CRITICAL CHAIN

PF2007: PASSION FOR EXECUTION, PASSION FOR RESULTS.

RESULTS AND LESSONS LEARNED

Over the past four years, hundreds of managers have attended Realization's Project Flow conferences. From maintenance and repair to high-tech product development, they have implemented Critical Chain Execution Management to increase project speed, throughput and due-date performance.

We thank the following organizations for sharing their case studies at our conferences, and have compiled a summary of their results and lessons learned in this document.

Boeing Space & Intelligence Systems

BHP Billiton

Central Nuclear Almaraz Trillo

AFOTEC U.S. Air Force

Hamilton Beach/Proctor-Silex

Airgo Networks

Bosch Security Systems

Action Park Multiforma Grupo

Celsa Group

HP Digital Camera Group

USAF Ogden Air Logistics Center

Chrysler

U.S. Marine Corps

Duke Energy

USAF Warner Robins Air Logistics Center

Edwards Airforce Base

TATA Steel

Danisco (Genencor International)

ThyssenKrupp (Johann A. Krause, Inc.)

Rapid Solutions Group

Alcatel-Lucent

Medtronic

Oklahoma City Air Logistics Center

U.S. Naval Shipyards

LSI Logic

Delta Air Lines, Inc.

Medtronic Europe

eircom

LeTourneau Technologies

Northern Digital Inc.

Oregon Freeze Dry

Proctor & Gamble Pharmaceuticals

Alna Software

Erickson Air-Crane

Skye Group

Marketing Architects

Valley Cabinet Works

U.S. Naval Aviation Depot Cherry Point

EXECUTION MANAGEMENT RESULTS

	BEFORE	AFTER
High Tech Medical Product Development Medtronic	1 software release every 6-9 months. Predictability was poor on device programs.	1 software release every 2 months. Schedule slips on device programs cut by 50%.
Theme Park Design, Install and Commissioning Action Park	121 projects completed in 2004.	142 projects completed in 2005. 153 projects completed in 2006.
Next Generation Wireless Technology Product Development Airgo Networks	Cycle time from first silicon to production for 1st generation was 19 months.	Cycle time from first silicon to production for 2nd generation was 8 months.
Telecomm Switches Design, Development & Upgrades Alcatel-Lucent	300 to 400 active projects with 30+ deliveries a month. Lead times were long. On-time delivery was poor.	Throughput was higher by 45% per person. Lead times are 10-25% shorter. 90+% on-time delivery.
Customized Software Development Alna Software	Throughput was stagnant for 3 years.	Throughput increased by 14% in first 6 months. Cycle time reduced by 25% and project completions increased 17% with 100% on-time delivery.
IT Projects Celsa Group	15 SAP functionality projects were completed per month.	SAP functionality project completions increased by 30% to 20 projects a month.
Nuclear Power Engineering Central Nuclear Almaraz Trillo	19 design evaluation and modification projects were completed per month.	Throughput increased by 25% to 24-30 projects per month.
Automotive Product Development Chrysler	Cycle time for prototype builds was 10 weeks.	Cycle time for prototype builds is 8 weeks.
Biotechnology Plant Engineering Danisco (Genencor)	20% projects on time.	87% projects on time. 15% immediate increase in throughput.
Telecommunications Network Design & Installation eircom, Ireland	On-time delivery less than 75%. Average cycle time was 70 days.	Increased on-time delivery to 98+%. Average cycle time dropped to 30 days.
Home Appliances New Product Development Hamilton Beach/Proctor-Silex	34 new products per year. 74% projects on time.	Increased throughput to 52 new products in 1st year, and to 70+ in 2nd year, with no increase in head count. 88% projects on time.
Digital Camera Product Development HP Digital Camera Group	6 cameras launched in 2004. 1 camera launched in spring window. 1 out of 6 cameras launched on time.	15 cameras launched in 2005. 7 cameras launched in spring window. All 15 cameras launched on time.
ASIC Design Technology Development LSI Logic	74% projects on time for small projects. Major tool releases were always late.	85% of small projects on time. Major tools released on time for three years in a row.
Advertising Product Development Marketing Architects	Completed 7 projects in 2006.	Completed 7 projects in 8 months of 2007.
Food Preparation & Packaging Oregon Freeze Dry	72 sales projects completed per year.	171 sales projects completed per year. 52% increase in throughput dollars.
Marketing/Publishing Support Rapid Solutions Group	Projects were always late. Lead times were not acceptable.	On-time delivery improved by 30%. Lead times were reduced by 25%.
Garment Design Skye Group	Product ranges were late to market.	100% due-date performance. 30% reduction in lead times and sampling costs.
Defense Products Design and Manufacturing TECNOBIT	Difficult to synchronize Design and Manufacturing. Long project cycle times with frequent delays.	Project cycle times were reduced by 20%.
Automotive Assembly Systems, Engineer-to-Order * Projects vary from large fully automated assembly lines to small retooling projects. ThyssenKrupp (Johann A. Krause)	70% of projects were late. High overtime and outsourcing.	Lateness reduced by 50%. 63% productivity gain. 15% more projects completed.
Custom Furniture Design and Manufacturing Valley Cabinet Works	Struggled to complete 200 custom furniture projects per year. Revenues were flat and business was just breaking even. A lot of firefighting in execution.	Completed 334 projects in 9 months. Revenues increased 88% and profits increased by 300% in the first year. Firefighting and thrashing eliminated.
High Tech Medical Product Development Medtronic, Europe	Device projects took 18 months on average and were unpredictable.	Development cycle time reduced to 9 months. On-time delivery increased to 90%.

EXECUTION MANAGEMENT RESULTS

	BEFORE	AFTER
Electrical Power Transmission, Engineer-to-Order ABB AG, Power Technologies Division	Throughput was 300 bays per year.	Throughput increased to 430 bays per year.
Iron Ore Asset Development Projects BHP Billiton	25,800 man-hours of engineering design work had to be completed in 8 months. Historical delays of 2 weeks and man-hour overruns of 20%.	Project was finished 3 weeks early. Productivity increased by 25% with only 19,500 man-hours needed.
Satellite Design and Assembly Boeing Space & Intelligence Systems	Antenna Assembly and Test was the constraint of the Satellite.	Antenna Assembly and Test was no longer the constraint of the Satellite. Productivity increased by 64% on the next Satellite and a further 26% on the subsequent Satellite.
Oil & Gas Platform Design & Manufacturing LeTourneau Technologies, Inc.	Design Engineering took 15 months. Production Engineering took 9 months. Fabrication and Assembly took 8 months.	Design Engineering takes 9 months (35% less cycle time). Production Engineering takes 5 months (44% less cycle time). Fabrication and Assembly takes 5 months (38% less cycle time) with 22% improvement in labor productivity.
Steel Plant Maintenance TATA Steel	Boiler Conversion projects took 300-500 days.	Cycle times were reduced to between 120-160 days. Saving of $13.4 million.
Engine Repair & Overhaul Delta Air Lines, Inc.	Produced 40 engines per month. 4 weeks piece part cycle time.	Increased production by 23% (50+ engines/month), 16%-26% reduction in engine turnaround time. 2.5 weeks piece part cycle time, 25% increase in piece part throughput.
Helicopter Manufacturing and Maintenance Erickson Air-Crane	Projects were constantly delayed with only 33% projects completed on-time.	Projects completed on-time increased to 83%.
Aircraft Repair & Overhaul US Air Force, Oklahoma City Air Logistics Center, B-1 Bomber Line	Turnaround time 162 days. 7 aircrafts in repair cycle.	Turnaround time reduced to 115 days. 4 aircrafts in repair cycle (3 returned to customer). Production output increased from 185 hours/day to 273. 1 1/2 dock spaces freed up.
Aircraft Repair & Overhaul US Air Force, Ogden Air Logistics Center, C130 Production Line	21-24 aircrafts on station.	Reduced to 18 aircrafts on station. 25 out of 26 aircrafts delivered on-time or early. (accumulated 191 days of early delivery in 6 months total)
Warfighter Systems Testing US Air Force Operational Test & Evaluation Center	Long cycle times. Low utilization of resources. Poor visibility on project slips.	30% reduction in cycle time measured over 900 projects. 30% improvement in resource utilization. 88% on-time delivery performance.
Aircraft Repair & Overhaul US Air Force, Warner Robins Air Logistics Center, C5 Production Line	Turnaround time 240 days. 13 aircrafts in repair cycle.	Turnaround time 160 days. 7 aircrafts in repair cycle. 75% fewer defects.
Aircraft Upgrade & Repair US Air Force, Warner Robins Air Logistics Center, C17 Production Line	Throughput of 178 hours per aircraft per day, turnaround time 46-180 days. Mechanic output 3.6 hours per day.	25% increase in throughput, turnaround time reduced to 37-121 days. Mechanic output increased to 4.75 hours per day. 40% overtime reduction.
Army Vehicles Maintenance & Repair US Marine Corps Logistics Base, Barstow, CA	Repair cycle time for MK48 was 168 days. Repair cycle time for LAV25 was 180 days. Repair cycle time for MK14 was 152 days. Repair cycle time for LAVAT was 182 days.	Repair cycle time for MK48 is 82 days. Repair cycle time for LAV25 is 124 days. Repair cycle time for MK14 is 59 days. Repair cycle time for LAVAT is 122 days.
Aircraft Repair & Overhaul US Naval Aviation Depot, Cherry Point	Average turnaround time for H-46 aircrafts as 225 days. Average turnaround time for H-53 aircrafts was 310 days; throughput was 23 per year.	Reduced H-46 turnaround time to 167 days, while work scope was increasing. Reduced H-53 turnaround time to 180 days. Delivered 23 aircrafts in 6 months; throughput of 46 per year.
Submarine Maintenance & Repair US Naval Shipyard, Pearl Harbor	Job Completion Rate = 94%. On-time delivery less than 60%. Cost per job was $5,043.	Job Completion Rate increased to 98%. Increased on-time delivery to 95+%. Reduced cost per job to $3,355, a 33% reduction. Overtime dropped by 49%, a $9M saving in the 1st year.

LESSONS LEARNED

We are grateful to our customers for helping us pioneer Execution Management and also for openly sharing their successes and challenges in implementing it. Based on wide ranging case studies over the last 10 years, we have compiled a list of traps to avoid when implementing Critical Chain, as well as guidelines for getting extraordinary results.

TRAPS TO AVOID	HOW TO GET EXTRAORDINARY RESULTS
Focus on cultural change, and expect that results will automatically come about. ■ Implement Critical Chain because it makes sense and everybody is doing it. ■ Educate and train the rank and file in Critical Chain to bring about behavioral changes. ■ Wait patiently for results until the required management skills are fully developed, and management processes are mature.	**To get results, we must focus on results. Cultural change will come about only if we get results first.** 1 ■ Implement Critical Chain only if improving project performance will also improve the organization's bottom line. ■ Results can be achieved quickly by changing rules, policies and measurements. ■ Get and monitor results from Day One. Once managers taste success, they will develop the required skills and processes.
The main job of executives is to sponsor the initiative and provide resources for the implementation. ■ Launch the implementation with a lot of fanfare, hoping the organization will understand its importance and go for it. ■ All that senior managers need to do during the implementation is to keep communicating. ■ Rely on classroom education and training to change the day-to-day management practices.	**Success is achieved when executives are intimately involved in the implementation.** 2 ■ An organization gets serious about the new rules only if it sees changes in policies and measurements. ■ During the transition senior line managers have to be like bulldozers, anticipating and removing obstacles in the way. ■ On-the-job coaching is required to make the new rules a habit. It is best done by managers, not trainers.
Critical Chain is about better planning and tracking. ■ Believe that project commitments are not met because they are unrealistic; and that Critical Chain helps by level loading the resources and adding buffers. ■ Use buffer reports to enhance visibility for top management. ■ Reflect all variables in the project plans so that we can optimize the plans and provide precise instructions. ■ Tweak existing processes to accommodate Critical Chain. ■ Integrate Earned Value with Critical Chain so that the same system can be used to report costs and manage execution.	**Critical Chain is about managing execution effectively.** 3 ■ Significant time and capacity are wasted due to multitasking and poor synchronization. Critical Chain addresses the root cause by changing the rules of Execution Management. ■ Exploit buffer signals to take swift actions to help execution. ■ Reflect only key constraints in the plans because uncertainties will cause even the most meticulous plans to go awry. ■ Discontinue redundant or conflicting management processes. ■ Keep Earned Value and Critical Chain at arms' length. Mixing the two solutions will render them both useless.
Accept compromises to achieve consensus. ■ Do not pipeline the projects because it is difficult to get agreement on relative project priorities. ■ Accept smaller than 50% buffers because people won't acknowledge or give up safeties hidden in task estimates. ■ Tolerate if task priorities are not followed, or if buffers remain red. "At least we are getting visibility".	**True buy-in comes from realizing that the current rules of managing are highly wasteful and need to change.** 4 ■ Get senior managers to appreciate the merits of working on fewer projects at a time. ■ Remove measurements that cause people to hide safeties into their estimates, and make 50% buffers mandatory. ■ Task priorities that cannot be followed, and buffers that are always red, point to systemic problems that must be solved.
Process discipline is the key to sustenance. ■ Enforce discipline through forceful management.	**Create an environment that demands and encourages superior execution.** 5 ■ Translate business pressures into aggressive execution goals. ■ An effective way to sustain success is to continue improving. Significant improvements in speed and efficiency are to be had even after the initial gains. Establish a process to continually prioritize and attack the causes of buffer consumption. ■ Furthermore, if operational improvements are leveraged in sales and marketing, the organization will have no choice but to sustain and improve. (In many industries superior delivery performance is a competitive advantage, and can help win sales and charge premium prices.)

*Complimentary DVD's of all the Project Flow presentations can be requested from **dvd@realization.com**.*

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