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**OVERHEAD, GENERAL, AND ADMINISTRATIVE COSTS**

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**INTRODUCTION**

Much of the attention to improvements in the factory goes to the most obvious source of cost, the actual production process, which includes manufacturing labor and purchased materials and parts. But direct manufacturing makes up only part of total weapons system cost. Less visible costs in the overhead, general and administrative (G&A) categories are larger than direct labor costs at the prime level, often by a factor of two or more. In this chapter, we discuss how the lean philosophy affects the indirect costs. We present some examples of how companies participating in this study have attempted to cut these costs and the results they achieved. The CCDR definitions for overhead and G&A costs can be found in Appendix C.

**THE OVERHEAD AND G&A CCDR CATEGORIES**

Overhead and G&A costs provide a catchall for incurred costs that do not fit into the previous cost categories. Overhead costs are those related to fabrication and assembly activities but which cannot realistically be charged on a direct basis to a particular product. Overhead is normally allocated to a base (such as direct labor hours) using a forecast rate (in dollars per hour) called a wrap rate. In general, overhead costs are between 150–250 percent of the cost of a direct labor hour. Factory overhead covers such expenses as electricity, cleaning, heat, plant depreciation, and factory support labor (depending on the company). G&A expenses relate more to the com-

pany as an entity and may not be related to activity levels at only one plant, especially in larger aircraft manufacturers. They include such costs as the salaries of the company's front office staff and the like. As a percentage of labor hours, G&A costs tend to be in the 10–25 percent range of the direct factory labor rate.

Far from being an insignificant area of concern, overhead and G&A costs are tremendous drivers of overall weapon system cost. One estimate indicates that overhead costs at the prime are 35 percent of the recurring flyaway costs of the total value stream of costs of the aircraft.<sup>1</sup> However, customers generally have less insight into components of overhead than other areas. Pressure on reducing manufacturing costs has the benefit of having a clear metric—labor hours—as well as an entire cadre of industrial engineers who can offer expert advice on how to make changes to reduce hours, particularly as they relate to manufacturing one aircraft or subsystem. However, overhead and G&A costs do not lend themselves as easily to industrial engineering techniques, and the responsibility for these costs tends to be more diffused within a company. These costs are allocated to all products being designed or manufactured. A key point here is that lean principles must be applied to these costs with equal fervor as they are to the direct manufacturing areas to get real, bottom-line cost reductions at the weapon system level.

## ADMINISTRATIVE COSTS

Lean manufacturing includes a number of initiatives that should help minimize administrative costs. One tool is to reduce the number of managers by having decisions made at the “lowest” possible level, that is, by the people closest to the work being done. This also suggests that trained workers have better insight into certain problems than do some senior manager up the chain of command.

Companies that participated in this research did not offer a great deal of insight into any efforts to reduce administrative overhead. They reported a range of between three and six organizational levels separating the lowest- and highest-ranked employees. However, it was impossible to determine if these numbers were really compara-

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<sup>1</sup>Joint Strike Fighter Program Office estimate.

ble or if plants combined worker and manager categories in different ways.

### **MATERIALS OVERHEAD**

As discussed previously, application of lean to procurement activities should reduce the materials overhead costs at the prime and major subcontractors. Materials overhead (or materials handling costs) has a wide range of values (5–40 percent) of the price to the prime, which vary by company, stage of development (EMD or production), whether special handling is required, volume of the purchased materials, and so forth. No “rule of thumb” savings can be developed for these changes, but application of the lean processes for supplier management should reduce these costs at the prime, major subcontractors, and supplier levels.

### **ENGINEERING AND MANUFACTURING OVERHEAD**

Overhead is a very significant cost driver in both engineering and manufacturing. Indirect labor, employee benefits, the costs of managing the facilities, and the cost of capital equipment are important drivers of total cost and can result in a total per-hour cost per employee that is two or three times the employee’s hourly wage rate. As such, it is an area ripe for rationalizing to help reduce final product costs.

Companies did report a number of efforts to help keep costs down, which varied in terms of their being driven by a lean philosophy and the resultant cost savings. Again, many initiatives were presented as being lean that were more accurately attempts to control costs rather than efforts being driven by formal attempts to reduce waste. For example, one firm realized a significant amount of savings by requiring all employees to switch to HMOs for their medical care. Another reported savings of \$50,000 per year across the factory by eliminating bottled drinking water dispensers that offered both hot and cold water.

One issue related to the cost of running the factory is an extremely common benchmark of lean manufacturing. This is the issue of factory floor space. Floor space requirements are used as a proxy for

lean implementation because the lean model calls for rethinking the way that factories are laid out, a process that quite often results in reduced space requirements. There should also be less space required for inventory storage and so forth. Furthermore, this metric is a relatively unthreatening one for companies to report, as it does not reveal proprietary information, as specific cost data does. In addition, space reduction does not necessarily threaten anyone's job. However, reductions in space requirements only produce real savings in two situations. The first is in a greenfield situation, where a planned production facility can be reduced in size after application of lean principles. (Indeed, one company reported redesigning a planned facility according to lean principles, resulting in a two-thirds reduction in size.) In a brownfield situation, a reduction in space requirements can result in real savings only if another revenue-generating production line can be placed into the freed-up space after lean principles are applied. Savings claimed by freeing up space that is then left unused but still must be environmentally conditioned and kept secure are illusory. Such actions to reduce floor space requirements may reduce the overhead charge to one particular program or product, but if the overall costs remain the same, they are merely reallocated among programs through overhead rate adjustments.

## **LEAN INVENTORY MANAGEMENT**

Inventory consists of three major components, each of which has associated costs. These are purchased materials (parts and materials delivered to the factory and not yet being worked on), WIP inventory, and finished-goods inventory. There are two direct avenues of cost savings from management of inventory: both in the absolute reduction of inventory (increase in inventory turns) and in the way the remaining inventory is managed.

One source of overhead expense that receives tremendous focus in lean manufacturing is the cost of WIP inventory, which is a part of manufacturing overhead. Keeping inventories as low as possible is a critical foundation of lean manufacturing, and that concern drives considerable efforts in all functions across the enterprise. Maintaining a buffer stock of inventory, as is usual in traditional manufacturing, can hide any number of costly problems. Quality problems,

machine breakdowns, long setup times, poor housekeeping, problems with suppliers' delivery and quality, problems among the work force, ineffective scheduling, and so forth can be hidden under a stock of inventory. Keeping excess raw material and WIP inventories allows workers to keep working if problems arise in the plant. Machinery breakdowns in one area will not stop production later on in the process if the later process can work on stored WIP.

However, maintaining this buffer of inventory is costly in and of itself and in its attendant problems. Eliminating the buffer forces discovery of solutions to the problems, and hence both cost drivers are reduced. Better management and reduction of inventory requires a major reassessment of processes within the firm. Inventory is such a critical cost driver that it needs to be eliminated throughout the whole production system, including at suppliers. If the costs are anywhere in the system, they will increase the cost of the aircraft. The goal is to reduce the total inventory in the system. The importance of eliminating the buffer of inventory shows up in the very name of lean manufacturing itself—the processes are lean because no buffers are in the system.

In a typical nonlean plant, parts are not being worked on for as much as 99 percent of the time they are on the factory floor. As parts move from one batch-processing cell to another, waiting their turn to be worked on, waste and costs increase. When one company analyzed the flow of a major composite subcomponent through the factory, they found that during 92 percent of the total cycle time, the part was not being worked on, being instead in idle storage or in queue. Transportation amounted to 1 percent of the time, and non-value-added processing consumed 4 percent of the total time. That meant that value-added work was being done to the component only 3 percent of the time that it was on the floor.

## **RESULTS ON IMPLEMENTATION OF LEAN INVENTORY MANAGEMENT**

As part of an overall effort to cut costs, one manufacturing facility began an aggressive approach to inventory management starting in the early 1990s. Many of the specific initiatives related directly to how they work with their suppliers. The company developed a sys-

tematic Material Resource Planning (MRP) approach to receiving and holding inventory.

One group of efforts has dramatically smoothed the receiving function. The company invested in technology to read bar codes; currently, about 90 percent of suppliers bar code their shipments. When supplies arrive in the plant, receiving employees use handheld scanners to accept the goods. The scanners use radio frequency technology (receivers are located throughout the plant) to update the inventory on the main computer system. Payment is automatically sent to the suppliers. In 1998, it took less than one day to go from “dock to stock,” much faster than the almost five days it had taken five years previously. Supplies are then put in the stock area with small parts being put on shelves. (Ideally, of course, parts would go directly to the production line for installation on an aircraft, but company analysis in this case showed the need for a minimal safety stock of parts.) Each area and shelf has its own bar code, which is also scanned when the part is put there. Locating parts has become a simple task—the inventory computer system can be queried about where items are. This has helped the company achieve an inventory accuracy of more than 99 percent. Cost savings result from lower carrying and storage costs of inventory, less missing inventory, and a decrease in the number of workers required to manage the inventory. Inventory head count as a ratio of manufacturing touch labor decreased from 15 percent in the fourth quarter of 1992, to 12 percent in 1995, to 8 percent in 1998.

The company reported a number of other specific inventory successes. For example, inventories turns increased from four in 1989 to 12 in 1998 and are projected to increase to 20 turns in 2002. Dock-to-stock time fell from 20 days in 1989 to less than one day in 1998 and was projected to fall further to less than half a day in 2002. On-time performance to schedule has risen from 90 percent in 1989 to 99.5 percent in 1998 and is projected to increase to 99.8 percent in 2002.

The results of these improvements are clear from information on the decrease in gross inventory per aircraft equivalent unit from 1994 through 1998. In 1994, the company carried well over \$200 million in inventory for every aircraft it built. This figure decreased steadily over the next five-year period, falling to about 50 percent of the original figure.

One measure of savings is based on the carrying cost of inventory. The company did not provide its carrying costs, but generally it is the prime rate plus some percentage. If the assumed rate is 10 percent, savings from inventory reductions between 1994 and 1998 amounted to over \$11 million a year per aircraft.

A second plant had not yet engaged in significant efforts to reduce inventory at the time they provided data, but they had embarked upon an initial analysis of the potential savings. In one high-speed machine cell, they calculated that reducing inventory from current levels to an amount that would support *takt*-time production would decrease inventory by more than 80 percent. The eliminated inventory had a value of over \$2.5 million. At their stated carrying cost of inventory of 19 percent, the analysis led the company to expect to save almost half a million dollars in carrying costs of inventory per year by reducing inventory in that one cell.

#### **SUMMARY RESULTS OF SAVINGS FROM REDUCED INVENTORY**

Firms reported the potential of significant savings from reduced inventory, but actual efforts to reduce inventory have been limited so far. Savings will be from the lower WIP inventory combined with an increase in inventory turns and fewer people needed to manage and maintain the inventory. WIP inventory is expected to be reduced by an average of 50 percent over the long term and about 10 percent with intensive effort in the first year. (This is in line with reports in the literature of inventory reductions from 10 to 50 percent.) Inventory turns should increase by 100 to 350 percent. Direct savings can be calculated by multiplying the amount by which inventory is reduced by the cost of holding the inventory, which is generally the prime rate plus some percentage, combined with fewer people needed to manage the inventory, less floor space needed to store it, and so forth.

#### **FORWARD PRICING RATE AGREEMENTS (FPRAs)**

The overhead and G&A areas would seem to provide a way of measuring company success in implementing lean techniques by analyzing overhead and G&A rates over time. These rates, part of the FPRAs

at each plant, are negotiated regularly with DoD. Assuming lean is successfully implemented, these rates should decline in real terms over time. Unfortunately, two other factors confound such an analysis. The first is the fluctuating business base at companies. As additional business is added to the overhead and G&A base for calculating rates, the rates will decline. If the company loses business, the rates tend to increase as less activity must support these basically fixed expenses. The other problem in analyzing rates is that companies, because of mergers, acquisitions, divestitures, and other reasons tend to change their accounting practices often, so normalizing rates over time is difficult. Thus, using FPRA's did not prove useful in illustrating that lean implementation was resulting in lowered overhead and G&A costs.