "dxva_sig.txt". It isn't clear where the files go when uploaded. The file maintenance should be laid out like the RSSM Causes with Remove functionality	2. Medium
Typographic Clarity	1	Column headers are cut off on the "Cost Avoid" and "Request to RSSM" pages	1. Low
	2	Feedback form and action pages do not use consistent look/feel – incorporate standard CSS	1. Low
	2	Re-Review column/line data "groupings" on Part Detail page for better clarity	1. Low
	3	Analyst Part Summary and Cost Avoid Reconciliation screens: The Column Header labels are getting cut off.	1. Low
Download & Response Time Reduction	2	How indexed (normalized) is the RSSM Register's Oracle database and can it be optimized for performance?	1. Low

Appendix M: Usability Testing Data & Questionnaire Results

Single Site Test – Original Application

	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	**Mean per task (sec.)**
Task 1	33	238	37	47	29	**76.8**
Task 2	172	345	108	74	143	**168.4**
Task 3	42	143	42	178	370	**155.0**
Total (sec.)	**247**	**726**	**187**	**299**	**542**	**400.2**

* Note: All numbers in seconds

Single Site Test – Revised Application

	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	**Mean per task (sec.)**
Task 1	38	24	20	29	119	**46.0**
Task 2	74	84	160	85	395	**159.6**
Task 3	110	64	85	51	114	**84.8**
Total (sec.)	**222**	**172**	**265**	**165**	**628**	**290.4**

* Note: All numbers in seconds

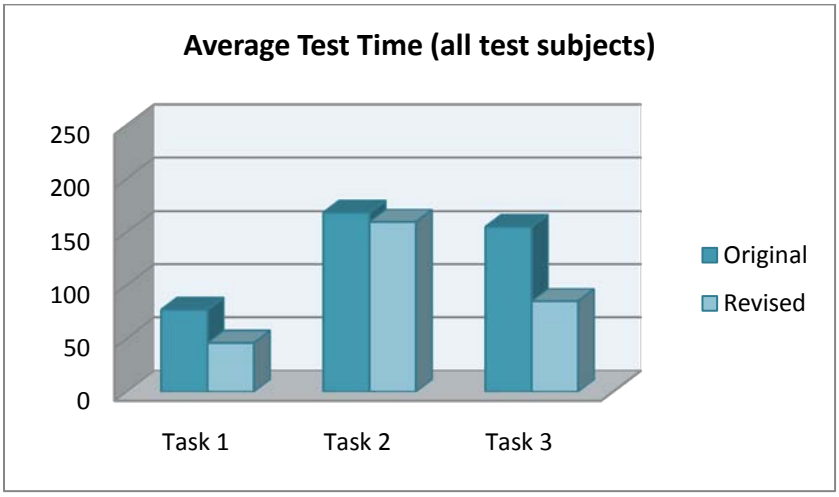
Data Comparison

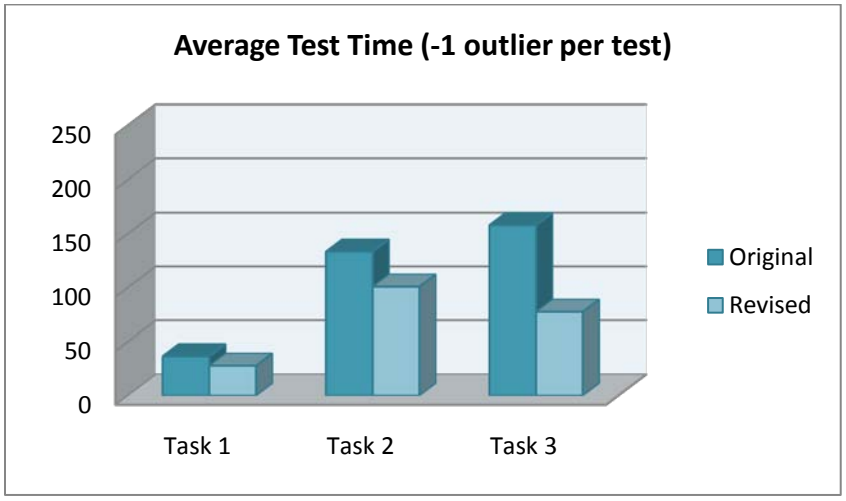
	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	**Mean per task**	**Mean Δ**
Task 1	33	238	37	47	29	**76.8**	**30.8**
O vs. R	38	24	20	29	119	**46.0**	
Task 2	172	345	108	74	143	**168.4**	**8.8**
O vs. R	74	84	160	85	395	**159.6**	
Task 3	42	143	42	178	370	**155.0**	**70.2**
O vs. R	110	64	85	51	114	**84.8**	
Total	247	726	187	299	542	**400.2**	**109.8**
O vs. R	222	172	265	165	628	**290.4**	
Mean	**82.3**	**242.0**	**62.3**	**99.6**	**180.6**	**133.4**	**36.6**
O vs. R	**74.0**	**57.3**	**88.3**	**55.0**	**209.3**	**96.8**	

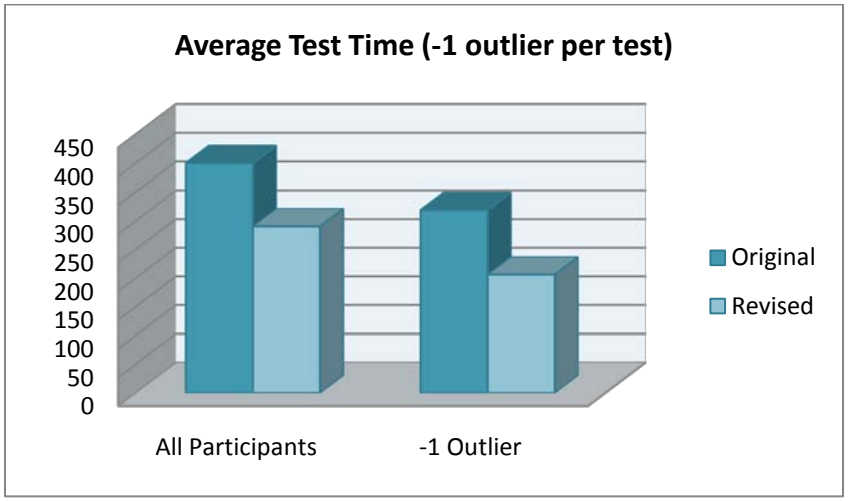
* Note: All numbers in seconds

* Original application numbers highlighted in blue. Revised application numbers highlighted in white.

Usability Test Result Charts







Post-Test Questionnaire and Results

User Number _____
Date: April 3rd, 2008
Application: Lafayette RSSM Register
Evaluator: David Craske

Please answer the following questions based on your experience using the revised Lafayette RSSM Register.

	Question	Strongly Agree (6)	Agree (5)	Slightly Agree (4)	Slightly Disagree (3)	Disagree (2)	Strongly Disagree (1)	Avg. Original	Avg. Revised
1	The language on the Task List you were given was easily understood?	☐	☐	☐	☐	☐	☐	5.2	5.4
2	The amount of information on the home page was adequate?	☐	☐	☐	☐	☐	☐	3.0	5.6
3	The use of color was appropriate?	☐	☐	☐	☐	☐	☐	5.0	5.6
4	Information was grouped consistently?	☐	☐	☐	☐	☐	☐	2.8	5.6
5	The application's navigation was inherently intuitive?	☐	☐	☐	☐	☐	☐	3.0	4.8
6	Colors and navigation was consistent throughout the revised application?	☐	☐	☐	☐	☐	☐	4.2	5.6
7	There was too much or too little information on individual pages?	☐	☐	☐	☐	☐	☐	4.4	1.8
8	There was adequate cross-referencing of topics and information?	☐	☐	☐	☐	☐	☐	3.2	5.0
9	Topic and page headings were self-explanatory?	☐	☐	☐	☐	☐	☐	2.4	5.4
10	It was necessary to scroll often to reach desired information?	☐	☐	☐	☐	☐	☐	4.4	2.6
11	The site's "Part Search" was helpful and reliable?	☐	☐	☐	☐	☐	☐	5.0	5.6
12	The terminology used was understandable throughout the site?	☐	☐	☐	☐	☐	☐	3.0	5.4
13	The text and graphics were presented in a visually aesthetic (pleasing) manner?	☐	☐	☐	☐	☐	☐	4.4	5.6
14	Overall, the pages were quick to load?	☐	☐	☐	☐	☐	☐	5.0	5.0

Overall, on a scale from 1 to 10, how would you rate the revised RSSM Register site based on today's test?

Low									High	Avg. Original	Avg. Revised
1	2	3	4	5	6	7	8	9	10	**5.4**	**9.2**

Please add any comments or suggestions below you feel will help evaluate the usability of the Lafayette RSSM Register application.

Original:

- I think after more familiarity as with any application, it could be usable. I hadn't used the application in a long time, since I hadn't needed to.
- Some of the headings were unclear (too vague). In the application it wasn't always clear which information was required or optional, or if only need to answer one or the other.

Revised:

- Much more user friendly! Really liked the updated layout.
- Easy to find what you needed. Nice revisions. Much clearer.
- I look forward to getting rid of the paper forms and being 100% electronic. This is a great start!

Appendix N: Focus Group Discussion Notes

Topic of Discussion	Notes	Action items
Use of Color	Yellow text on Black background and vice-versa is tough to read	Discuss with Corporate regarding possibly template change?
Use of Color	Primary/Secondary colors are known. Is there a tertiary (3rd level) color recommended for ColdFusion web sites?	Discuss idea with Corporate regarding topic.
Use of JavaScript	The JavaScript that is used to count how many remaining characters the user can put in to a text box is overkill. We can control that more effectively via HTML Form limits.	Possibly remove or at least limit overhead JavaScript, leaving some functionality behind.
File Maintenance screen	Only those people with access to the designated shared drive have ability to move documentation to the drive itself, and then set up links	Come up with more intuitive way to perform the file maintenance functionality, possibly reusing from a previous application.
Part Number justification	Part numbers are stored in database right-justified (due to mainframe standards), whereas some functions within the database trim the lead-in spaces, and leave data left-justified.	Review application for consistency in part number structure.
Drop Down functionality	Some people will attempt to select both drop-downs on the Part Detail, yet only one is needed. Disable one when the other has been set.	Re-review functionality to engineer best way of forcing user to selection one or the other, not both.
Grouping of data	Some facilities have some pieces of part detail, whereas others have more or less detail. How can we design the application to adapt and group part detail information appropriately for all facilities?	Review functionality and discuss with process owners at each facility. Designing something that can be controlled by application administration may be quite difficult.
Resolution	What is the corporate-recommended resolution all applications should be developed at?	Discuss with Corporate before beginning project.