

MSIS 6840  
Information Systems Analysis  
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# Part Number Tracking System

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## PaNTS

**Presented by**

**Group C**

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## **1.0 INTRODUCTION**

### **1.1 Purpose**

This document has been prepared for the Purchasing and Provisioning units of Boeing Company to describe how the *Part Number Tracking System (PaNTS)* project will be accomplished. Our purpose is to present two alternative systems – one cost-effective system and one recommended system – to address the data management issues experienced by these two units.

### **1.2 Project Overview**

Recently, Boeing has experienced an increase in customer orders for large numbers of aircraft parts. These large orders have created new data management problems for the Provisioning and Purchasing units inside the organization. These units are unable to track data changes, generate reports and orders, and do not operate in a secure environment. Our objective is to propose alternative solutions to address this data management problem in order to facilitate the work of the Purchasing department and, ultimately, improve order accuracy.

The challenge of the system resides in the fact that part numbers, supplier numbers, and the part quantities to be ordered change over time. Because the data is changing constantly, this creates problems when the Purchasing unit needs to refer to old part or supplier numbers. Therefore, there is a need to keep track of these changes and provide Purchasing with a way to retrieve historical data. The Excel spreadsheet, that has been used so far to keep track of the data, has worked adequately until now because each order did not contain many different parts. However, since the number of parts per order has significantly increased, the task of tracking this information has become difficult. The Purchasing department does not have any other mechanism to find information than go through the entire spreadsheet one record at a time.

Our objective is to provide Boeing with an alternative system to help the Provisioning and Purchasing units efficiently share data crucial to the ordering process. Our solution was developed with several constraints in mind: the part number and supplier number conventions cannot be changed; there is no current in-house information technology support available to the users of the system; the system must function with one or several of the existing software packages available in the company, namely MS

Office, MS Access, FoxPro, Oracle; the solution must be reusable with similar projects in the future; the process between the two units must remain the same but needs to be more efficient; and the solution should be user-friendly and easy to modify. Our team made a series of assumptions: the system will contain data similar to that provided by the representatives from Boeing; the users have a limited amount of technological expertise; the users are comfortable using technology available within the company; and, given today's business environment, it is fair to assume that the staff members also have access to use a company web server. Finally, the Provisioning and Purchasing units at Boeing reserved no specific budget for this project.

According to Angela Hall, the Boeing representative, staff members in the Provisioning and Purchasing departments are working in a Windows-based system environment and have access to the software previously mentioned. These two units also have access to a shared server, which they currently use to store the Excel spreadsheet.

### **1.3 Recommendation**

As explained above, the problem with the existing system is an issue of data management. The data is extremely volatile and the system does not provide an adequate way to track and control these changes. Furthermore, there is no automated way to query the data, as well as no system security – everybody can access and modify the data – and no standard for data entry. Currently, the Provisioning department collects information on the various parts needed for upgrading or repairing an aircraft, estimates the quantities of parts to be ordered for a specific project or aircraft, and enters this information into an Excel spreadsheet that is stored on a shared server. This information is updated on a regular basis, and as often as necessary. When contacted by a customer, the Purchasing department opens the Excel spreadsheet on the shared server to survey the data and determine the quantities of parts to be ordered [\[see appendix A\]](#).

According to the results of a survey conducted with the Provisioning and Purchasing staff members [\[see appendix B and C\]](#), not finding the correct part number is one of the major reasons why the Purchasing staff is unsatisfied with the current system. Staff members are never certain that the information displayed in the Excel spreadsheet is correct. This has resulted in too much time being spent

trying to confirm the part numbers, the part quantity's accuracy, or the accuracy of orders. Parallel to this claim, the Provisioning staff members indicated in the survey responses that it was "very difficult to maintain accurate records" and that "much time [was] wasted trying to maintain good records". The questionnaire identified another issue that was taken into account when proposing alternatives: the slow response time of the current system. According to the survey results, the most important characteristics that should be included in a new system are "multi-user access to the data", "easy identification of new part numbers", and "access to pre-determined queries and reports". One staff member commented that the ability to communicate changes to all users, as well as the elimination of redundancy, was crucial.

Given these facts, it is our recommendation that the Excel spreadsheet be eliminated and a new system developed. In the next section we will present two alternatives for a new system: an MS Access-based alternative, and an Oracle/Web-interface alternative. It is also our recommendation that the Provisioning and Purchasing units adopt the second alternative for reasons that will be reviewed in this report.

## **2.0 – NEW SYSTEM DESCRIPTION**

### **2.1 Alternatives**

Based on the client's requirements and the analysis of their current database system, two alternatives were developed [\[see appendix D\]](#). The first alternative, Alternative 1, uses MS Access as a front-end interface and back-end database of the system. The second alternative, Alternative 2, uses a Web interface as a front-end and an Oracle database as a back-end.

**Alternative 1:** An MS Access database is built and placed on the existing shared server, while each desktop is set up with an MS Access document linked to the copy on the server. In effect, this alternative is close to the Excel spreadsheet solution, but offers additional advantages. MS Access supports multiple users and allows users to query the data, and run reports. Furthermore, the software is already available within the organization on most desktops and can connect to most mainstream enterprise DBMS easily. The embedded VBA engine can be easily used by developers to build sophisticated functions or user interfaces.

However, there are some limitations to this alternative. MS Access works best for individuals and work groups managing small amount of data. The total data capacity for an MS Access file is limited to 2 Gigabytes.<sup>1</sup> As mentioned previously, the staff members of the Provisioning and Purchasing units identified the “slow response time” of the system as one of the major frustrations they had with the current system. We believe that MS Access does not provide them with a rapid response time due to the large amount of data with which they are dealing. According to Clearform Software, a database technology solutions company, performance will decrease as *“you reach a volume of approximately 25,000 records. Performance will decrease even further as you add more records and/or additional concurrent users.”*<sup>2</sup> Since we know that Provisioning and Purchasing are already dealing with over 10,000 records, MS Access does not offer enough flexibility for expansion in the future. Furthermore, MS Access uses a file-server architecture, rather than client-server architecture, which does not promote flexibility and may generate data corruption. Finally, although MS Access can support multi-users, it is most appropriate when dealing with a small amount of data in a single user (or few users) environment.

It is worth noting that the interface to this alternative can also be developed in VB, VC/C++, or any other development tools, instead of MS Access. However, this solution would mean additional investment since the client does not possess such development tools. Moreover, since there is no professional IT staff available to maintain the application, it would be difficult for the Provisioning or Purchasing staff members to maintain this interface. This explains why we did not retain this option in Alternative 1.

**Alternative 2:** As stated before, this alternative involves using a Web-based interface as the front-end of the system with an Oracle database at the back-end. This solution allows the system to be used across Unix, PC, as well as Macintosh platforms, and adds the characteristic of making the data accessible remotely. Furthermore, a Web-based interface does not require specific software on the client machines, except for a Web browser, which is free and widely available nowadays. ColdFusion could be

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<sup>1</sup> Chigrik, A., [A Comparison of SQL Server 2000 with Access 2000](#), May 14, 2003, viewed on November 29, 2003.

<sup>2</sup> [http://www.clearform.com/microsoft\\_access.htm](http://www.clearform.com/microsoft_access.htm) viewed on November 29, 2003.

used to develop the Web pages, but other technologies such as ASP, JSP, and PHP can also be considered.

Oracle seems to be the natural choice of selection for this large database with constantly changing data. Indeed, Oracle can easily migrate data over from MS Excel or even MS Access. Not only can Oracle migrate data, but it can also use existing Access queries and forms, making users already familiar with MS Access productive even on the Oracle platform without having to learn all of the intricacies of Oracle programming. The Oracle Database uses ODBC so it can be accessed via any front-end. Oracle also supports all known platforms, including Windows-based platforms, which is advantageous for future growth. Oracle also provides the benefits of data recovery and is also particularly well suited to provide system security to the units. Oracle is a robust and secure database that is ideal for use in a large organization like Boeing. Furthermore, according to Angela Hall, both the Purchasing and Provisioning units already have access to the company's enterprise Oracle database, allowing them to use the database without additional cost.

**Conclusion:** These two alternatives provide Boeing with solutions that allow the Provisioning and Purchasing units to track data changes, query the data and run reports on the data. Both solutions also provide a certain level of security so that only appropriate staff members can have access and/or modify the data, and establish data definition standards. Alternative 1 is cheaper to develop, but has serious disadvantages: the lack of portability and accessibility, as well as limitations in size and multi-user access. Alternative 2 not only offers cross-platform independence and complete accessibility, but it also looks toward the future and provides enormous growth potential for the company within its vision. The next section explores Alternative 2 in detail.

## **2.2 System Description**

As stated before, our recommended solution promotes the use of a shared Oracle database in a multi-user computing environment. The Oracle database is located on a secure server and is only accessible to users via a Web interface. In this configuration and per the requirements identified previously, the processes between the Provisioning and Purchasing staff members do not change. The Provisioning department enters the information that is gathered from various sources in the database,

and the Purchasing department staff accesses this information to generate orders. However, this solution provides the Provisioning and Purchasing staff members with multiuser access to the data, and a means to track data changes, and generate queries and reports.

Because Oracle offers excellent transaction management and concurrency control, it ensures the integrity of the data stored in the database, and provides staff members with a safe multi-user database environment. Additionally, in case of human errors or system failures due to internal or external reasons, the proposed system ensures that backup measures are in place and data can be restored to its previous state. For example, changes made to the data are automatically recorded in a transaction log, which allows for any particular change to be undone. This solution includes a back up program built into the system in order to ensure transactions recovery.

The database also provides users with the ability to efficiently manage the data, search for specific parts, run queries, and generate reports. This solution will make the entire information flow process much smoother than the present system does. In generating reports, the system allows for customized department-specific reports using the data provided. Keeping future growth aspects in mind, the system is ODBC compatible so it can be linked to any program that follows the industry standard. Part number tracking is made easy by means of specific tools that the system provides for searching part numbers and viewing the entire number change history of any part. Since these part number changes can involve a significant amount of data over the years, a robust database system is recommended, that can handle the volume of data even a couple of years down the road. Its ability to expand and serve as an enterprise level database is highly desirable as well.

In addition to addressing specific users' requirements, Alternative 2 also provides users with added security features, such as password-based schemes. In order to be secure, password-based schemes must ensure that passwords can be changed regularly, are of sufficient complexity, and cannot easily be guessed. Access control deals with the concept of who has access to what information and what types of operations can be accessed. A good database system should enforce the Principle of Least Privilege - that is, granting only privileges that allow users to perform their job functions, but not more. The database is secured by means of user level access and the ability to update the data will be given

only to persons who require it. These rights are also provided on a restricted basis and people are only able to read, write, and modify the components of the database to which they are given access. This reduces chances of errors, as well as allows for better concurrency of the database.

On the front end, users are able to interact with the database with easy to use and intuitive input and output screens. As stated above, the program is secured by providing each user login access. Depending on the user rights, a person is given access or denied access to parts of the program. The program is the single point of data entry for modifications made to the database. This ensures accuracy and consistency of the database and reduces the possibility of duplication, omission and other common errors. The program also allows users to generate customized reports and design specific queries to meet their departmental needs. This was not possible with the existing Excel-based system and is a value added feature of the new system.

In conclusion, the system makes the entire process of finding part numbers, adding part numbers and tracking part number changes much easier. It is optimized for speed and accuracy in order to reduce the time currently spent by users in manipulating parts data and adds value to the entire process [[see appendix E and F](#)].

### **3.0 – FEASIBILITY ASSESSMENT**

#### **3.1 Economic Analysis**

When evaluating the economic feasibility of the proposed alternatives, our major concern was to provide Boeing with a solution that would not be a “quick fix” to their current data management problem, but would be a system able to grow in the future to support the company's business objectives and goals of expansion.

Although Alternative 1 is more cost-effective in the short term, we believe that on a long-term basis it will be more costly since the company will have to redesign the system when it reaches full capacity. Although MS Access is already installed on the organization's desktops and employees are used to working with this software, investing in a system based on MS Access provides a temporary solution to current problems. On the other hand, Alternative 2, using an Oracle database with a Web front-end, is a

long-term solution in terms of allowing for system upgrades and expansion. The system would be able to grow with the business without requiring Boeing to invest in the development of a completely new system in a few years. As we have seen in the previous section, Oracle has the flexibility and robustness to support Boeing's business expansion and vision.

The difference in initial costs between Alternative 1 and 2 amounts to \$10,700. The phases required in the development of both solutions are very similar except for the work on the desktops that are unnecessary for Alternative 2 since a Web interface is used. However, Alternative 2 requires more programming work because of the Oracles database and the Web interface. Another point of difference between the two alternatives is training. Since Alternative 1 uses a software program, MS Access, with which employees are familiar, it requires less investment in training. Because Alternative 2 is more complex than Alternative 1, more investment is anticipated for the correction of the system and the management of the project in general. Table 1, below, summarizes the initial costs of both alternatives. [For a complete analysis of the project's initial costs, recurring costs, and tangible Benefits, please refer to appendix G].

**Table 1: One-time Costs for Alternative 1 and 2**

<b>Items</b>	<b>Attendant</b>	<b>Alternative 1</b>	<b>Alternative 2</b>
DB Analysis/Design	DB Designer/Analyst	\$4,000	\$8,000
Function and UI Analysis/ Design	Programmer/Analyst	\$9,000	\$12,000
Setting up Servers	DBA/ System Administrator	\$150	\$600
Setting up 10 user desktop	Systems Engineer	\$750	
Data Migration	DBA	\$300	\$300
Training (10 end users' training)	System Engineer	\$1,000	\$2,000
Testing	Testing Analyst	\$625	\$625
System Correction	DBA/Programmer	\$4,500	\$6,000
Project management	Project Manager	\$3,000	\$4,500
<b>Total:</b>		<b>\$23,325</b>	<b>\$34,025</b>

Recurring costs between the two alternatives also present some differences. Less investment will be required to maintain a database in MS Access, but the Web interface presents the advantage of avoiding the task of updating each and every user's desktop. However, the Oracle database will require more update and maintenance on the server. More training is also required since each new user will have to be trained in order to use the new web interface, whereas it is likely that a certain number of new employees will be familiar with MS Access. Recurring costs are summarized in table 2 below.

**Table 2: Recurring Costs for Alternative 1 and 2(year 1 through 5)**

<b>Items</b>	<b>Alternative 1</b>	<b>Alternative 2</b>
Application software maintenance	\$1,500	\$2,250
Setting up Servers	\$150	\$600
Setting up users' desktop	\$750	
Training	\$500	\$1,000
<b>Total:</b>	<b>\$2,900</b>	<b>\$3,850</b>

When looking at the tangible and intangible benefits of both alternatives, Alternative 2 is more advantageous than Alternative 1. Table 3, below, summarizes the annual tangible benefits for both alternatives. To calculate the tangible benefits, we estimate that approximately 2 hours per week are saved in managing data with a new system, which results in a saving of approximately 100 staff-hours a year. Since we were given the number of \$60 an hour by the client to use for the Provisioning and Purchasing units' employees, we estimate the "Cost reduction or avoidance" to be \$6,000 for each alternative. Furthermore, since the client shared with us that they are experiencing an average of 2 mistakes per week, we estimate the "Error reduction" benefits to be in the range of 1 staff-hour per two weeks for Alternative 1 and 1 staff-hour per week for Alternative 2, at a rate of \$60 an hour. The difference resides in the fact that MS Access locks at the record-level, compared to lower level locks with Oracle resulting in more flexibility and more time saved. The savings in "Increased speed of activity" are also estimated to be in the range of 2 hours per week since staff members do not have to worry about who is accessing the database anymore, as they did with the Excel spreadsheet, therefore finding the data faster and more efficiently than before. Alternative 1 is more efficient as far as training is concerned and requires less user training than Alternative 2. We estimate a requirement of 1 hour of training per user for Alternative 1, compared to 2 hours of training per user for Alternative 2. During the client's presentation, it was mentioned that approximately 10 people were using the system. We used this number to calculate the savings in training: the tangible benefits of Alternative 1 is equal to half of the training costs for Alternative 2, or a total of \$1,000. "Management planning and control" savings represent the time saved by having access to reports that are necessary to complete work more effectively, such as how much information changes, who changes it, and supplier information. We estimate this savings to be in the range of 2 staff-hours per week, at a rate of \$60 an hour. Since Oracle

databases are more stable and robust systems, the savings realized with Alternative 2 in terms of “Cost avoided because of an incorrect Order” are twice the savings realized with Alternative 1.

**Table 3: Annual Tangible Benefits for Alternative 1 and 2 (year 1 through 5)**

	<b>Alternative 1</b>	<b>Alternative 2</b>
Cost reduction or avoidance	\$6,000	\$6,000
Error reduction	\$1,500	\$3,000
Increased speed of activity	\$6,000	\$6,000
Less training necessary to use Access	\$1,000	-
Improvement in management planning or control	\$6,000	\$6,000
Possible Cost for an Incorrect Order that would be Avoided	\$5,000	\$10,000
Other		
<b>Total:</b>	<b>\$25,500</b>	<b>\$31,000</b>

When comparing the two Alternatives' Feasibility Studies [see appendix H] we see that both have a quick break-even and have good Return On Investments (ROI) variables. For both Feasibility Studies we use a discount rate of 10% to calculate our Present Value (PV) on the economic benefits and recurring costs. This rate of 10% is based on the assumption that Boeing would be able to profit that much on an investment elsewhere. From the Feasibility Studies we can see that each Alternative gives us an overall Net Present Value (NPV) in the \$60,000 range, which is very positive for this size of an investment. The ROI of each alternative is also very good, with #1 coming in at 1.82 and #2 coming in at 1.42 – any ROI that is above 1 should be considered a good investment. Finally, we get a break-even on each alternative in the second year, another positive financial indicator. As far as the Feasibility Studies go, both alternatives are a positive investment for Boeing.

### **3.2 Technical Analysis**

As a whole, we do not believe that this project holds a high percentage of technical risks for the Provisioning and Purchasing units of the Boeing company. In the section below, we identify several risks connected with the users, the new system, and the queries and reports generated by the new system. We present these risks grouped under the following framework: project size, project structure, development group, and user group.<sup>3</sup>

1. Project size – only a small number of units are involved in the development of the new system: Provisioning, Purchasing, and, possibly, a few staff members from the technology department.

<sup>3</sup> Hofner, J., George, J., Valacich, J., Modern Systems Analysis and Design, Pearson Education, 2002.

Although there is more programming involved with Alternative 2 (approximately 160 hours compared to 100 hours for Alternative 1), the size of the programming effort is still manageable and does not present any significant challenges.

2. Project Structure – given the structure of the existing system, a whole new system needs to be developed. However, we do not anticipate a real “organizational, procedural, structural, or personnel”<sup>4</sup> impacts on the departments’ staff since the work processes will not be changed. According to the questionnaire that was filled out by the employees of the Provisioning and Purchasing units, it seems that the users of the system will be very receptive to a new system that will allow them to perform their work more rapidly and effectively. Therefore, we do not anticipate any resistance from the users and know that management is committed to the development of a new system. Furthermore, because we feel we were able to identify clear requirements from the information gathered during client interactions, we believe that the new system is fairly simple and easy to use, addresses the users’ requirements, and is not confusing to the users.
3. Development group – we believe that this is the only high-risk factor in the PaNTS project. Since no IT staff is currently available for this project, the two units have the choice between outsourcing parts of the project, training their staff in order to complete the project, or convincing the top management at Boeing to finance the PaNTS project because of its significant benefits highlighted in the previous section. We believe that resources for this project should be relatively easy to secure to outsource. Therefore, it is highly unlikely that IT expertise will be needed to complete the project within the company, although it is certainly available among the Boeing IT group.
4. User group – as previously mentioned, considering the current business environment, we assume that all users of the new system will be familiar with using a Web browser and do not anticipate any risk with the choice of this interface. We also do not anticipate any problems with the use of the new Oracle database since the Boeing IT group is familiar with Oracle products. We do not know how much familiarity the current staff members have with the systems development process, but we do not anticipate any problems occurring with a project of this size if outsourced.

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<sup>4</sup> Hofner, J., George, J., Valacich, J., Modern Systems Analysis and Design, Pearson Education, 2002.

According to the above analysis, we estimate the size of the project to be relatively small and the technical risk of the project to be very low [\[see appendix I for a summary of risk factors\]](#).

### **3.3 Operational Analysis**

The proposed system in Alternative 2 will support Boeing Corporation's Vision 2016 of "People working together as a global enterprise for aerospace leadership," and the strategy to "Leverage strengths into new products and services." The system will do this by positioning Boeing to offer better service, obtain better supplier deals, reduce errors, and increase profits by better managing provisioning and purchasing – while creating a system that can be used world-wide. The Cost Benefit Analysis for the proposed system shows very low initial cost and maintenance in relation to the tangible and intangible benefits. With this system the initial costs are going to be under \$35,000 with recurring costs under \$4,000. Over a five-year period this would amount to under \$50,000 of overall costs. The intangible benefits of creating a world-wide system, with greater error reduction, able to handle many more airplane projects offset this cost. The tangible benefits that we would realize are the savings of work hours each year and the possible loss of profits from incorrect orders. Therefore the new system aligns the Provisioning and Purchasing units to better serve their clients while making their work more efficient and cost effective.

We recommend that Boeing proceed with this project immediately. This new system will allow the Provisioning and Purchasing units to expand in assisting other airplane lines and compile all the purchase orders together. This will position Boeing to offer better service, obtain better deals with suppliers, reduce errors as they expand, and increase profits by better managing provisioning and purchasing. This new system will help the Provisioning and Purchasing units to support the Boeing Company's Vision 2016 strategies, core competencies, and values.

### **3.4 Schedules, Timeline, and Resource Analysis**

We estimate that the new PaNTS project, following Alternative 2, can be designed and deployed within a time range of 5 months to 1 year, depending on delays incurred at the various stages of the project. Four phases have been identified: 1) database analysis and design, 2) function and user interface analysis and design, 3) deployment, and 4) system testing and correction. Training and project

management are two activities that will occur on a continual basis during the life of the project. Regarding resource allocation, we estimate that 24% of the budget will be allocated for database analysis and design, 35% for function and user interface analysis and design, 2% for deployment (setting up the server and migrating the data), and 19% for testing and correcting the system. User training will take up 6% of the budget, and project management 14% [see table 1 in section 3.1 Economic Analysis]. In terms of number of hours of consultants commitment to the project, we estimate that a total of 160 hours should be spent on the analysis and design of the database and user interface, 9 hours on server set up and data migration, 20 hours on user training, 45 hours on testing and system correction, and 30 hours on project management [see appendix J].

Given these facts, the schedule plan of completing the PaNTS project within a range of 5 months to 1 year should be feasible.

#### **4.0 – MANAGEMENT ISSUES**

##### **4.1 Project standards and Procedures**

The success of the new PaNTS system will be measured in the following ways:

- Survey and measure both the Provisioning and Purchasing units to ensure they are saving time (work hours) thanks to a better management of the data.
- Survey both units to ensure that they better understand the data.
- Measure if the Purchasing unit has been able to save money by better bunching orders with the managed data.
- Measure if the number of duplicated and incorrect purchase orders has decreased with the new system.

The project will be finished when the new data structure and the two interfaces for the Provisioning and Purchasing units are completed. Enhancements or additions to the data structure and interfaces will have to be made after the initial completion of the project.

#### **5.0 – CONCLUSION**

At the beginning of the report, we stated that our objective was to present the Provisioning and Purchasing units at Boeing with two alternative solutions to address their current database problem in order to improve their business performance and facilitate their work. However, we believe that Alternative 1, based on MS Access, does not provide the units with the performance, robustness, and flexibility that are required for a large company such as Boeing. Alternative 2 offers an effective way to track changes in part numbers, supplier numbers, and quantities to order, while providing the users with pre-determined queries and reports. However, the Oracle/Web-interface solution provides more flexibility and power. It offers multi-user access, faster decision-making, data integrity, data security, the ability to investigate more alternatives, and more timely information. Another significant difference between the two alternatives resides in the growth potential and stability of Alternative 2, which will be able to support the business objectives and goals of Boeing's Provisioning and Purchasing units, and align these units with the business goals and objectives of the Boeing Corporation. This solution is also re-usable and would not require the creation of another separate database for each project. Another major benefit of Alternative 2 is its platform independence and portability. Any user connecting with a web browser can have access to the Oracle database, as long as the user has appropriate security clearance. We believe this is a definite advantage when the system will grow.

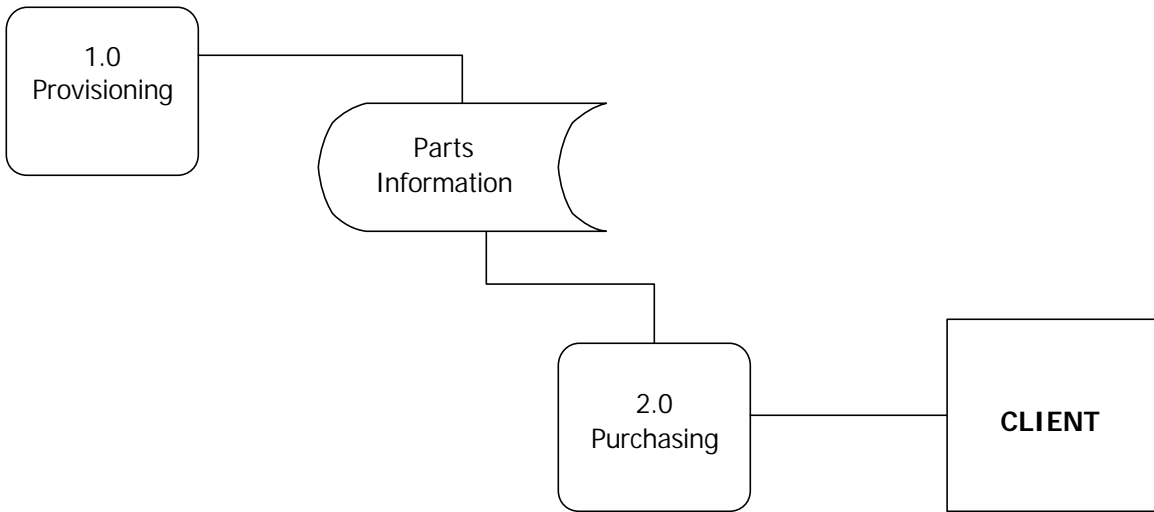
It is our recommendation that the Provisioning and Purchasing units of the Boeing company adopt Alternative 2: a system comprised of an Oracle database as a back-end and a Web-based interface as a front-end. Although Alternative 1 is less costly in the short-term, it is a temporary solution that does not allow for system growth. Alternative 2 is the path to expansion and the future, aligning the two units with Boeing's larger business goals.

## Appendix A – Data Flow Diagram of Current System

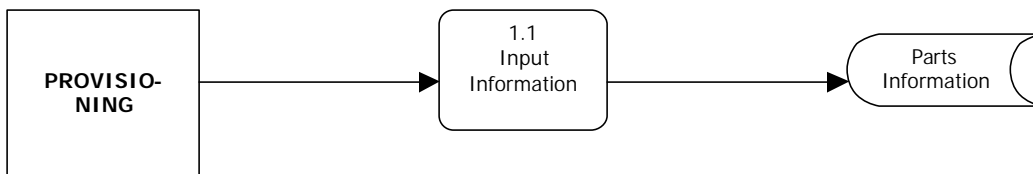
### Context Diagram



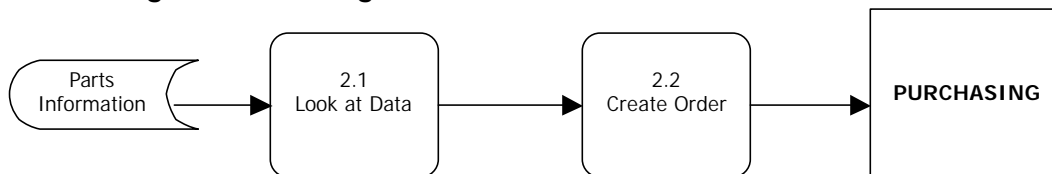
### Data Flow Diagram Level 0



### Data Flow Diagram Provisioning Unit – Level 1



### Data Flow Diagram Purchasing Unit – Level 1



## Appendix B – Questionnaire

The following questions are intended to help our group identify your needs in our efforts to develop a new part number tracking system. Your responses will be used to generate requirements for this new system. Please check the boxes as directed and type your comments in the text boxes provided. There is no size limit for your comments.

1. Which department do you work for?  
 Purchasing                       Provisioning
  
2. To manipulate data, which interface would you be most comfortable using?  
 Web browser (like Internet Explorer or Netscape)  
 Windows Program (like MS Access or Excel)  
 Text based program (entering text one line at a time)  
 Others: \_\_\_\_\_
  
3. If working with MS Access, do you find it easy to work with this software? (Evaluate on a scale of 1 to 7: 1 being the least important and 7 being the most important)  
 1                       2                       3                       4                       5                       6                       7
  
4. If you had to choose between "speed" and "visual good looks" in a program, which one would you choose (please select only one)?  
 Speed                       Visual good looks
  
5. Which of the following features do you feel most comfortable with when working with data (please select only one)?  
 Radio buttons (☉)                       Text boxes (a field where you write in your answer)  
 Check box (☒)                       Others: \_\_\_\_\_
  
6. Do you use kit numbers when working with the spreadsheet:  
 Yes                       No
  
7. Is it important to differentiate kit numbers from part numbers? (Evaluate on a scale of 1 to 7: 1 being the least important and 7 being the most important)  
 1                       2                       3                       4                       5                       6                       7
  
8. What is the most unsatisfying issue that you are concerned about with the current "parts number tracking system process" (please select only one)?  
 Slow response time                       Not finding the correct part number  
 Not able to change records                       Inability to generate reports  
 Not knowing the relationships between part numbers  
 Others: \_\_\_\_\_
  
9. If there is a chance for building a brand-new "parts number tracking system", what are the most important characteristics you think the new system should have?  
 Multi-user access to the data                       Easy identification of new part numbers  
 Access to pre-determined queries and reports                       Ability to generate ad hoc queries and reports  
 Others: \_\_\_\_\_
  
10. Have you had any experience with maintaining a web site?  
 Yes                       No  
If yes, explain: \_\_\_\_\_
  
11. Can you describe the process you use to track the parts numbers, and how it influences your job?  
\_\_\_\_\_
  
12. If working for Provisioning, how often do you open the spreadsheet and have a read-only message?  
\_\_\_\_\_
  
13. If working for Provisioning, which information sources do you use to enter data in the Excel spreadsheet?  
 Internal Drawings                       Client Information  
 Vendor Information                       Other Sources: \_\_\_\_\_

Please return this questionnaire to Isabelle Mertha at [imertha@earthlink.net](mailto:imertha@earthlink.net),  
No later than Tuesday, November 18.

Thank you for taking the time to fill out this questionnaire.

## Appendix C – Survey Results

### Question 1

Purchasing: 5 responses  
Provisioning: 2 responses  
Total: 7 responses

### Question 2

Preferred Interface:  
Web browser: 5 / 7  
Windows program: 7 / 7  
Text based program: 0 / 7  
Others: 0 / 7

### Question 3

MS Access – easy or not:  
Level 7 5 / 7  
Level 5 2 / 7

### Question 4

Speed 7 / 7  
Visual good looks 0 / 7

### Question 5

Preferred features:  
Radio Button: 0 / 7  
Check box: 0 / 7  
Text boxes: 7 / 7  
Others: 0 / 7

### Question 6

Do you use kit numbers?  
No: 7 / 7

### Question 7

Is it important to differentiate kit numbers from part numbers?  
Level 1: 7 / 7

### Question 8

Unsatisfying issue?  
Slow response time 5 / 7  
Not able to change records 1 / 7  
Not knowing the relationships between part numbers 2 / 7  
Not finding the correct part number 4 / 7  
Inability to generate reports 1 / 7  
Others: very difficult to maintain accurate records (provisioning staff); much time wasted trying to maintain good records (provisioning staff);

**Question 9**

Most important characteristics of a new system:

Multi-user access to the data 77  
Access to pre-determined queries and reports 5/7  
Easy identification of new part numbers 7/7  
Ability to generate ad hoc queries and reports 2/7

Others: Ability to communicate changes to all users, elimination of redundancy (provisioning staff);

**Question 10**

Experience with maintaining a web site?

Yes 1/7

No 7/7

(Someone answered yes and no)

**Question 11**

Description of process:

I enter data into the spreadsheet, and then enter changes. It becomes difficult if there is more than one change per part number.

Part numbers are tracked on the spreadsheet. Additional columns are added as required. This is not a good system, but it does show part number change history.

It is a spreadsheet system that quickly becomes very complicated. Tracking is very difficult.

Most tracking is done on a spreadsheet, but often email and phone calls are required.

At this time I just look at the spreadsheet. If there are changes I may not know about them.

Part numbers are sent to me on a spreadsheet. I often have to email corrections back when a supplier tells me that part numbers have changed.

Part numbers are tracked on a spreadsheet. Changes are not always known.

**Question 12**

If working for Provisioning, how often do you open the spreadsheet and have a read-only message?

Not applicable. I have my own master spreadsheet from which to work.

**Question 13**

If working for Provisioning, which information sources do you use to enter data?

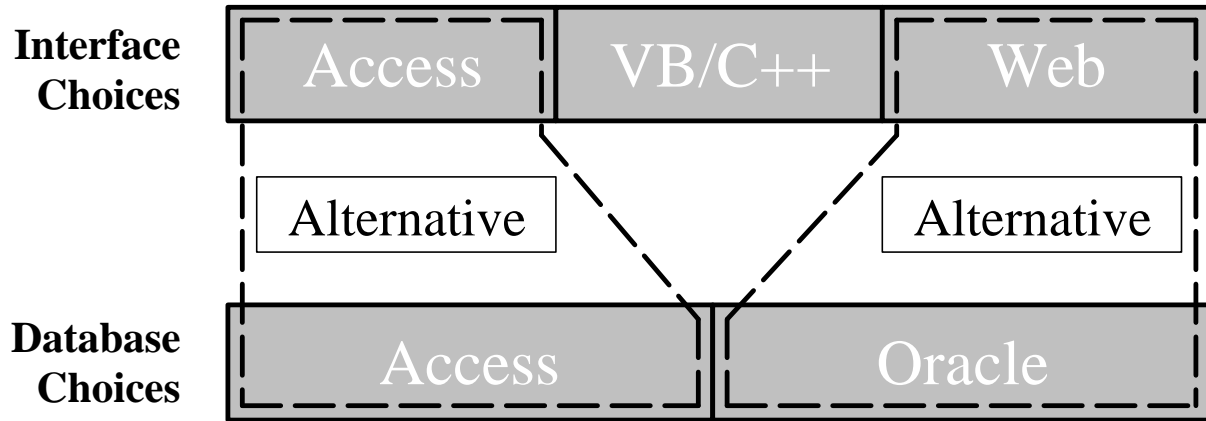
Internal drawings 2/2

Vendor information 2/2

Client information 2/2

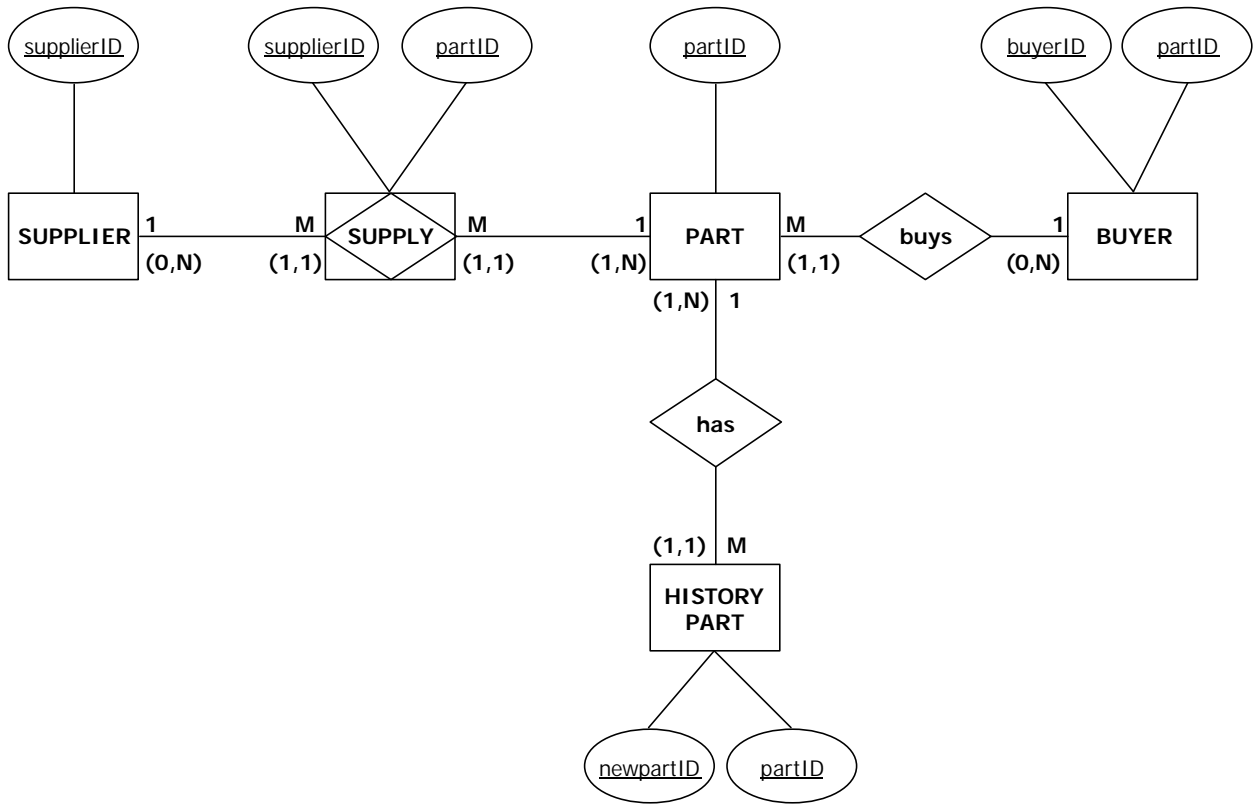
Other sources: information directly from design engineering; feedback from the buyers in purchasing.

Appendix D – Alternative Solutions



- |              |   |   |
|--------------|---|---|
| <b>Pros:</b> | <ul style="list-style-type: none"> <li>• On users PC</li> <li>• Run own reports</li> <li>• Low costs &amp; maintenance</li> </ul> | <ul style="list-style-type: none"> <li>• Cross platform</li> <li>• Growth potential</li> <li>• Accessible anywhere</li> <li>• Lower PC power</li> </ul> |
| -----        |   |   |
| <b>Cons:</b> | <ul style="list-style-type: none"> <li>• Growth limitations</li> <li>• Windows only</li> <li>• Higher PC power needed</li> </ul>  | <ul style="list-style-type: none"> <li>• Need I.T. support</li> <li>• High costs &amp; maintenance</li> </ul>   |

## Appendix E – New System Entity-Relationship Diagram



## Appendix F – Data Dictionary

The following is the data dictionary depicting the database for the proposed project. The information for all five tables is shown below.

Primary Keys are marked in BOLD Text and Foreign Keys have been Underlined.

Part Table – This table stores all the information about a Part, as well as its number change history.

FIELD NAME	DATA TYPE	SIZE	DESCRIPTION
<b>PartID</b>	Number	9	Old Part ID
<u>NewPartID</u>	Number	9	New Part ID (if there is none, leave as 0)
PartName	Text	25	Name of the Part
PartDesc	Memo	Memo	Description of the Part
InstallNotes	Memo	Memo	Installation Notes for the Part
PartAddedDate	Date/Time	Date/Time	Date the Part was added to the database
PartAddedTime	Date/Time	Date/Time	Time the Part was added to the database
PartAddedBy	Text	3	Initials of the Person who added the part
<u>BuyerID</u>	Text	9	The unique ID of the Buyer who bought the part
LastModifiedDate	Date/Time	Date/Time	Date the part was last modified
LastModifiedTime	Date/Time	Date/Time	Time the part was last modified
LastModifiedBy	Text	3	Initials of the Person who last modified the part.

Buyer Table – This table stores all the information about a Buyer

FIELD NAME	DATA TYPE	SIZE	DESCRIPTION
<b>BuyerID</b>	Text	9	Unique ID representing the Buyer
<u>PartID</u>	Number	9	Unique ID representing the Part
BuyerName	Text	25	Name of the Buyer
Date	Memo	Memo	Date of the Transaction

HistoryPart Table – This table stores all the necessary information required for Part Substitutions.

FIELD NAME	DATA TYPE	SIZE	DESCRIPTION
<b>OriginalPartID</b>	Number	9	Unique ID representing the Original Part
SubstPartID	Number	9	Unique ID representing the Substitute Part
SubstNotes	Memo	Memo	Any particular information about the part substitution

Supplier Table – This table stores all the necessary information about a Supplier

FIELD NAME	DATA TYPE	SIZE	DESCRIPTION
<b>SupplierID</b>	Text	9	Unique Number Identifying the Supplier
NewSupplierID	Text	9	New Supplier ID if old one has changed, else leave as 0
SupName	Text	25	Supplier's Name
SupStAddress	Text	25	Supplier's Street Address
SupCity	Text		Supplier's City
SupState	Text	2	Supplier's State
SupZipCode	Number	5	Supplier's 5 digit Zipcode
SupTelephone	Number	10	Supplier's Phone Number

Supplier Part Table – This table links the Supplier and Parts tables as a bridge table, in order to allow for a many different parts to be ordered from many different suppliers.

<b>FIELD NAME</b>	<b>DATA TYPE</b>	<b>SIZE</b>	<b>DESCRIPTION</b>
<b>SupplierID</b>	Text	9	Unique Number Identifying the Supplier
<b>PartID</b>	Text	9	Unique Number Identifying the Part
LeadTime	Number	3	Lead Time for this part when acquired from this supplier
RevisedLeadTime	Number	3	Revised Lead Time
PLT	Number	3	Planned Lead Time
Notes	Text		Notes about the Supplier for this Part
FirstQty	Number	9	First Quantity
OriginalQty	Number	9	Original Quantity
NewQty	Number	9	New Quantity

## Appendix G – Cost/Benefits Analysis

### Cost/Benefits Analyses

#### Initial Costs

Items	Attendant	Alternative 1			Alternative 2		
		Time(hours)	Cost (/hour)	Costs	Time(hours)	Cost (/hour)	Costs
DB Analysis/Design	DB Analyst/Designer	40	\$ 100.00	\$ 4,000.00	80	\$ 100.00	\$ 8,000.00
Function and UI Analysis/Design	DB Programmer/Analyst	60	\$ 150.00	\$ 9,000.00	80	\$ 150.00	\$ 12,000.00
Setting up Servers	DBA/System Administrator	1.5	\$ 100.00	\$ 150.00	6	\$ 100.00	\$ 600.00
Setting up 10-user desktops	System Engineer	10	\$ 75.00	\$ 750.00			\$ -
Data Migration	DBA	3	\$ 100.00	\$ 300.00	3	\$ 100.00	\$ 300.00
Training (10 end users)	System Engineer (2h/end user)	10	\$ 100.00	\$ 1,000.00	20	\$ 100.00	\$ 2,000.00
Testing	Testing Analyst	5	\$ 125.00	\$ 625.00	5	\$ 125.00	\$ 625.00
System Correction	DBA/Programmer	30	\$ 150.00	\$ 4,500.00	40	\$ 150.00	\$ 6,000.00
Project Management	Project Manager	20	\$ 150.00	\$ 3,000.00	30	\$ 150.00	\$ 4,500.00
<b>Total</b>				<b>\$ 23,325.00</b>			<b>\$ 34,025.00</b>

#### Annual Recurring Costs (year 1 through 5)

Items	Alternative 1			Alternative 2		
	Time(hours)	Cost (/hour)	Costs	Time(hours)	Cost (/hour)	Costs
Application software maintenance	10	\$ 150.00	\$ 1,500.00	15	\$ 150.00	\$ 2,250.00
Incremental data storage required: (estimated cost/MB=\$50)			-			-
Setting up Servers	1.5	\$ 100.00	\$ 150.00	6	\$ 100.00	\$ 600.00
Setting up desktops	10	\$ 75.00	\$ 750.00	0	\$ 75.00	\$ -
Training	5	\$ 100.00	\$ 500.00	10	\$ 100.00	\$ 1,000.00
<b>Total</b>			<b>\$ 2,900.00</b>			<b>\$ 3,850.00</b>

#### Tangible Benefits

Items	Alternative 1			Alternative 2		
	Time(hours)	Cost (/hour)	Costs	Time(hours)	Cost (/hour)	Costs
Cost reduction or avoidance	100	\$ 60.00	\$ 6,000.00	100	\$ 60.00	\$ 6,000.00
Error reduction	25	\$ 60.00	\$ 1,500.00	50	\$ 60.00	\$ 3,000.00
Increased speed of activity	100	\$ 60.00	\$ 6,000.00	100	\$ 60.00	\$ 6,000.00
No training necessary to use MS Access	10	\$ 100.00	\$ 1,000.00		\$ -	\$ -
Improvement in management planning or control	100	\$ 60.00	\$ 6,000.00	100	\$ 60.00	\$ 6,000.00
Possible Cost for an Incorrect Order that would be Avoided		-	\$ 5,000.00		-	\$ 10,000.00
<b>Total</b>			<b>\$ 25,500.00</b>			<b>\$ 31,000.00</b>

## Appendix H – Feasibility Studies

### Economic Feasibility Analysis - Alternative 1 Inventory Tracking System

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Net economic benefit	\$0	\$25,500.00	\$25,500.00	\$25,500.00	\$25,500.00	\$25,500.00	
Discount rate (10%)	1.0000	0.9091	0.8264	0.7513	0.6830	0.6209	
PV of Benefits	\$0	\$23,182	\$21,074	\$19,159	\$17,417	\$15,833	
<b>NPV of all Benefits</b>	<b>\$0</b>	<b>\$23,182</b>	<b>\$44,256</b>	<b>\$63,415</b>	<b>\$80,832</b>	<b>\$96,665</b>	<b>\$96,665</b>
<b>One-time Costs</b>	<b>(\$23,325)</b>						
Recurring Costs	\$0	(\$2,900)	(\$2,900)	(\$2,900)	(\$2,900)	(\$2,900)	
Discount rate (10%)	1.0000	0.9091	0.8264	0.7513	0.6830	0.6209	
PV of Recurring Costs	\$0	(\$2,636)	(\$2,397)	(\$2,179)	(\$1,981)	(\$1,801)	
<b>NPV of all Costs</b>	<b>(\$23,325)</b>	<b>(\$25,961)</b>	<b>(\$28,358)</b>	<b>(\$30,537)</b>	<b>(\$32,518)</b>	<b>(\$34,318)</b>	<b>(\$34,318)</b>
<b>Overall NPV</b>							<b>\$62,347</b>
<b>Overall ROI - (Overall NPV / NPV of all Costs)</b>							<b>1.82</b>

#### Break-even Analysis

Yearly NPV Cash Flow	(\$23,325)	\$20,545	\$18,678	\$16,980	\$15,436	\$14,033
Overall NPV Cash Flow	(\$23,325)	(\$2,780)	\$15,898	\$32,878	\$48,314	\$62,347

Project break-even occurs between years 1 and 2.

**Actual break-even occurred at: 1.15 years**

Used first year of positive cash flow (Year 2) to calculate break-even fraction.

### Economic Feasibility Analysis - Alternative 2 Inventory Tracking System

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Net economic benefit	\$0	\$31,000.00	\$31,000.00	\$31,000.00	\$31,000.00	\$31,000.00	
Discount rate (10%)	1.0000	0.9091	0.8264	0.7513	0.6830	0.6209	
PV of Benefits	\$0	\$28,182	\$25,620	\$23,291	\$21,173	\$19,249	
<b>NPV of all Benefits</b>	<b>\$0</b>	<b>\$28,182</b>	<b>\$53,802</b>	<b>\$77,092</b>	<b>\$98,266</b>	<b>\$117,514</b>	<b>\$117,514</b>
<b>One-time Costs</b>	<b>(\$34,025)</b>						
Recurring Costs	\$0	(\$3,850)	(\$3,850)	(\$3,850)	(\$3,850)	(\$3,850)	
Discount rate (10%)	1.0000	0.9091	0.8264	0.7513	0.6830	0.6209	
PV of Recurring Costs	\$0	(\$3,500)	(\$3,182)	(\$2,893)	(\$2,630)	(\$2,391)	
<b>NPV of all Costs</b>	<b>(\$34,025)</b>	<b>(\$37,525)</b>	<b>(\$40,707)</b>	<b>(\$43,599)</b>	<b>(\$46,229)</b>	<b>(\$48,620)</b>	<b>(\$48,620)</b>
<b>Overall NPV</b>							<b>\$68,895</b>
<b>Overall ROI - (Overall NPV / NPV of all Costs)</b>							<b>1.42</b>

#### Break-even Analysis

Yearly NPV Cash Flow	(\$34,025)	\$24,682	\$22,438	\$20,398	\$18,544	\$16,858
Overall NPV Cash Flow	(\$34,025)	(\$9,343)	\$13,095	\$33,493	\$52,037	\$68,895

Project break-even occurs between years 1 and 2.

**Actual break-even occurred at: 1.42 years**

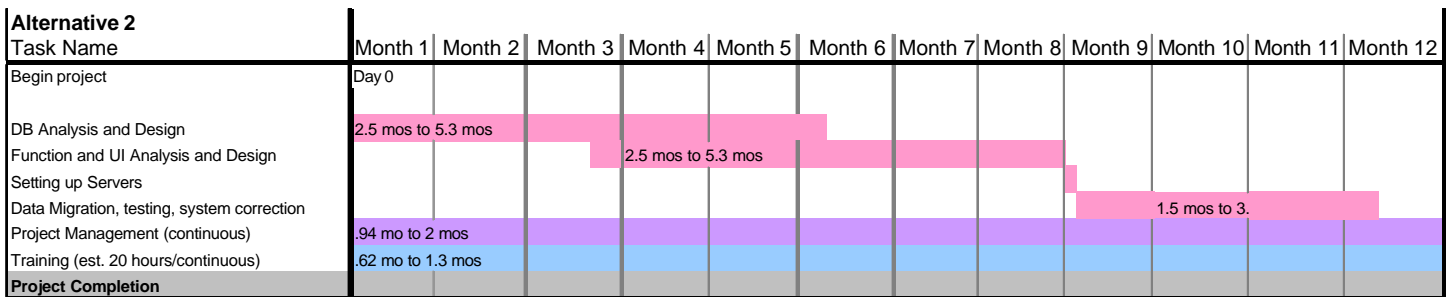
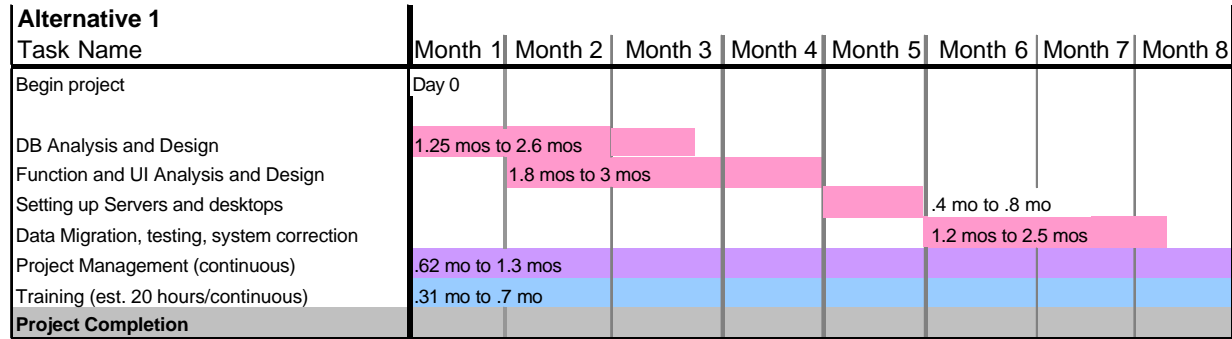
Used first year of positive cash flow (Year 2) to calculate break-even fraction.

## Appendix I – Summary of Risk Factors

<b><i>Risk Factor</i></b>	<b><i>Examples</i></b>
<b>Project Size</b>	Number of organizational units involved Size of Programming efforts Project duration time
<b>Project Structure</b>	Organizational, procedural, structural, or personnel impact of new system Management commitment and support Ease of use of new system
<b>Development Group</b>	Familiarity with target hardware and software Familiarity with Web technologies Involvement of IT staff
<b>User Group</b>	Familiarity with target hardware and software Familiarity with use of Web interfaces Familiarity with information systems development process

Source: Hoffer et al, Modern Systems Analysis & Design, Pearson Education, p. 178.

## Appendix J – Project Schedule



In order to estimate the time that is necessary to develop Alternative 1 or 2, two methodologies were used. In the first methodology, we estimated that one work-hour would be equal to 5 hours of actual time. In the second methodology, we estimated that one work-hour would be equal to 2 days of actual time. The results are explained below (methodologies results are in months):

	<b>Alternative 1</b>			<b>Alternative 2</b>		
	Hours	M1	M2	Hours	M1	M2
DB Analysis/Design	40	1.25	2.60	80	2.50	5.30
Function and UI Analysis/Design	60	1.80	3.00	80	2.50	5.30
Setting up Servers and desktops*	11.5	0.40	0.80	6	1 day	1 day
Data Migration, Testing, System Correction	38	1.20	2.50	48	1.50	3.00
Training	10	N/a	N/a	20	N/a	N/a
Project Management	20	N/a	N/a	30	N/a	N/a
<b>Totals</b>	<b>179.5</b>	<b>4.65</b>	<b>8.9</b>	<b>264</b>	<b>6.5</b>	<b>13.6</b>

\* Alternative 2 doesn't include desktop setup.

Because of overlaps activity, Alternative 1 would take between 4 months to 8 months, and Alternative 2 between 5 months to 1 year.

## Appendix K – Prototype

**Look Up A Part Number**

Enter a Part Number

Part Number Entered	Latest Part Number
746434	T3S4344

**Part number change history for this part**

Original Part Number	Became Part Number
F4353	X43530
X43530	746434
746434	T3S4344

