CHANG

CRITICAL CHAIN AND A FULL KITTING PROCESS PROVIDE A MUCH-NEEDED BOOST FOR A FALTERING AEROSPACE COMPANY.

E IS IN THE AIR

BY PETER FRETTY

For mankind, flight has always been the direct result of phenomenal engineering—starting with the Wright brothers' successful foray at Kitty Hawk, North Carolina, USA, back in 1903.

The industry has grown to become highly competitive with a comprehensive supply chain of technology-advanced firms jockeying to capture market share. The complexity of aircraft has also intensified to the point that most planes today have millions of parts and require numerous companies to produce.

Considering the need for continual innovation and collaboration, many successful organizations heavily depend on their engineering teams to guide their forward propulsion. So when the engineering department at Spirit AeroSystems, a company that manufactures airplane parts, regularly struggled to meet its project commitments, the management team at the propulsion structures and systems business segment altered its processes and procedures.

"Any missed commitment erodes our credibility with customers. Even more important is the internal cost for late engineering, which can force high overtime rates, supplier expediting fees, rework and potential quality issues," says Steve Pryor, engineering director of propulsion structures and systems at Spirit in Wichita, Kansas, USA. "We needed to change the way we performed managing product engineering. We came to a point where we needed to make a drastic change. We had implemented various project management initiatives to help improve performance, but these did not provide the change we needed."

In fact, since 1996, the tier-one aerospace component contractor had tried a number of approaches to correct its deficiencies, including lean, knowledge-based engineering, cycle-time and cost reduction teams, 5S and FIFO (first in, first out) work cells.

"These were all improvement ideas yielding nominal results. It was not until we took a critical chain project management approach that we have been able to enjoy significant advances," says Joseph Zenisek, critical chain project manager at Spirit. "We now look at critical chain project management as a true game-changer for us."

Links to the Critical Chain

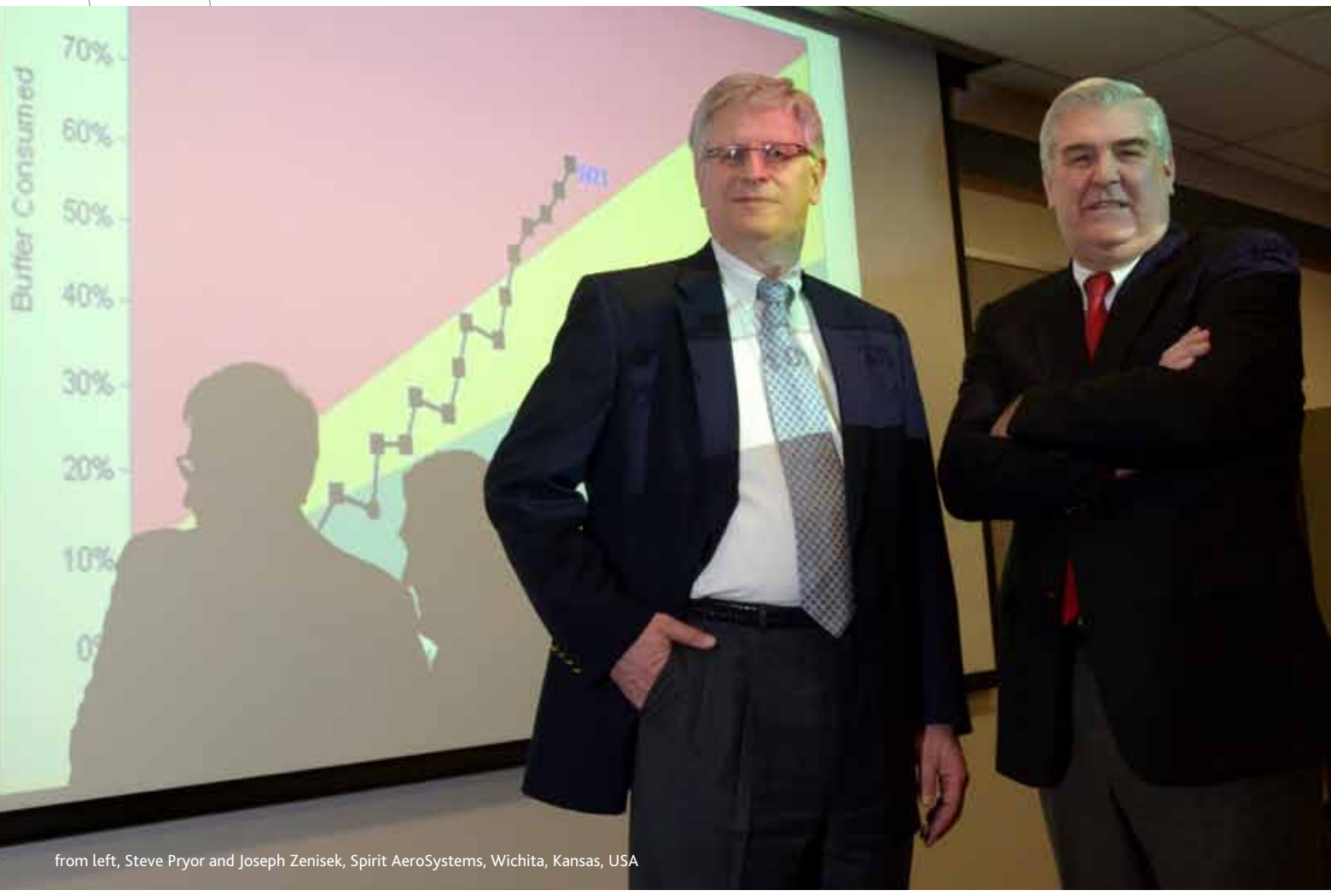
PIPELINING: This technique to limit the number of active projects is a key element of critical chain. Concentrating resources on fewer projects at one time allows teams to focus and reduces multi-tasking. This not only allows projects to be executed faster but creates capacity to undertake more initiatives.

EFFECTIVE BUFFERING: Typically, a project is planned to be completed 25 percent faster while being protected by a buffer that absorbs individual task variation.

BUFFER MANAGEMENT: Uniform task priorities are implemented across all departments and levels of management. The focus is on having the right number of resources focused on the right tasks at the right time. Tasks are prioritized based on how they consume the overall project buffer.

FULL KITTING: The approach requires having all the pieces in place prior to moving a project work package forward. This step helps significantly reduce the number of second actions to complete a single stage.

> Although we had a kitting process in place for manufacturing, **our new approach is more stringent** in that everything needs to be in place before a work package is fully staffed and actively worked. This full kitting system is now being applied to engineering. — JOSEPH ZENISEK



from left, Steve Pryor and Joseph Zenisek, Spirit AeroSystems, Wichita, Kansas, USA

PHOTOS COURTESY OF SPIRIT AEROSYSTEMS

The organization implemented two key strategies:

1. Manage resources more effectively according to buffer consumption. Providing projects with buffers helps avoid any padding during the estimation process and can allow for faster execution because work does not expand to fill the time available.
2. Have a resource pool of highly qualified engineers who can provide short-term support as dictated by the buffer consumption.

The goal of the critical chain process was to reduce work in progress and create and manage a project buffer to ensure better program visibility and resource management.

The new approach also included a comprehensive kitting process for each work package, split into high-level groups such as structural systems. The completion of the full kit is an integration point so that the work package can be fully staffed and actively worked.

"Although we had a kitting process in place for manufacturing, our new approach is more stringent. Everything needs to be in place before a work package is fully staffed and actively worked. This full kitting system is now being applied to engineering," Mr. Zenisek explains.

For instance, if the manufacturing project team performs assembly with missing pieces, it eventually has to disassemble some things to fit in the late arrivals.

Within engineering, using the full kit process makes sure that data, such as loads, temperatures, pressures and interfaces, are in place so that project teams can complete analysis and design without interruption, rather than allowing information to trickle in and prompt costly changes.

PUTTING THE PROCESS TO THE TEST

An opportunity to prove the mettle of this new approach arose during a project to manufacture pylons for a regional jet customer, one of the first initiatives to incorporate critical chain processes.

The first key deliverable was a pylon assembly needed to perform a fan blade-off test. During this test, an engine's fan blade is rigged to fail to see if it remains contained and to ensure that the engine and pylon attachments do not fail. Comprised of a handful of systems and more than 300 parts (not including fasteners), this task once took 17 months from initiation to delivery, according to Mr. Zenisek.

"However, using our project management-focused critical chain approach, we were able to cut three months off of the time allotment," he says. "This was an 18 percent reduction in cycle time."

That time savings "meant we had figured out how to plan and manage resources far better than ever before," Mr. Pryor says.

When projects involve so many partners—including the original equipment manufacturer, engine supplier and certification agency—any one component or piece of information that runs late can cause delays. This often creates a situation where rush requirements become a necessity downstream.

"Critical chain implementation played a key role in enabling value stream customers to fabricate, procure the parts and build the tooling—without paying for overtime or rush expenses—while still meeting the customer-defined deliverable," he adds.

Because teams often complete projects faster, cost can be reduced as throughput increases. But more importantly, it reflects on the organization's reliability, Mr. Zenisek explains.

"We accomplished what we said we could do. We satisfied the customer."

THE WHOLE KIT AND CABOODLE

A number of measurable changes in man-hours, resource investments and product costs become apparent when comparing the project to past initiatives. But the overall culture is the most noticeable change at Spirit, Mr. Zenisek says.

"The difference is especially noticeable when considering our implementation of an unwavering full kitting step," he explains. "Before, people would be

Uniting Divisions

As part of Spirit's new approach to project management, most programs have integrated product teams with 10 to 15 members. They are now aware of their group's critical role in supporting the engineering schedule on a project and can see task priorities, which lets them know what needs to happen first.

"We have a similar relationship with assembly," says Joseph Zenisek, critical chain project manager. "We get a pulse of a program by looking at the value stream," the materials and information required to bring a product or service to a stakeholder.

For one customer, the team quickly understood the health of its pylon program by the status of the work package full kit and the rate it was being filled, he says.

"Such interconnectivity among organizations can only help improve the relationships among functions going forward," Mr. Zenisek asserts.

Critical Chain Reactions

May 2010
Critical chain test pylon project begins.

October 2010
First drawing released.

March 2011
Systems test hardware delivered.

April 2011
Last drawing released.

July 2011
First key deliverable, a test pylon for a fan blade-off test.

August 2011 through 2012
Advanced test and flight test pylon deliveries.

yelling for resources. But now they understand the importance of having full kits before they move forward and of staying focused on fewer work packages. We have become adept at addressing near-term deliverables and then moving on to the next item of importance to develop a more systematic approach. Completion has taken on a new meaning at Spirit."

At the same time, the overall sense of urgency has also increased. "The propulsion structures and systems department has seen the escalation of issues," Mr. Pryor says. "As problems arise, we are more active in communicating. When you are focusing on fewer work packages, you can more quickly address and focus on the deliverable. Issues no longer percolate."

Mr. Zenisek attributes the change in culture to Spirit's operational structure enabled by the critical chain approach.

"We have a steering team that incorporates senior leadership, such as program managers, chief engineers and the general manager's leadership team, so that they remain actively engaged in our very visible approach to continuously improve and manage our programs," he says.

Teams use software that reveals such items as the percent of the critical chain that has been completed and how much of the buffer has been consumed.

This creates an atmosphere where it's possible to identify and address causes of extensive use of safety buffers, allowing the organization to manage the impact of variation and uncertainty around projects—before problems creep up and impact completion times, Mr. Zenisek adds.

In embracing the critical chain project management philosophy, the engineering team had leadership backing, including an endorsement from the vice president/general manager and CTO. However, even with executive support, transformational projects always run into resistance, Mr. Pryor attests.

"We had to really build upon the strengths of the culture change as supported by the philosophy. We focused on getting leadership and the lead engineers engaged so that there was an acceptance of the changes associated with our new processes," he says. "We see this as a journey of constant learning and continual improvement. There is not an endpoint or destination. We are constantly addressing areas of concern to perfect our approach."

Spirit plans to apply critical chain techniques to new programs for its other customers.

"The division has gone from being a stress on the organization to being able to support program commitments to a point that it is a best practice within our business segment," Mr. Pryor says. **PM**

Full Kitting Process

1. Identify full kit items.
2. Review with in-house experts.
3. Customer review.
4. Execute full kit within timelines.
5. Full kit manager accepts full kit, including resources.
6. Full kit review by management.
7. Work package released based on work in progress control.

Spirit AeroSystems attributes critical chain project management to a

50%

reduction in employee overtime and an

18%

reduction in project cycle time for the pylon assembly process.