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Delta's MRO Overhaul

By Melissa R. Bowers and Gary Adams

Delta Air Lines is bucking the industry trend in maintenance, repair, and overhaul (MRO). In 2006, Delta Air Lines Technical Operations (Delta Tech Ops) grew its engine maintenance business with a resounding 33 percent increase in orders from external customers. This remarkable achievement was accomplished during a time when Delta was facing bankruptcy and amidst an industry push to continue to outsource airline MRO operations. Such substantial growth was achieved through the infusion of a new execution management system rooted in Eli Goldratt's theory of constraints (TOC).

In 2005, Delta filed for Chapter 11 bankruptcy in response to its financial crisis. As part of Delta's recovery plan, the Tech Ops Group was charged with increasing 2006 revenues to $270 million. Moreover, they were required to achieve this goal without added capital investment and with no additional labor. Operationally, this goal translated to a 20 percent increase in production volume as well as a 20 percent reduction in turnaround time.

An attitude of loyalty and determination in the workforce created an atmosphere ripe for change and improvement. Through the implementation and sustainment of a drum-buffer-rope (DBR) scheduling system in its repair and support shops and critical chain project management (CCPM) in the engine disassembly and reassembly areas, Delta's Engine Maintenance Group played a critical role in the company's emergence from bankruptcy.

Key elements of the execution management system

The design and implementation of the new execution management system at Delta was built on seven simple principles.

1. Using the system constraint to set the drumbeat: restricting the rate of release of engines into the disassembly area to match the capacity of the Delta's system constraint, the repair and support shops

2. Managing backshop queues: releasing work to the repair and support shops based on a DBR system and processing the jobs according to a strict first-in-first-out discipline

3. Avoiding multitasking: delaying the reassembly of each engine until 100 percent of the parts are available

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4. Synchronization of execution priorities: using critical chain project management to provide integrated priorities across all engine disassembly and reassembly shops in parallel with both DBR buffer management and a real-time information system to track and manage component parts through all stages of the repair process

5. Anticipating and rectifying the potential for delays: enforcing a well-defined set of rules for managing parts approaching their targeted turnaround time (less than 5 percent of total parts)

6. Using flexibility to respond to variation: reallocating a flexible workforce and other resources among different areas to respond to variation in workload

7. Adopting and adhering to a doctrine of accountability: building and maintaining a dedicated workforce committed to sustaining the highest level of accountability, communication, and discipline.

Identifying the system's constraint

The first step in the TOC process of ongoing improvement is to identify the system constraint. This step presented a significant challenge in the MRO environment due to the number and complexity of products. Depending on the type of repair required at any particular time, the repair and overhaul of each product, engine, APU, etc. may be viewed as a unique project comprised of a specific set of tasks with a number of constraints in the repair process.

The process of identifying the system's constraint started by trying to answer a basic question: Why was it so hard to get parts back on time for reassembly? Labor and equipment were originally thought to make up the predominant constraint. However, after some analysis, it was established that there were no physical constraints in the existing system, only policy and managerial constraints. Delta's current rules and methods of management were actually turning the repair and support system as a whole into a constraint.

With repair and support identified as the system constraint, a solution was needed, as prescribed by Goldratt's TOC approach, to exploit, subordinate, and elevate the constraint. Since the repair and support shops are shared resources among nine distinct product lines as well as with line, hanger, and component maintenance, the shared resources adopted a simplified DBR system to control the release of work into the repair and support shops, and provide uniform priorities to all the shops.

Engine maintenance at Delta was once considered a cost center, with long engine turnaround times and rising levels of inventory and work-in-process. Through the implementation of the DBR scheduling system in the repair and support shops and its synchronization with CCPM, engine turnaround times dropped 15 percent and throughput increased by 22 percent. Over a period of

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one year, the repair and support shops decreased turnaround times on parts by 40 percent, increased throughput by 18 percent, and cut WIP levels in half. In addition, Delta was able to increase the total engine maintenance workload from customers outside of Delta by 33 percent.

As for the bottom line, Delta's Tech Ops Group not only met its 2006 revenue goal of $270 million, but Delta exceeded that goal by $42 million and has emerged as a true leader in the business of maintenance, repair, and overhaul in the airline industry. For an in-depth look at the Delta program, look for a feature article on this subject in *APICS* magazine in early 2008.

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