CASE STUDY

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Department of Defence Saves £207,000 Per Year

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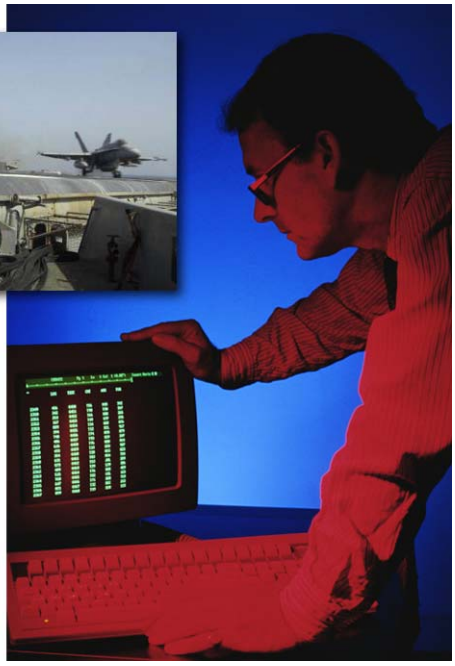
Re-engineering of an environmental compliance process will provide the Department of Defence with a cost avoidance of $300,000 per year by eliminating the need for six full-time positions. The re-engineering was accomplished with the use of WITNESS. The software allowed engineers to analyse the current process and evaluate alternatives inexpensively in a minimal amount of time. The process involves analysing the 2,000 spare parts purchases made each year by the Redstone Arsenal in order to reduce environmental impact. The software helped engineers identify which aspects of the process took up the most time so they could focus their efforts on developing solutions and automating where practical.



"The success of WITNESS in improving the environmental compliance process convinced management to commission a study of all of the organisation's business processes."

- Dan Holder, Ray Harrell, Department of Defence

Environmental compliance is becoming a much more important part of the mission of the U.S. Armed Forces. The 1992 Federal Facilities Compliance Act removed immunity from prosecution of governmental bodies and employees for environmental infractions. This means that the Department of Defence and its employees are subject to essentially the same environmental laws and potential penalties as private industry. As with all Department of Defence facilities, the Redstone Arsenal is responsible for evaluating every activity and material used at the base from the construction of guided missiles to maintenance of the base swimming pool in an effort to reduce its impact on the environment. Each major subordinate command has the responsibility for developing its own pollution prevention program.

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Company	Department of Defense
Industry	Military
Application	Business Process Re-engineering
Benefit	Annual £207,000 Cost Avoidance

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Evaluating parts purchases

An important part of the Redstone Arsenal environmental compliance program involves evaluating spare parts and materials purchases to reduce their environmental impact. In the past, this evaluation consisted of one engineer looking at each order and using his or her best judgment to determine the need for the quantity of the hazardous materials. The problem with this approach was that with one person evaluating 2,000 purchases per year, there wasn't time to do more than a cursory examination. Only in unusual cases did the reviewer delve into a particular application to determine whether the hazardous substance could be reduced or eliminated.

The new emphasis on environmental compliance made it necessary to develop a more comprehensive approach. The arsenal developed a list of hazardous substances that draws from the Department of Defence SD-14 document. Spare parts orders are generated from the base's purchasing system. A corresponding Technical Data Package Listing (TDPL) is compared to the hazardous substances list. Whenever a hazardous item is identified on an order, the reviewer examines the part drawings in conjunction with the design engineers responsible for the components to determine whether a non-hazardous material can be substituted or whether the volume of the substance can be reduced. Finally, the reviewer must update the database to permanently change the specification for that particular part.

Avoiding excess material usage

As an example, 1-1-1 trichloroethane, an ozone-depleting chemical, is commonly used for cleaning purposes, but not always. In one instance, the material has been used as a bearing carrier material, where its function is to reduce the viscosity of the lubricant so it fully penetrates bearing areas. Once the lubricant is in place, the 1-1-1 trichloroethane evaporates without leaving any residue. In cleaning operations, more 1-1-1 is used than in the latter example. Best engineering judgments would have recorded higher amounts of hazardous material usage for the bearing example. Under the new process, when a reviewer identifies an order for this material, he or she examines the part prints in detail to determine whether a different material can be used. If not, the next question is to examine the volume of material being used. It is not known from the existing specifications how much material is actually required without looking at the part drawings.

The problem with the proposed new approach was that it took much longer than the old one. When the new process was first modelled, eight people were required, compared to only one person for the old process. The old approach, because it took so little time, could be run in series as a final check at the end of the old purchasing process. The new approach was so much longer that running it in series would substantially delay the entire purchasing process. This made it necessary to run the new process in parallel with the other steps required for spare parts purchasing.

Discrete event simulation

A member of a core group of government process modelling engineers was assigned to the problem. This group works as consulting engineers to military and civilian defence organizations with the mission of looking for cost improvements in Redstone Arsenal's operations. While the team has used discrete event simulation for in a variety of manufacturing applications, this was the first time they had applied it in a business process re-engineering project. Simulation adds an important dimension to process analysis by factoring in the dynamics of time-based material flow, which cannot be represented in a spreadsheet. Properly validated, simulation models reflect existing systems within a 5% tolerance range.

We chose WITNESS, a program the Army has used for manufacturing simulation over the past

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eight years. WITNESS has demonstrated the ability to accurately simulate a wide range of processes in a remarkably short period of time.

Gathering data

The first step in analysing the compliance process was to talk to people to find out how long each portion of the process took. These steps varied depending on the size of the order and the complexity of the parts involved. We developed a probability distribution that approximated the relative weighting of different types of orders. This information was used to model the process in WITNESS. The ability to have time distributions instead of a single duration is a major advantage over spreadsheet models; the model more closely matches real-world conditions.

The results of the simulation gave us unique insights into the process. We first checked the model results against actual results and found a close correlation. Then we looked at the exact proportions of time involved in each step of the process. This helped us focus on improving those steps that would have the most impact. The simulation showed two primary bottlenecks in the existing process. The first was the time spent going through the TDPL to identify hazardous substances for further examination. The second came after the substance was identified and drawings were ordered. Searching through the drawings to find all instances of the hazardous substance was another onerous process.

Automating processes

We focused on automating these two processes. We conceived of an interface between the separate purchasing and hazardous substance databases. We had earlier developed a Visual Basic macro that searched a Microsoft Word document for all instances of words appearing in database. We identified this macro as a key enabling technology that would make it possible to automate the initial review of the TDPL listings. Automating the process of locating the substances within the drawings was a bit more complicated. The drawings exist as raster files. We developed a process in which the files are converted to text files using optical character recognition so that they can be searched by the same method used to scan the TDPL listing.

The software enabled us to alter various process parameters and see the results on cycle time and manpower requirements. This provided a powerful method of determining the sensitivity of the process to various types of changes. The final process was so much more efficient than the starting point that only two people were required to meet all environmental requirements, 75% less than the initial process. Another key advantage of the new process is that it greatly simplifies the reviewer's task. Instead of the eight tasks required by the old process, the new one involves only three: 1) perform a quick manual "sanity check" of the hazardous materials detected in the TDPL listings 2) check the physical size of parts to determine material requirements and 3) update the database to reflect the new requirements. The reduction in the number of tasks and the elimination of mind-numbing routine tasks is expected to reduce the error rate of the process substantially.

Decision to implement

Management quickly made the decision to implement the new process. A total of $300,000 will be required to develop the software interfaces and perform OCR on the existing drawings. This expenditure will be recovered in just a single year of operating the new process. The success of WITNESS convinced management to commission a study of all of the organisation's business processes. Plans are being finalised to use WITNESS with a workflow system to provide real-time visualisation and control of the business process so that adjustments can be quickly evaluated and implemented in response to a changing work environment.

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