Critical chain project management flies

In 2004, the Warner Robins Air Logistics Center in southern Georgia was flying high. Officials had significantly reduced the number of days required for the repair and overhaul of the C-5 Galaxy aircraft from nearly 360 in late 2000 to about 240 today. The reduction was accomplished through a concerted lean initiative that established cell teams, standard work within each cell, parts kits, materials at point of use, modified 5S initiatives, method sheets, and pull systems.

These efforts also reduced the work-in-process, namely the number of aircraft in the center awaiting repair and overhaul. In 2001, the average WIP was 16 aircraft. By end 2004, it was 12.5. These efforts led to the air logistics center winning the Shingo Gold Prize in 2005, marking the first time it was awarded to an organization in the public sector.

Despite these improvements, the center faced pressure to reduce flow days and WIP further. The U.S. Air Force had only 114 C-5s in its fleet. The 12 to 13 aircraft in WIP accounted for more than 10 percent of the entire fleet. To address the need of the Air Force, the Air Logistics Center revisited the C-5 repair and overhaul process to assess where improvements could be made for other aircraft projects.

Fighting procrastination

A study in December 2004 revealed a number of problems. In the presence of resource contention, the tendency was to give priority to working on aircraft that were closest to completion even if they were ahead of schedule. Such a decision, however, delayed other aircraft that warranted higher priority because they were behind schedule.

As delays mounted, a firefighting mode of operation promoted a tendency to begin work on aircraft or tasks as soon as possible, which led to many aircraft in various stages of repair. The resulting competition for mechanics, parts, and other elements led to more firefighting, multitasking, and delays.

Due to uncertainties in task durations, task times had been buffered to protect against uncertainty. Furthermore, all tasks were scheduled and managed using milestones that specified when they should begin and end. That led to numerous behavioral problems, including Parkinson’s Law — the tendency for work to expand to fill the time available for completion — and the Student Syndrome, in which people put off working on a task until the due date draws near.

Amid the operational disillusionment, a C-5 aircraft was scheduled to arrive for repair and overhaul approximately every 22 days. The mechanics took 22 days in the disassembly phase even though they could have done it much faster because they knew the next aircraft would not come for 22 days. When some personnel postponed working on tasks, others were forced to multitask. However, multitasking only served to delay each of the tasks being worked on. With the C-5, the study revealed a lot of multitasking with sheet metal work.

Critical chain gang

In January 2005, the Air Logistics Center decided to adopt critical chain project management to manage the repair and overhaul process. The center contracted with Realization Technologies to implement the project management method.

The first step in the implementation was to form a dedicated cross-functional core team. After considerable discussion, the core team arrived at an aggressive target of 160 flow days (including the project buffer) for repairing and overhauling the C-5. A network incorporated a critical chain length of 105 days and a 55-day project buffer.

Implementation sparked numerous challenges, the first of which was to reduce WIP without incurring additional overtime or personnel. A second challenge was to break a cultural barrier by moving away from aircraft-level priority to task-level priority. This was especially difficult when an aircraft was at functional test ready for test flight, but the information indicated that scarce resources should go to an aircraft that just arrived and the jet at the functional test should sit idle. A third challenge was to overcome a dated-driven mentality, dislodging the notion of working toward milestones.

Prior to the implementation of critical chain project management, each cell had its own cycle time and milestone end date. That resulted in Parkinson’s Law and the Student Syndrome, with each cell using up at least the amount of time allotted to the cell. After implementation, the facility moved away from cell cycle times to one cycle time for the entire aircraft. The Air Logistics Center now works with just one date in sight: the customer delivery date.
Freeing up time

Through critical chain project management, flow days were reduced from 240 to 160 within eight months without additional overtime or personnel. Much of the credit for that goes to the elimination of multitasking. The reduction in flow days allowed the Air Logistics Center to release five additional C-5 aircraft back to the Air Force’s operational inventory and provided additional revenue to the Transportation Working Capital Fund, estimated at $49.8 million annually. The replacement value for these aircraft is estimated at $2.37 billion.

The implementation provided numerous additional benefits. It re-energized lean and corrected process inefficiencies. For example, personnel resources were aligned by skill for much better task completion efficiencies, resulting in a faster pace of maintenance. The implementation also yielded efficiencies in labor that routinely allow the C-5 team to address additional unexpected work for the aging C-5 fleet. Critical chain project management identified the paint barn as a constraint, leading to a reduction in lead-time for aircraft in the paint barn by 45 percent. The Air Logistics Center is now able to paint the C-5 in less than half the time of the benchmark commercial facility, and for much larger aircraft. The increased efficiencies allow other aircraft to be painted in the barn.

Energized by the success with the C-5 line, plans are under way to implement critical chain project management in other critical areas that require better performance to meet growing demands in the future.

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