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PULL REMANUFACTURING - A CASE STUDY

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Pull Remanufacturing - A Case Study

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OBJECTIVE

This paper describes how pull production methods have been applied to a manual transmission remanufacturing line at Tooele Army Depot in Utah. The paper emphasizes techniques for linking the control of disassembly and cleaning operations to the repair and assembly portions of the production system (PP&C). The primary objective is to show that production planning and control can be simplified when pull mechanisms are combined with shop floor improvements.

INTRODUCTION

One approach to applying MRP II to remanufacturing is to use a separate production schedule for the disassembly and assembly portions of the operation (Demmy and Powell 1991). This approach is primarily needed when managing the delivery and inventory of cores is critical to the successful operation of a remanufacturing organization. Because Army depots frequently have an adequate inventory of cores on hand (somewhere on-site), this requirement is usually less significant. Therefore, it is possible to eliminate the use of a master production schedule for disassembly and rely on pull linkages from the repair and assembly operations to control the activity of the disassembly and cleaning operations. In remanufacturing environments having multiple products and adequate buffers of core inventory, effective coordination of disassembly and cleaning functions with assembly production requirements becomes a key production control issue.

DESCRIPTION OF THE ENVIRONMENT

Prior to the improvement effort, a remanufacturing line repaired and reassembled two models of manual transmissions within a building at Tooele Army Depot. The disassembly operation was done in a nearby building. Disassembled parts were transported to a third building to be cleaned, along with parts from other remanufactured products. The cleaned components were delivered to the remanufacturing building and transferred to the manual transmission area. Used parts were inspected, repaired, and placed in subassemblies at workstations located along a manual conveyor. Final assembly occurred at the end of the line. All reassembled transmissions were tested on equipment located near the end of the line. Problems in this production environment included excess work-in-process; unusable parts being discovered at assembly; and difficulty in coordinating disassembly, cleaning, and the remanufacturing line.

This product line was selected for a cross-functional improvement effort to demonstrate advanced manufacturing concepts that would facilitate operation in a new consolidated maintenance facility (CMF) being built at Tooele Army Depot. The design of this new facility created operating requirements that were expected to place greater emphasis on controlling work-in-process and minimizing material handling. A team of shop floor and support personnel was formed to identify and implement operating concepts that would be consistent

with this new facility while yielding gains in the present operating environment. Technical specialists supported the work of the shop floor teams.

SOLUTION ADOPTED

The team developed and implemented a number of changes to move toward pull remanufacturing and successful operation in the new consolidated maintenance facility. Three critical changes included: (1) modifying test equipment and its operation, (2) establishing a "staging area" for new and used parts, and, (3) establishing pull mechanisms to feed the remanufacturing line and control disassembly operations. Test equipment and procedures were modified to allow testing of either transmission model type with virtually no time lost due to changeover. These changes required a modest capital investment. A parts staging area was set up next to the line to consolidate new and used parts. This staging area concept is similar to the use of "focused storage" for cellular manufacturing (Harmon and Peterson 1990). Sets of parts are delivered from the staging area to workstations on the line using pull triggers. As levels of parts decline in the staging area, pull triggers are sent to disassembly to signal additional teardown. Cleaning is run as a push operation with a fixed schedule to ensure transmission parts are cleaned and delivered to the staging area within one day. See Figure 1.

RESULTS

A value engineering study of the various changes was prepared by depot staff. The study identified a benefit of about $1 million in both avoided costs and increased revenue because of improved throughput. Requirements for floor space and forklift movement were substantially reduced. The need for a second shift to run the test equipment was eliminated. Of equal significance, shop floor personnel were motivated to continue identifying second-generation improvements to be implemented after the move into the new facility.

DISCUSSION

Strategies for production planning and control of remanufacturing are frequently driven by the need to organize work based on the use of centralized cleaning equipment. Since the cleaning operation normally occurs between the disassembly and repair operations, this centralization usually mandates pushing disassembled parts through the resource. Achieving greater production flexibility and shorter cycle time will require eliminating such centralization and moving to product-focused layouts that include dedicated disassembly and cleaning operations. Dedicated layouts will also improve quality through better communication among co-located employees. Specifically, this approach is likely to result in better screening of unrepairable items and eliminating scrap and excess parts before they consume additional resources (e.g., cleaning, material handling, etc.).

Recent advances in portable, small-scale cleaning equipment make such changes increasingly possible. Tooele Army Depot has been evaluating the usefulness of this technology for the types of products they remanufacture. Implementing a complete pull system through the entire remanufacturing process in a product-focused layout is becoming feasible for many types of products. Therefore, efforts to improve (PP&C) of remanufacturing should not overlook

the opportunities for simplifying the production planning and control task through imaginative shop floor layout.

CONCLUSIONS

Significant gains in productivity and reductions in work-in-process are achievable in the government remanufacturing environment using relatively low-cost improvement techniques. These gains require employee involvement, cross-functional teams, and an integrated improvement strategy that stresses shop floor simplification, set-up reduction, pull production, and a product-focused layout. Because of the inherent variability of remanufacturing, a staging area for both new and used parts located near a product-focused line provides the operating flexibility needed to realize the potential gains.

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ABOUT THE AUTHOR

Lawrence Levine joined Pacific Northwest Laboratory (PNL), a national laboratory of the U.S. Department of Energy, in 1983. His professional experience has included management systems assessment, application software design and development, technology assessment, and R&D planning and assessment. At PNL, his recent focus has been on ways to improve management effectiveness, especially as it relates to reducing cycle time in administrative processes, and implementing pull remanufacturing. Mr. Levine has a B.S. in Engineering from the University of Michigan and an M.S. in Industrial Administration from Carnegie Mellon University.

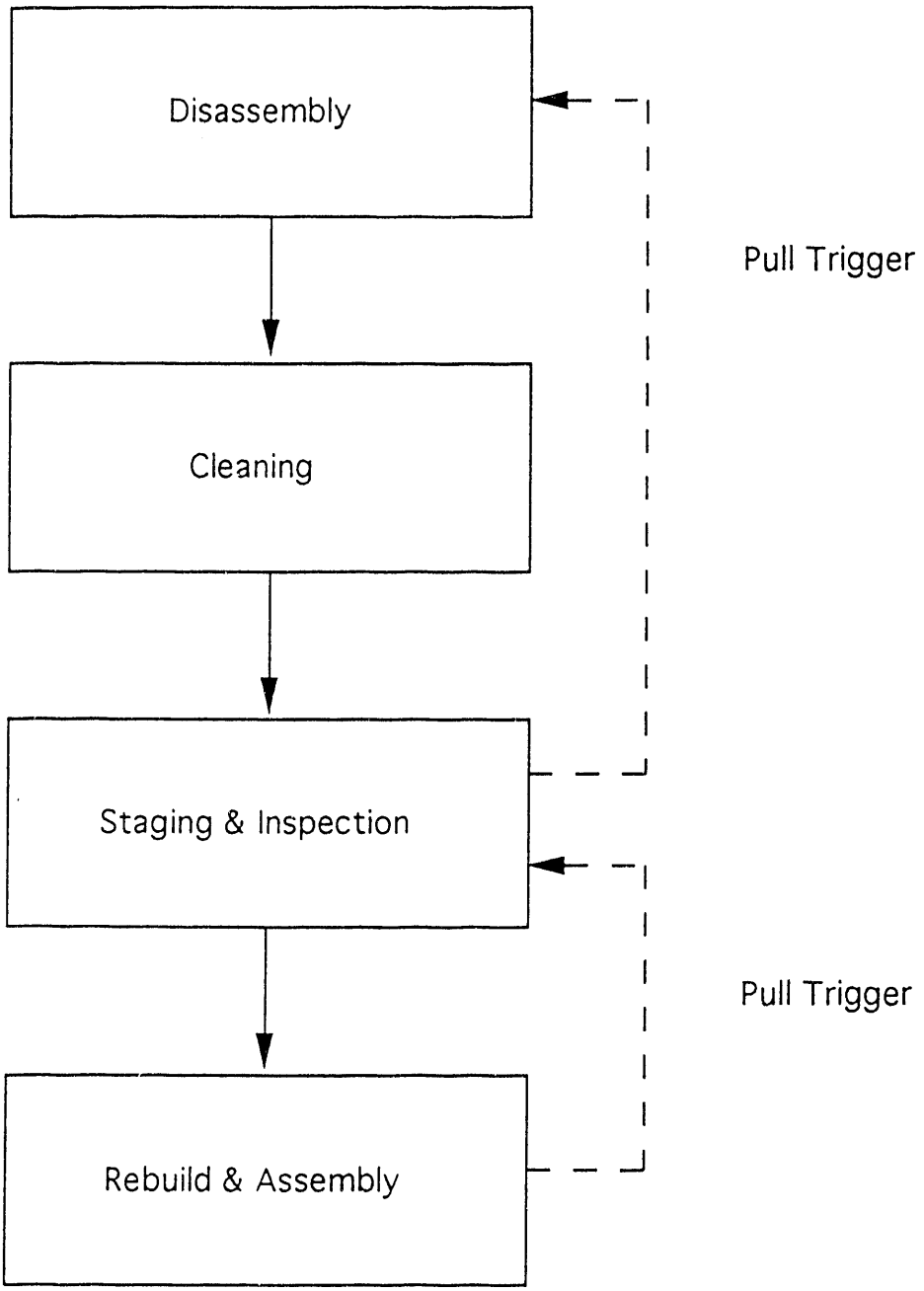

Figure 1. Material Flow and Pull Linkages

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