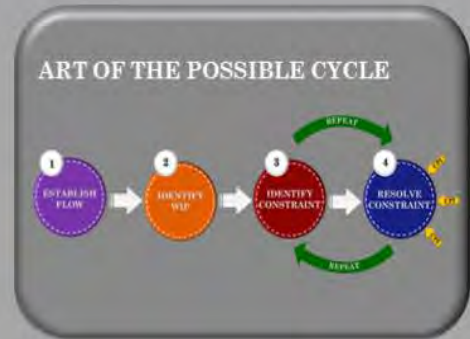


Art of the Possible Handbook

AFSCH60-101

Date



Air Force Sustainment Center



One Center
Three Air Logistics Complexes
Three Air Base Wings
Two Supply Chain Wings *with a diverse mission set*



The Air Force Sustainment Center's (AFSC) mission is to deliver combat power for America. Our success is the foundation of the warfighter's success, whether it is ensuring our nation's nuclear deterrent, maintaining air supremacy, fueling the fight, or delivering hope and saving lives. Our warriors in combat cannot succeed without the air, space, and cyberspace capabilities the AFSC produces.

Behind this war-winning mission, we have an amazing team. If you look at how far the organization has come in the few short years since its inception, it is truly a model for success. Moving forward, there will be no change in direction away from the fundamentals that have made AFSC great under its first two commanders. Together, we will build on the legacy of greatness already achieved, as we continue to explore the many untapped opportunities "Art of the Possible" (AoP) can provide. With your hard work, dedication and professionalism, AFSC will continue to realize incredible results across the enterprise. The reward will be improved war-winning capabilities in the hands of our Total Force Airmen.



AoP is the fundamental basis of how we operate across the entire AFSC. It is not what we do, it is HOW we do everything. It is both a philosophy and a methodology that enables us to achieve significant results while being good stewards of taxpayer dollars. It is also the "playbook" that allows us to operate as one team across each of our 26 operating locations. We directly benefit our customers and our suppliers when we speak with a consistent voice and use one set of operating principles. We are one team, with one operating system, one language, and common goals. This is what makes us a world-class organization.

AoP enables us to have a better understanding of our processes and identify the constraints that prevent us from operating better, faster, and cheaper. Once we understand our constraints, we can directly focus our resources and energy to eliminate, or reduce them. It does not matter if we are conducting aircraft maintenance in one of our Complexes, or executing an administrative action in one of our Air Base Wings, there are processes we must follow. By focusing on the constraints within every process, we gain a better understanding of how to improve our efficiency in every area of the AFSC.

AoP requires leadership and commitment at all levels. While we embrace the challenges of AoP and recognize its benefits, every leader must commit to its principles to make it work. I expect all leaders to have the ability to build and run a team, to influence outside organizations, and to possess mastery of their processes. AoP is our management framework for all processes. It provides the right way to achieve the right results. Getting the right results the wrong way is not only non-compliant, it is not sustainable.

This handbook is an important part of institutionalizing AoP across our enterprise. It reflects collective experiences, lessons learned, best practices, acumen, and important content on how AoP should be applied in every work area. This handbook is the foundation of our training activities and I expect every supervisor and leader within AFSC to be very familiar with its purpose and content – and to apply it every day!

AoP must be the thread that runs through everything we do. Through commitment and disciplined implementation, we will continue to operationalize AoP and make continuous process improvement and cost-consciousness a part of our culture. AoP is how we do business, and through your leadership, it will help us deliver even more combat power for America.

Your Fellow Airman,

A handwritten signature in black ink, appearing to read "D. Kirkland".

Donald E. Kirkland
Lieutenant General, USAF
Commander

BY ORDER OF THE COMMANDER
AIR FORCE SUSTAINMENT CENTER

AIR FORCE SUSTAINMENT CENTER
HANDBOOK 60-101

Date:



Standardization

AFSC Art of the Possible Handbook

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This is a newly revised handbook and should be reviewed in its entirety. As stated in Joint Publication (JP) 4-0, Joint Logistics, “the relative combat power that military forces can generate against an adversary is constrained by a nation’s capability to plan for, gain access to, and deliver forces and materiel to required points of application”. Art of the Possible (AoP) is the constraints based management system used by the Air Force Sustainment Center (AFSC) to provide effective support to the delivery of combat power by the warfighter. This handbook implements Air Force Policy Directive (AFPD) 60-1, Air Force Standardization Program and prescribes minimum requirements for implementing AoP, a standard constraints based management system for managing, conducting, tracking, and reporting workload performed within AFSC. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) listed above using the AF Form 847, Recommendation for Change of Publication; route AF Forms 847 from the field through the appropriate chain of command. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual (AFMAN) 33-363, Management of Records, and disposed of IAW Air Force Records Disposition Schedule (RDS) located in the Air Force Records Information Management System (AFRIMS).

SUMMARY OF CHANGES

This document has been substantially revised and must be completely reviewed. Major changes include the preface, Andon, focus and finish, takt time, and radiator chart paragraph re-write. The radiator chart has been updated replacing “Networks” with process flow.

1. Scope. This publication is the keystone document for AFSC's AoP. It provides overarching doctrine on constraint based management of center Mission Essential Tasks (METs). It provides the foundation, fundamentals, and core tenets that guide commanders and directors in implementing, executing, and, assessing AoP.

2. Purpose. This publication has been prepared under the direction of the commander of the AFSC. It sets forth Center doctrine for the activities and performance of the AFSC in constraints based management and provides the basis for the implementation, execution, and assessment of AoP within AFSC units. It provides guidance for the management of center METs. It provides the framework within which METs can be optimized to support Air Force operations throughout the world. This publication is intended to provide guidance to AFSC commanders, directors, and their staffs for constraint based management of METs.

3. Application.

3.1. AFSC directives established in this publication apply to all AFSC organizations.

3.2. The AoP Handbook is implemented by AFSCI 60-101 and will be used by AFSC senior leaders to create a culture that relies on the skills, abilities, and forward thinking of the entire enterprise to create the teamwork necessary to enable AoP. If conflicts arise between the contents of this publication and the contents of complex, wing, or directorate publications, this publication will take precedence unless the commander of the AFSC has provided more current and specific guidance.

Chapter 1 – INTRODUCTION

- 1.1. What is Art of the Possible (AoP)?
- 1.2. Why does AFSC practice AoP?
- 1.3. The Concept of Speed
- 1.4. What are the Core Tenets of AoP?
- 1.5. How do I Implement AoP?

Chapter 2 – LEADERSHIP MODEL

- 2.1. Introduction
- 2.2. Leadership Model Breakdown
- 2.3. Key Behaviors
- 2.4. Keys to Success
- 2.5. Leadership and Change
- 2.6. Leadership Model – Key Take Aways

Chapter 3 – FLOW AND THE SCIENCE OF THROUGHPUT

- 3.1. Introduction
- 3.2. The Concept of Flow
- 3.3. Little's Law
- 3.4. The Science of Throughput – Critical Path
- 3.5. Critical Path vs. Critical Chain
- 3.6. Gated Process Machines

- 3.7. Process Discipline
- 3.8. Summary
- 3.9. Principles of Flow and the Science of Throughput – Key Take Aways

Chapter 4 – THEORY OF CONSTRAINTS AND CONSTRAINT RESOLUTION

- 4.1. Introduction
- 4.2. Changing the Way People Think
- 4.3. Constraints Based Management
- 4.4. Theory of Constraints (ToC)
- 4.5. Drum-Buffer-Rope (DBR)
- 4.6. Constraint Resolution
- 4.7. Constraint Resolution – Continuous Process Improvement (CPI)
- 4.8. Summary
- 4.9. Theory of Constraints and Constraint Resolution – Key Take Aways

Chapter 5 – RADIATOR CHART

- 5.1. Introduction
- 5.2. Road to...
- 5.3. Process Flow
- 5.4. Gates
- 5.5. Release Points
- 5.6. Tactical Execution: The Bottom Four
- 5.7. Leadership Pillars
- 5.8. Process Pillars
- 5.9. Summary
- 5.10. Radiator Chart – Key Take Aways

Chapter 6 – WALL WALKS AND TACTICAL MANAGEMENT

- 6.1. Introduction
- 6.2. Wall Walks
- 6.3. Tactical Management
- 6.4. Summary
- 6.5. Wall Walks and Tactical Management – Key Take Aways

Chapter 7 – HOW TO GET STARTED

- 7.1. Step 1: Identify and Define Mission Essential Task List (METL)
- 7.2. Step 2: Select One Task for AoP Implementation
- 7.3. Step 3: Define Flow and WIP
- 7.4. Step 4: Implement Wall Walks
- 7.5. Step 5: Implement Tactical Management
- 7.6. How to Get Started – Key Take Aways

Chapter 8 – ORGANIZATIONAL MATURITY AND THE MATURITY MATRIX

- 8.1. Introduction
- 8.2. Summary

Appendix Section

APPENDIX A – CASE STUDIES

- A.1. 72 Air Base Wing (ABW) – 72nd Logistics Readiness Squadron (LRS) Personal Property Processing
- A.2. AFSC Logistics Directorate's Performance Management Division (LGS) Non-Technical Special Projects
- A.3. Oklahoma City Air Logistics Complex (OC-ALC) KC-135
- A.4. Ogden Air Logistics Complex (OO-ALC) Strategic Planning
- A.5. Warner Robins Air Logistics Complex (WR-ALC) Safety

Attachment 1 - GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

Executive Summary

The Art of the Possible (AoP) is a constraints-based management system designed to create a workforce culture focused on efficient process execution. The AoP methodology does this by first creating a Mission Essential Task List (METL) in each work area. A thorough understanding of what each unit does in reference to their mission and customers is critical. Next, setting common goals and vetting them through the enterprise and all process stakeholders ensures commitment, ownership and teamwork toward accomplishing goals. Operationalizing a common enterprise vision by building process machines with measurable performance that guide data-driven decisions will ensure AFSC achieves AoP results.

AFSC processes are set up as machines that have specific, predictable results once they are understood. Process machines are based upon established AoP core tenets, principles of standard work, and visual displays that help the process doers understand the status of the process machine and how they affect the overall process. Any process can be gated in order to measure throughput and focus process improvement activities. There is science behind the creation of process machines leading to predictable outputs. Once a process machine is set up according to AoP methodologies and science, it is monitored and measured for performance. Tactical process management allows constraints in the process to be identified and the application of Continuous Process Improvement (CPI) techniques produces more efficient processes and execution. Process efficiency, coupled with eliminating non-value added process waste, equates to speed.

AoP creates a culture that is focused on identifying and urgently eliminating process constraints affecting the process critical path during execution. This culture relies on the skills, abilities and forward thinking of the enterprise workforce to create the necessary teamwork to enable speed.

Process speed is the key indicator that the machine is set, and the culture is in place, to enable processes to reach AoP goals and results. Process efficiency is the backbone of cost effective readiness. AoP results within AFSC will positively affect the cost of sustainment for the Air Force, thereby determining the size of the future Air Force and the ability of our nation to fight and win the next war.

The intent of this book is to communicate the core tenets and guiding principles of AoP to ensure these ideals become the foundation for daily operations. It also provides a simplified approach to getting started with AoP. Embracing AoP requires a culture shift. Together, we must build a culture of “believers” in the machine methodology and the necessity of an enterprise approach to constraints based management in order to attain AoP results. This will require leaders to be champions of change by identifying their burning platform(s), administering AFSC’s compelling vision, and driving the workforce toward maximum efficiency.

Ultimately, the AoP is about utilizing a methodical approach to improve processes in order to obtain AoP results. It is about reaching beyond today’s limitations to grasp previously unimagined heights of performance. It is about challenging each other to recognize opportunities, eliminate constraints, improve processes and optimize resources to achieve world-record results. It isn’t about working harder, cutting corners or jeopardizing workplace safety but about expanding our vision of what is truly possible and refusing to settle for marginal improvements.

Chapter 1

INTRODUCTION

1.1. What is Art of the Possible (AoP)?

1.1.1. Art of the Possible (AoP) is a constraints based management system designed to create an environment for success by: creating a culture of problem-solvers, defining processes (aka machines), eliminating constraints, and continuously improving.

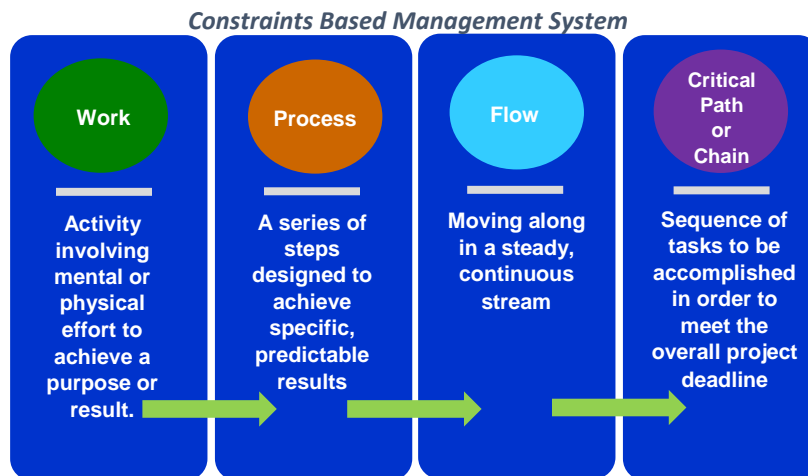
1.1.2. AoP is the framework for how the Air Force Sustainment Center (AFSC) conducts business and how we strive to achieve world class results in warfighter support. AoP is a deliberate, scientific approach to cost reduction through improved process control. Everything AFSC does is a process. All AFSC processes can be mapped and developed into process machines using flow principles:

1.1.2.1. All work is a process and has flow.

1.1.2.2. Flow is defined through a critical path or critical chain.

1.1.2.3. Once a machine is set, and displayed visually, it's monitored for performance.

1.1.2.4. Find a constraint, fix the constraint...continue to monitor.



1.1.3. AoP is a methodical approach to our business; a science behind our operations that is based on sound “flow” principles utilizing a constraints based management philosophy that leads to a predictable output. AFSC processes are seen as machines that can be set up to have specific, predictable results once they are understood. Process machines are designed to exceed customer expectations, reduce Work In Process (WIP), and increase throughput to expose capacity for increased warfighter support. In addition, process machines must be customer focused and directly aligned with customer requirements. Daily identification and elimination of process constraints affecting the critical path or chain is necessary for success. Process machine performance is monitored through standard work and visual displays with

a focus on Continuous Process Improvement (CPI) for more efficient processes and execution.

1.2. Why does AFSC practice AoP?

1.2.1. The bottom line: rising weapon system readiness costs. Weapon system sustainment costs are growing at an unsustainable rate. These costs determine the size of the force we can afford to sustain. The size of our force determines the ability to fight and win the next war. AFSC already performs well in effectiveness, now we need to focus on cost-effectiveness.

1.2.1.1. More readiness, same cost.

1.2.1.2. Same readiness, less cost.

1.3. The Concept of Speed.

1.3.1. AoP accomplishes its objectives by increasing speed. The term speed in AoP lexicon, is meant to be synonymous with efficient processes that promote throughput paced to a road to... (aka the burning platform). In its most basic sense, speed equals reduced flowtime. AoP creates a methodology that measures performance in a manner that focuses the organization on the weakest link in their processes. This focus leads to process improvement initiatives that affect the speed of throughput for the organizational process. Speed also means quickly resolving constraints that affect the critical path of the process during execution to enable the process to continue to move forward unhindered.

1.3.2. The AFSC could continue to follow the old way of doing business to complete our processes. However, considering time, money, space, manpower and other severe constraints facing us, we must leverage speed. AFSC's workforce must not cling to an inefficient process out of a fear of change. We must free up limited resources by increasing the speed, in other words reducing wasted time and effort. Speed is not working faster; it is working more efficiently, and thereby increasing value for the warfighter.

1.3.3. The game plan, the tools, the science, and the philosophies are all in support of increasing speed. With speed comes reduced WIP, with reduced WIP comes reduced resource requirements - less dock space, less shop space, less equipment, less labor costs, less supporting overhead. Speed is good. Focusing on speed provides the mechanism that will lead to reduced cost and increased capabilities for the Air Force.

1.3.4. It is very important to note that the concept of speed, is not a speed at any cost proponent. It is not about hurrying, or cutting corners, nor is speed obtained on the backs of the workforce. Speed must be achieved through improved processes, an enterprise focus, and a common agreement and understanding of the goal of speed. Speed must be mindful of safety and quality. The AFSC recognizes that speed without quality is not beneficial; therefore the focus on speed is about understanding the processes that fuel our execution, both on and above the shop floor, and improving those processes with the goal of making the

processes more expedient. AoP's focus on efficiency serves to create speed while improving quality and safety – making quality and safety integral parts of the process.

1.4. What are the Core Tenets of AoP?

1.4.1. The following six items are identified as core tenets to AoP. Each of the core tenets will be broken down and explained in the subsequent chapters of this book:

- 1.4.1.1. Leadership Model – principles to create an environment for success.
- 1.4.1.2. Radiator Chart - to optimize flow of products & services through entire process.
- 1.4.1.3. Establish Flow (includes flow principles).
- 1.4.1.4. Identify WIP.
- 1.4.1.5. Identify Constraint (includes wall walk, visual management, and data-driven decisions).
- 1.4.1.6. Resolve Constraint (Theory of Constraints (TOC), Lean, and Six Sigma will be used to resolve constraints).

1.4.2. The core tenets of AoP ensure a standardized approach toward building process machines and the requirements necessary to operate them once they are established.

1.5. How Do I Implement AoP?

1.5.1. AFSC has designated five senior AoP Subject Matter Experts (SMEs) responsible for setting AoP doctrine and policy and have developed a standardized implementation plan all AFSC units can utilize to get started. The steps will be summarized here and broken down in detail in chapter six.

- 1.5.1.1. Step 1: Identify and define Mission Essential Task List (METL).
- 1.5.1.2. Step 2: Select one task for implementation.
- 1.5.1.3. Step 3: Define flow and WIP.
- 1.5.1.4. Step 4: Implement wall walks.
- 1.5.1.5. Step 5: Implement tactical management.

1.5.2. To reach our objective of operationalizing AoP across the AFSC, proactive engagement from leadership as change champions is essential. Focused leadership is the lynchpin that will enable AFSC to evolve our culture in support of a process improvement drive that is sanctioned by everyone. An engaged workforce vested in mission success is the

catalyst for AoP results. Leaders focused on developing our people, improving our processes, and managing our resources will set our course. The combination of leadership, AoP core tenets, and process machine management create an environment for success and when properly managed, ensure unity of effort and unity of purpose within our organization.

Chapter 2

LEADERSHIP MODEL

2.1. Introduction: AFSC has developed a Leadership Model to communicate the vision that leadership culture is the foundation which creates the environment for success. “Therefore creating a leadership culture motivated to both initiate and achieve common goals with an emphasis on the ideals of developing *people*, managing *resources* and improving *processes* under the tenets of speed, safety, quality, and cost effectiveness while embodying the character traits of *teamwork*, *accountability*, *respect*, *transparency*, *credibility*, and *engagement* is essential in order to establish an environment for attaining *art of the possible* goals” (Litchfield, 2012). This model provides a valuable overview of the leadership ideals that is vital to the successful execution of the AFSC mission. It encompasses theory, behaviors, and recommended actions relating to some of the leadership, management, and supervisory considerations needed to be successful in AFSC’s complicated industrial environment. Our business is complex in many ways and requires a balanced approach to ensure we excel at all levels of the enterprise.



2.1.1. Sustaining weapon system readiness to generate airpower for America is AFSC’s mission and overarching focus. Successfully accomplishing our mission in a time of unprecedented challenges demands we achieve our full potential as we strive for art of the possible results. In an environment where organizations are struggling to survive, we are looking to thrive, lead, and exceed. We must provide greater military capability and improved readiness at less cost than ever before. It is not about working harder, cutting corners, or jeopardizing workplace safety; it is about recognizing opportunities, understanding, and eliminating true limiting constraints, improving processes, and maximizing available resources. To achieve our full potential, we must start with a common sight picture that focuses on creating an environment for success. The Leadership Model provides enduring principles to equip everyone with a holistic approach to gaining effectiveness and efficiency. By creating a leadership and management construct where teamwork, accountability, respect, transparency, credibility, and engagement are paramount, we create an environment where we can achieve art of the possible results. We must embrace a culture of performance that encompasses the individual, the agency, and the enterprise.

2.2. Leadership Model Breakdown.

2.2.1. **Common Goals:** Common goals are the rallying point for everyone in AFSC. To drive success oriented behavior through the organization, these goals must be decomposed to relevant objectives and improvement areas that are meaningful at every level and every shop ensuring each work center has their own accountability to meet mission expectations. Common goals drive us to provide “best on the planet” sustainment support with the right capability at the least cost. It is imperative that both professional leaders and the professional workforce understand their specific work center goals and roles in meeting performance targets. We would not expect everyone in

AFSC to recite a list of organizational goals, but each and every individual should understand what is expected in their work area and how they measure up against specific targets. Understanding roles and expectations allows everyone to know if we are winning and keeping our promises.

Common Goals



2.2.1.1. To reach these common goals, we must foster a culture of transparency. We are not in the business of looking good, we have a mandate to be good; in fact, best on the planet. To foster that culture, senior leaders must identify the critical focus areas to achieve cutting-edge, innovative, and sustainable results from process improvement initiatives. Center team members need to define stretch goals that are out of reach of current performance levels and embrace creative and innovative thinking. Proactive engagement from leadership is essential as we evolve our culture to support a process improvement drive that is championed by everyone. An engaged workforce vested in mission success is the catalyst for art of the possible results.

2.2.2. **People, Process and Resources:** Leadership focus on developing our people, managing resources, and improving processes will set our course.

People: The strength of our organization lies in our dedicated, competent, and professional workforce. As leaders, we have a responsibility to build confidence and trust that our priorities balance both mission requirements and workforce needs. Our workforce needs the right skills, training, education, and experience to tackle the challenges of today and tomorrow. Developing both hard and soft skills is paramount to ensuring the workforce is ready to achieve mission success. Taking care of our people is the utmost priority.

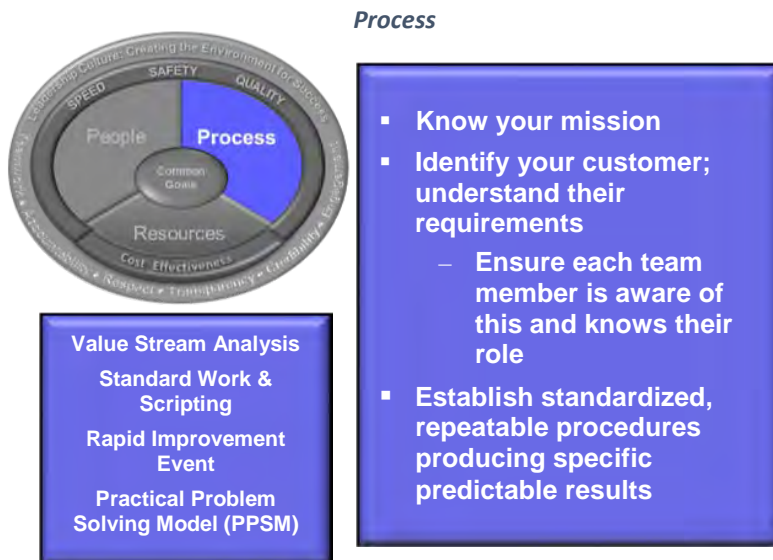


2.2.2.1.1. A key principle of leadership is a commitment to the growth of people.

A leadership focus requires that we develop employees who are equipped with knowledge that allows them to understand the enterprise, where they fit into the enterprise, and gives them the tools and opportunities to think for themselves by coming up with solutions to issues. Leaders can offer advice, provide direction,

and share thought processes, but developing those around us involves letting others develop answers and the way forward. The key is participation and practice. If pre-determined solutions are dispensed or employees are always handed the answer, they do not learn to perform root cause analysis or think through and find the answer for themselves – they do not become thinkers or problem-solvers.

2.2.2.2. Processes: Direct leadership involvement at all levels is the lynchpin that



binds this model together and the force that will increase our abilities to meet our demanding mission. In our organization, leaders must understand their processes and maximize their resources to not only meet the overall mission objectives, but also strive to reduce organizational costs through AoP process controls. AFSC’s battle rhythm and performance reviews allow for review of key performance metrics and identification of gaps and areas for improvement at every level to monitor progress toward achieving common goals. Leaders

in the center, regardless of position or function (strategic, operational, and tactical), will use AoP to target process constraints and will use CPI to resolve those constraints. Everyone in AFSC is accountable for improving the business and making today better than yesterday, while making tomorrow better than today.

2.2.2.2.1. Engaged leadership is a mindset that requires development and begins with a good understanding of expectations. These expectations include how the organization reacts when process execution is endangered, as well as nurturing a CPI culture that utilizes processes to solve the problems of today...today, so they will no longer be problems tomorrow.

2.2.2.2.3. Resources: Proper planning and responsible stewardship of resources is an essential prerequisite for success. Leaders are accountable for planning the right work environment and must identify needs lead-time away. Without proper planning and management of facilities, infrastructure, IT systems, equipment, tools, funding, and parts, we severely jeopardize mission capability and readiness. In our industrial and support environment, we must ensure our workforce has the necessities to accomplish the mission while understanding they may not have everything they desire.

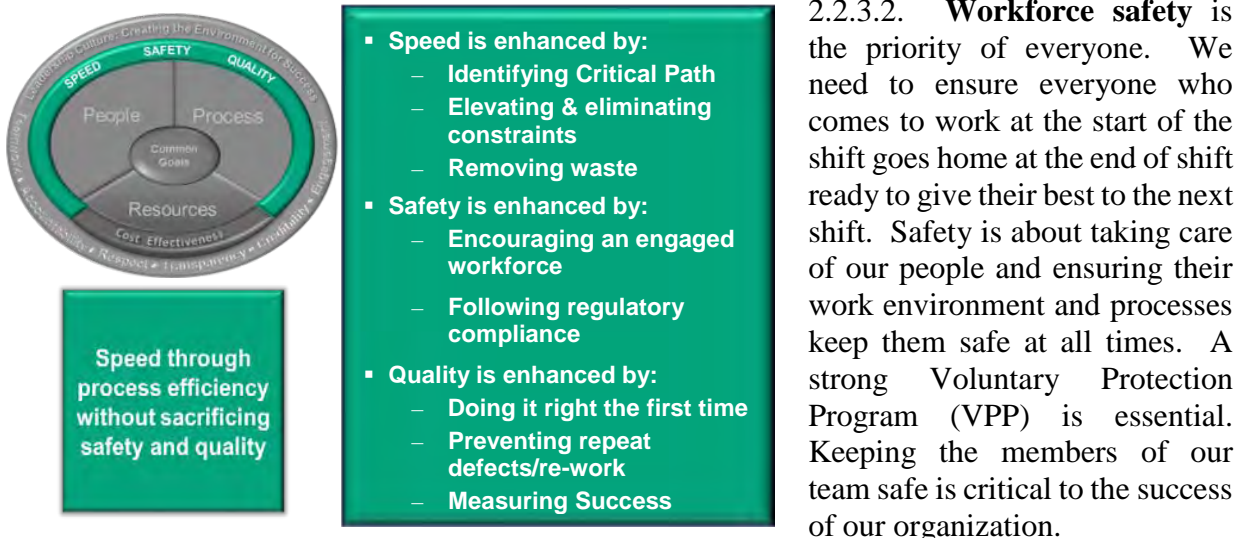
Resources



2.2.3. Speed, Safety, and Quality: The next step in the model is to use the people, processes, and resources to ensure our tenets of speed, safety, and quality are met.

2.2.3.1. Speed is NOT about cutting corners or simply working harder and faster. Instead, speed is enhanced by our ability to quickly identify, elevate, and eliminate constraints on the critical path of process execution. Our workforce must feel constraint and waste elimination are valued attributes. We must operate with the same sense of urgency to sustain critical path timelines as we do when facing mission failure.

Speed, Safety, and Quality



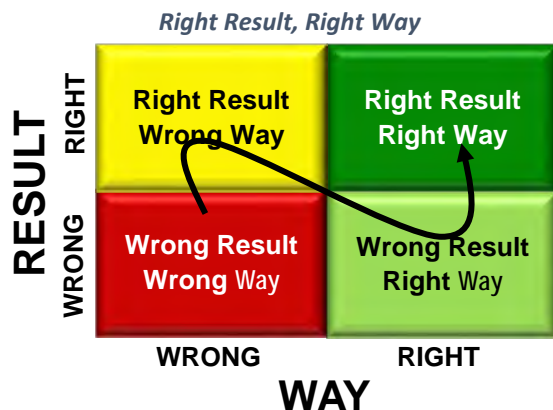
2.2.3.3. Quality: While speed and safety are important, quality is paramount. Defects in our products have the potential for disastrous effects on our warfighter. Leaders reinforce the mandate for quality and take the necessary steps to ensure quality is

sacrosanct. Mistakes will happen but we have the tools to identify and prevent repeats and take proactive steps to eliminate quality escapes. We build trust and confidence by doing our jobs right the first time.

2.2.4. Cost Effectiveness: The defense environment is changing and a heightened awareness of cost is forcing Air Force leadership to take an ever-mindful look into our spending. For Air Force leaders, this is a paradigm shift in the way we operate. Fluctuating annual budgets dictate the need to develop and implement cost-effective solutions to reduce operating costs, specifically within our organization. To understand where we can reduce cost, we must first have a firm grasp of what it costs to produce our end items. Once we understand where we spend our money, we can identify areas to reduce costs and eliminate wastes. The Department of Defense (DoD) and our warfighter customers are counting on us to provide available, affordable, and capable weapon systems on time and on cost. Our ability to reduce the cost to sustain weapons systems will affect our ability to defend our nation.



2.2.5. Culture: Creating the environment for success is the responsibility of every professional across the sustainment enterprise. AFSC's cultural foundation is built around the valued traits of our organization: professionalism, teamwork, accountability, respect, transparency, credibility, and engagement. To be best on the planet and reach excellence in warfighter support, we must get **the right result...the right way**. Creating a culture that recognizes and utilizes process improvement as a tool is really what leadership focus is all about.



2.2.5.1. Getting wrong results the wrong way ensures enterprise failure. Obtaining the right result the wrong way does not drive the proper AoP mindset. Getting the wrong result the right way is a signal that we are learning as an organization. Getting the right result the right way is the mark of a world-class organization.

2.2.5.2. All of these elements, along with process improvement tools, are essential leadership tools to be utilized in creating a CPI culture, but

engaged leadership is the trait that ensures the culture endures. Engaged leaders create opportunities to reinforce important concepts and ensure actions stay on track in order to get the right results. Opportunities for reinforcement include wall walks, Rapid Improvement Event (RIE) out briefs and updates, and weekly production meetings where improvement

initiatives are tied to gate performance. Reinforcement occurs during these opportunities by setting the tone that progress must be made on initiatives, improvements must be tied to performance, and events and initiatives must be collaborative within the enterprise.

Leadership Culture



2.2.5.3. Engaged leaders also look for opportunities to reinforce the culture through the use of CPI tools to attack the problems they see within their organizations. For example, insistence on the use of the Practical Problem Solving Model (PPSM) to address issues confronting the organization will eventually lead the organization to naturally turn to the model when faced with a problem. Continued insistence to call together a team of respected peers for an RIE to address performance gaps will eventually lead the organization to rely on this tool for improvement. A culture change requires dedication to the basics of the new culture and a consistent, relentless application of its principles.

2.2.5.4. The combination of organizational traits and process machine management creates the environment for success and when properly managed, ensures unity of effort and purpose within our organization. As leaders, it is our job to encourage everyone in the organization to be successful.

2.3. Key Behaviors.

2.3.1. **Teamwork:** Work in a collaborative/cooperative/integrated manner with customer/stakeholders/coworkers.

2.3.1.1. Actions to exemplify:

2.3.1.1.1. Pull together to identify and remove obstacles to achieving common goals; drive maximum results.

2.3.1.1.2. Cooperate with teammates to remove friction between organizations; seek to see the situation from the other's point of view.

2.3.1.1.3. Seek out and learn new skills, take initiative, and share learning and success with others.

2.3.1.1.4. Demonstrate commitment to providing the greatest value to internal and external customers.

2.3.1.1.5. Exhibit consistency of purpose to shift to a change/problem solving culture.

2.3.1.1.6. Demonstrate an openness to listen and learn from others.

2.3.1.1.7. Execute your assigned role.

2.3.2. **Accountability:** Do the right thing even when no one is looking. Be answerable for personal and organizational behavior.

2.3.2.1. **Actions to exemplify:**

2.3.2.1.1. Demonstrate alignment to the vision, strategic focus, and goals.

2.3.2.1.2. Set stretch goals to achieve AoP results and be personally and organizationally accountable to those goals.

2.3.2.1.3. Utilize guidance, tools, training, and standard processes to ensure compliance and individual responsibility.

2.3.2.1.4. Utilize expertise and knowledge of constraints based methodology to establish standard work and share best practices; use CPI to resolve constraints.

2.3.2.1.5. Demonstrate courage and integrity; clearly communicate defects observed or created.

2.3.2.1.6. Set clear expectations.

2.3.2.1.7. Demonstrate willingness to learn; standardize processes to ensure sustainment and resource optimization.

2.3.2.1.8. Make data-driven decisions, no guessing.

2.3.3. **Respect:** Actively display positive appreciation and consideration for the value and contributions of teammates.

2.3.3.1. **Actions to exemplify:**

2.3.3.1.1. Treat teammates with dignity and respect.

2.3.3.1.2. Accept and act on good ideas and innovation...listen and attend.

2.3.3.1.3. Promote an environment where personnel are passionate about process improvement and a culture of problem solvers.

2.3.4. **Transparency:** Communication that is open, honest, and continuous up, down, and across organizations.

2.3.4.1. **Actions to exemplify:**

2.3.4.1.1. Demonstrate horizontal and vertical integration and collaboration.

2.3.4.1.2. Ensure visual management is actively used to depict real-time performance and identify opportunities for improvement.

2.3.4.1.3. View constraints as opportunities for improvement, not for punitive measures.

2.3.4.1.4. Do not be afraid to identify shortfalls in your own process.

2.3.5. **Credibility:** Commitment to be the most effective, efficient, innovative, and respected world-class organization.

2.3.5.1. **Actions to exemplify:**

2.3.5.1.1. Build trust with customers by being responsive to their needs.

2.3.5.1.2. Leadership, labor management, and the workforce exemplify and share a strong sense of pride and ownership in AFSC's reputation.

2.3.5.1.3. Encourage innovation to improve performance for current and future requirements and support.

2.3.5.1.4. Provide the highest quality products and service to our customers.

2.3.5.1.5. Talk with data.

2.3.6. **Engagement:** Workforce authorized to identify constraints/waste and remove roadblocks to accurate reporting.

2.3.6.1. **Actions to exemplify:**

- 2.3.6.1.1. Delegate responsible decision making authority to the lowest possible level.
- 2.3.6.1.2. Delegate down to a level of personnel who are willing, able, and experienced.
- 2.3.6.1.3. Ensure employees are engaged in the implementation and successful sustainment of value-added solutions from CPI initiatives.
- 2.3.6.1.4. Seek inputs, listen carefully, and require data-driven actions/decisions.
- 2.3.6.1.5. Empower and inspire the workforce to identify improvement opportunities and possible solutions.
- 2.3.6.1.6. Foster self-directed actions and decisions to support customer requirements.
- 2.3.6.1.7. Be the expert at AoP.

2.4. Keys to Success: Institutionalize AoP – leading the process...achieving art of the possible results.

2.4.1. Commit to AoP core tenets:

- 2.4.1.1. Leadership Model.
- 2.4.1.2. Radiator Chart
- 2.4.1.3. Establish flow (includes flow principles).
- 2.4.1.4. Identify WIP.
- 2.4.1.5. Identify constraints (includes wall walks, visual management, and data-driven decisions).
- 2.4.1.6. Resolve constraint (includes Lean, Six Sigma).

2.4.2. Lead by example.

2.4.3. Identify and define METLs.

2.4.4. Establish common goals.

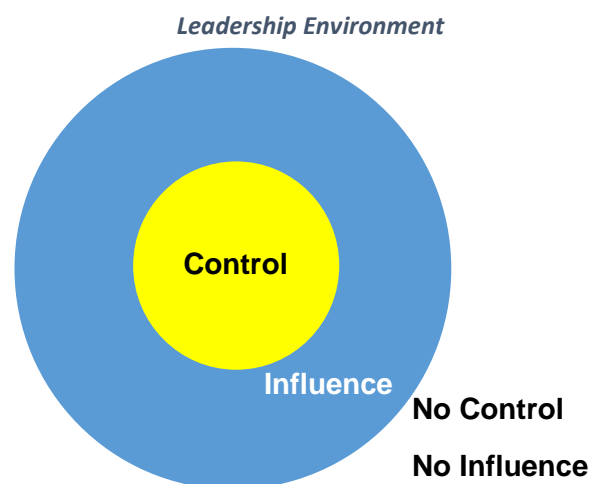
2.4.5. Know and measure your METL process machines.

- 2.4.6. Encourage creativity, initiative, and innovation.
- 2.4.7. Foster a culture of problem-solvers and critical thinkers.
- 2.4.8. Communicate openly and honestly.

2.5. Leadership and Change: Earlier in this chapter, we stated that the Leadership Model creates the environment for AoP success. It follows that leadership is the most important component in the AoP business model and influence is the single most important characteristic for leadership. Influence is defined as the effect that a person or thing has on someone's decisions, opinions, or behavior or on the way something happens. It is not about using your authority or position to get what you want – that will not even be an option outside your own area – it is about using data, facts, and logic to convince or motivate others to take a particular course of action. In the context of process management, influence is focused on mission accomplishment and organizational success. Using AoP helps break down organizational barriers and fosters relationships with internal and external customers, suppliers, and mission partners. Since few leaders actually control everything required to execute their process(es), influence is a key leadership skill to assure mission accomplishment and the relationships that follow enhance organizational success.

2.5.1. The leadership environment is composed of a sphere of control, a sphere of influence, and an outer area where the leader has no control and no influence.

2.5.2. Within the leaders sphere of control is process execution. AoP leaders guide their organizations to execute and improve processes using the AoP method in a continuous effort. A sphere of influence is created because using AoP forces organizations to form relationships with internal and external suppliers, customers, and partners since processes often cross organizational boundaries.



2.5.2.1. **Influence:** Building relationships not only builds trust and a common purpose, but also improves influence. Influence is the single most important characteristic for leadership. A leader must be able to affect outcomes through their influence of those who are responsible for action. The characteristic of influence is not meant to convey one of positional authority, but rather the use of influence to persuade or convince others using data and facts to build a consensus call for action (Greenleaf, n.d.).

2.5.2.1.1. In addition to relationships, a leader relies on their experience and character traits to create influence. Experience in the represented field lends credibility to the leader and helps to amplify influence on related topics. As previously stated, relationships play a huge role in determining the influence available within and outside an organization. To the extent a leader has built bridges and created a unifying purpose, their influence is likely to be increased.

2.5.2.1.2. Just to be clear, building relationships does not translate to not rocking the boat. Job one for a leader is to be engaged, assertively ask for and expect what is needed based on facts and data, to meet and exceed common goals. However, just because a request has facts and data to support it does not mean the request will be easily accepted. Leadership must use their influence to elevate issues, utilizing the impact to the critical path of the process as the center of discussion, to ensure teammates are able to function within their swim lanes in order to resolve issues. Relationship building can be a rocky road, but should be conducted with the intent of rallying everyone around common goals. This is a critical part of AoP's strength in creating a common language as organizations interact.

2.5.2.1.3. Finally, too many leaders spend too much time worrying about things they cannot control or influence and get pulled into the trap of "if only..." thinking. Spending time, effort, and resources in that area for very long removes the motivation for the unit to take any action until the "if only..." condition is resolved. AoP leaders should devote very little time to things they can neither control nor influence unless they can devise a strategy to change it.

2.5.2.1.4. To change the fabric of any organization, relationship building is essential. The Leadership Model requires "building the valued traits of our organization around teamwork, accountability, respect, transparency, credibility and engagement each day" (Litchfield, 2012). Amplifying these traits in our organizations and our leaders propels the influence of both within our enterprise; in effect, relationships are at the core of the Leadership Model. Creating a road to... vision, with buy-in from the enterprise stakeholders, requires the building of relationships in order to unite the enterprise around a common goal. Relationships are built from interactions that create an understanding of each teammate's role and perspective and are an important part of organizational span of control. Taking the time to build strong relationships with those who work for you and with you, as well as process stakeholders, is essential for success.

2.5.2.1.5. Relationships should be built around common goals. Center the discussion on process with the goal being constraint resolution. If the process is at the center of discussion and the team meets to resolve constraints, the finger points at the constraints rather than the stakeholders, thus, facilitating better business relationships and synergistic problem solving ability. The idea is to build bridges through relationships to overcome obstacles and enable the smooth execution of tasks that lead to positive results.

2.5.2.1.6. Effective leaders quickly assess where an organization is, project where it needs to go, and have strong ideas about how to get it there. Being comfortable in red is a condition to which AFSC leaders must become familiar. Reaching a new goal is meant to be challenging and requires living in red metrics while trying to achieve the next level of performance. The key is to create transparency in the organization by understanding performance gaps (red metrics), identifying the actions that will lead to the improvement required, and utilizing leadership to put the plan into action in order to improve organizational performance.

2.5.2.1.7. Transparency involves open communication of the constraints and action plan tied to improved performance. A crucial step is to identify the constraint or unacceptable situation which begins with recognizing the situation is unacceptable in the first place. This recognition comes from looking at the tech data and requirements. What are the rules that govern what is needed for the task at hand? Tech data and requirements provide the data that serves as the impetus for getting the right tools, parts, equipment, etc. and leadership sets the expectation that what is written is what is required.

2.5.2.1.8. The problems faced in AFSC often require enterprise solutions, therefore it is important to ensure all process stakeholders across all disciplines are present and participate in the constraint solution. A critical step to effective AoP implementation is to share the logic and the process behind the solution. People are usually interested in the process used to arrive at the solution in front of them. The more buy-in that is needed to execute the solution, the more information about the logic and process of arriving at the solution is needed. This allows those who were not able to be part of the solution process to at least make a judgment and gain understanding that the reasoning behind the solution is sound. Depending on the scope of the change desired, it may be necessary to communicate utilizing several different methods such as AoP SME assistance and further training.

2.5.2.1.9. Change does not occur overnight and concepts, especially complex concepts, may be heard but not fully understood initially. Be prepared to deliver the AoP concepts in different formats and many times in order to ensure the concepts are understood and the intent is clear. Engaged leaders create opportunities to reinforce important concepts and ensure actions stay on track in order to lead to results.

2.5.2.1.10. Engaged leaders also look for opportunities to reinforce the culture through the use of CPI tools to attack the problems they see within their organizations. Changing a culture requires a continued insistence on the basics of the new culture and a consistent and relentless application of its principals. This is what engaged leaders do and what is expected of everyone in an AFSC leadership role.

Leadership Model – Key Take Aways

- **Creates the environment for AoP success.**
- **Leadership is the most important part of AoP; influence is the single most important characteristic of leadership.**
- **Direct leadership involvement is the lynch pin that binds the model together and the force multiplier that will increase our abilities to meet our demanding mission (success starts with you and your commitment).**
- **Must create buy-in.**
- **Leaders in the center, regardless of position or function (strategic, operational, and tactical), will use AoP to target process constraints and will use CPI to resolve those constraints. Everyone in AFSC is accountable for improving the business and making today better than yesterday, while making tomorrow better than today.**
- **Being comfortable in the red is a condition to which AFSC leaders must become accustomed.**
- **It is more important to be good than to look good.**

Chapter 3

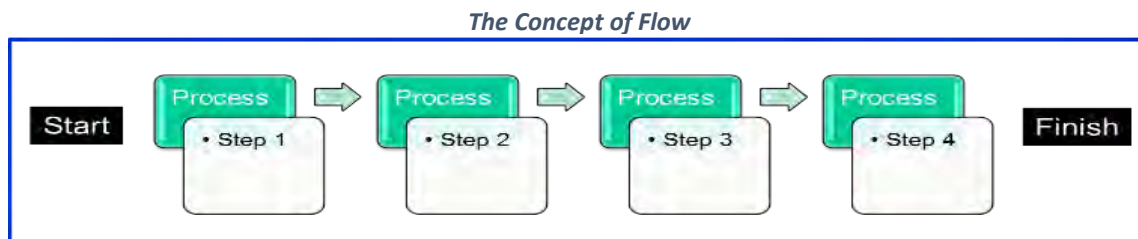
FLOW AND THE SCIENCE OF THROUGHPUT

3.1. Introduction: This chapter provides the framework for process machine philosophies in order to create a standardized throughput language within AFSC. It clearly defines a science for designing and operating process machines based on the fundamental principles of flow; controlling WIP, supportable work, manloading work, and rapid issue resolution. These are basic principles for creating flow in order to enable throughput. Flow involves having an input, creating value to that input, then producing an output.

3.1.1. AoP process machine principles can be applied in both administrative and production environments. A process machine can have almost any process descriptor. For instance: the *Service Contract Machine*; the *Installation Projects Machine*; the *Material Ordering Process Machine*, the *Demand Planning Machine*, the *Test Program Sets Machine*. There is a common misconception that AoP cannot be applied outside of a production-oriented organization; this concept is false. It is possible to take the principles outlined in this handbook and create a process machine which enables virtually any process to be built on AoP principles and monitored for performance. The challenge is to gain an understanding of AoP concepts, and then consider the endless possibilities where the principles can and should be applied to improve success.

3.1.2. AFSC process machines must be designed to exceed customer expectations and reduce WIP with the future state requirements in mind rather than current state performance. With reduced WIP comes reduced infrastructure and reduced resource requirements creating capacity for additional workload and reducing costs. This chapter introduces the relationship between WIP, flowtime and throughput in the context of Little's Law. It is critical for AFSC to increase the level of throughput in all of our processes....**THROUGHPUT IS KING**. A properly designed process machine provides a methodical approach to assessing throughput performance and allows AFSC to communicate changes and impacts in a common language. Well-built process machines allow users to adjust for known changes, such as increased or decreased requirements, and understand how to fine tune the process machine to achieve improved performance. Once the process machine is set, as long as it is operating within its designed boundaries (WIP, flowtime, etc.), it will produce the desired output, it must.

3.2. The Concept of Flow. As previously stated, all work AFSC accomplishes is a process. All processes have flow. Flow is the action of moving along in a steady, continuous stream...the continuous adding of value... the orderly movement of work through a series of established steps as depicted below:



3.2.1. What happens when we establish a repeatable process flow and monitor it? We will find out where work stacks up, thus identifying constraints in the system. We then resolve the constraint and continue to monitor flow, improving the flow each time we resolve a constraint.

3.2.2. What are sound flow principles in AoP?

3.2.2.1. Control WIP.

3.2.2.1.1. Understand multi-tasking and how it impacts efficiency (see multi-tasking below).

3.2.2.2. Allow only work that is supportable to be inducted into the process machine.

3.2.2.3. Manloading of work.

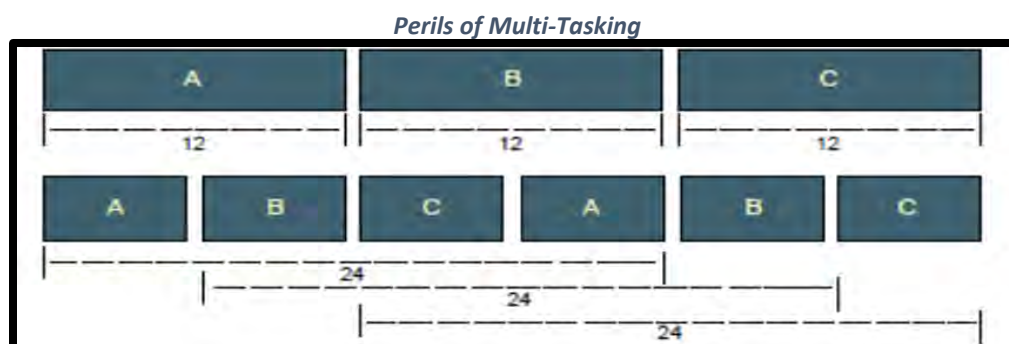
3.2.2.3.1. Putting the maximum number of people that can be reasonable applied to a project to allow it to finish as quickly as practical.

3.2.2.4. Resolve issues quickly.

3.2.2.4.1. Andon (rapid escalation).

3.2.3. **Multi-Tasking.** In the bullets above, multi-tasking refers to one person concurrently working on numerous tasks rather than working on one task at a time until they have reached a stopping point. In an administrative setting, there are often gaps of time in projects when the process doer is waiting on input/concurrence/feedback from others. During this waiting period, the process doer will work on other tasks; this is NOT the type of multi-tasking we are referencing.

3.2.3.1. Inefficient multi-tasking is stopping a process without first reaching a natural pause point or a completion point before beginning another process. This leaves both processes unfinished and the process doer's time spread between competing projects. Part of controlling WIP is not allowing work to move into the process machine until it is ready. Because balance is the key to a smooth process, we do not want to overwhelm or starve the process machine. To explore the negative impact of spreading resources too thin, also known as multi-tasking, consider the visual representation below:



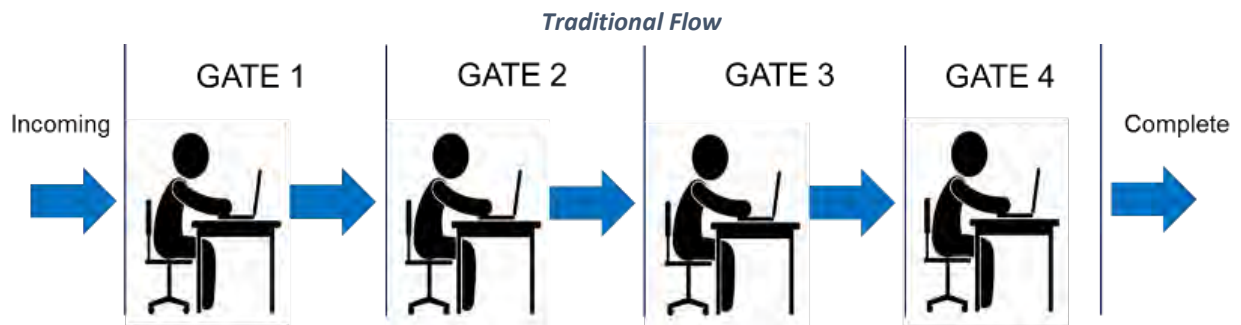
3.2.3.2. This diagram depicts a shop with three projects, A, B and C, each with a 12 day lead time from induction to completion. Unfortunately, many organizations are under pressure and feel the need to make progress on all projects rather than working each project sequentially. Instead of working each project from start to finish A, B, then C and finishing each project within 12 days of induction, the organization chooses to work six days on each project so they can report progress to each customer. The result of this decision is depicted in the second portion of the diagram – A, B, C, A, B, C – and results in each project taking 24 days from induction, double the original lead time! Furthermore, the sequential scheduling method at the top of the graphic has project A delivering on day 12, B on day 24 and C on day 36. The multi-tasking method has project A delivering on day 24, B on day 30 and C on day 36. In this case, the shop met the expectations of one customer while completely disappointing the other two!

3.2.3.3. From a warfighter's perspective, if we were to work on the repair process of three Mission Impaired Capability Awaiting Parts (MICAPs) concurrently instead of completing them one at a time as depicted above, three aircraft would be grounded for longer than necessary. From an administrative perspective, if we were to work on three major projects at a time instead of completing them one at a time as depicted above, three major projects would be late to completion.

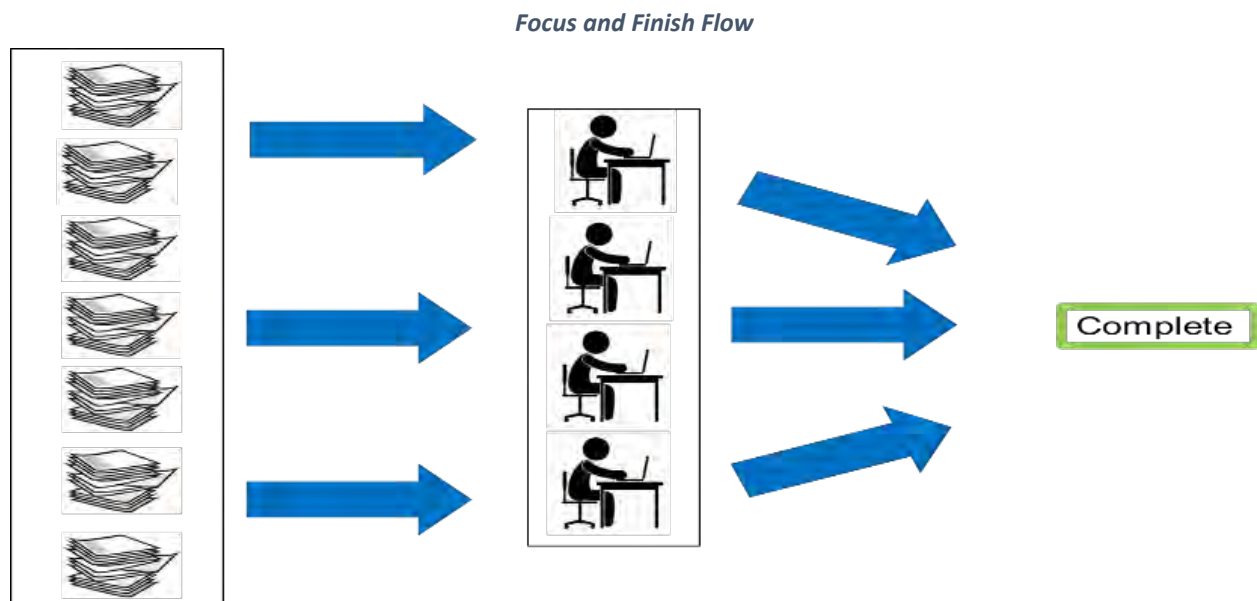
3.2.3.4. Bottom line: the price of multi-tasking is extended flowtimes. Since excess WIP creates multi-tasking, utilizing queue to control active WIP within a gate keeps the gate from spreading resources just to show coverage and serves to increase the throughput through the gate. (See gated machines in this chapter).

3.2.3.5. Before we leave the concept of flow and move on, let's look at some common examples of flow.

3.2.3.5.1. Traditional flow has a critical path divided into gates with various levels of WIP flowing through the system, (see critical path later in this chapter). Constraints are identified as the gate with the lowest throughput rate. This may manifest itself with queue before the gate or excessive WIP within the gate. Work enters the process and flows from one gate to the next until complete as depicted below:



3.2.3.5.2. Focus and Finish Flow: Focus and finish is a means of controlling WIP to prevent process doers from inherently taking on more work than can be efficiently managed in order to complete projects in a timely fashion. Focus and finish prevents inefficient multi-tasking from occurring through a controlled release of work. Think of an engineering office with people who can take on a variety of projects of various durations. Typically projects (or WIP) are assigned based on area of responsibility, skill, etc. and we hand out all the work to all the people or they receive the work and we do not even know they are working it. In the focus and finish flow, all WIP is held in a queue and we assign only one to five projects at a time to each person. They should focus on only those projects and finish them before we assign the next one out of the queue. While the projects sit in queue we may have an expert look at them, determine difficulty, develop a critical path, and make sure they are ready to be worked when assigned. Operationally, constraints are measured by the size of the queue (Is it growing or shrinking?). See graphic below:



3.3. Little's Law: When examining an AFSC process machine utilizing a gated monitoring system, one must grasp the concept of Little's Law before the methodology behind the gates can be understood. A description of Little's Law will help strengthen the understanding of important concepts such as throughput, flowtime, WIP, and takt time. Little's Law provides the foundation for creating and setting up a process machine.

3.3.1. Why is Little's Law important? A thorough understanding and committed application of Little's Law will facilitate the reduction of WIP, improve speed, and increase throughput for the process machine. At steady state, all process machines have an average throughput, WIP, and flowtime. The fundamental relationship between all three is described by Little's Law: **WIP = throughput x flowtime**. Throughput is the required output of a process machine expressed in units per time. Flowtime is the average time that a unit stays in a process machine. WIP is the average number of units in work throughout the process

machine. To fully understand the relationship between these three components (WIP, throughput and flowtime) and how they relate to AFSC's concept of speed, we need to explore Little's Law.

3.3.2. In AoP, speed equals reduced flowtime. For a constant throughput, increasing the speed of a process machine (reducing the flowtime) will reduce WIP. If you have a system with unlimited demand, and you keep a constant WIP, then increasing the speed (reducing the flowtime) will result in an increased throughput for your process machine. It is important to understand these relationships because your focus on improving speed will result either in 1) reduced WIP or 2) increased throughput for your process machine. For the purposes of an AFSC process machine, we will modify Little's Law to include the concept of takt time.

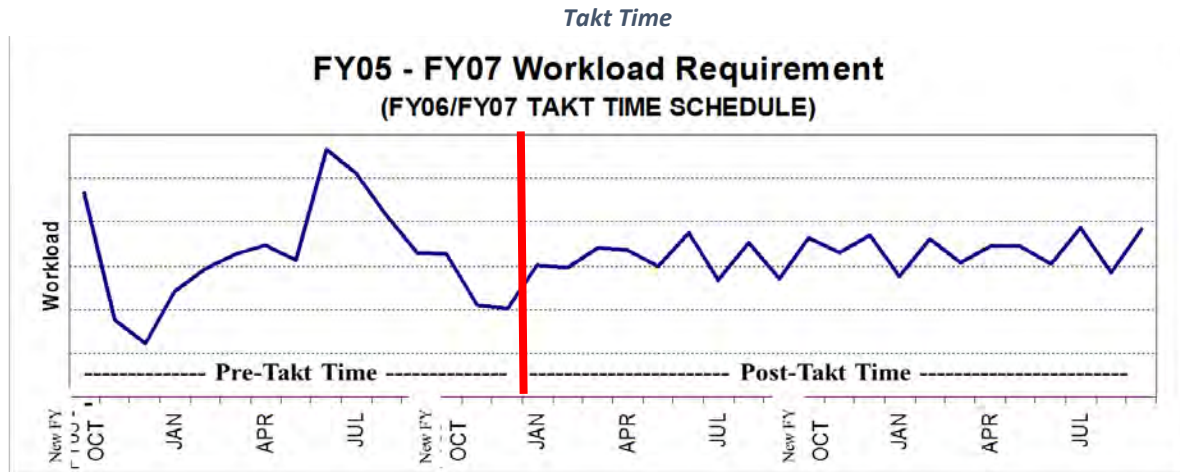
3.3.3. Takt time is the heartbeat of a process machine. It defines how often a single unit must be produced from a process machine in order to meet the road to... For example, a takt time of 10 days means that the process machine must produce one unit every 10 days. Mathematically, it is the reciprocal of throughput as defined above. (Reciprocal is also called multiplicative inverse. In mathematics, the ratio of unity to a given quantity or expression; that by which the given quantity or expression is multiplied to produce unity: the reciprocal of x or $x/1$ is $1/x$.) Takt time is determined by dividing the available time by the required output in that amount of time (expressed in units of time).

3.3.3.1. **Takt Time = Available Time / Required Output**

3.3.4. It is important to note that when calculating takt time the available time for a process should reflect the total number of units of time that is available, whether it is in minutes, hours, days, months or years. The required output is a measurement of customer demand, or, how many products or units of service a process-doer is required to complete in the given period of time that is available. For example, if a process machine is designed to produce 37 units in one year, the throughput rate is 37 units / 365 days or 0.1 unit per day. The takt time would be 365 days divided by 37 units which equal to a takt time of 10 days. Said another way, every 10 days the process machine must produce a unit and all enterprise teammates must support this tempo. Another example would be to imagine a doctor's office that operates 600 minutes per day (10 hour shift) the demand is 30 patients per day. The takt time is then calculated: $600 / 30 = 20$ minutes. In other words, the doctor cannot spend more than 20 minutes per patient to meet the requirement of treating 30 patients per day for work.

3.3.4.1. **The AFSC modified version of Little's Law now becomes: Flowtime = WIP x Takt Time.**

3.3.5. Why is takt time important? Takt time schedules workload to ensure the process machine is balanced and minimizes variation in processes as depicted below:



3.3.6. Now let's see Little's Law illustrated in a common, everyday situation. Suppose you arrive at a movie theater 10 minutes before the movie begins and you are the 10th person in line when you arrive. It is taking the ticket agent approximately 30 seconds to process each movie patron. Will you make it to the movie on time?

Little's Law

Intuitively, we can calculate:
At 30 seconds per person, it will take 5 minutes to get your ticket.

Let's check Little's Law...

WIP = FLOWTIME X THROUGHPUT
WHAT IS THE FLOWTIME?

WIP = 10
(Total Number of Movie Attendees That Must Be Processed)

THROUGHPUT = 2
(Number of Attendees That Must Be Processed Per Minute)

10 = ? x 2
(WIP / THROUGHPUT = FLOWTIME therefore 10 / 2 = 5)

FLOWTIME = 5 Minutes

3.3.6.1. You made it to the movie on-time! Additionally, you built your first basic process machine! Now let's quickly do an aircraft production and administrative example.

Little's Law

Little's Law: Flowtime = WIP x Takt Time
Two of the three variables must be defined (typically WIP and throughput)

SPO XYZ has funding to induct 73 aircraft next year

Takt Time = Available Time / Required Output in that Timeframe
365 / 73 = 5 day Takt Time

SPO XYZ has an Aircraft Availability goal that allows only 18 in depot WIP at one time

Flowtime = WIP x Takt Time
18 x 5 = 90 day flowtime

Process machine must produce 73 aircraft, at a flowtime of 90 days, while processing only 18 aircraft at a time.

Little's Law: Flowtime = WIP x Takt Time
Two of the three variables must be defined (typically WIP and throughput)

SPO XYZ's Budget Analysis Office has 30 funding requests that must be validated and input into the overall AFSC budget within a 90 day timeframe

Takt Time = Available Time / Required Output in that Timeframe
90 / 30 = 3 day Takt Time

Due to manning, SPO XYZ's Budget Analysis Office can only validate 5 funding requests at a time

Flowtime = WIP x Takt Time
5 x 3 = 15 day flowtime

Process machine must complete 30 funding requests, at a flowtime of 15 days, while processing only 5 requests at a time.

3.4. The Science of Throughput – Critical Path: The concept of critical path is central to the constraint resolution process. Critical path assumes there are no resource constraints and is the longest sequence of tasks in a project plan which must be completed on time in order for the project to meet its deadline. An activity or task on the critical path cannot be started until the predecessor activity is complete. When work slows or stops on the critical path, the overall performance of that entire process machine is impacted.

3.4.1. Critical path implementation is paramount for any task or project planning event:

- 3.4.1.1. Identifies all critical tasks.
- 3.4.1.2. Offers a visual representation of the task.
- 3.4.1.3. Provides flexibility to maneuver tasks.
- 3.4.1.4. Allows focus on the most important steps.
- 3.4.1.5. Gives management an accurate completion date of the overall project.

3.4.2. To reach the overall critical path objective:

- 3.4.2.1. Identify the overall task.
- 3.4.2.2. Create a practical sequence of events (including: predecessors, successors, concurrent/parallel tasks, duration of each task).
- 3.4.2.3. Determine the critical path.
- 3.4.2.4. Calculate the overall project duration (sum of all critical path activities).

3.4.2.5. Manage daily.

3.4.3. Let's take a look at a critical path example:

3.4.3.1. You run JJ's Auto Shop.

3.4.3.2. A customer wants to have a tire changed and have their wiper blades replaced.

3.4.3.3. You need to figure out the critical path to best support the customer request in the least amount of time.



3.4.3.4. First, calculate how long each process takes.

3.4.3.4.1. 33 minutes for tires + 16 minutes for wiper blades = 49 minutes total.

3.4.3.5. Is the critical path 33 or 49 minutes? Why?

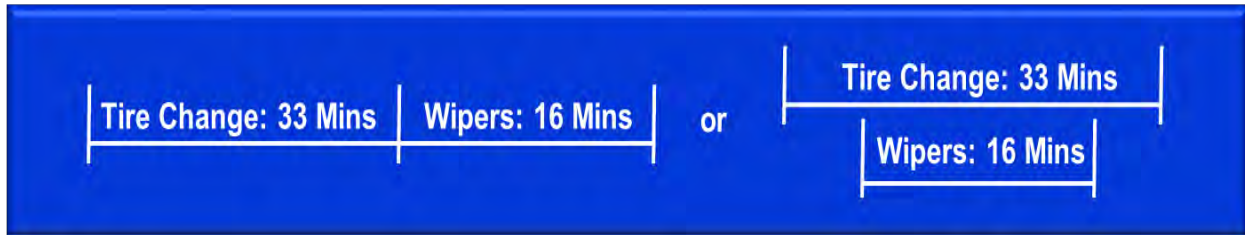
3.4.3.6. Is there more than one person doing the work?

3.4.3.6.1. The tire takes 33 minutes to be done no matter what.

3.4.3.7. The wiper blades only take 16 minutes and could be done anytime during the duration of changing the tires as long as they are complete before the 33 minute tire change.

3.4.3.8. The wiper blades could be a concurrent task.

Critical Chain vs. Critical Path



3.5. Critical Path vs. Critical Chain

3.5.1. Critical path is the optimum arrangement of tasks to complete a task in the shortest and most efficient time period in a resource loaded, unconstrained system. In JJ's Auto Shop, if there were two employees available, the tires and wiper blades can be changed concurrently.

3.5.2. Critical chain is the sequence of events in a resource constrained system. In JJ's Auto Shop, if there is only one employee available, the tires and wiper blades must be changed one after the other. Therefore, this lengthens the overall completion time.

Critical Path vs. Critical Chain



3.6. Gated Process Machines: Gating is the grouping of similar work within a process machine's overall flow. Process machines with long flowtimes present a unique challenge and may need to be broken down into smaller challenges or sub-gates within each overall process machine gate.

3.6.1. Each gate should have:

3.6.1.1. Clearly defined goals.

3.6.1.2. Roles and responsibilities.

3.6.1.3. Cadences.

3.6.1.4. Well defined release points to the next higher gate.

3.6.2. When the process machine is designed properly, it drives:

3.6.2.1. Consistent, predictable results.

3.6.2.2. Improved performance.

3.6.2.3. Increased capacity.

3.6.2.4. Increased throughput.

3.6.3. Process machines utilize a gated process to:

3.6.3.1. Provide a methodical approach to assessing throughput performance.

3.6.3.2. Communicate change and impacts in a common language.

3.6.3.3. Allow the process doer to adjust for known changes.

3.7. Process Discipline: The primary purpose of the gate is to provide succinct data to pinpoint underperforming processes and clearly illustrate where to apply CPI techniques in order to improve process machine performance. As such, it is imperative gates are constructed to allow this type of visibility. Key factors to consider in the gate construct include work content, concrete (rather than abstract) boundaries, length and total number of gates. These factors work together to construct gates that provide repeatable comparisons.

3.7.1. Following the mathematical design of a gated process machine, performance must be closely monitored within each gate. Key aspects of the monitoring system include the performance trends of the WIP through the gate as well as control of the active WIP within the gate. Monitoring this data allows leadership to ensure there are proper resources available, preventing task saturation and subsequently a loss of prioritization. Additionally, this method also allows for the identification of constraints in each gate driving focus to CPI measures.

3.7.2. When monitoring a gate's flowtime, it's important to direct CPI efforts to the gate's processes rather than focusing on the individual unit of WIP that is flowing through the gate. If a gate is not performing at its required flowtime, CPI must focus on waste removal, concurrent work opportunities, and constraint resolution. Despite these efforts, it may be necessary to queue WIP prior to the constrained gate. Work is not performed on WIP that is in queue. Queued WIP sitting idle while waiting to enter the next gate is non-value-added and undesirable. Queue, however, can be used as a tool to control active WIP within a gate making it a critical part of ensuring subsequent gate resources (direct labor employees, engineering, tooling, support equipment, parts, etc.) are not overwhelmed or spread too thin causing increased flowtime within the process machine.

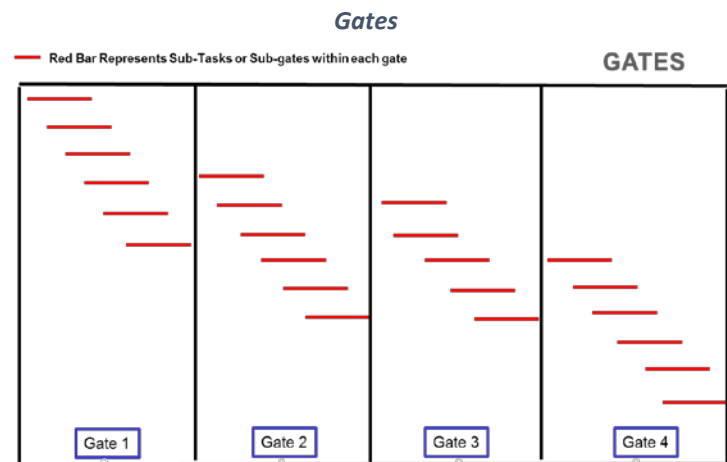
3.7.3. Controlling WIP is important because it ensures process resources are not spread thin and enables speed because adequate effort is applied to the project/asset when it is in work. In order to eventually eliminate a queue of projects/assets, it may be necessary to intentionally break WIP rules; however, this must be done by considering the impact the induction of the project/asset will have on the resources required. When there are different

resources required at the beginning of a bucket of work than at the end, it may make sense to induct a new project or asset during this particular part of the bucket of work in order to reduce the overall queue of projects/assets. This step should be taken only after consistent flow has been established and only to reduce the queue of projects/assets. This step should be taken only after consistent flow has been established and only to reduce the queue. This is an example of pulling a lever of well-understood machine in order to obtain a specific result. Reduced WIP, and an understanding of gap resolution through process improvement, equates to speed.

3.7.4. The length of a gate is an important consideration when constructing the process machine to guard against constructing gates that are too short or too long. Gates should be

long enough as to show a significant portion of the process and can encompass several hand-offs between skill sets in order to make the gate a meaningful length. Similar work scope and content, is a key determinant when constructing gates. For example, all prep work completed before a product enters a primary

repair location could be grouped together, even if there are hand-offs within the gate, in order to make the gate a significant representation of the process machine. Gates need to show the processes of the process machine, but do not need to detail every sub-process or sub-task within the specific gates (see graphic). It is also important to ensure the gates are not so long that it becomes difficult to monitor the progress or determine failure points within the gate. The ability (or inability) to consolidate gates based on work scope and content, the process machine critical path and actual product physical constraints work together to determine the number of gates required within a process machine.



3.7.5. Gates should be designed with concrete boundaries, ending triggers (release points) that need to physically occur in order to complete the current gate and transition to the next gate. Abstract boundaries make consistent application of gate transition decisions difficult. Additionally, it is helpful if the concrete boundary is part of the process machine's critical path. This will alleviate transitioning to the next gate without the concrete, critical path boundary requirement being met. Good gate transition habits are dependent upon how well each gate boundary is clearly defined to trigger the transition.

3.7.6. Clearly defined work content and concrete boundaries also help management better visualize and define traveling work. Traveling work is work that should have been completed in a prior gate, but is allowed to travel to a subsequent gate. Traveling work has the ability to degrade the integrity of the gated production machine process. Too much

traveling work puts undo pressure on the subsequent gate and can be the primary cause of not completing the gate on time.

3.7.7. Management review processes must be established to control the movement of WIP from one gate to the next and must ensure the unit is truly ready to transition. Movement of work to a gate that adversely impacts the critical path of the subsequent gate should not be allowed. Instead, management should utilize the situation to highlight the impacting constraint, and create an enterprise call to action through the use of urgency tools.

3.7.8. In the following example, each gate uses takt time to calculate flowtime:

Gated Machine Example #1

GATE 1: 4 WIP x 5 takt = 20 flowdays GATE 3: 6 WIP x 5 takt = 30 flowdays								
Available Time (Days)	Required Output	Takt (Days)	Gate 1 (Pre-dock)	Gate 2 (PDM)	Gate 3 (Build UP)	Gate 4 (Post Dock)	TOTALS	
365	73	5	4	4	6	4	18	WIP
	Req'd Flowtime (Days):		20	20	30	20	90	Flowdays

3.7.8.1. How do you determine WIP in each gate?

3.7.8.1.1. This is an iterative process that considers physical constraints (i.e. dock availability, resources availability/capacity, equipment availability) and work content required in each gate.

3.7.8.1.2. While the WIP and flow days can vary depending on those factors, the mathematical relationship cannot be compromised.

3.7.9. Little's Law application within the gate is critical to maintaining a balanced machine.

3.7.9.1. Enables proper resourcing of the system.

3.7.9.2. Ensures resources are not overwhelmed by an unbalanced machine.

3.7.10. Following is another gated machine process example in an administrative area:

3.7.10.1. The Safety Office typically processes 480 accident reports per year.

3.7.10.1.1. Air Force Instruction (AFI) requires completion in 30 days.

3.7.10.1.2. Goal is to process investigations in 22 days.

3.7.10.1.3. There are five gates in the investigation machine.

Gated Machine Example #2

WIP = (22 / 365) X 480 ≈ 29		TAKT = 365 / 480 = .76		WIP = FD / TAKT				
Available Days	Required Output	Gate 1 (Init Inv)	Gate 2 (Classify)	Gate 3 (Inv)	Gate 4 (Report)	Gate 5 (Rel of Rep)	TOTALS	
365	480	1.3 WIP	7.9 WIP	6.6 WIP	6.6 WIP	6.6 WIP	29	WIP
		FD = 1	FD = 6	FD = 5	FD = 5	FD = 5	22	FD
GATE 1: 1 FD / .76 TAKT = 1.32 WIP				GATE 2: 6 FD / .76 TAKT = 7.9 WIP				

3.7.10.2. How is WIP handled when it is a fraction?

3.7.10.2.1. WIP is used as a guide.

3.7.10.2.2. Resource allocations are monitored closely.

3.7.10.2.2.1. Input rate for an administrative office is typically very variable.

3.7.11. The AFI set the goal at 30 days. The team gave themselves a buffer of eight days and set an internal AoP Road to goal of 22 days. Remember, when you round down, you decrease flow and when you round up, you increase flow. Round up or down according to the mathematical data.

3.7.11.1. In our example, gate 1 has a WIP of 1.3.

3.7.11.1.1. This means 30% of the time, the WIP will be above one so it makes sense to round down in this scenario.

3.7.11.2. In our example, gate 2 has a WIP of 7.9.

3.7.11.2.1. This means 90% of the time, the WIP will be above seven so it makes sense to round up in this scenario.

3.7.12. The needs of a specific customer form the basis for that process machine's road to...; however, it is not the only component in the formula. Another important component of the formula is the overall capacity of the organization. For instance, the footprint of an individual weapon system, based on its aircraft availability calculation alone, may be greater than that available to a complex given its total workload requirements. There may be cases where increasing the speed of a weapon system is necessary to reduce its footprint (WIP) in order to free capacity for new or increased workload for the complex. For this reason, it is important to understand the workload requirements of the organization in its entirety to ensure the individual road to... goals allow the organization to meet its overall workload obligations.

3.7.13. The application of Little's Law is critical to maintaining a balanced process machine. This enables proper resourcing of the system ensuring those resources are not overwhelmed or starved by an unbalanced machine.

3.7.14. If you are not monitoring the system, you are failing. Focus on the processes in each gate, not the challenges of each unit of production (WIP). You must trend performance of the processes within each gate; this identifies constraints to the system and creates a tool to link CPI to the constraints.

3.8. Summary: A process machine is a process set up to have specific, predictable results. AFSC utilizes process machines to create increased throughput paced to the road to...goal. The road to... is the common destination and site picture for the enterprise to measure how well a process is executing. A unique component of the process machine design is that it begins with the *future state requirement*; it is not designed based on existing performance. The process machine is based upon consistent execution methods. The process machine must be designed to reduce flowtimes and WIP, exceed customer expectations, subsequently reducing required infrastructure. Process machine output can be anything from an aircraft to a completed purchase request; the process machine produces whatever end product the area is responsible for generating. Staying disciplined to the process machine with respect to WIP ensures active WIP control and prevents overwhelming the system with too many units in work, stretching resources too thin, multi-tasking beyond the capability of the process machine, and reducing the speed of the entire system. Decreasing flowtimes (increasing speed) reduces WIP and levels resources to accomplish throughput, thereby exposing capacity for additional warfighter support, which is the ultimate goal of the AFSC process machine.

3.8.1. This chapter described process machines based on constraints based management principles. It provided a methodical approach to defining and monitoring operations in the AFSC. A process machine designed in accordance with Little's Law ensures a well-balanced process and a disciplined approach to controlling active WIP. Monitoring each gate's performance provides increased transparency, enables timely constraint identification-elevation-resolution and ensures optimum performance of the overall process machine. Identifying a known constraint, and pacing the entire operation to the constraint's output capability, provides an effective framework for managing a process machine and is one focus of the next chapter. Aggressive CPI is then used to reduce the limitations of a pacing constraint.

3.8.2. All CPI must be analytically driven by data analysis (data-driven decisions). A strong constraint resolution process must be in place in order to effectively address constraints within the process machine. All levels of management must monitor the performance of the gates and the process. Metrics must be in place from the shop floor to the senior leader conference rooms, and they must be aligned for optimum process machine performance. While properly designed process machines and the monitoring tools discussed in this handbook are meant to limit the impacts of variation on an operation, significant variation will still create serious perturbations to a process machine. Drastically changing the number or mix of WIP inducting in the process machine during execution will create

ineffectiveness in AFSC operations. Major constraints during process execution can also reduce the throughput of the process machines. It is important that everyone recognize that process variation is the enemy.

3.8.3. Its imperative leadership is active, informed, vigilant, and engaged while adopting AoP philosophies, aggressively eliminating constraints, continually challenging the processes and seeking improved performance in order to reach the art of the possible!

Principles of Flow and the Science of Throughput – Key Take Aways

- **If a gate is constraining throughput of a process machine, CPI must focus on waste removal, concurrent work opportunities, and constraint resolution.**
- **Process discipline.**
- **It is imperative to have an active, informed, vigilant, and engaged leadership team.**
- **Flow principles are controlling WIP, supportable work, manloading work, and rapid issue resolution.**
- **Little's Law is $WIP = \text{throughput} \times \text{flowtime}$.**
- **Critical path is the longest sequence of tasks in a project plan which must be completed on time in order for the project to meet its deadline.**
- **Takt time is determined by dividing the available time by the required output in that amount of time (expressed in units of time). $\text{Takt Time} = \text{Available Time} / \text{Required Output}$.**

Chapter 4

THEORY OF CONSTRAINTS AND CONSTRAINT RESOLUTION

4.1. Introduction: Creating an organizational culture that promotes problem solving is essential for success in all AFSC organizations. This culture must include a constant focus on processes and keeping those processes moving forward along their critical paths. Problem solvers are in constant search of roadblocks and constraints to this path. They know how to urgently utilize process improvement tools to minimize and/or eliminate the effect of these constraints on the process critical path. A culture of problem solvers is essential for creating an AoP mindset. This chapter will describe the components of problem solving as well as tips for how to sustain process machines. It begins with “Changing the Way People Think” by placing the focus on the process; creating process flow, identifying gaps and utilizing process improvement tools to minimize and eliminate those gaps. It involves constraints based management and constraint resolution which provides the framework to urgently resolve constraints before they impact the critical path of the process.

4.2. Changing the Way People Think: Creating a culture of problem solvers begins by changing the way people think, the way they approach daily execution of processes and how they view their role in the process. It involves seeing the process in terms of the bigger picture (AFSC’s compelling vision); the overall road to... AoP goal, and understanding the gaps that must be addressed to achieve that goal. In order to assure a good understanding of the intended AFSC culture, people must map their processes and see flow, identify constraints in their processes, and resolve constraints with a thorough understanding of their process.

4.2.1. AoP starts with the foundation of creating flow for any process (shop floor or administrative process). Basic flow principles apply to any process and consist of 1) controlling WIP, 2) supportable work, 3) manloading work, and 4) rapid issue resolution. All processes have an input. Input might be an aircraft, an engine, a request for a part, a request for data, or a request for resolution to a problem. Once the input is received into the process, the process does take steps to create value for the input. The value may consist of performing depot maintenance on an aircraft or an engine, ordering and/or retrieving a part, researching and compiling information into a report, or researching and assessing a situation then providing a written answer to a resolution request. The output of the process would be the completed depot repair of an aircraft or an engine, handing the requested part to the requestor, handing a completed report to a requestor, or providing the written resolution request. The concept that all processes are based upon basic flow principles is what allows AoP methodology to be universally applied throughout AFSC.

4.2.2. All processes are not created equal. Some processes are relatively simple, while others can be very complicated. In order to better address the flow of a complicated process, the value portion of the process should be broken into buckets or chunks of work. This can be accomplished using the gates. Next, establish where the WIP is within the process machine and where the WIP is within each gate of the process machine. While you monitor the flow of WIP through the machine, you will find where work stacks up and this is where you will focus your CPI efforts.

4.2.3. Process execution data (WIP/flow performance) is then translated into metrics that allow process execution trends to be analyzed in order to determine process constraints/gaps. When using the gated process, constraints are identified by the gate with the lowest throughput rate which often manifests itself as high queue in front of the gate or high WIP within the gate. The constraints are seen as opportunities for improvement and should address the primary driver of extended execution time. Addressing the constraints should result in a step change with regard to the speed of a process machine.

4.2.4. These constraints or gaps then become the basis for focusing process improvement efforts. CPI tools and methodologies are applied to the constraints in order to eliminate process waste and improve touch time within the overall process.

4.2.5. Flow, gap identification, and process improvement efforts that resolve constraints all have the overarching objective of first creating consistency within the buckets of process execution and then creating speed. Additionally, active control of WIP within any process is extremely important in order to keep from overwhelming the doers within the process. WIP is controlled by limiting inductions into the process (or gates of the process) and can be accomplished by either queuing projects/assets at the beginning of or within the overall process, or by limiting the acceptance of inductions to the process. Controlling the amount of WIP into and within the process will ensure the process resources are not overwhelmed within the gates or within the system as a whole.

4.2.6. Controlling WIP is important because it ensures process resources are not spread too thin and enables speed because adequate effort is applied to the project/asset when it is in work. The most immature organizations should not violate WIP rules. When organizations become more mature in AoP, it may be applicable to intentionally break WIP rules; however, this must be done by considering the impact the induction of the project/asset will have on the resources required and machine flow days. When there are different resources required at the beginning of a bucket of work than at the end, it may make sense to induct a new project or asset during this particular part of the bucket of work in order to reduce the overall queue of projects/assets. This step should be taken only after consistent flow is established and only to reduce the queue. This is an example of pulling a lever of a well-understood machine in order to obtain a specific result. Reduced WIP, and an understanding of gap resolution through process improvement, equates to increased throughput and speed.

4.2.7. Another key component of AoP that requires a change in thinking is the concept of being comfortable in red (not meeting the goal). This is the basis of creating AoP goals; goals that are not easily obtained and may not at first seem possible. In order to achieve these goals, organizations and the people in them must be comfortable with not reaching the goal at first. This means they have to be comfortable with a red metric while taking steps to create flow, identify gaps, execute corrective action plans and reduce WIP in order to achieve the goal.

4.2.8. Being comfortable in red is NOT the same as being complacent in red. When an organization is comfortable, rather than complacent (in red), they have identified a goal that is difficult to reach and will require attention to their processes. The goal must seem to be out of reach and will require the organization to challenge the status quo and aggressively work to improve and resolve their process gaps. The goal must make the organization uncomfortable, knowing they will show red to their goal while they make step changes that will move the organization toward the goal.

4.2.9. Once the execution goal is achieved, the organization is still not finished. They need to take steps to achieve the goal with less total effort; for example, they may need to utilize less overtime, less manpower, less foot print, less cost. All of these measures mean first being red for the metric, then taking steps, through process improvement, to achieve the metric.

4.2.10. Finally, there must be a mindset of constraints based management during execution that is focused on protecting the critical path of the project during execution. This means everyone in the process is focused on identifying and elevating execution constraints and employing CPI to urgently resolve those constraints.

4.3. Constraints Based Management: The key to improving speed is maintaining focus on the process and pace of execution. Successful execution is directly linked to a culture that recognizes the power of effective constraint resolution while protecting the critical path. This constraints based culture must understand the need to identify, elevate and urgently resolve constraints.

4.3.1. In a world filled with variability, the one certainty is that problems and issues WILL arise during the execution of a process machine. An organization utilizing AoP understands the importance of properly reacting to those issues and problems (constraints) so as not to allow an impact to the critical path of execution. The constraints based management culture also understands the more proactive the recognition of the constraint, the more lead time available to resolve the constraint and avoid impact to critical path.

4.3.2. Constraints based management is a mindset of the organization to recognize problems that delay execution, and frame those problems in a way that allows everyone to understand the impact, when the impact occurs, and what options are available to minimize and eliminate the impact. Much of this information may not be readily available to the impacted organization, thus the culture must require CPI involvement in order to determine all possible courses of action and ultimately resolve the constraint.

4.3.3. Effective constraints based management urgently involves all necessary personnel and collaborates to resolve constraints. It is imperative each organization urgently resolves constraints for their specific process in order to continually progress along the critical path.

4.3.4. For a gated production system with a high volume of throughput and a lot of variation (different applicable processes, induction mix variations, etc.), or a known system constraint (i.e. only one tester), the application of Drum, Buffer, Rope (DBR) may be

appropriate. DBR is a special application of flow and will require the unit to contact their AoP SME for assistance in building a DBR machine process.

4.4. ToC: The ToC premise is process machines act like a chain: they are only as strong as the weakest link. The weakest link is the constraint preventing the system from meeting the desired performance. The constraint is identified as the gate with the lowest throughput rate. This may manifest itself with queue before the gate or excessive WIP in the gate. ToC utilization requires all CPI to be focused on the constraint. CPI efforts that do not attack the constraint will not improve the overall system performance and can result in the process machine performing less effectively. The five basic and sequential steps for proper application of ToC are described below (Goldratt, 1997):

4.4.1. Identify the Constraint: As mentioned earlier, the constraint is usually identified as the gate with the lowest throughput rate. This may manifest itself with queue before the gate or excessive WIP in the gate.

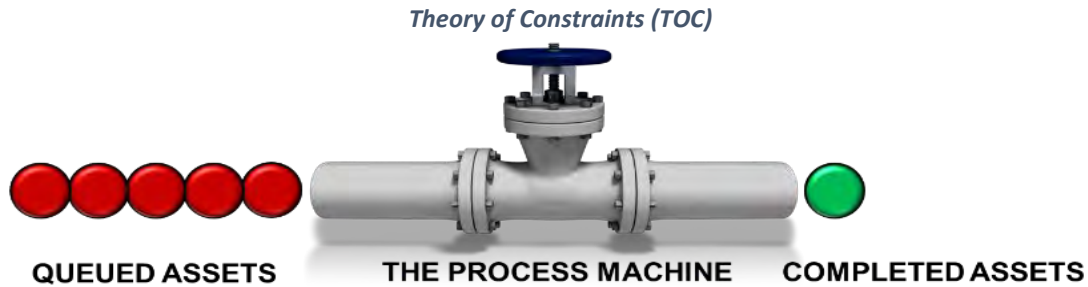
4.4.2. Exploit the Constraint: Usually this involves obtaining the immediate maximum potential out of the constraint without significant investment. For example, if a machine tool is limiting the system's output, the constraint is exploited by continually operating the machine during second or third shifts, lunch breaks, weekends, etc. Buying a second machine tool is not a way to exploit the constraint (see paragraph 4.4.4. Expand the Constraint below).

4.4.3. Subordinate Everything to the Constraint: It is inefficient to allow unconstrained functions to operate above the limiting constraint's capability. All operations must match the constraint's pace to prevent overwhelming or starving the preceding and succeeding tasks.

4.4.4. Expand the Constraint: Expansion of the constraint is elevating the output of the limiting process or shop until overall system performance can be met or until another process or shop becomes the limit to the system. This might include the purchase of additional equipment, addition/realignment of personnel, or preferably an increase in output through waste removal or other CPI activity.

4.4.5. Repeat the Process (Identify, Exploit, Subordinate, Expand): If a constraint still exists, these steps must be repeated until all constraints are removed. It should be noted that if the desired performance of the system is attained, no limiting constraint requires attention however, different processes or shops may have different capacities (i.e. the system may not be balanced).

4.4.6. Queue: Queue is a tool to control WIP between gates and it is a critical part of ensuring the subsequent gate resources are not overwhelmed or starved causing increased flowtime within the machine.



4.4.6.1. Is queue good or bad? Both!

4.4.6.1.1. Queue is waste; however, it can be viewed as good because it means the process doer has identified the constraint and is controlling WIP, the process, and multi-tasking.

4.4.6.1.2. It is bad because it means there is a known constraint in the machine.

4.5. Drum-Buffer-Rope (DBR): DBR is a planning and scheduling methodology for the application of ToC. It is effective in high volume, low flowtime and high variation systems comprised primarily of short duration tasks where the system constraint cannot be eliminated and instead must be managed. The ‘drum’ is the set schedule based upon the constraint’s output capacity and is used instead of takt Time. The ‘buffer’ is a protection against variability and is used to protect the performance of the schedule or drum. In DBR, the buffer could be time or material. The ‘rope’ is used to subordinate all other processes to the constraint. The rope is the lever that strategically releases WIP (time or material) into the machine at the appropriate time, ensuring the constraint isn’t starved or overwhelmed. In essence, the rope synchronizes the schedule of all resources to the drum or limiting constraint (TOC Step 3 above: Subordinate Everything to the Constraint). Each individual process or shop can utilize Little’s Law to determine the appropriate Flowtime, WIP, and Takt relationships, but the overall process machine is synchronized via the DBR system.

4.5.1. In order to execute DBR it is important to begin with a commitment to an overall system performance (delivery date of the product). Once this date is established a right to left schedule is established for the drum to execute to the delivery schedule. All the processes that occur downstream of the drum are then scheduled so the delivery date is met. A similar process is applied when scheduling work upstream of the drum to ensure material arrives to the constraint on time. Time buffers and inventory buffers are utilized at critical locations throughout the system to protect the overall delivery of the schedule against variations due to rework, peak demands, unscheduled production interruptions, etc.

4.5.1.1. When Executing DBR

4.5.1.1.1. Commit to a delivery date

4.5.1.1.2. Schedule backward...to the left of the delivery date

4.5.1.1.3. Processes are scheduled with delivery date in mind

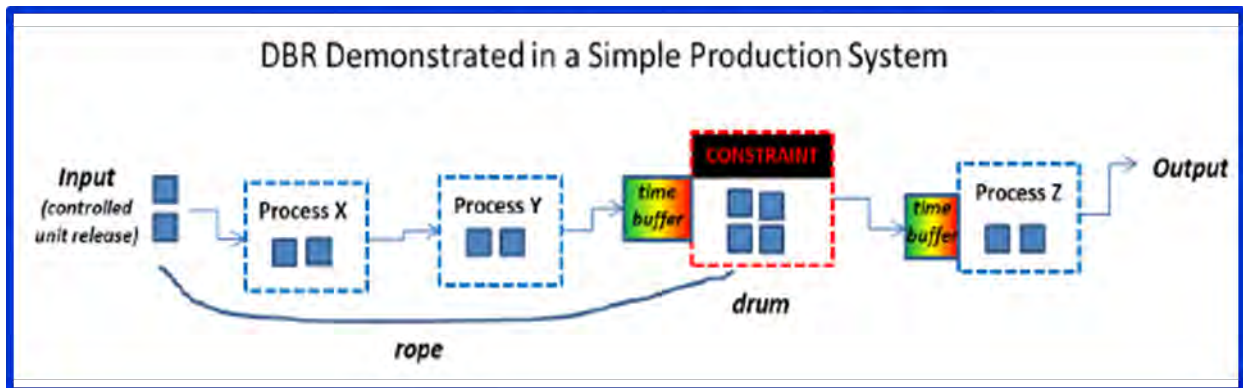
4.5.1.1.4. Time buffers are typically used (in lieu of WIP) to protect against:

4.5.1.1.4.1. Variations due to rework

4.5.1.1.4.2. Peak demands

4.5.1.1.4.3. Unscheduled production interruptions

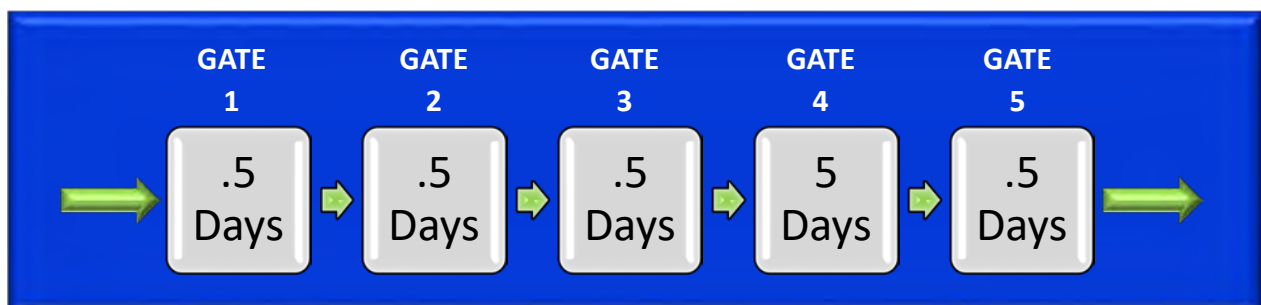
Simple Production Example of DBR



4.5.2. An example of a time buffer is the scheduling of a product from the constraint to the delivery point for 25 days even though the product delivery is not expected for 30 days after passing through the constraint. Depending on the existing process variation, the additional 5 days could provide near 100% on-time delivery and can essentially remove delivery uncertainty. A similar time buffer, or inventory buffer depending on the process, is often applied upstream of the constraint to ensure the original schedule is protected and the drum (the constraint) never shuts down due to upstream variability (TOC Step 2: Exploit the Constraint).

4.5.3. DBR Examples

Flow Example 1

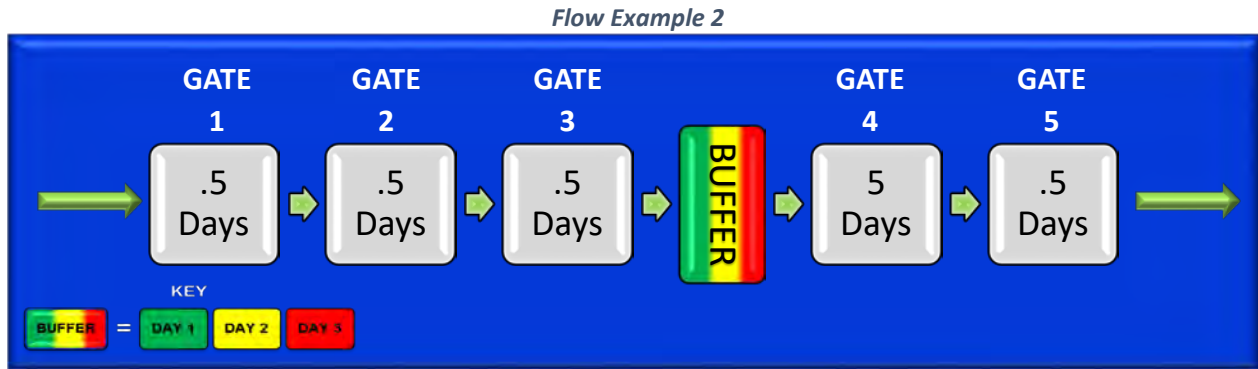


4.5.3.1. Where is the constraint in the graphic above? Gate 4.

4.5.3.2. What is the highest throughput I can achieve with this machine? 1 unit every five days.

4.5.3.3. Where should I put a buffer? In front of Gate 4.

4.5.3.4. How much buffer is needed? Three days (release work into Gate 1 when it is scheduled to start in Gate 4 in 3 days). Assume that at most it takes three days for an item to travel through Gates 1-3 and arrive at the buffer.



4.5.4. If I start work today in the constraint system above, when do I release the next work into the machine?

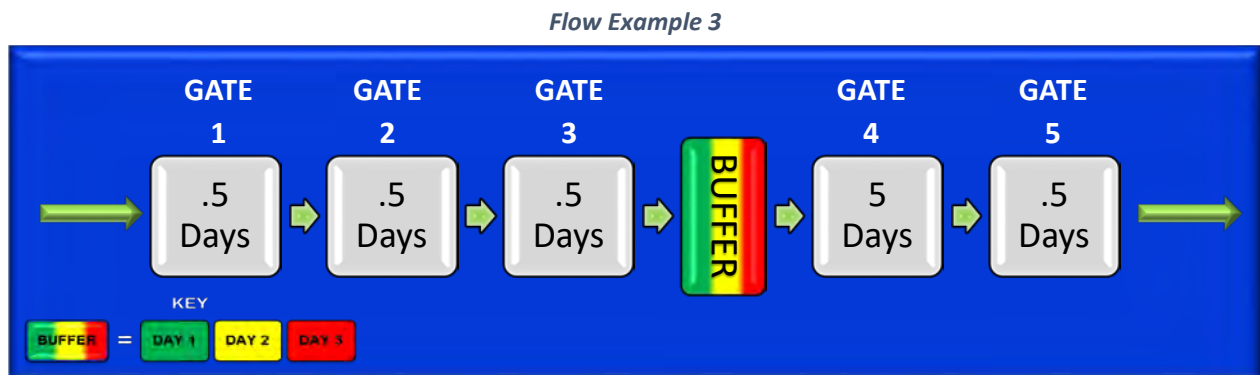
4.5.4.1. Day 1? (No) Too early.

4.5.4.2. Day 2? (No) Too early.

4.5.4.3. Day 3? (Yes) On time.

4.5.4.4. Day 4? (No) Too late.

4.5.4.5. Day 5? (No) Too late.



4.5.5. How do I monitor progress of work moving through Gates 1-3 above?

4.5.5.1. Expedite at beginning of day three to ensure it reaches constraint by end of day.

4.5.6. Some of the key measures used to monitor the success of a DBR machine are inventory turns, delivery date performance, and constraint operation. Inventory turns measures the number of times inventory is turned per year (Annual Throughput/Average WIP). Delivery date performance is the percentage of on-time deliveries or aggregate lateness. Constraint operation refers to ensuring the constraint is continuously operating and elevating for immediate resolution if it is not. In a DBR machine, the constraint needs to continuously operate for the machine to be successful as all other processes have been subordinated to the constraint.

4.5.7. Some key actions to take are to keep the buffer healthy and monitor the flow of work after it is released into the machine. In other words, tactically manage your machine to avoid disruptions.

4.5.8. Examples. It can be beneficial to relate new concepts to everyday practical examples. Furthermore, examining indicators of a problem, then utilizing the concepts to identify what can be done to fix the problem; can help bring a stronger understanding of its principals.

4.5.8.1. The Laundry Example. One of the simplest and most practical examples of TOC is laundry in a home setting.

4.5.8.1.1. The laundry workflow consists of two pieces of equipment: the washer and the dryer. The laundry process is often exacerbated by “stock outs” in the form of the lack of clean clothes on shelves and in closets. These stock outs often lead to reactionary firefighting in the form of completing a specific load of laundry to resolve the current stock out situation (rushing through a load of clothes containing specifically what is desired to be worn at the time). Everyone is happy for the moment – at least until the next stock out.

4.5.8.1.2. In this laundry example, individuals need a way to 1) prevent stock outs from occurring and 2) respond when a stock out is imminent in order to take measures to prevent the stock out from occurring. The first step is to examine and understand the process. In this case, dirty laundry is collected into a pile. Items from the pile are placed into the washer and then the dryer. Once the laundry completes the dryer step it is ready to be stocked on the shelves and in the closets.

4.5.8.1.3. One problem that may be apparent in the laundry process, especially in times of stock outs, is the pile of dirty laundry in front of the washer. This pile of laundry represents WIP - the larger the pile of dirty laundry, the more likely a stock out. Finding a way to minimize WIP would make the process less likely to experience a stock out and, consequently, enter the firefighting mode.

4.5.8.1.4. In keeping with the five focusing steps discussed previously in the TOC section, the next step in the laundry example is to identify the constraint in

the process. In this case, it takes longer to dry the clothes than it does to wash the clothes; thereby making the dryer the constraint. In order to create the necessary flow through the process it is necessary to exploit the constraint. In this case, exploiting the dryer constraint means establishing process discipline to ensure the dryer operates any time the WIP exceeds a certain level.

4.5.8.1.5. In order to subordinate the process to the constraint, it is necessary to operate the washer only to the extent it allows the dryer to keep drying. Washing loads of clothes and piling clean, but wet, laundry in front of the dryer will result in clothes that are mildewed and in need of washing again (rework). In this case, the process discipline instilled under the step of exploiting the constraint should preclude the necessity of expanding the constraint by purchasing a larger or faster dryer. However, if the process continues to experience stock outs that cannot be resolved with process discipline, then purchasing a new dryer, or more clothes, may be necessary to preclude stock outs!

4.5.8.2. The X-Ray Machine Example. Consider a surgery center in which patients must have blood tested and x-rays taken before undergoing an operation.

4.5.8.2.1. The center has four stations each patient must process through before being released for surgery.

4.5.8.2.1.1. Administrative intake.

4.5.8.2.1.1.1. Blood lab.

4.5.8.2.1.1.2. X-Ray lab.

4.5.8.2.1.1.3. Administrative discharge.

Patient Preparation Stations

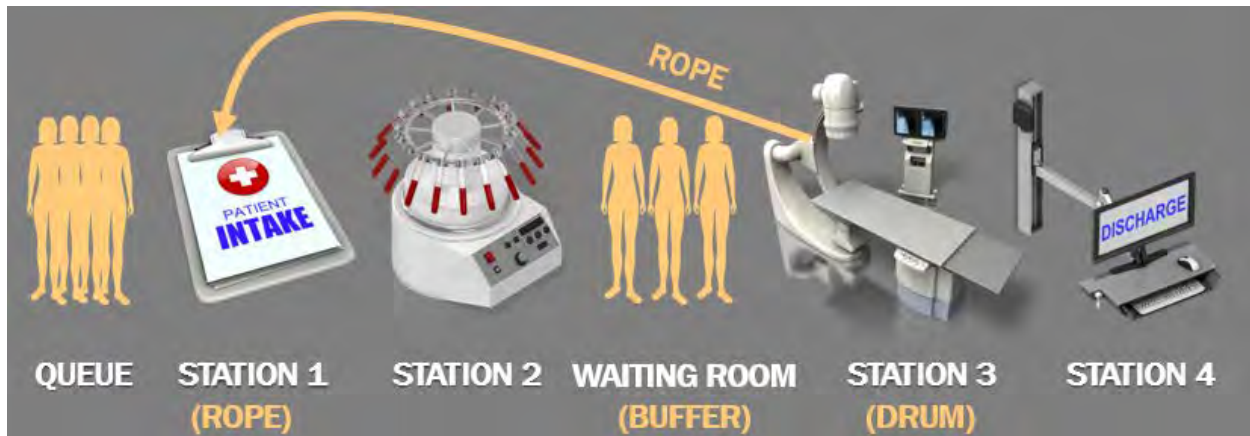


4.5.8.2.2. The x-ray lab only has one machine available for use, greatly limiting the surgery center's overall patient processing capacity. Because the x-ray lab can only handle one patient at a time, it becomes the drum setting the pace of the entire process machine's capacity and output. In order to keep the constraint continuously operating at maximum capacity and ensuring the constraint is never idle, the office

manager creates a waiting room buffer of three patients in the x-ray lab waiting room. This patient buffer ensures the lab remains full at all times.

4.5.8.2.3. When a patient initially arrives for administrative intake, the x-ray buffer is checked. If the lab waiting room is full, the new patient is not admitted to administrative intake until a patient finishes in the x-ray lab, opening a spot for the next patient. The administrative intake acts as the process machine's rope by checking the waiting room's capacity and controlling release of patients accordingly. This ensures the constraint (x-ray lab) is never overwhelmed or starved of patients.

DBR in Patient Preparation Process



4.6. Constraint Resolution: Constraint resolution is a critical concept to keep the AFSC process or production machines operating smoothly. There are three concepts key to constraint resolution: protecting the critical path, communicating constraints, and the expected response. Effective constraint resolution is a highly collaborative process as many organizations provide the resources and conditions necessary to achieve AoP results. Each process machine is a dynamic organism that relies on the union of a diverse range of synchronized resources executing a well scripted plan; examples include skilled manpower, the right parts, tools, equipment, data, facilities, and technical support. Any resource that is not available at the time and location necessary represents a constraint that must be identified, understood, communicated, elevated, and resolved appropriately. Constraint resolution must be executed judiciously to ensure the right resources are applied to keep the machine on track, without unnecessarily prioritizing resources that are required for more urgent activities.

4.6.1. Understanding the basic definitions of the resolution process is integral to proper communication across organizations as well as up and down the chain of command. Below are a few of the terms that will be used to describe the AFSC methodology:

4.6.1.1. **Constraint** is a problem or issue that negatively impacts the critical path or chain of a process machine. A constraint is identified as the gate with the lowest throughput rate. This may manifest itself with queue before the gate or excessive WIP in the gate. It can be a resource that is not available at the point of use exactly when and where the production schedule requires it. A constraint must be identified, understood,

communicated, elevated, exploited and resolved appropriately. Some causes of constraints may include, but are not limited to; a lack of skilled manpower, the lack of correct parts, improper tools and equipment, funding shortages, conflicting or absent technical data, shortage of facilities, and unresponsive technical support.

4.6.1.2. **Critical path** is a sequence of tasks in a project which must be completed, on time, in order for the project to meet its deadline. Critical path assumes there are no resource constraints. An activity or task on the critical path cannot be started until its predecessor activity is complete. The concept of the critical path is central to the constraint resolution process. When work slows or stops on the critical path, the overall performance of that entire process or production machine is impacted. When work slows or stops off the critical path, processes/tasks may or may not have the ability to adjust and compensate to maintain aggregate performance.

4.6.1.3. **Andon** is a sign that someone somewhere needs help, either to prevent a line stoppage or get the process going again in case of a stop. It alerts and highlights where action is required. The word Andon is often perceived as a negative situation, but the result should be a collaborative effort to quickly understand and rapidly resolve to get the process flow moving forward. As organizations mature the Andon process, the team will ensure the next step is accomplished: identify the root cause of the delay and resolve with permanent fixes to avoid reoccurrence. Efforts must be made to avoid a culture that attributes a negative message to the initiating organization, or the organization best postured to provide relief, lest the collaborative mindset be lost. The desired response needs to be conditioned by focusing positive efforts on a shared road to... rather than attributing blame.

4.6.1.3.1. Everyone in AFSC is responsible for communicating an impact to the critical path of a process. Everyone should be using a constraints based management system for their machines with a defined critical path or critical chain so they know when something is really a constraint. The purpose of an Andon is to provide visibility, a means of communication, elevation, and management to drive immediate and appropriate response for resolving work stoppages affecting the critical path or critical chain of a process machine. The work may be stopped due to an eminent safety concern, a critical quality defect, or any occurrence which stops the flow of product or service in the machine. Continue to work and report open Andons until a resolution is developed. An Andon should be elevated when it cannot be resolved at the current level. An Andon should be closed when the process machine is once again moving regardless of whether or not the end item flowing through the process machine remains off the critical path.

NOTE: The importance of teamwork in the rapid constraint resolution process cannot be over-emphasized. Personnel should work together and cooperate with internal as well as external stakeholders (i.e. Defense Logistics Agency (DLA), System Program Office (SPO), Item Managers (IM), Judge Advocate (JA), Directorate of Personnel (DP), Air Force Personnel Center (AFPC), etc....) to resolve issues/constraints to the critical path/chain at the lowest possible level.

4.6.1.4. An **Issue** is any constraint or hindrance to process improvement, improved safety, or higher quality. An issue may cause work stoppage but all issues do not result in a work stoppage, therefore, all issues are not Andons.

4.6.1.5. **Workaround** is any temporary, or non-permanent solution to a work stoppage on the critical path. If a workaround or temporary solution is in place allowing a process machine to continue moving along the critical path, then there is no longer an Andon...there is an issue.

4.7. Constraint Resolution – Continuous Process Improvement (CPI): It is very important to understand that AoP IS NOT CPI and CPI IS NOT AoP. The two are complimentary. AoP is a constraints based management system that identifies the constraint in any process machine. CPI is then utilized to resolve constraints in the process machine. CPI is a proven, standardized methodology you can draw upon to meet your performance objectives.

4.7.1. The role of leadership in CPI is to create a culture that recognizes and utilizes CPI as a tool. CPI solicits employee input and creates a culture of problem-solvers empowered to identify constraints, gaps and countermeasures directed at problem resolution. Personnel leverage CPI to create speed and reduce costs (cost effective readiness). A CPI champion is an individual with the authority to commit and dedicate resources, assets, and manpower toward improvement initiatives. CPI champions guide initiatives through critical understanding of how the organization fits into the enterprise.

4.8. Summary: This chapter discussed creating a culture that promotes problem-solving as paramount in achieving organizational success. Culture change must include constant focus on processes and critical path progress. AFSC leaders are essential to adoption of the constraints based methodology and driving performance in the process machines. This requires them to be problem-solvers who continually search for roadblocks and constraints to the critical path or chain. Every team member should know how to utilize urgency and process improvement tools to minimize or eliminate the effect of constraints on their processes.

4.8.1. AFSC leaders should be comfortable in red metrics as they lead their units to achieving challenging road to... while operationalizing AoP across the center. This chapter also described the components of problem solving as well as tips for how to sustain process machines. It began with changing the way people think by placing the focus on the process – creating process flow, identifying gaps and utilizing process improvement tools to minimize and eliminate those gaps. Constraints based management and constraint resolution involves urgently utilizing CPI tools to resolve constraints before they impact the critical path of the process.

4.8.2. A critical component of understanding AoP is focusing on the foundational elements of the Radiator Chart and how each element is related to the fundamental AFSC machine building process. As the primary focus of the next chapter, the Radiator Chart will be broken down and explained so the process elements can be understood and utilized while building process machines. The Radiator Chart ties together the execution of process machines to ensure the organization moves forward toward operationalizing AoP. It draws

the leadership and the science of AoP into a single game plan that represents AFSC's compelling vision of how we will achieve world-class results.

Theory of Constraints and Constraint Resolution – Key Take Aways

- **Creating an organizational culture that promotes problem solving is essential for success in all AFSC organizations.**
- **Being comfortable in the red is not the same as being complacent in the red.**
- **Find the constraint and fix it.**
- **Successful execution is directly linked to a culture that recognizes the power of effective constraint resolution while protecting the critical path.**

Chapter 5

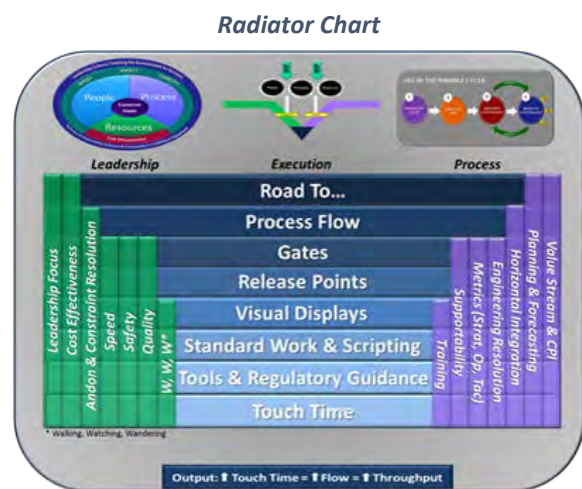
The Radiator Chart

5.1. Introduction: AoP is about reaching beyond today's limitations to grasp previously unimagined heights of performance. It is about challenging each other to recognize opportunities, eliminate constraints, improve processes and optimize resources to achieve world record results. It is not about working harder, cutting corners or jeopardizing workplace safety but about expanding our vision of what is truly possible and refusing to settle for marginal improvements.

5.1.1. Thus far, there has been discussion on the importance of leadership with regard to creating an environment for success and how establishing a road to... provides the foundational step in the journey toward achieving an AoP mindset. There has been discussion of how the fundamental principles of Little's Law and ToC can be applied to create the science for designing and operating AFSC process machines. This chapter will add discussion of how standard work, visual management, and technical data/engineering support as well as other AoP elements set the stage for efficient execution. In a previous chapter, we discussed the value of creating a culture of problem solvers; but, how does it all come together to ensure the organization moves forward in its evolution of the AoP? In an effort to answer that question, and to establish a singular sustainment game plan for the enterprise, the Radiator Chart was created.

5.1.2. A radiator is essential to keep a car's engine running properly. The cooling fluid within the system circulates through the radiator to be cooled. Without the radiator, the car's engine would overheat causing catastrophic failure. In much the same manner, the elements on the Radiator Chart are essential to a well-functioning AFSC process machine.

5.1.3. The Radiator Chart brings the leadership focus and the science of throughput together into a single game plan which represents the vision of how an AFSC process machine is set up to achieve world class status and AoP results. Within the chart, the horizontal and vertical intersect to represent the complexity and interdependence of its components. Focusing on select areas of the chart in isolation will not translate to success. Success depends on focus and implementation of all areas of the chart as a whole. The enterprise approach is woven into the elements throughout the radiator chart. The entire enterprise must align metrics and objectives of each element for the whole to be successful. Leaders will need to utilize and leverage the unique capabilities encompassed within each bar of the chart to unite the vertical leadership and process qualities with those of the horizontal execution qualities in order to optimize the flow of products and services through the enterprise process.



5.1.4. At first glance, the Radiator Chart seems complex because its representative of our own complex business, AFSC is the supporting command for readiness. The stacked and overlapping design signifies the interdependence of the chart elements, just like each AFSC organization is dependent on another. The length of each bar signifies the ability and scope of influence each particular bar has over the other chart elements. The Radiator Chart is the way we execute our game plan and the standardized set of operating principles by which we set-up machines. The elements on the chart touch every part of the enterprise. The horizontal elements depict how the machine is set up. The vertical elements enable the machine to work effectively and efficiently. Without these elements working together, the machine will fail.

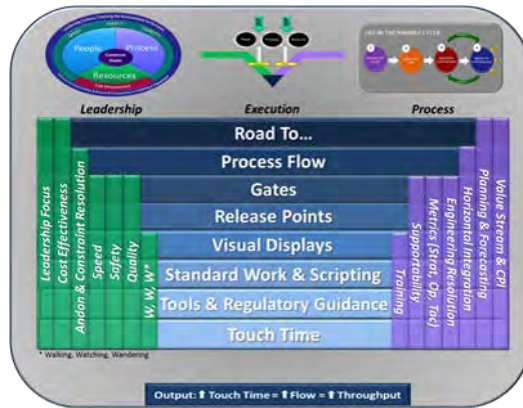
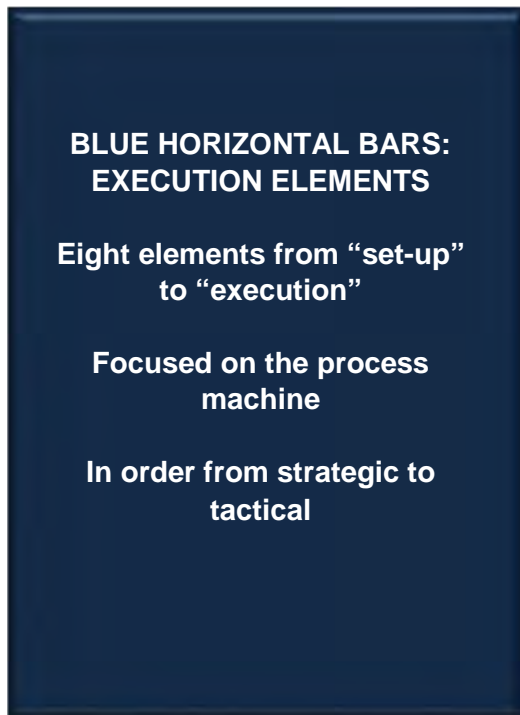
5.1.5. In *Building Lean Supply Chains with the Theory of Constraints*, Dr. Mandyam M. Srinivasan stresses the importance of Systems Thinking with regard to creating the ideal supply chain. The traditional approach to building a supply chain is to create autonomous units structured around individual processes so managers can optimize their specific portion of the process. This traditional method creates silo thinking and does not allow each silo to understand their impact to an upstream or downstream silo. This also creates confusion as each silo speaks their own language. Local optimization does not consider the impact of each function on the whole system and does not lead to global optimization of the entire supply chain.

5.1.6. Taking the ideas from Dr. Srinivasan's book, an enterprise approach is woven throughout the Radiator Chart. Enterprise involvement is necessary for successful planning and execution of AFSC common goals and the enterprise must align metrics and objectives in order for the AFSC as a whole to be successful. Dr. Srinivasan says, "A stable, enduring lean supply chain has to focus on throughput... For a nonprofit enterprise, throughput can be viewed as the rate at which the enterprise accomplishes its mission with the available resources." By focusing the enterprise on the creation of disciplined processes that enable the improvement of throughput through the system, the enterprise can create the capacity necessary to sustain our Air Force systems.

5.1.7. The Radiator Chart is a model which conveys the game plan to implement AoP in order to increase throughput, reduce WIP and reduce costs. Cost reductions are a result of speed, quality, and safety and make AFSC more competitive. ***"Sustainment cost will drive the size of the force that the Air Force can afford which, in turn, impacts its ability to provide global vigilance, reach and power."*** A cost effective mind-set is essential to ensure our limited taxpayer dollars are spent in a manner that provides our Air Force with the most readiness capability. Reduced WIP equals reduced costs (less floor space, equipment, manpower, and support personnel required for the same or more throughput). AFSC leaders must set the tone and ensure the process machine is built with integrity by critically integrating each pillar of the Radiator Chart into the mapped machine process. Doing this will insure the process machine is strategically mapped for success.

5.1.8. In the following graphic, the top four bars on the execution portion of the Radiator Chart are leadership roles and responsibilities (strategic) while the bottom four bars are focused on the process doer (tactical).

Execution Elements



Execution



5.2. Road to... A journey of a thousand miles begins with the first step, but careful planning is necessary to ensure that first step is taken in the right direction. The right step is identifying the burning platform and establishing data-driven goals. Creating a road to...goal is the foundational step in the journey toward achieving an AoP mindset. The road to... bar communicates the need for a future state goal that will be used to set the pace for throughput and focus the enterprise in the same direction. It is the road map for accomplishing AoP results. It includes the process of communicating the goal up, down, and across the enterprise and requires stakeholders' ownership and integration into their objectives. The means to the ends AoP results is thru building a process machine.

5.2.1. Achieving the required throughput for the process machine requires the focus of not only the organization, but also that of its teammates. For this reason, an important element of this phase of the process is to communicate and create buy-in through all levels within the organization and with external teammates throughout the enterprise. External partners include the customer, suppliers and organizations that support the processes. Understanding and buying-in to the road to...goal provides the signal external



organizations need to pace their processes to the requirement.

5.2.2. **Elements of road to... Communication:** A successful road to... communicates the four elements which support the goal, especially when attaining the goal requires a comprehensive shift in cultural norms for the pace of production. Elements that will make the communication successful include:

- 5.2.2.1. Explanation of the reasoning behind the goal – *the burning platform*.
- 5.2.2.2. Explanation of the science behind the goal – *through the process machine*.
- 5.2.2.3. An understanding of the performance history – *frame the challenge*.
- 5.2.2.4. An outline of actions necessary to reach the goal – *action plan*.

5.2.3. **Burning Platform:** The burning platform communicates the urgent and compelling reason to establish the road to... goal looking first to the needs of the customer. What is the pace of the customer requirement today? What is on the horizon for the customer that could affect the current pace? In the case of an aircraft production environment, future modifications or anticipated repair challenges can threaten to extend the time aircraft spend in a depot maintenance environment. Extended flowdays, in turn, can increase the number of aircraft captured in a depot repair setting, increasing the pressure on the customer's aircraft availability goals. A burning platform for an aggressive AoP road to... can be created around the need to maintain a specific number of depot aircraft in the face of challenges that, unchecked, will increase the number.

5.2.3.1. Perhaps the look into the future did not uncover changing needs for the customer. The next question to ask: is the current pace supported by the organization's constraints such as facility limitations in a production environment? If the pace of the customer requires 20 aircraft to be captured and in work at one time, does the organization have space for 20 aircraft? Other workloads competing for the same capacity requirements should be reflected in the burning platform of a road to...goal.

5.2.3.2. In the case of an administrative environment, what are the customer's requirements and how are those requirements regulated by law or policy? When building contracts, what needs to be funded, what is the duration of the contract, what aspects of service or product should be covered? Will there be care and maintenance of systems, services, or parts? What portions of industry will the contract be focused? Is the contract commensurate with policy (i.e. Federal Acquisition Regulations)? What is the customer need date for the contract? An aggressive road to... should consider all current and future customer requirements and reflect the customer's enterprise approach.

5.2.4. **Process Machine:** This communication tool is a visual representation of process flow and an understanding of the mathematical science behind the road to.... Process owners must understand the machine science will dictate the expected pace of the machine. The

science used to create a particular process machine should be communicated so the enterprise understands the science behind the ultimate road to...

5.2.5. Frame the Challenge: A challenging road to... will not be easy to achieve. Road to... require the organization to closely examine themselves and use data analysis to uncover the gaps in the organization's current processes. Detailing the gaps between current and desired performance will lead to an understanding of what needs to change in order to meet the ultimate road to...

5.2.5.1. Framing the challenge should include comparing current flow day performance to the required future performance. Specifically state the reduction required so the enterprise understands the extent of the challenge. Later, as performance improves, and the organization moves closer to meeting its road to..., this variance can be used to show the improvement and motivate the enterprise to see that success is possible.

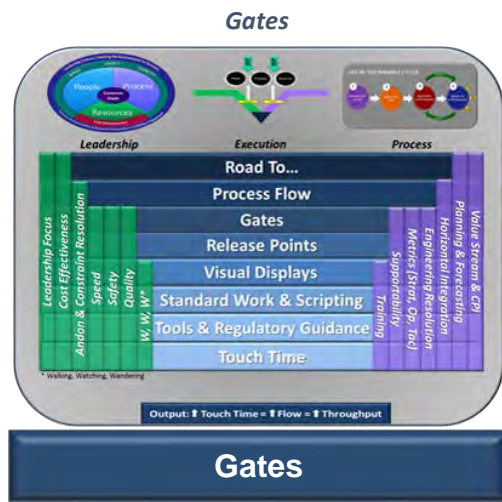
5.2.5.2. The challenge should be framed from an enterprise view. While an organization should certainly focus on internal processes that can be improved; framing the challenge should be about communicating gaps from an enterprise perspective. Are there specific supportability elements that need to be met? Does engineering need to help develop standard, repeatable repair processes or define processes to enable concurrent work? Does the organization need to develop a standard script for the desired flow? Is there a facility challenge that needs to be overcome? An organization frames the challenge in order to leverage the burning platform. This empowers and motivates the enterprise to resolve and overcome the challenges to attaining an AoP road to...

5.2.6. Action Plan: The action plan is the key that will set the organization on the road to success. The action plan should make use of CPI principles and should include target completion dates. The events and actions listed should involve the enterprise. The action plan should consider not only current gaps, but should account for future challenges that could add days to the machine in order to protect machine flow days. The action plan should allow the organization to communicate to the enterprise the big bucket actions necessary to achieve ultimate success.

5.3. Process Flow: Process flow is a visual representation of the tasks required to complete the execution plan. It defines the critical path/chain and serves as the basis for creating standard work with repeatable, disciplined processes with predictable outcomes. The process flow and execution plan paced to the Road To... goal. The process flow (process map) serves to eliminate gaps or duplication and allow users to interface and tactically manage the machine to control WIP and flow. A well-structured process flow identifies predecessors, successors, and concurrent work along the critical path. A well-structured process



flow also allows the identification of constraints by showing where WIP stacks up within a process and allows users to expeditiously attack and resolve their constraints or disruptions to ensure steady flow of WIP.



5.4. Gates: Refers to the practice of breaking long flowtimes into buckets or discrete increments of work along the critical path or critical chain of a process with tangible ending points (release points). The use of gates creates a disciplined monitoring system with a focus on critical path urgency. CPI efforts should be tied to improving gate performance. Gates control active WIP to prevent overwhelming or starving existing resources. Remember, the entire enterprise OWNS THE GATE, even if portions of the process are owned by other stakeholders. Taking ownership ensures team accountability.

Gate Examples



5.5. Release Points: Release points are defined concrete triggers or business rules; approval at the appropriate level to move work between gates and release work into the process machine. Release points within the gated process instill both the mindset and the discipline to not pass work and problems to later gates – especially as it relates to the critical path/chain of a network. Release points require business rules to create a cultural awareness that ensures specific actions are taken at critical points in the process. Creating a culture that uses these rules to create the urgency necessary to elevate and resolve issues prior to the gate release point (and



protect the critical path/chain) is essential to creating the type of throughput that leads to attaining an AoP mindset. Leaders must enforce gates and release points dogmatically.

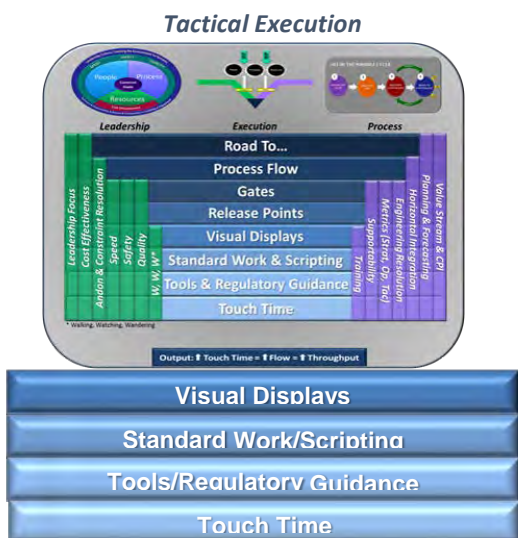
5.6. Tactical Execution: The Bottom Four.

5.6.1. The next four bars of the Radiator Chart serve as the interface to the process machine.

5.6.1.1. They provide the insight into the machine to determine if all systems are go and the machine is working as it should.

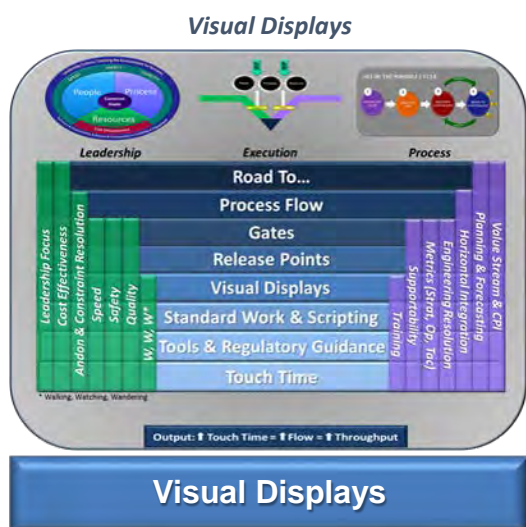
5.6.1.2. This interface should also provide warning signals that adjustments need to be made or actions need to be taken.

5.6.1.3. These four execution elements are key to determining “How I know I’ve had a good day.”



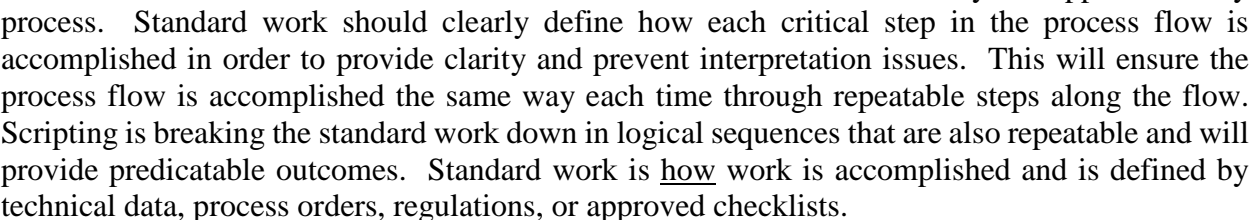
5.6.2. **Visual Displays:** Information is power, meaning the sharing of information can make the information owners more effective, thereby making the organization as a whole more successful. In the current reality of increasing computing power and the connectivity that comes with it, there is an increased emphasis on sharing information. However, it is important to promote effective sharing of information in order to avoid information overload.

5.6.2.1. In order to be effective, the reason for the communication needs to be considered. For the purpose of this section, the display of process information to help the employee or the process support team understand process status as it relates to a particular process, as well as information to help managers and senior leaders understand the overarching process status is imperative. Communication of information is generally accomplished via visual displays located in the work area while dashboard type documents are often utilized to communicate overarching information to managers and senior leaders.



5.6.2.2. Visual displays are a graphic depiction of the process map or network (machine) and are a visualization of information covering speed, safety, and quality in the work area. These can be boards on the production line or in the administrative area and should be meaningful. Visual displays should be process doer-centric; allowing everyone to understand their role, especially as

5.6.2.3. Some basic elements that will be considered in each type of visual display include: 1) relevancy; 2) simplicity; and 3) accuracy. An understanding of what is relevant to the intended audience will ensure the visual display is not cluttered with unnecessary information that disrupts the intended message. Another element that can add clutter to the message is complexity. A simple and straightforward design enables a more effective information delivery. It goes without saying that information must be accurate in order to be useful.



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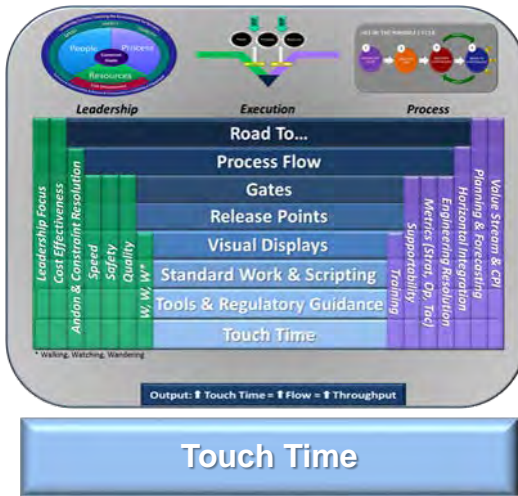
5.6.3.2. Scripts provide both a monitoring and measurement function. Monitoring is visible to the doer through displays in the work area and tells the entire team if the project is on track. Measuring the variance of execution in critical path tasks provides important data for process improvement. Scripting also provides a mechanism for resources (people, parts, equipment, etc.) to be synchronized to the flow of work. The focus is to create repeatable processes in order to reveal constraints and enable a predictive repetitive process. Scripts and standard work represent the best flow based on the information available. They represent codified processes changed only through process improvement efforts and through the vetting of appropriate stakeholders. The goal is not to create robots who mindlessly execute to scripts and regulations, but rather to create opportunities for critical thinkers to identify improvements through CPI.

5.6.3.3. Synchronization can occur when discipline has been instilled with regard to following the sequence of steps. Discipline means that the ability to free-lance with regard to the order the steps will occur has been removed. Any change in the order of the scripted steps needs to be considered by the team and the change documented into the agreed upon script. This process allows for continuous improvement as a collective effort.

5.6.4. **Tools and Regulatory Guidance:** This involves the authority to have and use tools, technical data, equipment, supplies, AFMC 202s, etc...and follows standard work in accordance with critical path requirements. In addition, it addresses all tools required in all areas that surround and impact the process doer and the critical path. Tools and regulatory guidance give workers what they need, when they need it and strongly affects touch time. If this bar is executed properly, touch time will be positively affected.



Touch Time

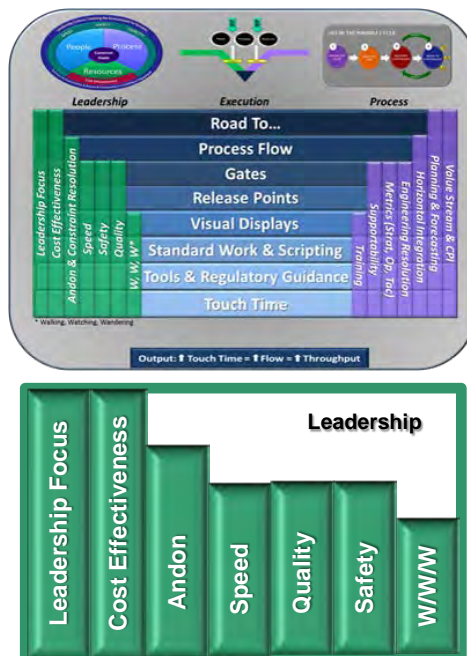


5.6.5. Touch Time: Touch time involves keeping hands on the product/project. It focuses the workforce on value-added steps in the process and delivers what the employees need to minimize hunting and gathering. What can be done in any and all areas surrounding the employee that can positively affect their output along the critical path? An example is kitting assets needed during execution where touch time is increased and non-value added time is reduced. This is accomplished by kitting what is need to complete the task and having it readily available at the point of use.

5.7. Leadership Pillars: The green vertical elements of the Radiator Chart are the leadership pillars. These vertical bars are focused on the leadership aspect of the enterprise and are used to set the organization up for success. Systems and execution tools do not give you permission to not manage processes and people. Leadership sets the tone for achieving the AoP mindset by creating an environment for constraint resolution that leads to execution of efficient processes.

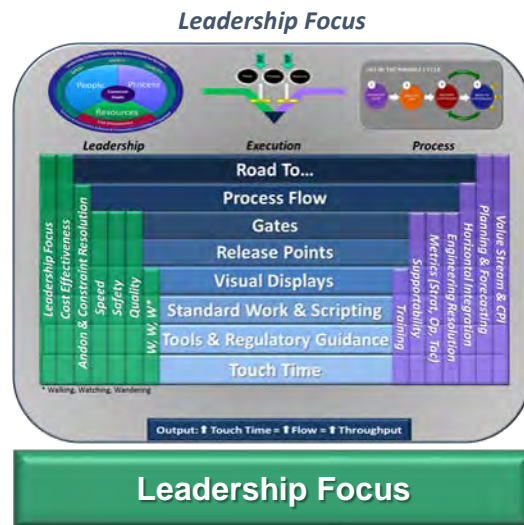
5.7.1. These seven elements are set to manage the process machine and are tools that personnel must employ to achieve success. Managing the process machine requires the leader to completely understand the process and create an environment for success during execution. The goal of cost effective readiness cannot be reached without cost effective process machines.

Leadership Pillars

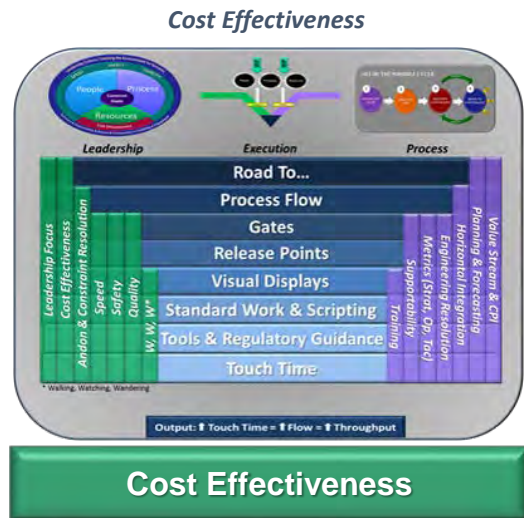


5.7.2. **Leadership Focus:** Leadership Focus creates an environment that allows everyone to succeed--It MUST start with leadership! Focused Leadership:

- 5.7.2.1. Fosters an environment for success.
- 5.7.2.2. Engages all personnel regularly.
- 5.7.2.3. Protects the critical path.
- 5.7.2.4. Creates urgency.
- 5.7.2.5. Resolves constraints.
- 5.7.2.6. Understands gaps to AoP and action required to mitigate.



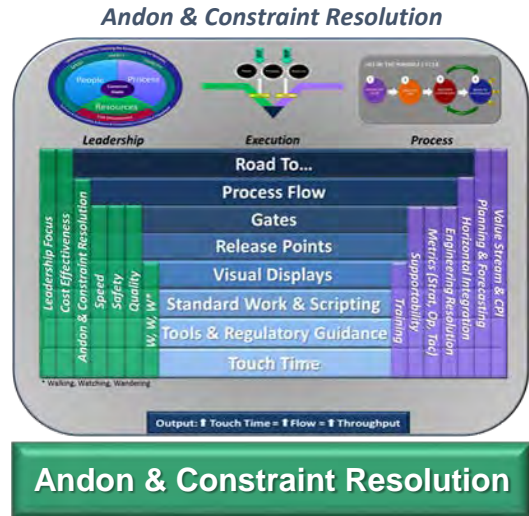
5.7.3. **Cost Effectiveness:** AFSC's White Paper on Cost Effective Readiness (2014) provides insight into the Cost Effective element of the Radiator Chart. It states: *"Sustainment cost will drive the size of the force that the Air Force can afford which, in turn, impacts its ability to provide global vigilance, reach and power."* A cost effective mind-set is essential to ensure our limited taxpayer dollars are spent in a manner that provides our Air Force with the most readiness capability. Executing this mind-set requires leadership to foster the use of a scientific, data-driven approach to attack each cost driver and challenge historical business practices. This is accomplished by focusing on cost drivers through the application of process improvement tools with the goal of identifying gaps and opportunities to reduce these costs and therefore, the budget where these costs reside. This is a more effective approach than simply cutting the budget which could result in reduced capability.



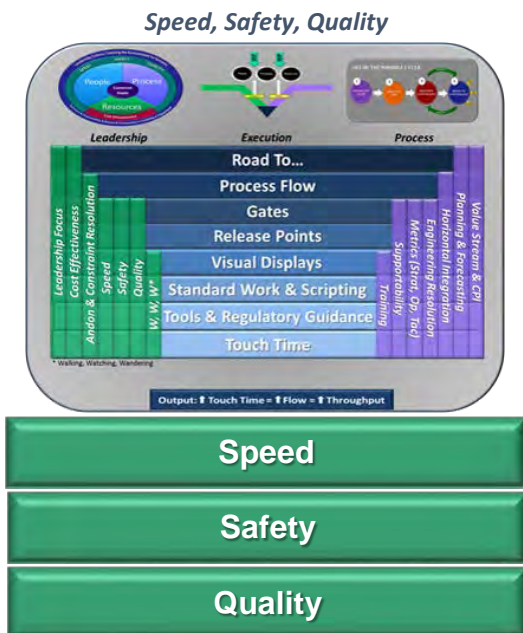
5.7.4. Andon & Constraint Resolution:

Much of the previous chapter was dedicated to Andons so we will not repeat all the information. Just keep the ideas below in mind when discussing Andons:

- 5.7.4.1. Utilized as an urgency tool.
- 5.7.4.2. Signals that work has stopped.
- 5.7.4.3. Calls the enterprise to action.
- 5.7.4.4. Requires a culture that elevates constraints and communicates impact based on critical path.



5.7.5. Speed.



- 5.7.6.3. Understand safety gaps.

5.7.7. Quality.

- 5.7.7.1. Remember reputation, don't sacrifice quality for speed.
- 5.7.7.2. Expect a standard of excellence-set the expectation daily.
- 5.7.7.3. Communicate quality measurements to the lowest levels.
- 5.7.7.4. Deep dive problem areas to uncover root causes.

- 5.7.5.1. Paces throughput to the road to...
- 5.7.5.2. Requires a focus on the process.
- 5.7.5.3. Eliminates non-value added steps.
- 5.7.5.4. Targets efficiency for the process doer.

5.7.6. Safety.

- 5.7.6.1. Remember our responsibility to protect our people.
- 5.7.6.2. Improve safety by involving the doer.

Imbed quality and safety into the culture – then let process improvement and constraint resolution take care of speed.

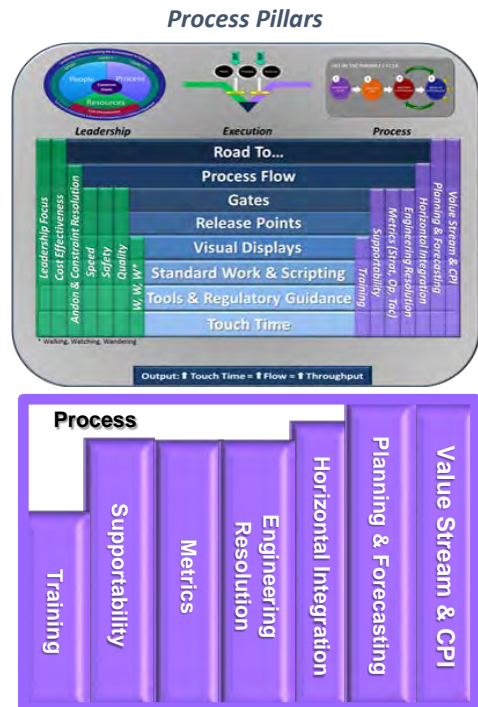
5.7.8. Walking, Watching, Wandering (W3). Management by walking around has been around for a long time and refers to consistently reserving time for the leader to walk through their areas of responsibility. Managers that spend time walking, watching and wandering through their areas are available for impromptu discussions, engaging employees to gain insight into the organization's processes and culture. Utilizing W3 in supervision ensures leaders get out of the office and stay informed. This insight will help leadership focus on how to create an environment that focuses on touch time.



5.7.8.1. W3 are things supervision should do (Gemba Walks) and are things process doers should not do. W3 may be why process doers are not on task. The process doer may not have everything they need to carry out the task successfully, thus spending time hunting and gathering materials or information to accomplish the task. Eliminating W3 by the process doer improves touch time and creates a minutes matter mentality.

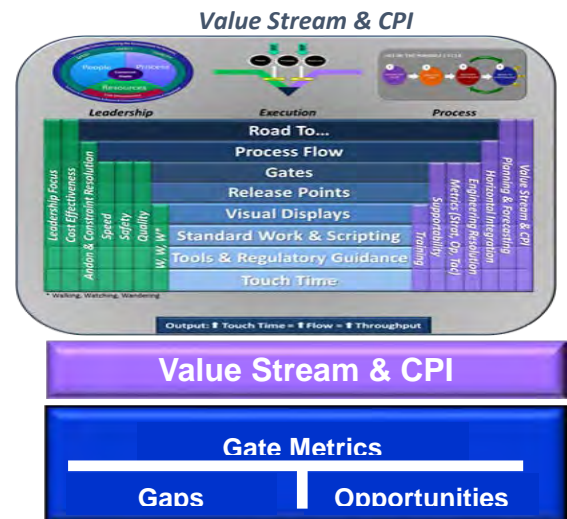
5.8. Process Pillars: The purple vertical elements of the Radiator Chart are the process pillars. These vertical bars are focused on the processes that enable success within the enterprise. Leadership will utilize these “tools” to achieve the “Art of the Possible” mindset throughout their organization. These bars are not intended to just improve performance, but are also intended to deliver sustained and enduring performance.

5.8.1. There are seven elements to involve the enterprise in reaching standardized repeatable processes that are effective and efficient. The power and influence within the enterprise process lies within these strategic process elements. The process pillar improves machine performance and is the key to sustained world class results for the warfighter.



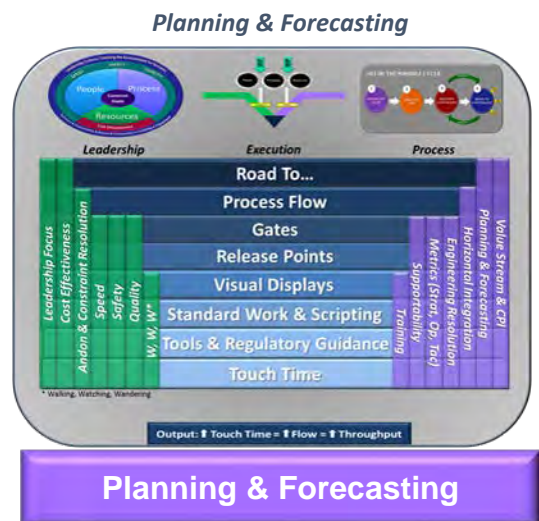
5.8.2. **Value Stream & CPI:** Data from established gates and release points provides the information necessary to identify problem areas to focus process improvement efforts. Success should be measured against your road to... goal.” **Success is measured by results, not activities** and comes from obtaining knowledge from the level closest to the process.

- 5.8.2.1. Use data to drive decisions.
- 5.8.2.2. Focus on underperforming gates.
- 5.8.2.3. Identify performance gaps.
- 5.8.2.4. Map the process.
- 5.8.2.5. Involve the Enterprise.
- 5.8.2.6. Measure against road to... goal.
- 5.8.2.7. Measure results NOT activities.
- 5.8.2.8. Understand the power of the wall walk.

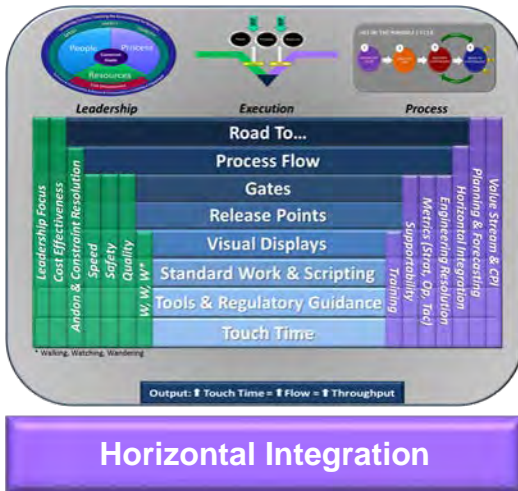


5.8.2.9. The process element of Value Stream/CPI provides a process improvement overview in terms of machine gates. It identifies gaps and improvement opportunities and requires understanding of what is impacting the machine/gate performance. Further, this element enables organizational learning by requiring involvement at all enterprise levels.

5.8.3. **Planning & Forecasting:** Good planning translates into good forecasts that allow the enterprise to strategically plan for the needs of execution. Collaborative planning with all functions in the supply chain (i.e. SPO, Facility Engineers, Maintenance Planning and Production, DLA and the 635th, etc.) translates into better forecasts for requirements which allows a proactive approach to supportability. For administrative areas, good planning and forecasting translates into on time products to customers.



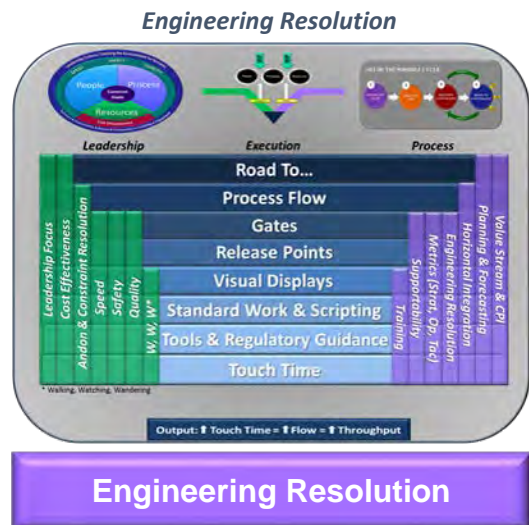
Horizontal Integration



5.8.4. Horizontal Integration: Horizontal integration is the increased synergy that is possible when all members of the enterprise adopt and work toward the road to...goal. Horizontal integration is focused on process output: what the customer needs. Regardless of the process, all parties in the process are responsible for the output (final product) not just the specific work they have to do. Horizontal integration creates a culture of customer orientation/satisfaction rather than isolated task execution.

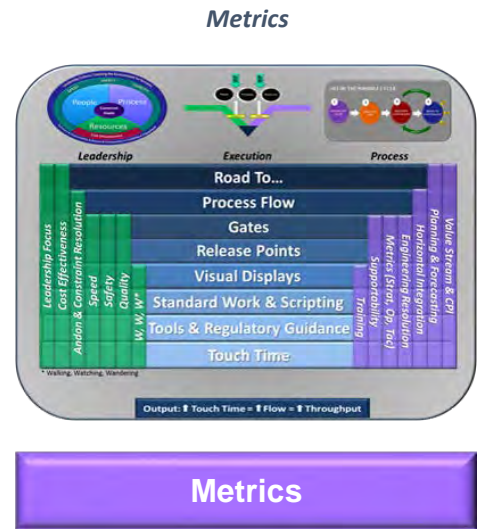
5.8.5. Engineering Resolution: This bar focuses on getting final defect resolution in a timely manner. Total technical resolution must be focused on a collaborative solution that provides a quality product to the customer while recognizing the time constraints associated with depot repair. Leadership must set the tone as a demanding customer that clearly communicates depot repair needs to be considered in the repair disposition. In an administrative process, processes may not engage engineers or even have an engineer in the process. However, this could mean an irregular requirement from an outside agency. The process will need the agency to answer timely and with an understanding of the needs of the process machine. Resolution requires a delicate balance:

- 5.8.5.1. What is best for this end item.
- 5.8.5.2. What is best for the system.
- 5.8.5.3. What keeps the machine moving.



5.8.6. Metrics Strategic/Operational/Tactical):

Metrics are the foundation of a data-driven organization and must be aligned from the strategic through the tactical levels. Tactical metrics should be directly related and subordinate to operational metrics and operational metrics should be directly related and subordinate to strategic metrics. Metrics should be clear, actionable, and relate to the critical path/chain of the product, project, or service; however, leadership discernment is required to react to data and metrics in order to allow experience to drive interpretation of the data as it translates to action. Metrics provide data for identifying gaps and opportunities, creating transparency and accountability, and driving behavior.



5.8.7. **Supportability:** Involves proactive actions to move supportability efforts to strategic and operational levels based on findings and experience at the tactical level. Aggressive constraint identification-elevation-resolution efforts at the tactical level keep the plan executing along the critical path/chain. Process owners should strive to never release

work into the process machine unless it is supportable. With process discipline and maturity, WIP rules may be broken. It emphasizes an enterprise focus for constraint resolution and process improvement and involves:

5.8.7.1. People.

5.8.7.2. Process.

5.8.7.3. Resources (facilities, tools, equipment, parts).



The diagram illustrates a process flow and its components, organized into three main sections: Leadership, Execution, and Process.

Leadership

Execution

Process

Road To...

Process Flow

Gates

Release Points

Visual Displays

Standard Work & Scripting

Tools & Regulatory Guidance

Touch Time

Leadership Focus

Cost Effectiveness

Andon & Constraint Resolution

Speed

Safety

Quality

W. M. A.

Training

Supportability

Metrics (Strat., Cp, Tnd)

Horizontal Integration

Engineering Revolution

Planning & Forecasting


Value Stream & CPI

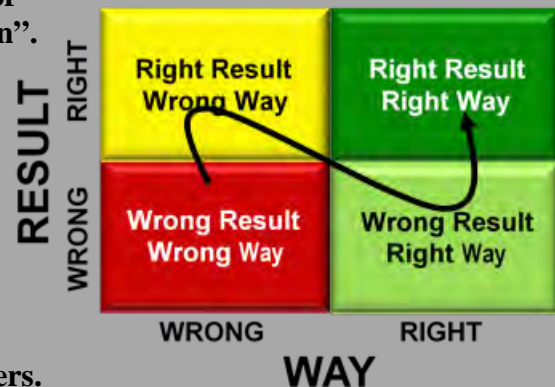
Value Stream & CPI

Output: Touch Time = Flow = Throughput

5.9. Summary: The Radiator Chart horizontal bars represent the standard vision of how process machines across the AFSC will be setup to achieve “world-class” performance. As such, these execution elements then become measurable expectations of sub organizations throughout the AFSC and the game plan to achieving success. The horizontal and vertical lines overlap to represent the complexity and interdependence of its components. Focusing on select areas of the chart in isolation will not translate to success. Success depends on **focus** and **implementation** of all areas of the chart as a whole. The entire enterprise must align metrics and objectives of each element for the whole to be successful. Leaders will need to utilize and leverage the unique capabilities encompassed within each bar of the chart to unite the vertical leadership and process qualities with those of the horizontal execution qualities in order to optimize the flow of products and services through the enterprise process. Taken together, the Radiator Chart elements synchronize processes to ensure decreased variability and increased efficiency.

Radiator Chart – Key Take Aways

- Brings the leadership focus and the science of throughput together into a single “game-plan”.
- Represents the vision of how an AFSC process machine is set up.
- Right results the right way. 
- The Radiator Chart is to increase throughput, reduce WIP, and reduce cost.
- Horizontal bars are execution.
- Vertical bars are leadership and process levers.
- About achieving previously unimagined heights of performance.



Chapter 6

WALL WALKS AND TACTICAL MANAGEMENT

6.1. Introduction: There has been extensive discussion on identifying gaps in order to focus process improvement efforts. Wall walks focus on the operational performance of the process machine in order to identify and resolve the constraint. Tactical management is a recurring review of WIP flowing through the process machine that focuses on the individual items of WIP (tail numbers, commodities, projects, contracts, etc.) flowing through the process machine rather than performance at the operational level.

6.2. Wall Walks: A wall walk is a recurring process-focused review to understand process machine performance, to identify constraints, and to coordinate constraint resolution. Wall walks enable organizational learning and require involvement at all levels. They are not a briefing to leadership and are not tactical level management for the process team. As your organization grows in their AoP journey, the wall walks will mature and include deeper analyses.

6.2.1. Wall walks utilize visual displays set up around process execution gates. A gated process machine has separate charts for each respective gate. Each chart portrays performance trends, business rules, and the improvement opportunities for its respective gate.

6.2.2. Wall walks allow an organization to understand how the process machine is performing with measured data. Metrics used should be meaningful to the process doer, data-driven, specific, and tied to the organization's road to... goal. Wall walks allow for transparent assessment of an organization's performance in relation to mission objectives and hold personnel accountable for meeting performance expectations.

6.2.3. The power of the wall walk is in the creation of ownership of gaps and improvements. Ownership for a gate, gap, and/or improvement initiative is an important component in improving the performance of a process at the process doer level. Further, the wall walk creates a means for self-sustaining process improvement by the process doers and provides opportunities for both accountability and praise for improvement initiatives and results.

6.2.4. Wall walks must include all enterprise teammates and subject matter experts to resolve gaps and improve processes. Enterprise teammates should also be present during wall walks in order to show support for initiatives in which they play a part and to continually understand the goals and initiatives of the organization to whom they provide support.

Wall Walks

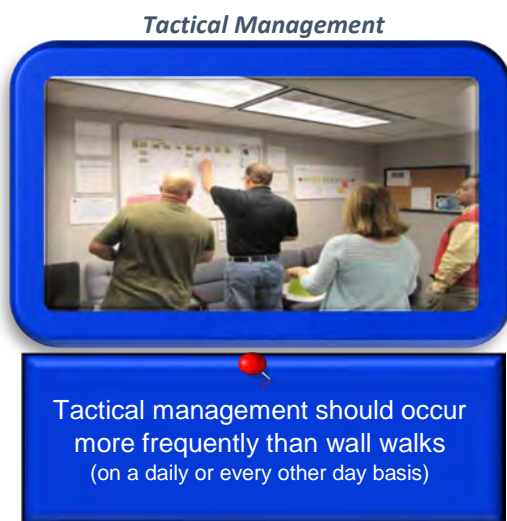


Wall walks allow an organization to understand how a process machine is performing.

6.2.5. Wall walks also present the opportunity for leaders to provide guidance and encouragement to members of their organization. Leaders should not miss the opportunity to open the door for critical thinking and to celebrate small successes. This is an excellent opportunity to coach, mentor, and teach everyone at the wall walk briefing.

6.2.6. It is also important to recognize and celebrate small successes along the journey to AoP goals; however, do not allow these small successes to create complacency toward the larger goal. Encourage out-of-the box thinking to create engagement. With a truly engaged workforce, the boundaries of traditional thinking can be lifted, and freedom from the “good enough” approach can be obtained, as AFSC organizations reach for AoP results.

6.3. Tactical Management: Tactical management is an established frequent review of WIP flowing through the process machine. It focuses on the individual items of WIP (tail numbers, commodities, projects, contracts, etc.) flowing through



the process machine rather than performance at the operational level. Tactical management should focus on constraint resolution opportunities to ensure timely delivery and the quality of individual products/projects has been met. Tactical management should occur more frequently than operational level wall walks.

6.3.1. Tactical management of processes should occur with the process ownership team, the process stakeholders, and process teammates who have a stake in the process outcome. Tactically managing WIP within the machine should be a team effort allowing stakeholder input and influence on process improvement.

6.4. Summary: Organizations should leverage process improvement to link constraints, gaps, and improvements to execution through wall walks and tactical management of process machines. A wall walk is a recurring process-focused review to understand process machine performance, to identify constraints, and to coordinate constraint resolution. Tactical management is an established frequent review of WIP flowing through the process machine that focuses on the individual items of WIP (tail numbers, commodities, projects, contracts, etc.) flowing through the process machine rather than performance at the operational level.

6.4.1. **Bottom Line:** Learn AoP and start using it! Get started on a process, establish flow, monitor machine performance, and identify and eliminate constraints. Do not be afraid to ask questions and utilize your AoP subject matter experts. The next chapter focuses on where the AoP journey begins: getting started using the five steps to implementation outlined in the introduction. The five steps provide an implementation approach intended to get the organization and the workforce into “the struggle” by utilizing AoP techniques.

Wall Walks and Tactical Management – Key Take Aways

- **Wall walks are the focal point of the AoP system at the operational level.**
- **The wall walk purpose is to understand process machine performance, gate trends, where the constraints are, and constraint resolutions that are in work.**
- **Tactical management is an established and frequent review of WIP flowing through the process machine.**

Chapter 7

HOW TO GET STARTED

7.1. Introduction: While introducing this book, we summarized how to get started with five basic steps to implement AoP in any organization. Now, we will break those five steps down into meaningful tasks to assist in generating gated process machines. The goal is to help prioritize and focus effort. The bottom line is to just get started and do not make implementing AoP harder than it needs to be.

7.2. Step 1: Identify and Define METL. AoP is a constraints based management system that uses the science of throughput and principles of flow to improve process speed, quality, and safety. When implemented across the AFSC, it will create a culture that is focused on the efficient execution of essential processes. Under AoP, processes are defined as machines that can be set up and calibrated to produce specific, predictable results. Once a machine is set, it is monitored for performance. AoP should be implemented on the processes that are critical to an organization successfully accomplishing its mission. Units implementing AoP must first know their critical processes. For this reason, AFSC has adopted a best practice of identifying and defining a METL for use across the center.

7.2.1. Previous experience in implementing AoP, particularly in administrative organizations, has shown there can be significant confusion in identifying an organization's critical processes. In most cases, units define far too many tasks as mission critical. This delays implementation and frustrates the workforce as they try to implement AoP. This section describes how the use of the METLs can assist unit commanders and directors in identifying critical processes where AoP should be implemented.

7.2.2. The METL provides the analytical framework to determine the right focus and priority for implementation across a broad range of functions within an organization. It ensures standard documentation of essential processes within an organization, determination of processes not supported by an appropriate regulatory source, and identification of processes that could be divested or streamlined through simple waste and resource analysis. Use of the METL for prioritization of implementation is designed to aid in maturity and understanding of AoP methodologies and provide a useful indicator of the overall mission performance of the organization.

7.2.3. The METL concept is used across all services. Most military organizations have defined missions and a METL that supports that mission. Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3500.04F defines an essential task as "Tasks based on mission analysis and approved by the commander that are absolutely necessary, indispensable, or critical to the success of a mission." A unit's METL is a complete list of all such tasks for the unit. The use of the terms MET and METL in AoP are not operational terms. They are used to assist the unit in finding its most important processes and are used only as the starting point for AoP implementation.

7.2.3.1. METLS should align within the squadron and group to the wing/complex

strategic goals and objectives. AoP should then be seen as the enabler to rationalize, define and align the right METLs that directly support AFSC, AFMC and AF vision, mission, and strategic goals and objective.

7.2.4. AFSC/CC's direction to implement AoP across the center applies to critical processes down to the squadron/division level. Critical processes are those that are essential to the successful execution of a unit's mission. The unit mission can be thought of as the reason for the unit's existence. This reason must be considered from the customer's perspective. Critical processes are those that create outputs upon which the unit's customers are depending.

7.2.5. The following points are meant to assist a commander/director in reviewing or defining a unit's METL:

7.2.5.1. Review the squadron/division mission statement and identify and prioritize specified and implied tasks. Specified tasks are those tasks directly stated in the mission, by the next higher commander, or by law or regulation. Implied tasks are actions or activities not specifically stated but which must be accomplished to successfully complete the mission.

7.2.5.2. From the list of specified and implied tasks, identify essential tasks. The criteria of essentiality are whether or not the unit mission can be accomplished without the task being performed to the standard.

7.2.5.3. For service and staff organizations, apply the essentiality criteria from the unit's customer's perspective. Care and feeding type functions (ie. time sheet approval, leave request approval, TDY voucher approval etc.) that do not deliver value to a customer are not essential tasks.

7.2.5.4. Specified tasks directed in the mission statement or by the next higher commander are normally mission essential.

7.2.5.5. Tasks providing support to other organizations, particularly organizations delivering goods or services directly to the center's customers, are normally mission essential.

7.2.5.6. Most unit METLs will contain 10 or fewer essential tasks. If you have fewer than five or more than 10, you should consult with your AoP SME.

7.2.5.7. Each AFSC unit down to the squadron/division level, should develop a METL and "get in the struggle" by simply picking an essential task upon which to implement AoP. AoP SMEs are available to provide mentoring and coaching of AoP fundamentals such as establishing flow and assisting units with their internal machines.

7.3. Step 2: Select One Task for AoP Implementation. Analyze and prioritize METL tasks for impact and complexity. Select one METL task per squadron or division for initial AoP implementation. For the initial selection, choose ease of implementation over mission impact in order to learn and apply basic techniques. Get an AoP SME to review the METL with you and provide recommendations and assistance. Finally, build a implementation plan for the remaining METL tasks that are listed. The burn-down plan should show when each organization intends to have AoP implemented on all METL tasks.

Mission Essential Task

Priority	Task	Source (Law or Regulation)	Customer	Direct Support of AFSC Outputs Critical Path	CC/Complex/Directorate/Wing Priority 1-5: 1. Successfully execute our mission in most cost-conscious and warfighter-focused manner 2. Develop and support for our people 3. Plan for the future state and synchronize with our mission partners 4. Continue to improve in every aspect of our assigned mission area 5. Stewards of our resources	Major Graded Areas (MGA) 1-4: 1. Managing Resources 2. Leading People 3. Improving the Unit 4. Executing the Mission	Full Time Employee (FTE)
<i>Will show the final priority of tasks for Critical Path implementation and management. Based on 1, 2, 3, 4 scale</i>	<i>List task that is performed. Spell out any acronyms.</i>	<i>List public law, DoD/AF/AFM C/AFSC regulation or instruction that mandates the task</i>	<i>List the primary external customer(s)</i>	<i>Place an X in this block if the task directly supports or impacts the Critical Path of any product or process. This column will be filtered once all tasks have been documented and analysis is complete to help establish priority for column A</i>	<i>List which Complex AIP Priority the task supports. More than one may be selected (Example: 1, 3 and 5)</i>	<i>List which MGA per AFI 90-201 the task supports. More than one may be selected (Example: 2 and 4)</i>	<i>List the number of personnel that are working the task based on numbers with decimal points defined in whole numbers and tenths. (Example: 1.5)</i>

Example OB METL

	PRI	TASK	SOURCE	CUSTOMER	ORI PRI	1-5	MGA	FTE
OBM	1	Hiring Execution	WR-ALC/DV; Title 5	Complex	X	5	1	
	1a	Workforce Shaping	DoDI 1400.25 Volume 1702, AFI 38-101/201, ALC/DV Direction	Complex	X	5	1	
	1b	UMD Management	AFI 38-201	Complex		5	1	
	2	Appraisal Management	AFI 36-1001, AFI 36-1004.25 Volume 430, DODI 1400.25 Volume 451	Complex	X	5	1	
	3	OBMB: GTC Program/DTS Support	AFI 24-101, Federal Travel Regulation	Complex	X	5	1	
	4	OBMB: Timekeeping and Leave Programs	AFI 36-815, DODI 1400.25 Volumes 610, 630, 631.	Complex		5	1	
OBP	1	Depot Maintenance Activation	Title 10 USC 246412466, AFI 63-101/20-101 & AFMCI 21-101	AFLCMC, SCMG, OEM		1,3,5	1,2,4	
	2	Manage Public Private Partnerships (PPPs)	Title 10 USC 24641246612474 & AFI 63-101/20-101	AFSC, MXGs, Private Partners, PM/SCMG		1,3,5	1,4	
	3	Manage Large Public Private Partnerships (PPPs): C-17 JON Closeout Machine Complete	Title 10 USC 24641246612474 & AFI 63-101/20-101	MXGs, Private Partner, PM/SCMG		1,3,5	1,4	
	4	Depot Source of Repair (DSOR)/Source of Repair Assignment (SORA)	AFI 63-101/20-101 & AFCI 21-135	AFSC/LG, MXGs, AFLCMC/SCMG		3	1,4	
	5	Workload Approval Document (WAD)	AFMC/A4 Memorandum	AFSC/LG, MXGs, AFLCMC/SCMG		1	1,4	
	6	Strategic Planning & CPI Transformation	AFI 21-102-AFI 90-201	ALC/OBPS		2,3,4,5	1,2,3	14

7.4. Step 3: Define Flow and WIP:

7.4.1. Use the Radiator Chart to build a process machine for the selected METL task.

7.4.2. Establish flow.

7.4.3. Identify WIP and where WIP resides in the process machine.

7.4.4. Apply the principles of flow to WIP in the process machine.

7.4.5. Before you finish your process machine you **MUST** understand the current condition of the process. Some key items to consider when building your machine are:

7.4.5.1. Walk the process (“Gemba Walk”).

7.4.5.1.1. Your ears will lie to you!

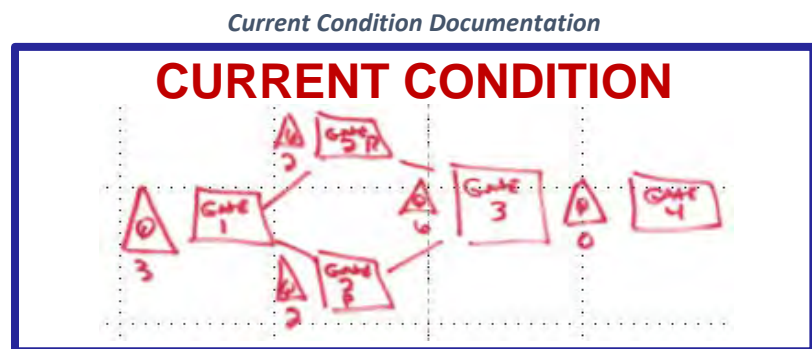
7.4.5.1.2. Go and look at the process.

7.4.5.1.3. Take notes and/or pictures.

7.4.5.2. Ask questions.

7.4.5.2.1. What are your gates?

7.4.5.2.2.



How are you monitoring/tracking your machine?

7.4.5.2.3. How are you impacting the customer?

7.4.5.2.4. How are you performing against your metrics?

7.4.6. Draw out the process machine’s current condition, show the WIP. Don’t worry about pretty, just document the current state of the process. This should take no longer than three days.

7.4.6.1. Understand the **target condition** (future state) of the process machine:

7.4.6.1.1. What result does the process machine need to produce?

7.4.6.1.2. What is the process machine's AoP road to...goal?

7.4.6.1.3. What pace does the process machine need to be set to?

7.4.6.1.4. What is the demand on the process machine?

7.4.6.1.5. What is the available time?

7.4.6.1.6. Reference throughput fundamentals.

7.4.6.1.6.1. Flow, Little's Law, WIP, takt time

7.5. Step 4: Implement Wall Walks: As stated in the previous chapter, wall walks should contain at a minimum; a visual representation of flow, WIP, and gate performance. They are recurring process-focused reviews that provide a process improvement overview in terms of machine gates. This enables organizational learning and requires involvement at all levels. Wall walks are an organization's opportunity to demonstrate how the machine is performing and allow for transparent assessment of the organization's performance in relation to mission objectives while holding personnel accountable for meeting performance expectations. Remember that metrics for machine performance should be; meaningful to the process doer, data-driven, specific, and linked to the organizations road to...goal.

7.6. Step 5: Implement Tactical Management: Tactical management should occur more frequently than wall walks and should focus on individual items of WIP flowing through the process machine. The primary focus is on tactical constraint resolution to ensure timely delivery of quality products/projects.

7.6.1. Establish frequent reviews of WIP flowing through the machine.

7.6.2. Tactical management focuses on the items (tail numbers, commodities, projects, contracts, etc.) flowing through the machine.

7.6.3. Focus is on tactical constraint resolution to ensure timely and quality delivery of individual products/projects.

7.6.4. Following the five steps of implementing AoP with discipline, coupled with the science and principles of AFSC's constraints based management system, will ensure process owners build process machines that get them started toward implementation. As the process matures and waste/constraints are eliminated, fine-tuning



the process machine and the process will likely be necessary. Further, as process owners, stakeholders, and teammates gain an intimate understanding of the process, the process machine may need to be adjusted for less variability and better performance. In other words, each process machine may go through several iterations or adjustments until the process machine reaches optimum performance and the future state road to....

7.6.5. Organizational maturity is covered next in the final section. The Maturity Matrix provides guidance for how process machines progress from initial set-up and evolve to reach world-class maturity.

How to Get Started – Key Take Aways

- **Just get started.**
- **Do not make it harder than it needs to be:**
 1. **Identify your METL.**
 2. **Pick one.**
 3. **Use Radiator Chart to build a process machine.**
 4. **Implement wall walk.**
 5. **Conduct tactical management.**
- **Consult with AoP SMEs when necessary.**
- **Refine later.**

Chapter 8

ORGANIZATIONAL MATURITY AND THE MATURITY MATRIX

8.1. Introduction: Once a unit implements AoP using the principles described throughout this handbook, AFSC has devised a way to measure improvement. The maturity matrix was created in an effort to measure the transformational progress towards world-class performance envisioned by AFSC. The maturity matrix is a measurement tool used by leaders to add transparency to their organizations. Used at all unit levels down to the squadron and division, the maturity matrix provides a common yardstick to self-assess how well an organization is implementing the science necessary to reach AoP results for the center. By assessing unit status for each of the horizontal execution bars on the Radiator Chart, the Maturity Matrix helps provide a top-to-bottom view from road to... to floor-level touch time. Using the matrix, units across AFSC may self-assess using a common standard.

8.1.1. The Maturity Matrix establishes a 1 through 5 grading scale for each execution element of the Radiator Chart (each of the eight horizontal bars). This grading scale defines stages of maturity evolving from initial set-up, to institutionalization, to the ultimate goal of establishing a world-class organization. Shown below is one page of the maturity matrix as it relates to one bar of the Radiator Chart:

Maturity Matrix

	SET-UP		INSTITUTIONALIZATION		WORLD CLASS
	1	2	3	4	5
ROAD TO ..	Goal created based on AFSC/CC Priorities, current AFMC, AFSC or Complex Strategic Plans, future customer requirements, existing capacity / capability gaps	Goal communicated to Key Stakeholders and Leaders vertically down within the organization to the Flight/Branch level	Enterprise Value Stream Mapping (EVSM) with Mission Partners has been completed; mission partners accept the Road To goal and path Goal communicated vertically up to all levels within Complex / Directorate / Wing organization WIP Reduction, CPI, and constraint resolution process are operating and linked directly to Road To Goals	Goal is communicated horizontally across AFSC enterprise, supporting external organizations across the enterprise Stakeholder metrics and leadership objectives aligned to Complex / Directorate / Wing metrics and objectives Significant Progress on Road To Goal with incremental goals achieved Targets have been adjusted to achieve stretch goals, second pass EVSM with mission pass completed; evidence of time/cost reduction impacts	ENTERPRISE ALL-IN! Goal is adopted and worked toward by stakeholders; up, down and across Complex / Directorate / Wing and Stakeholder leadership integrating and influencing strategic objectives and initiatives across all parts of the Sustainment and Life Cycle enterprise based on Road To... and cost effectiveness goals

8.1.2. Criteria for assessing the organizational stage of maturity are listed within the matrix under the respective grading scale level. The verbiage is succinct in nature and creates a well-defined common language by which organizations within AFSC can grade themselves. The criteria for moving from 1-5 on the grading scale becomes progressively

more difficult to achieve and drives leaders to reach outside their own organizations for support. This is by design and is intended to strengthen and drive additional collaboration within and even outside of the enterprise. Units must meet all criteria within the respective grading scale level before assessing themselves with that score.

8.1.2.1. Contains five levels of maturity.

8.1.2.1.1. Set-up levels (1-2).

8.1.2.1.2. Institutionalization (levels 3-4).

8.1.2.1.3. World class (level 5).

8.1.2.2. Criteria in each level must be met before graduating to next level toward world class.

8.1.2.3. Each level should contain:

8.1.2.3.1. Proactive action plan to achieve the next level of maturity.

8.1.2.3.2. Rating determined by supporting data.

8.1.3. Leaders utilizing the maturity matrix should thoroughly understand the criteria for each stage of maturity and transparently assess their organizations against it. They should also recognize that advancing through the stages in the matrix will be difficult and whereas achieving a level 1 or 2 may be fully within their control, achieving level 3 or beyond may require enterprise alignment and the commitment of external stakeholders. Additionally, it is logical that in order to progress to the next level of maturity, each of the criteria must be met within the current level.

8.1.4. The criteria verbiage may appear to be subjective, but leaders should be able to describe and provide evidence of the rating they have chosen. Though presentation requirements may vary from organization to organization, several constants remain: what is your currently assessed maturity rating; what evidence supports your assessment and what actions will be taken to advance to the next level or desired state?

8.1.5. A maturity score reflects the state of the unit's process machines, a critical self-awareness of the current maturity level of the process, and how it will evolve toward world class. Maturity matrix scores and associated action plans are intended to inform unit and center leadership.



8.1.6. The maturity matrix is an excellent tool that when used honestly will drive progress toward a world class operation and the enterprise alignment envisioned by AFSC. A current version of the maturity matrix can be found here:

<https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Tools/1.6.%20AoP%20Maturity%20Matrix>

APPENDIX A – CASE STUDIES

A.1. 72 Air Base Wing (ABW) – 72nd Logistics Readiness Squadron (LRS) Personal Property Processing

A.1.1. Mission Overview. The 72 LRS Traffic Management Section consists of 18 military personnel and civilians who provide personal property and passenger movement services to 40 associate units representing five MAJCOMS, the Navy's Strategic Communications Wing One, and AFSC. They support a \$4.2B Permanent Change of Station (PCS) program, deployment operations, and provide customer service for 24,000 DoD military and civilians as well as provide contract oversight. The team's mission statement is to "always convey a passion for the customer and to constantly deliver the best service experience". They operate in an administrative environment. The team processes the paperwork necessary for service members and civilians, their families, and household goods to move to their next duty assignment and the team physically makes sure it is done according to the government's contract. As a team, each employee within the Traffic Management Section was asked "How do you know you are having a good day?" Through their responses the section was able to find some beginning identifiers for mapping mission success and developing the MET for study.

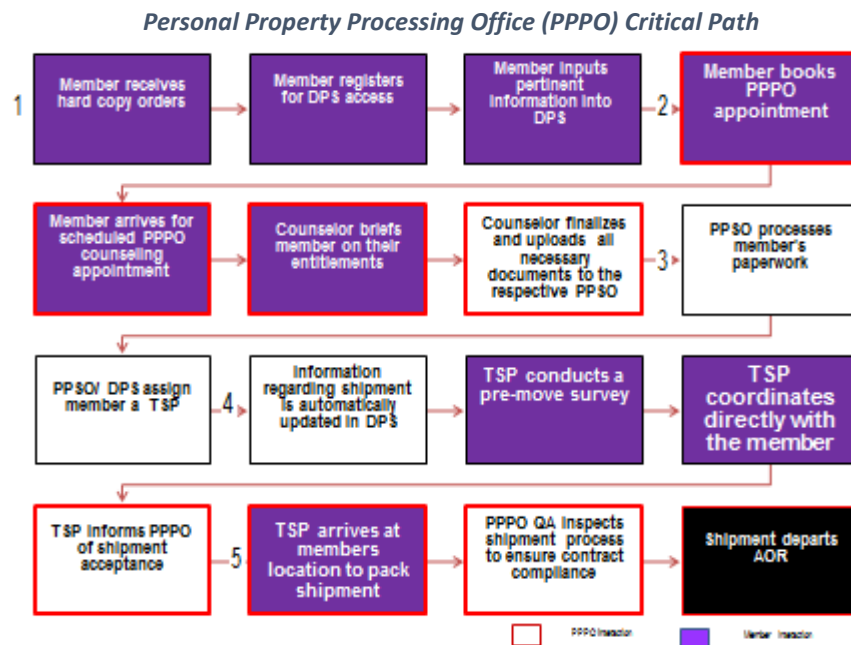
A.1.1.1. The Traffic Management Section's MET is to provide traffic management office services, to arrange official travel, and to ensure personal property is processed IAW regulations. With this in mind, employee engagement and customer feedback, as well as quantitative data, were used to determine the team's focus areas. The Personal Property team came up with two measurable tasks to focus on in order to achieve the overall MET for study.

A.1.2. MET for Study. One of the organization's main processes is face-to-face counseling sessions for each of the thousands they process each year. Team counselors interview the service member or civilian and, based on the orders, lets them know what they are authorized and what they can and cannot do during the PCS process. Then, a moving company is assigned to pack and pick up the household goods. The other part of their MET is to conduct oversight of the contracted moving operation. As this is a government contracted operation, the moving company is held to certain standards in packing and moving the household goods. The team's quality assurance inspectors ensure the government is getting what it pays for during this process and that the member's property is moved safely and securely. The moving companies are paid based on distance and weight. The team verifies a sample of the population to ensure accuracy. When asked, "How do you know you are having a good day?" the team responded based on the evaluation of these two processes "we know we are having a good day if..." 1) the team completed a member's face to face personal property briefing on entitlements in fewer than 60 minutes and 2) if up to two personal property shipments were reweighed each week. These became the team's common goals established in order to meet their MET.

A.1.3. Case for AoP Implementation. The highest volume of customers the Traffic Management Section serves occurs from April until August every year. Because of the

compressed requirement, leave, fit for life, and training had been rescheduled or in some cases canceled every year during this time period. At one point, customers waited in the lobby to be seen for over three hours. If a standard of work could be developed and increase our throughput, it would allow the team to give time back to Airmen and employees. Along with giving time back it would allow the team to repurpose man hours to expand their reweigh program, saving the government hundreds of thousands of dollars a year spent on un-validated shipments. Giving time back not only helps the team but the members they serve. This became the section's burning platform. It is the reason they strive for defining and understanding their process and increasing their throughput.

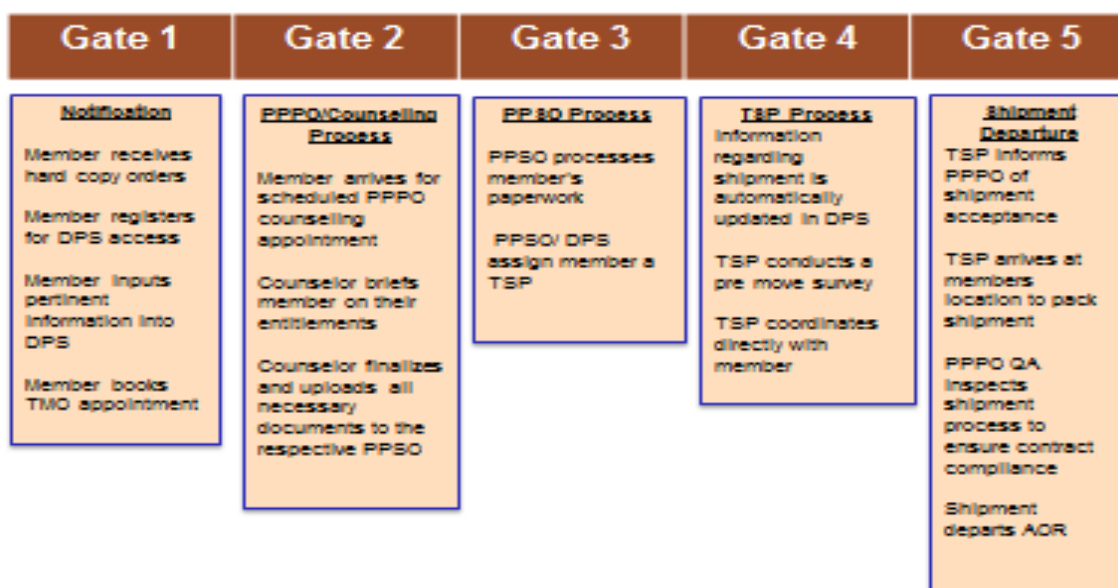
A.1.4. Flow. Along with identifying achievable common goals, one of the section's first tasks was to develop a process guide for household good shipments. For the first time, the team was able to codify its processes in order to allow employees the ability to achieve the right results, the right way. The team defined and put into place the process from start to finish and was able to identify a critical path and map a gated process. The critical path provided the team with a road map and showed them their chief process and the touch points along the way and their gated process was the first ever in an Air Base Wing. It gave the team a segmented and manageable progression assisting them in constraint resolution and CPI. The section determined that the process of shipping household goods begins when an individual receives their hard copy orders and ends when the shipment departs from the Tinker Air Force Base area. The team determined the Traffic Management Section directly affects only part of the overall process and that several other gates in the process rely on others that are separated by organization and/or geographically. The steps in the chain require seamless collaboration between the service member, the Personal Property Office, multi-service military agencies and industry.



A.1.5. WIP. The section's WIP is determined by the organizational needs of the DoD. Despite the fact that they own only a small piece of the process, the office is the face the customer sees when there is a problem with a shipment. There are five gates in this overall

process. Gate 1 occurs when the member is notified of their assignment and receives their hard copy orders. At that time, the member makes an appointment with the office. Gate 2 happens when the team counsels the member, briefing them on their entitlements, and finalizing and uploading all necessary documentation to the respective Personal Property Shipping Office (PPSO) for shipment booking. During Gate 3, the PPSO in San Antonio, TX processes the paperwork and books shipment by assigning them a Transportation Service Provider (TSP). TSPs are private companies that are under government contract and are assigned to complete the move. During Gate 4, the TSP coordinates directly with the member to plan for the shipment departure. In Gate 5 the TSP informs the Personal Property Office of the shipment departure and arrives at the member's location to pack the shipment. The Personal Property, Quality Assurance (QA) section inspects the shipment to ensure acceptability and the shipment leaves the Area of Responsibility (AOR). It requires

PPPO Gates



disciplined communication and collaboration to successfully accomplish this mission and identify any constraints that exist during this chain.

A.1.6. Constraint Identification. Moving is one of the most stressful times in a person's life. When the process doesn't work as expected, it negatively impacts a member and their family. Since the team does not control several of these gates, understanding the whole process and facilitating communications between organizations became crucial to mission success. As a result of this manageable chain of progression, the team was able to focus on each aspect of the process and find their fit. Data collection became an integral part as they used laser focus to identify areas that could use CPI techniques. As a result of the data collection and identification using the gated process, the section was able to rapidly deploy countermeasures to many of their constraints. One of the first items identified through gating the process was how the team booked their one-on-one appointments. The office had one pen and paper hard copy appointment log which was maintained at the customer service counter. Visibility of the scheduled appointments and counselor availability was only available for the individual working the front desk. If a counselor booked an appointment from their desk, they would walk to the front counter and write the information in the book.

Obviously, this process was not very lean. Along with being able to critically view their appointment process, gating allowed the team to view the overall process and search for breaks in the chain. As the section does not control several aspects of the overall process, their perspectives were driven by their gut. For example, during the summer season, it may take up to four weeks for a shipment to get booked. The team can process the paperwork in a short amount of time, however, the move will not be conducted until a month later or sometimes longer. Why? The team did not know the answer to that question and they did not understand where their gaps were. Data collection, as well as dialog, prompted the team to search for ways to fully understand their process and break down the constraints.

A.1.7. Constraint Resolution. Gating the process allowed the team to focus, and their appointment process was the first challenge they worked. From a single paper appointment sheet, the team developed an electronic appointment book. Each individual was given access to schedule appointments from their desk. This was seemingly a simple project; however, the elimination of walking back and forth saved approximately 33 miles of wasted travel and gave back 31 non-value added man hours per year. While the team understood their processes, they did not understand why it took so long to complete the process. They reached out to their partners at the Joint Personal Property Office in San Antonio, TX and discussed how they operate and to look for ways to mutually improve operations. It turned out their assumptions were wrong; the booking process and constraint regarding times did not lie within this gate. The data collected illustrated the four week booking time frame was not a gap in application, it was a gap in communication. Availability of moving companies drove the month long lead time; however, through a simple change in process, the team could eliminate the extended wait time to a more manageable two week maximum window simply by communicating and checking the availability of the moving companies. Instead of a disjointed office to which we simply submitted paperwork to, the section developed a relationship and expanded their team. Their non-DoD partners were also brought into the fold as the section reached out to private industry and held industry partner meetings. Using data points and lessons learned they built discussion topics. Through these meetings, the team was able to build and strengthen their partnerships and help eliminate negative trends as well as communicate changes across the program.

A.1.8. Results. Two years into their journey, the team has made tangible results as part of their common goals. While their original goal was 60 minute appointments, their efficiency and throughput has increased tremendously and their average appointment time is currently 27 minutes. They did not sacrifice quality as a result of the increase in throughput. Utilizing an Internal QA Plan each individual team member is an inspector of work quality and, utilizing the process guide, ensures the results are consistent and correct. They also listen to the voice of their customer and have received a 100% customer satisfaction rating through over 2,000 customer surveys using the Interactive Customer Evaluation (ICE) system. The section achieved their goal and have given back time to families, training and fit for life. Not only have they supported the warfighter and their family by giving back time, but they are cost saving stewards as well. Although the section looked to increase its reweighs to two per week, they increased their overall throughput by 4%. With their validation program, they saved \$248,384 in FY 16 in shipment weigh verification. Since FY 13, they ensured the government did not pay for 544 tons of non-

verified weight. Verifying weight and household good shipments have allowed the team to save over \$1.3M to date.

A.1.8.1. The section shared its initiatives and accomplishments with wings and groups including the 72 ABW, 78 ABW, 75 ABW, 448 SCMW, 58 MXG/ 58 MXS Kirtland AFB, NM. Other organizations and private industry, including DLA Aviation, built their own process excellence programs utilizing some of the tools they established at Tinker AFB. Furthermore, the Headquarters/DoD level: AF Installation and Mission Support Center (IMSC) Personal Property Headquarters Activity (PPA-HQ), AETC-Logistics, EN and Force Protection Principal Deputy Assistant Secretary of the Air Force for Installations, Environment and Energy have visited the section to gain insight into AoP. The team is truly leading the Air Force, as their process guide and their vision is available through the PPA-HQ. The tools they established have been benchmarked and are nearing application across the program.

A.1.9. Visual Display. When the team started, their visual displays were three recycled, enclosed bulletin boards with their metrics and charts visible to their customers. When Lt Gen Litchfield visited the section in 2015, the team had somewhat expanded. Their processes were on display using magnetic boards along a 10 foot wall in the office lobby.



their goals, processes, constraints and CPI efforts surround their customer waiting area. The sections customers have visual proof of what the team does, where their gaps are, and their plan to get better. The visual display allows the team to communicate more effectively with their customers and with their team members to better see performance levels and understand data points for improvement.



A.1.10. Next Steps. As the sections looks towards the next two years they focus on collaborative execution and strive to break down further compartmentalization. AoP has allowed the section to build a community within the wing, developing task forces with their local ABW partners within the finance community, Military Personnel Section, Force Support Squadron, Housing Office and Security Forces. The team was the voice of

possibility at the Personal Property Symposium in February 2017 where they were asked to brief their process to over 150 individuals from throughout the DoD. Through that meeting, they established a network and sharing library to ensure their geographic barriers would remain unbroken and they could work challenges together and they will continue the work of communicating their message and successes.

A.1.11. Lessons learned. Employee engagement is crucial for success. Developing common goals and crafting the way forward requires teamwork, community and patience. Leaders have to engage with their teams and find realistic, obtainable and data-driven goals. Leaders must understand that culture change does not occur overnight and be willing to allow their team to find results. The sections successes came from employee buy in through cooperation and understanding. Each team member assisted in crafting their process guides, gates, and their initial goals. Team members facilitate continuous process improvement initiatives that tie directly into the Squadron, Wing and AFSC's strategic plans. The team is engaged and empowered to break down constraints and work together to find solutions. All of this has allowed for a consistent and sustained AoP culture.

A.1.12. Contact Information: Christopher Fellows, 72 LRS/LGRDF, 884-8967.

Additional case studies are available on the AoP SharePoint site:

<https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Tools/1.2.%20AoP%20Case%20Studies%20and%20Success%20Stories>

APPENDIX A – CASE STUDIES

A.2. AFSC Logistics Directorate’s Performance Management Division (LGS) Non-Technical Special Projects

A.2.1. Mission Overview. AFSC/LGS is a staff organization that provides AFSC with executive level decision support through performance assessments, metrics development and reporting, facilitating decision making forums, and executing special projects. Its work is administrative in nature and its products include written reports, briefings, position papers, center level procedures, and center level meeting facilitation. AFSC/LGS’s customers are Air Force leaders at the center, complex, wing, and center staff levels. Some products are reported up to AFMC/CC and HAF. When AFSC/LGS embarked on implementing AoP, division leadership reviewed its specified and implied tasks in order to define its METL. The AFSC/LGS METL is made up of six METs. These are:

A.2.1.1. Administration – Workflow, SOCCERs, and Action Officer (AO) Management

A.2.1.2. Non-Technical Special Projects

A.2.1.3. Recurring Center-Level Reviews

A.2.1.4. Tool Development

A.2.1.5. Metric & Data Reporting

A.2.1.6. Analysis & Studies

A.2.2. Non-Technical Special Projects. One of the primary tasks AFSC/LGS performs for the center is executing enterprise level projects. These projects frequently originate as directives, questions, or taskings from leadership at the LG or center level. One unique aspect of these projects is they generally will not be repeated. They are typically special-one time-efforts to establish or implement a new capability. AFSC Strategic Objective 7.1, to “institutionalize Art of the Possible across the AFSC to achieve the right results the right way,” is one such example. It is a special project directed by AFSC/CC. Once complete, it will not be executed again.

A.2.2.1. Case for AoP Implementation. Special projects assigned to AFSC/LGS vary widely in size, complexity, and the frequency with which they are assigned. AFSC Objective 7.1 is an example of a very large and complex project; however most special projects are shorter in duration and not as complex. There is also no set cadence for how or when projects are assigned. In addition, customers can vary from peer divisions to AFSC/CC or higher. In the past, this variability drove focus to the project or task level. Each project was managed individually and no operational level management occurred to identify process level problems or constraints that impacted the delivery of special projects nor was any effort made to prioritize competing projects. Each project was

assigned equal importance and all were worked at the same time. This tactical level approach resulted in the poor utilization of team members with some overtasked and others underutilized. It drove work on everything but delivery of few things. Firefighting took place on the day's hottest project and leaders were frequently dissatisfied with results. These were all compelling reasons to consider managing this workload differently. Lastly, this process was responsible for institutionalizing AoP for the center. It clearly had to be able to demonstrate the very management process it was institutionalizing. In the fall of 2016, AFSC/LGS set out to implement AoP on its non-technical special projects workload.

A.2.3. Special Projects Flow. While each special project has a unique implementation timeline, there are common steps across all special projects. The AFSC/LGS team faced the challenge of defining the flow at a level above project uniqueness but low enough to provide insight into where constraints impacted the delivery of projects. The team started by assessing all the current special project WIP and the steps required to deliver these projects. The goal was to identify four to eight steps that are common to all special projects. These steps would become process machine gates. Four basic steps emerged: project planning, project execution, project reporting, and project documentation. During this time, AFSC/LGS had the privilege of visiting the AFSOC C-130 line at WR-ALC. One of the key concepts that team had implemented was a supportability gate, or gate 0, that ensured workload was supportable prior to being inducted. In a production sense, this meant all the parts, tools, and data were available for the mechanic before the workload was inducted. While the gate 0 concept originated in the production world, the concept applied to staff work as well. The team used this concept to identify the things needed for an AO to begin work on an assigned project. This led to the identification of one additional special project gate, that of project definition.

A.2.3.1. Gate 1: Project Definition. The first step is to receive the project from the customer and to define the essential information that will be needed by the AO to execute the project. Without this information, AOs may deliver the wrong project, answer the wrong question, or provide it to the wrong stakeholder(s).

A.2.3.1.1. Identify the Lead Stakeholder. This is the leader or customer for whom AFSC/LGS is delivering the project. Their approval will be required at key milestones in the project and they will ultimately decide when a given project is complete.

A.2.3.1.2. Define the Problem. The inventor Charles F. Kettering stated "a problem well-stated is a problem half-solved." In order to provide a clear understanding of the intent of the project, the correct problem must be clearly defined. This must define the cause or the opportunity for change. It must be validated by the lead stakeholder. This is necessary to ensure the project is addressing the right problem.

A.2.3.1.3. Define the Desired End State. After the problem has been defined a clear end state should be communicated to ensure the AO understands the vision

for what he or she is to implement. This end state should be defined from the perspective of value to the lead stakeholder or customer.

A.2.3.1.4. Workload Balancing. Before the project is assigned to an AO, the AFSC/LGSA supervisor must review the currently assigned workload to determine which AO to assign the project. If there is no open capacity within the team, projects must be prioritized to ensure the highest priority project is being worked. If necessary, a lower priority project may need to be pulled back from an AO and put in queue so the higher priority project can be worked. No work should be done on projects in queue.

A.2.3.1.5. Release Point: Assign to an AO. The final step of gate 1 is for AFSC/LGSA to assign the project to an AO.

A.2.3.2. Gate 2: Project Planning. The AO assumes responsibility for the project at gate 2: Project Planning. During this gate, the AO develops a detailed plan with milestones and dates. This should include the key steps of:

A.2.3.2.1. Validating project definition. AOs should meet with all stakeholders necessary to ensure they understand the problem and desired end state.

A.2.3.2.2. Identifying all project stakeholders. AOs cannot work in a vacuum or even only with the lead stakeholder. They need to identify and include all impacted stakeholders or they risk rework and missed milestones.

A.2.3.2.3. Developing a draft Integrated Master Schedule (IMS) or project plan considering Doctrine, Organization, Training, materiel, Leadership, Personnel, Facilities, and Policy (DOTmLPF-P). Medium and large projects require a deliberate plan with carefully considered milestones associated with dates. This plan should consider whether the project will affect any of the areas of DOTmLPF-P.

A.2.3.2.4. Brief through leadership up to the lead stakeholder for approval. The AO's leaders, up to the lead stakeholder, must understand and validate the plan.

A.2.3.2.5. Release Point: Leadership Approval of Plan. When leadership approves the plan, the project is released from gate 2 into gate 3.

A.2.3.3. Gate 3: Project Execution

A.2.3.3.1. Execute according to plan. Once plan approval is gained, the AO should execute the project according to the plan and work to deliver on schedule.

A.2.3.3.2. Re-plan as necessary. If new requirements or changes occur, the plan may need to be adjusted or redone.

A.2.3.3.3. Provide status updates through appropriate leadership level. The AO should keep leadership informed on the progress of the project.

A.2.3.3.4. Release Point: All Tasks Complete. Once the plan is complete and all milestones have been achieved, the project progresses to gate 4.

A.2.3.4. Gate 4: Reporting

A.2.3.4.1. Report project recommendations, findings, or results through appropriate leadership. Upon completion of the plan, project results should be reported up to the lead stakeholder for approval. This can be done via a formal briefing or the staffing of a package or paper up to leadership.

A.2.3.4.2. Release Point: Gain Leadership Approval. The project is complete when deemed complete by the lead stakeholder. At that point, it moves to gate 5.

A.2.3.5. Gate 5: Documenting

A.2.3.5.1. Document project results. The AO should document the products of the project along with any approval documentation.

A.2.3.5.2. Post/archive project documentation in the appropriate repository. Project documents should be retained for reference if there are questions or if related issues/projects arise.

A.2.3.5.3. Close project. Upon archiving all the project documentation the project is closed.

A.2.3.5.4. Release Point: Branch Approval

A.2.4. WIP. Individual projects make up the WIP for the special projects machine. WIP is separated into three tiers based on the complexity of the project. Projected time to completion is the method used to assess the project as a large, medium, or small project. While this is not a perfect approach, it allowed the team to get its machine up and running. Additionally, the branch chief may deviate from this convention based on other circumstances. For example, a high priority project directed by AFSC/CA that will be of a duration less than a year can be assess as a large project due to the high level of direction.

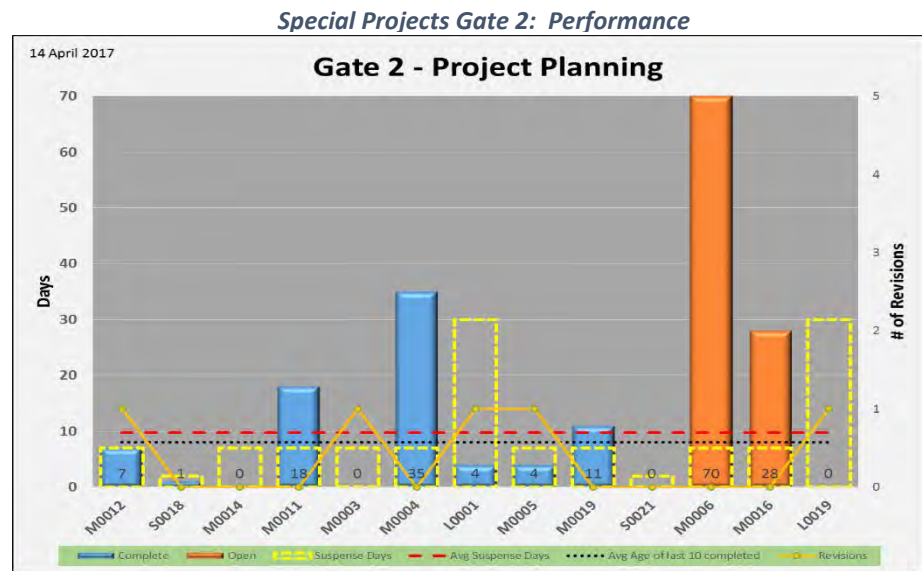
A.2.4.1. Large projects are defined as those that will take more than a year to complete.

A.2.4.2. Medium projects are defined as those that will take more than a month but less than a year to complete.

A.2.4.3. Small projects are defined as those that will take more than a week but less than a month to complete.

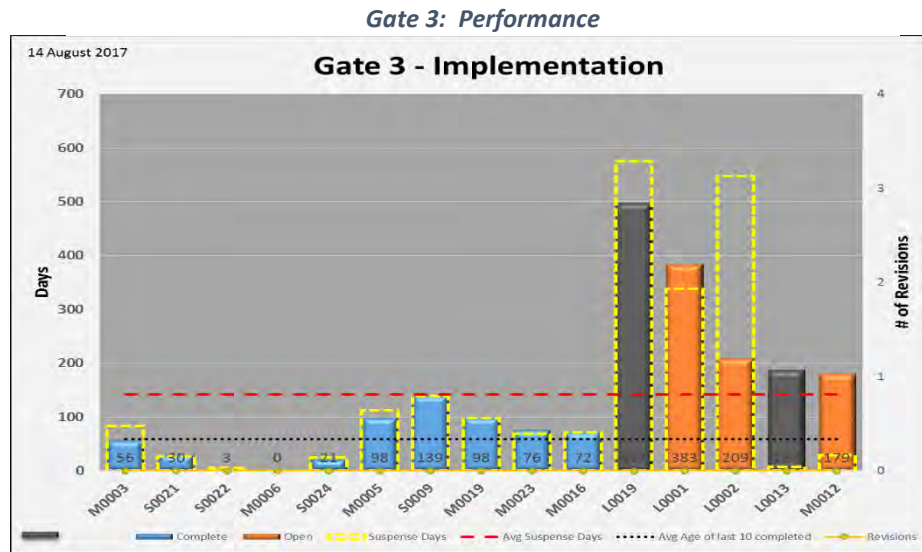
A.2.5. Constraint Identification. Constraining gates are identified as the gate with the lowest throughput rate; however, each project within the special project machine is unique. Each has its own planned execution time for gate 3. This means that the throughput required for gate 3 changes each time a new project is added or a project is completed. For this reasons, the special project constraining gate can most easily be identified by identifying the gate that is accumulating the most queue.

A.2.5.1. Post Implementation Constraint. Immediately following the implementation of the special projects machine, WIP began to pile up in gate 2, project planning. Additionally, gate performance was poor as the planning for most projects exceeded the target completion time. The figure below shows gate 2 performance in Apr 2017. At that time, the average time to complete planning for medium sized projects was 10.7 days, or three days higher than the target planning time. Four of the last 10 projects to complete gate 2 were late and two of the in work projects far exceeded their target planning time. In addition, the quality of the plans were not good. Four of the last 10 completed plans had been redone and one of the projects still in planning was being reworked.



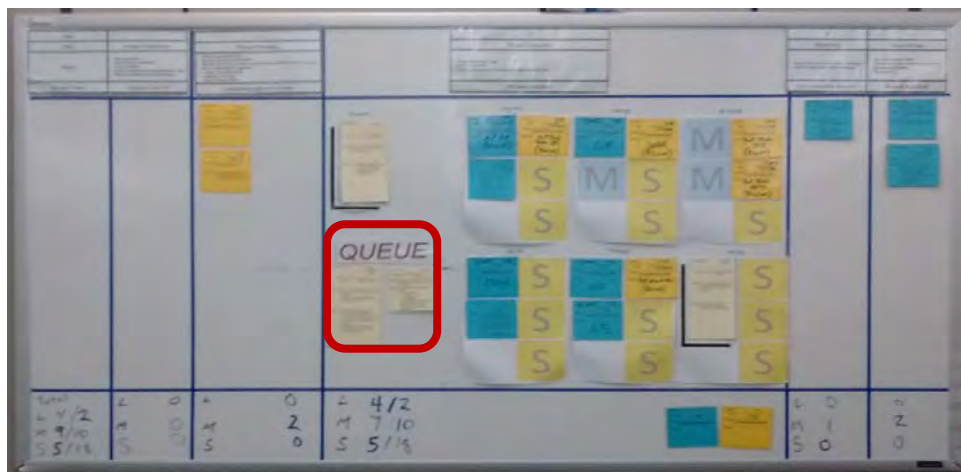
Much of this problem was created by the newness of our approach which included a deliberate planning process. The team focused on developing quality plans within the target completion time. Results have come with practice. While the average planning time remains above the target of 7 days for medium projects, the average completion time for medium projects has been driven down to 7.3 days. Additionally, there have been no quality problems in the last ten projects that have completed gate 2.

A.2.5.2. Current Constraint. As of the writing of this case study, gate 2 performance has improved but gate 3 data shows an alarming trend. While nine of the last 10 projects to complete gate 3 have done so on time, the open projects reveal a growing problem. See the figure below.



Three of the projects have already exceeded their planned time for gate 3. Four of the five projects in gate 3 have been characterized as large projects. This means they were planned to take over a year in duration or are of a high degree of complexity or difficulty. These projects require AOs with the skills, ability, and experience to independently plan, communicate, lead, and execute large projects. Currently, the team assigns large projects to only two AOs. This results in a queue of two large projects in front of gate 3. See below.

Large Project: Queue in the Special Projects Machine



The current constraint is the ability to execute large and complex projects.

A.2.6. Constraint Resolution. AoP has served its purpose by identifying the current constraint in AFSC/LGS's ability to execute special projects. The resolution for the current constraint is not quick and easy. The team is working to develop the necessary skills within its AOs to execute complex projects, thereby expanding its capacity in this area. Team member roles on current large projects are expanding as part of the development effort and opportunities are being given to develop the needed skills. Additionally, the performance

planning process is being utilized to lay out personal performance and development goals that are in line with closing the large project constraint.

A.2.6.1. Results. While the constraint remains in gate 3, AoP has proven successful in effectively prioritizing and managing workload in a constrained administrative environment. In Feb 2017, AFSC/LGS had three AOs capable of taking on large projects and it was working three large projects (projects A, B, and C) in gate 3. At that time, center leadership placed a higher priority on another project (project D) that was rated as a medium project at the time. The elevation in priority set a very aggressive schedule for project D—cutting the planned time to completion in half. Due to the accelerated schedule and the high level of attention to project D, the AFSC/LGSA chief reclassified the project as a large project and took it to division and directorate leadership for prioritization. Both the AFSC/LG deputy and the AFSC/LGS division chief were very familiar with the special project machine and understood its limited large project capacity. They recognized the high priority given to project D. Both leaders agreed to pull project C out of gate 3 and put it in queue so one of the large project capable AOs could focus exclusively on project D. As a result, the assigned AO was able to focus on and finish project D by the very aggressive date. This most certainly would not have been the case without AoP. A likely scenario is AFSC/LGS would have been directed to complete project D. Projects A, B, and C would have remained in work with AOs being overtasked. None of the projects would be completed on time. Having missed their delivery date, one or more of the projects would have become a crisis with senior leadership. At that point, staff ‘heroics’ would have ensued to push to deliver the project with poor results and dissatisfied leaders.

A.2.7. Visual Display. The AFSC/LGS special projects process machine is set up in a cube environment on a magnetic dry erase board. It provides the visual displays for the team to conduct weekly wall walks at 1400 each Monday and tactical management at 1030 on Tuesdays and Thursdays. The magnetic board portraying flow and WIP of the special projects machine is surrounded by supporting AoP and performance charts. See the figure below.

Large Project: Queue in the Special Projects Machine



A.2.7.1. The surrounding charts are in counter clockwise order from the top left:

A.2.7.1.1. The Leadership Model

A.2.7.1.2. AoP implementation approach, or the five steps for implementing AoP

A.2.7.1.3. AFSC/LGS METL

A.2.7.1.4. AFSC/LGS AoP burn down plan

A.2.7.1.5. Gate performance charts for gates 1-5.

A.2.7.1.6. Principles of flow

A.2.7.1.7. Gate time and quality targets assessment chart

A.2.7.1.8. Road to goal.

A.2.7.2. The machine flow and WIP are portrayed on the magnetic board at the center of the wall.

A.2.7.2.1. Gates are displayed as columns from left to right.

A.2.7.2.2. WIP is displayed as post it note sized magnetic cards that document essential attributes of the project. See example to the right. As the project progresses from gate to gate, the project card moves on the board through the gates.

A.2.7.2.2.1. Large projects are visually portrayed on 3" x 6" beige cards.

A.2.7.2.2.2. Medium projects are visually portrayed on 3" x 3" blue cards.

A.2.7.2.2.3. Small projects are visually portrayed on 3" x 3" yellow cards.

A.2.7.2.3. Employee Capacity Model. One area where administrative work can be different from production workload is the area of manloading and multi-tasking.

Example: Special Project Card

Project #:	A004	AO:	Michelle Jackson
ECD:	31 Mar 17	Lead Stakeholder:	Wg Cdr Lloyd
Problem:	AoP Newsletter: AFSC workforce uninformed on latest AoP institutionalization efforts and implementation resources and events		
End State:	Develop and publish AFSC AoP Newsletters for CY17 <ul style="list-style-type: none">• Develop format• AoP SME vetting approach• Distribution approach• QC approach• Schedule		

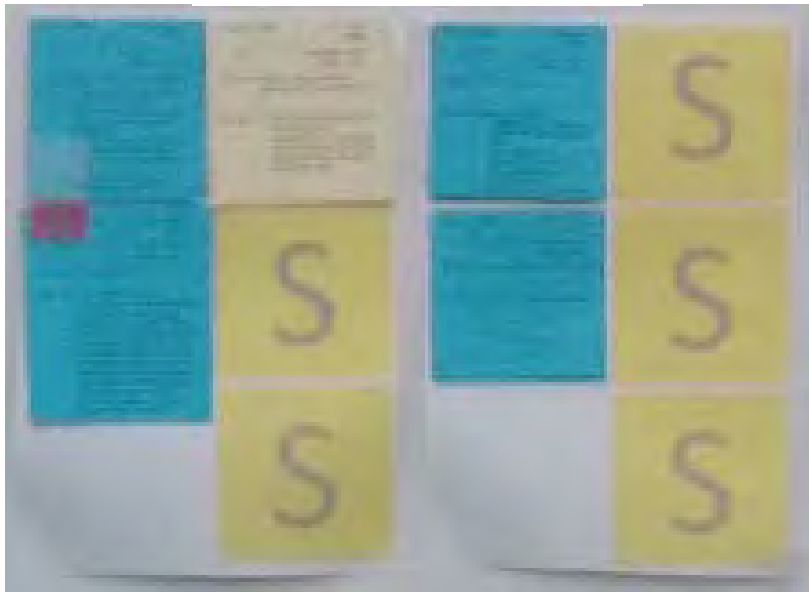
One of the four principles of flow is to manload work. This means put all necessary labor on an item of work with a focus to complete the task. The inverse of this principle is multi-tasking. Under multi-tasking, an employee diffuses his or her focus across all available work. Multi-tasking is bad. It is better to focus the employee on a single task until it is finished. This focus and finish approach minimizes the time needed to generate a single unit of output. Once one project is complete, another is issued to the employee. The reality of staff work is there are very few projects that can be worked non-stop for eight hours every work day. Most, if not all, require wait time while meetings are scheduled, emails are returned, and coordination takes place. For this reason, it is unrealistic to focus an administrative employee on only one task. There also is no precise, optimum answer for how many projects should be assigned to an employee. That optimum answer is dependent on the complexity of the tasks and the skills and aptitude of the employee. The special projects team addressed this question by developing an Employee Capacity Model to represent the work capacity of a GS-13. This model is not perfect but is good enough to make the machine functional. It sets a usable framework for loading AOs with projects. Under this framework, at any point in time an AO may be assigned up to three small projects and either two medium projects or one large project. As projects are assigned, the project cards are placed over an available spot of corresponding size on the employee's model. Large projects use a card that covers both medium spaces on the employee's model visually reinforcing the two mediums or one large rule. This approach reinforces two principles of flow. First, WIP is controlled by limiting how much each employee can work at any point in time. Second, manloading is achieved by keeping employees focused on a limited number of projects. When they complete a project, another can be issued from queue. To make the display practical, the model is only displayed under gate 3. When the project is not in gate 3, a place holder is placed on the employee's model with the project number and a reference to the gate where that project resides. The actual project card is placed under the gate where it resides.

Example: Special Project Card



A.2.7.2.4. Late projects. Projects that are behind schedule have a red tab placed on them to add emphasis and urgency. An example of two employee models are provided below.

Example: Employee Work Loading



A.2.8. Next Steps. AoP is never finished. AFSC/LGS continues to work on its special projects machine to both resolve its current constraint and to improve the machine itself. Current efforts include:

A.2.8.1. Continuing to develop AOs in order to increase large project capacity.

A.2.8.2. Developing more robust approaches to characterizing large, medium, and small projects; employee capacity; and target times for each gate, particularly gate 4 when projects need to be reported through the center command section (data has shown this to be a highly variable process).

A.2.9. Lessons learned. AFSC/LGS continues to learn daily from its use of AoP. Several key lessons stand out as worth sharing across the center.

A.2.9.1. Get started and, if necessary, use guesses to overcome barriers to building a workable machine. Do not allow the lack of a perfect answer to prevent you from implementing a workable process machine. There are many imperfect but adequate guesses that underpin the special projects machine. These include the time standards for large, medium, and small projects for gates 1, 2, 4, and 5; as well as the Employee Capacity Model. These are not mathematically precise models but they work for getting started. As you learn more, you can modify and improve your guesses. When you get started, best guesses will allow you to build a machine that is good enough to identify your constraint. As you improve your process and learn more, you will begin to have data to replace your guesses.

A.2.9.2. Visit other organizations, similar and dissimilar to yours, that have implemented AoP. Consider what you may use from their application of AoP. The application of AoP in three other areas played prominently in the development of the special projects machine.

A.2.9.2.1. AFSOC C-130 line at WR-ALC contributed the concept of supportability and the need to ensure the employee, whether it be a mechanic or a staff AO, is adequately equipped to begin work.

A.2.9.2.2. TSP area of WR-ALC contributed the idea of engineers having a set capacity to work projects. This was used to develop the AFSC/LGS Employee Capacity Model.

A.2.9.2.3. Contracting area of OO-ALC/OB contributed the idea of using different standard for different variations of workload. Their machine segregated work into three tiers based on the dollar value of the contract. Each tier was measured against an appropriate time standard. This approach provided the flexibility to operationally manage work with high variability within the same machine.

A.2.9.3. If necessary, define your road to goal last. Do not get hung up on defining a road to goal before you fully understand your process at an operational level. You may not know enough to set a goal. Establish flow, identify your WIP, and let the data identify your constraint. After you utilize your machine for several weeks you should start to understand your baseline performance and should have enough information to set a Road to Goal based on speed, quality, and safety.

A.2.9.4. Leadership cannot delegate AoP. The role for leaders who are not building a machine is different but as important. They must understand and recognize the limitations of the machines in their organization. They must understand and respect the rules of flow. When constraints exist, provide prioritization on the sequencing of workload. Expect problems and issues to be communicated through AoP: What is the constraint? How do you know? What are we doing to fix it? Observe wall walks and tactical management. The project D example in 1.6.1. would not have been successful if leaders were not also practicing AoP.

A.2.10. Contact Information: Scot Doepker, AFSC/LGSA, DSN 674-0092.

Additional case studies are available on the AoP SharePoint site:

<https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Tools/1.2.%20AoP%20Case%20Studies%20and%20Success%20Stories>

APPENDIX A – CASE STUDIES

A.3. Oklahoma City Air Logistics Complex (OC-ALC) KC-135

A.3.1. Mission Overview. The KC-135 Tanker Maintenance Squadron's (564 AMXS) mission is to provide our customers responsive, cost-effective maintenance, repair, and overhaul capabilities while delivering safe, reliable, and defect-free aircraft to enable our warfighters' mission accomplishment. This mission upholds our vision of being a world-class maintenance, repair, and overhaul capability for our customers. The goals we have set also support our mission and vision: 1) Continually improve quality and safety 2) Strive to develop our people, professionally, and technically 3) Meet or beat aircraft availability improvement program goals 4) Increase the productivity of our people and processes 5) Strategically position ourselves for long-term success. The primary customer for 564 AMXS is the KC-135 SPO as the negotiator for all workload scheduled for maintenance, repair, and overhaul for the warfighter's (ANG, AMC, AFRC) KC-135 aircraft. The KC-135 Tanker Maintenance Squadron is an all organic facility for the KC-135 fleet of 399 aircraft. The METs for 564 AMXS revolves around the mission, vision, and goals for the squadron and the type of work performed. The METs support the Major Graded Areas (MGAs) defined in AFI 90-201, *The Air Force Inspection System*, and AFI 1-2, *Commander's Responsibilities*: 1) Managing Resources 2) Leading People 3) Improving the Unit and 4) Executing the Mission. The METL for 564 AMXS is as follows:

A.3.1.1. MET 1 - Execute the KC-135 Programmed Depot Maintenance (PDM) workload with safe, reliable, and defect-free aircraft. The MET supports MGA to Execute the Mission.

A.3.1.2. MET 2 – Execute business operations to support KC-135 workload. Through various business operations (financial, training, supervisor development programs, book reviews, etc.) this MET supports MGAs to Manage Resources and Lead People.

A.3.1.3. MET 3 – Execute the KC-135 Block 45 modification workload with safe, reliable, and defect-free aircraft. The MET supports MGA to Execute the Mission.

A.3.1.4. MET 4 – Execute the KC-135 Unprogrammed Depot Level Maintenance (UDLM) workload with safe, reliable, and defect-free aircraft. The MET supports MGA to Execute the Mission.

A.3.1.5. MET 5 – Execute constraint resolution operations to support the KC-135 workload. The MET supports MGA to Improve the Unit through CPI, RIEs, etc. by using data driven information to select areas for improvement.

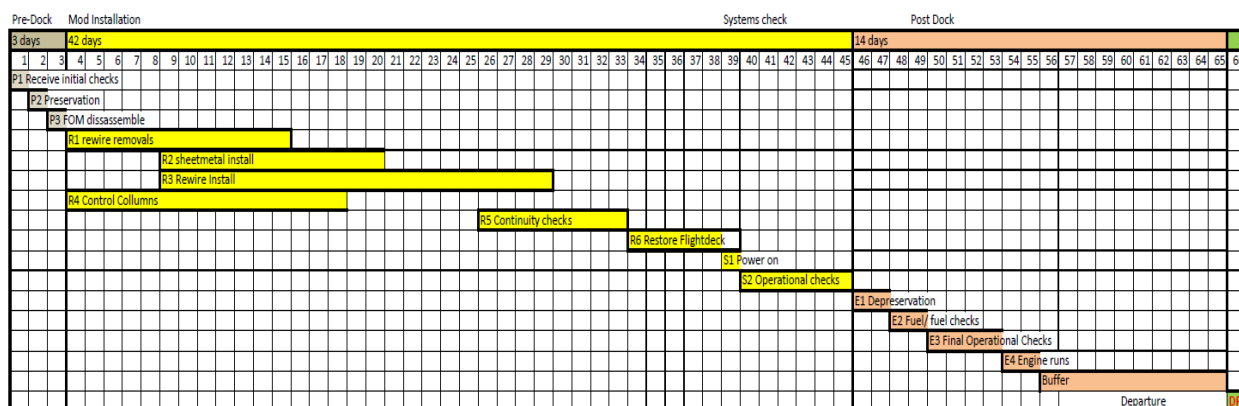
A.3.2. MET for Study. MET 3 to execute the KC-135 Block 45 modification workload with safe, reliable, and defect-free aircraft was selected for this case study. The Block 45 modification workload was identified as an avionics upgrade replacing flight director, radar altimeter, autopilot, and engine instruments due to low reliability and obsolescence issues. The requirement was for the modification to be performed on the fleet of 399 KC/OC-135

R/T aircraft. A contract was awarded to a contractor (ARINC) in May 2014 for them to perform the first Low Rate Initial Production, Phase 1 (LRIP-1). The first aircraft was delivered in July 2014. The contractor performed two prototypes and then an additional 15 aircraft followed. 564 AMXS traveled to the ARINC facility (Will Rogers Airport facility) to observe the maintenance on one of the aircraft receiving the Block 45 modification. The intent was for the modification to be performed second organically with 564 AMXS beginning June 2015 with LRIP Phase 2 (LRIP-2) for 19 aircraft to be accomplished in a one year timeframe. Planning of the workload was done to not affect overall aircraft availability. The organic modification time was estimated to be approximately 2,600 hours per aircraft with a total estimated cost of \$65M (including parts) and the WIP was planned for four aircraft with the requirement to complete the work in 65 days with an AoP goal of 45 days. ARINC completed the LRIP-1 modifications in September 2015 with an average flow days per aircraft of 93 days.

A.3.3. Case for AoP Implementation. The Block 45 workload was planned to be accomplished in a geographically separated location from regular PDM work. All of the work is performed on Romeo Ramp with support staff located in Building 985. The first prototype aircraft (62-3526) for 564 AMXS under LRIP-2 was produced in 97 days. Delays were due to aircraft requiring a full weight and balance (requires hangar/jacking), legacy issues (fuel leaks, rudder issues, engine component issues, and hydraulic leaks) and operation re-sequencing and learning curve proficiency. The second prototype aircraft (61-0266) produced in 118 days due in part to aircraft requiring a full weight and balance and dealing with legacy issues: Main Landing Gear (MLG), rudder and flap indication. When it became apparent this second aircraft was running behind schedule due to the extra time added to the flow for weight and balance and working legacy issues a daily triage team meeting was set up to begin work to get the aircraft headed in the right direction towards the AoP goal of 45 days.

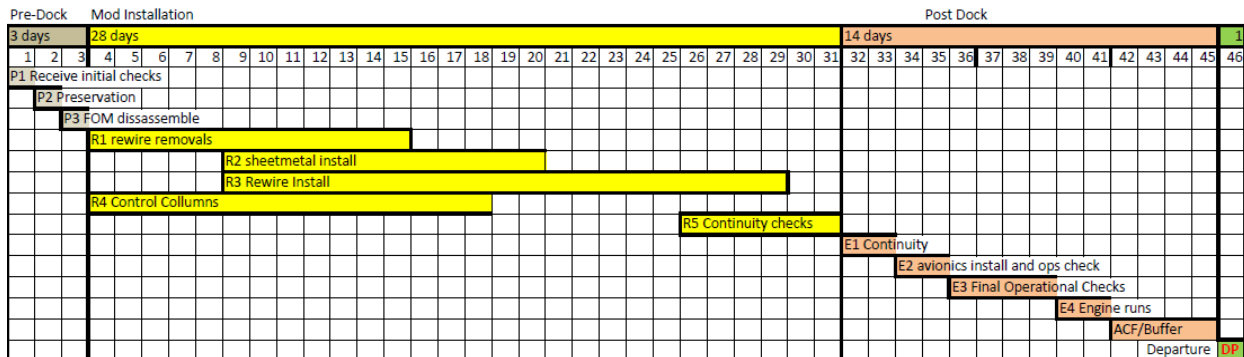
A.3.4. Flow. Before the first aircraft was delivered for the Squadron to begin the LRIP-2, there were regular Block 45 Modification Working Group meetings held beginning in July 2014 to discuss facility needs, manpower, drawings, hazardous chemicals, Industrial Prime Vendor (IPV) hardware, tools, equipment, layout, etc. The first network for the Block 45 workload in LRIP-2 was built on the requirement of 65 flow days for the first two aircraft.

Block 45 Flow Chart – Network A – 65 Day Flow Chart



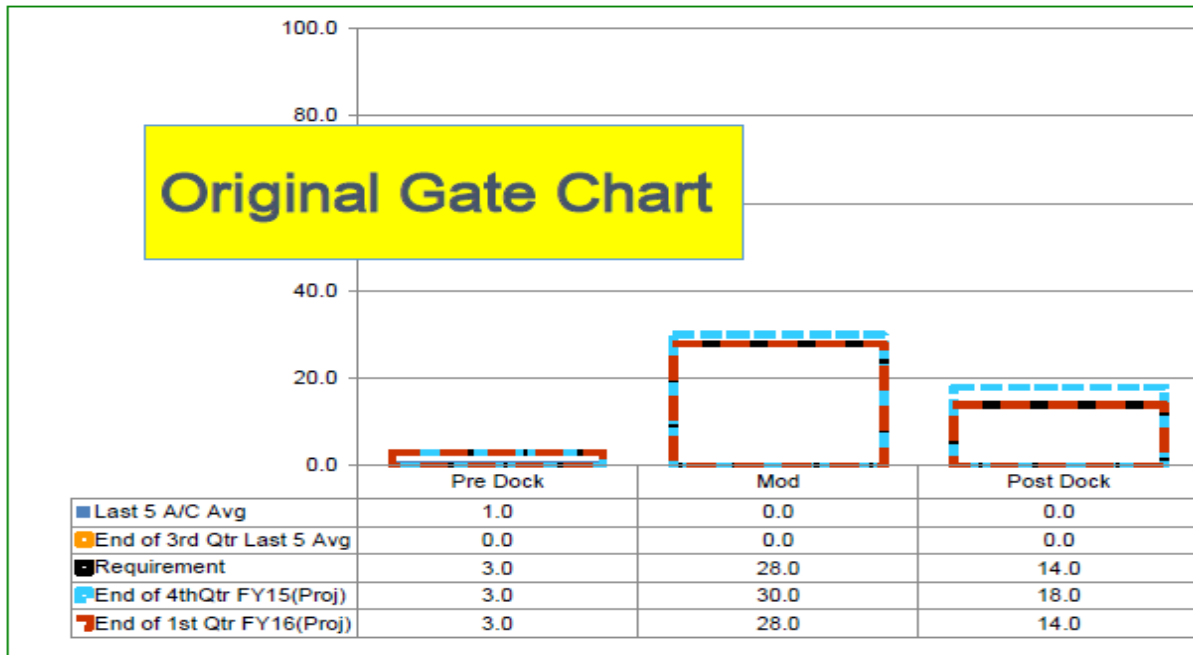
A.3.4.1. The AoP network with 45 flow days was instituted on the third aircraft in LRIP-2.

Block 45 Flow Chart – Network A – 45 Day Flow Chart



A.3.4.2. The workload was placed in three gates originally with a planned WIP of four aircraft. The gates consisted of pre-dock/strip for teardown; modification install for all of the replacement/build up; and post dock for aircraft departure preparations.

KC-135 Gates Block 45 Mod

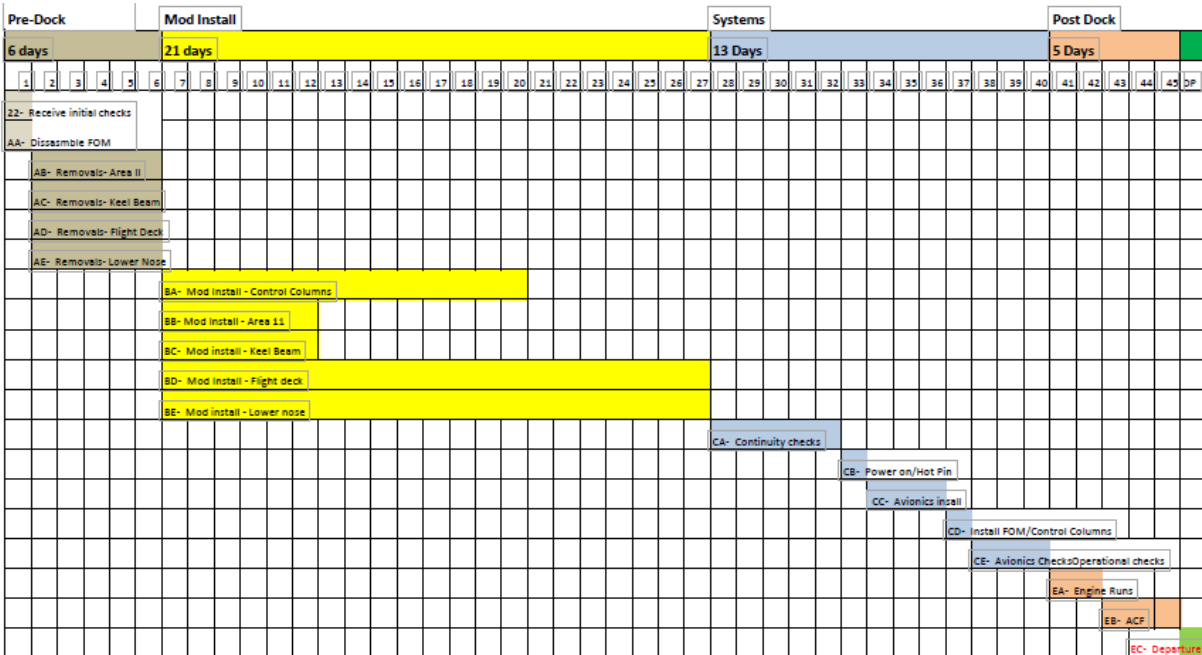


Total Requirement : 45 Days
Total Avg. Days: 0 YTD
Total Days (End of 4th Qtr): 50

As of: 14 July 15

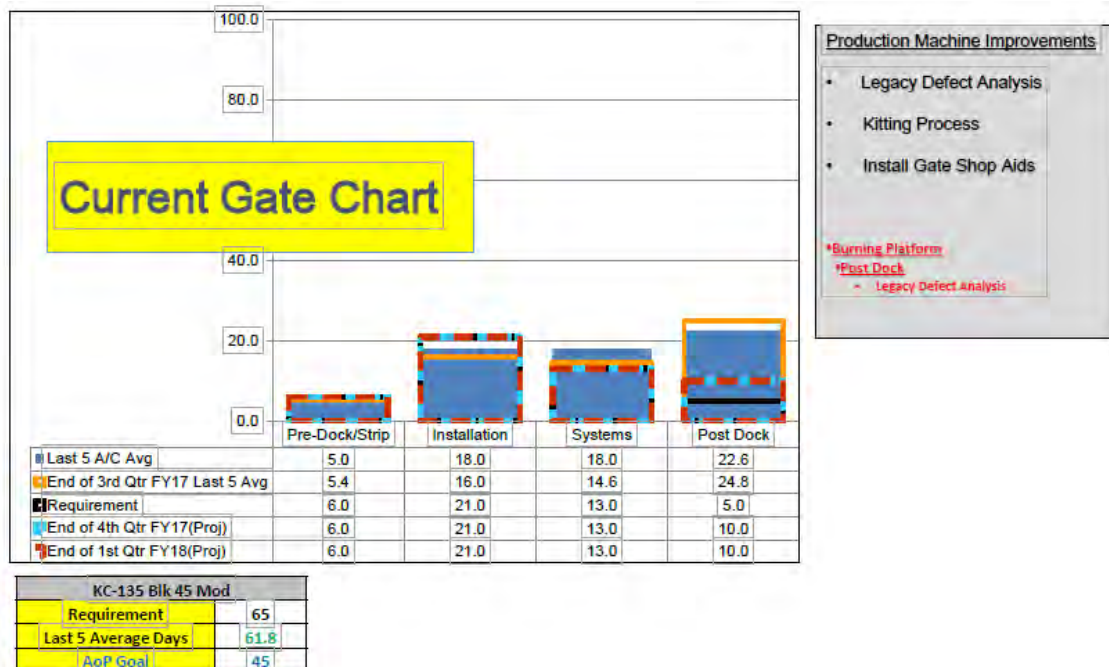
A.3.4.3. When the last LRIP-2 aircraft was completed in 2016, the new flow for the Full Rate Initial Production, Phase 1 (FRIP-1) was started on the third aircraft.

Block 45 Flow Chart – Art of the Possible 45 Flow Days



A.3.4.4. The gates were also adjusted to four gates with the modification install gate split in to the installation gate and systems gate. The gates were changed from the three to four gate process to better identify constraints, and stream line the process for a faster flow.

KC-135 Gates Block 45 Mod



A.3.5. WIP. The WIP for the Block 45 Modification is planned for four aircraft. The WIP was determined by the TAKT input schedule based on the projected flow day average. All WIP deviation has been caused by either legacy issues, parts constraints or lack of flight crew when aircraft has been ready for ACF (Acceptance Check Flight). The daily triage meetings also provided the much needed tactical management of the Block 45 modification workload. A portion of the meeting was dedicated to focusing on each tail number in WIP. Monitoring the flow in the production machine allowed the team to see where the work was stacking up and identify constraints that needed attention.

KC-135 Block 45 Mod Production Machine

THE 135 MACHINE FY 17 Block 45

Days	Inputs	Schedule Takt	Wire Removal	Rewire Install	Ops Checks	Post Dock	TOTALS	
365.0	31.0	11.8	0.5	1.8	1.1	0.4	3.8	WIP
Reqd Cal Days:			5.9	21.2	13.0	4.7	44.7	Cal Days
Goal			6	21	13	5	45	Cal Days

AoP WIP of 3.8

Projected WIP of 4.7

A.3.6. Constraint Identification. The modification parts are delivered in two kits, A Kit and B Kit. The A Kit is the installation kit containing 44 wire harnesses, 220 single run wires and eight mechanical kits. The B Kit contains all the Line Replaceable Units (LRU) and avionics black boxes. Production on the first three aircraft in LRIP-2 was a struggle (average 102.7 flow days) due in part to the Work Control Document (WCD) layout and the incoming kit configuration. Process improvements were needed to bring down flow days quickly. Constraints were identified in the daily triage team meetings as listed below. As constraints were identified, members of the triage team took action with just-go-do-it's to resolve the issues.

A.3.6.1. Full weight and balance required hangar availability. With program office and engineering approval, full weight and balance requirement was changed to record adjustments only. Hangar requirement for weight and balance was resolved by the fifth aircraft.

A.3.6.2. Mechanics did not have easy access to required tools to do the tasks. To resolve this issue, with quality office approval the tool boxes were placed on the aircraft for at hand use.

A.3.6.3. Mechanics were spending too much time looking through hardcopy drawings on the table in the aircraft. Wi-Fi is not available on Romeo ramp so eTools is not a possibility. To resolve, the planning office copied all drawings on a disk which is available to check out to the mechanic for use. Upon completion the disk is returned to planning. The planning office has the responsibility for keeping the disk up to date with revision changes.

A.3.6.4. Technical assistance/information was not readily available for technician to troubleshoot/identify avionics issues. There was wait time for Rockwell Collins engineering assistance. To resolve this issue, we requested a data bus analyzer with all the software rights to aid in pin pointing avionic issues. The equipment and software purchase was approved and ready for use by October 2015.

A.3.6.5. Parts/material was not on hand/available when required/needed for tasks being done on every aircraft. A 100% list for material was created and material ordered 30 days before need date. When received, the parts are added to the installation kit.

A.3.6.6. Rockwell Collins guides/drawings with process and parts for terminating connectors was not the easiest/best way to perform task. Rockwell Collins created the drawings for the work but by the time the LRIP-2 began in the tanker squadron there was a new process for terminating connectors with multiple shielded wiring, requiring a clamp and band. The triage team identified 50 connectors the bands and clamps could be used on. The program office agreed it was a better process and approved the use of over and above funds to purchase the parts.

A.3.6.7. Encountered delays for parts/material when legacy issues unrelated to the Block 45 modification were discovered. To resolve the issues a replenishable kit was created for high use replaced parts whether legacy or organically caused. The kit is maintained by production support. When a part is used it is reordered immediately to replenish the kit for next use. The kit includes connectors, back-shells, clamps, bands, etc. The inventory is based on history/usage. The stock is used to pull parts and allows ability to be tracked rather than waiting three hours to a few days to get the parts when ordered.

A.3.6.8. Small parts in harness kits were lost/misplaced. The mechanics did not like having termination parts in the harness kits because many small part pieces were lost. To resolve, planning created and implemented a kitting process changing the 46 kits into skill and component specific kits. There were 106 kits created and stored by skill (i.e. electric, avionics, sheet metal) and component identification number (or name). This was implemented on the fourth aircraft.

A.3.6.9. Difficulty with the 130 page removal drawing layout separated in eight sections by system. To reduce the time required to remove the wires, planning created new WCDs to remove by area rather than system. Original 12 WCDs with long definitized guides for removing wires and components were replaced with 26 WCDs by area (i.e. pilot's panel, nav table, lower nose, etc.). A reference chart for mechanic's use

was also created showing which wires in each area are removed and kept for re-termination, moved to another location or totally deleted from the aircraft. The reference chart was approved through the quality office. The new WCDs were implemented on the fourth aircraft. The changes to the WCDs and kit builds ensured each shift could more clearly see their area of work and were able to identify 3 large areas where a lot of maintenance is performed concurrently, leaving little room for all technicians needed in the space.

A.3.6.10. One of the areas being worked dealing with congestion due to amount of work required for the area was the avionics rack, shelf four (top shelf). Mechanics were not able to work in the area concurrently causing wait time. A shop aid (board) was created for shelf four where the mechanics were able to assemble everything off the shelf/aircraft on to the board. When the area was clear the mechanics were able to take the shop aid on the aircraft and move the parts/wires from the board on to the aircraft. The area where the parts/wires were being installed was also a difficult to reach area due to the space and width, the shop aid also benefited/overcame the awkwardness of the work in the space leaving a neater appearance as well. The shop aid was implemented on the 12th aircraft.

Routing and Terminations

- 3500 termination points
- 125 plugs
- 12 Relays
- 50 terminal strips
- Misc. splicing and switches
- 99% of wiring is Nuclear-hardened
- Deletion of 2000+ wires and
- About 100 reroutes
- Routing & Terminations
- -35 wire bundles = 8382.7 ft of wire
- -500 single wires = 4895 ft of wire
- Totaling 13,277.7 ft of wire

- 35 bundles-10 shelf 4= 500 terminations
- 70 singles for another 300 terminations
- Constraints- room for only one person to work – lower area unable to work
- Solution – work shelf 4 off aircraft
- Shop Aid – 5 days to build up- saving



A.3.6.11. Routing and termination WCDs (46 ea) were set up by the contractor (Rockwell Collins) as a drawing installation method work package. There were 46 engineering drawing kits for the mechanic to install everything in the bag and move on to next task. The mechanics were not installing in that order and requested the WCDs be component specific rather than drawing specific. The planning Office deleted 260 WCDs and created 620 WCDs for the Kit A components. The issue was resolved with the WCDs

in place for the sixth aircraft. The WCDs were placed in the appropriate Kit that was created before.

A.3.6.12. Landing gear issues caused delays for jacking/hangar availability. This issue was lessened with engineering's approval to accomplish a modified lever lock check with the aircraft on the ground. This 202 process was implemented on the 9th aircraft. The first nine aircraft had a 66.7% jack requirement; with the modified lever lock check the last 27 aircraft had a 24.3% jack requirement.

A.3.6.13. The shop aid discussed previously (para 3.6.10) was such a success that it led to further brainstorming for additional areas that could benefit from a shop aid where work could be accomplished off the aircraft and transferred to the aircraft's avionic racks. Shelf one and radio altimeter junction box shop aids were created and implemented by the 14th aircraft.

A.3.6.14. Turnovers used by production had different "breaks" in them that caused confusion when looking at G097/PDMSS to track flow process. To resolve the confusion the network flow was changed to match the turnover layout being used by production which included changing the network to 4 gates as well.

62-3514

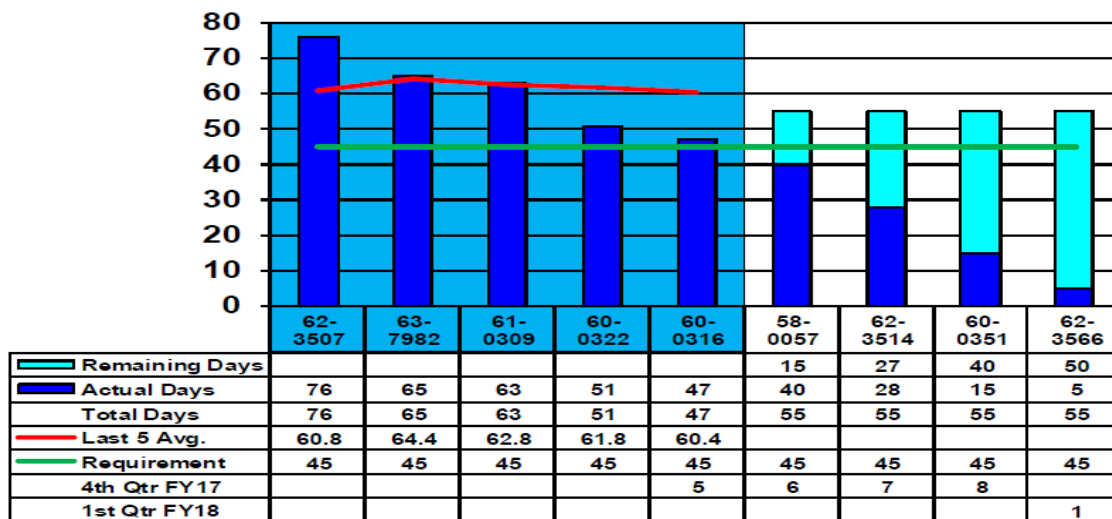
62-3514			<div> <div>G</div> <div>Y</div> <div>R</div> </div>		19 of 45	
Pre dock (6)	Scheduled Start	Flow Day	Scheduled Completion	Flow Day	Actual Start	Actual Completion
Receive/initial checks	19-Jul-17	DAY 1	19-Jul-17	DAY 1	19-Jul-17	19-Jul-17
Disassemble FOM	19-Jul-17	DAY 1	19-Jul-17	DAY 1	19-Jul-17	19-Jul-17
Removals-Area 11	20-Jul-17	DAY 2	24-Jul-17	DAY 6	20-Jul-17	24-Jul-17
Removals-Keel Beam	20-Jul-17	DAY 2	24-Jul-17	DAY 6	19-Jul-17	24-Jul-17
Removals- Flight Deck	20-Jul-17	DAY 2	24-Jul-17	DAY 6	20-Jul-17	24-Jul-17
Removals- Lower Nose	20-Jul-17	DAY 2	24-Jul-17	DAY 6	19-Jul-17	24-Jul-17
Mod Installation (18)	Scheduled Start	Flow Day	Scheduled Completion	Flow Day	Actual Start	Actual Completion
Mod Install Area 11	25-Jul-17	DAY 7	29-Jul-17	DAY 12	25-Jul-17	27-Jul-17
Mod Install-Keel Beam	25-Jul-17	DAY 7	29-Jul-17	DAY 12	25-Jul-17	27-Jul-17
Mod Install-Flight Deck (18)	25-Jul-17	DAY 7	11-Aug-17	DAY 24	25-Jul-17	
Mod Install-Lower Nose (18)	25-Jul-17	DAY 7	11-Aug-17	DAY 24	25-Jul-17	
	Scheduled Start	Flow Day	Scheduled Completion	Flow Day	Actual Start	Actual Completion
Continuity (6)	12-Aug-17	Day 25	17-Aug-17	Day 30		
Power on / Hot Pin (1)	18-Aug-17	DAY 31	18-Aug-17	DAY 31		
Install FOM/Control Column (1)	19-Aug-17	DAY 32	19-Aug-17	DAY 32		
Avionics Install (2)	20-Aug-17	DAY 33	21-Aug-17	DAY 34		
Avionics Checks (3)	22-Aug-17	DAY 35	24-Aug-17	DAY 37		
Post Dock (8)	Scheduled Start	Flow Day	Scheduled Completion	Flow Day	Actual Start	Actual Completion
Engine Runs (3)	25-Aug-17	DAY 38	27-Aug-17	DAY 40		
ACF (5)	28-Aug-17	DAY 41	2-Sep-17	DAY 45		
DEPARTURE						

A.3.6.15. Parts were placed in 106 kits (discussed earlier in para 3.6.8) for the mechanics to pull to perform a task. The mechanic would search through all 106 kits to find the kit they needed for the system they were installing. To resolve the issue planning added unique configuration codes to the WCD by shift, gate, task, and area so that the inventory/kitting technician does not have to look through 620 WCDs repeatedly looking

for the operations they need/want. The production controller can print out by configuration codes (i.e. dayshift routing, shelf four, shelf one, rad alt, etc.). The packets are delivered to the kitting technician or production saving man hours in searching through the large number of WCDs. With further process improvements the mechanics are given a binder for each area (i.e. pilot's panel, navigator's table, lower nose, shelf two, etc.) that contains everything needed to perform tasks in the area.

A.3.7. Constraint Resolution. Initially it was expected we may be late to the requirement (65 days) due to the new workload, training and development of the technicians. The first aircraft proved to be a challenge with the legacy issues that occurred with a fuel leak, rudder issue, engine issues and a hydraulic leak and the need to secure a hangar for a full weight and balance. When the second aircraft began to fall behind the squadron started daily triage team meetings with team members consisting of the Planning Chief, Production Support (scheduling) Chief, Production Chief, supervisors from all skills, work leaders from all skills required, SPO equipment specialist, Rockwell-Collins engineers, program engineers, facility engineers, SPO supervisors, the modification manager, and mechanics from all skills required. The team included members from both day shift and swing shift. Topics of discussion were aircraft status and any issues encountered. The triage meetings were also used to brainstorm for ideas to make the modification run more smoothly. The biggest challenge was bringing the triage team together to meet in the area the Block 45 modifications are performed on Romeo ramp. The area was geographically separated from the PDM workplace and required restricted/controlled area badges or an escort. The goal of the daily triage team was to focus on the Block 45 modification workload and to identify constraints preventing us from reaching the AoP goal of 45 flow days. The triage team was tasked to perform constraint buster activities with all resolutions being mechanic centric. The daily triage meetings provided the tactical management needed for the WIP. We also incorporated wall walks for an operational view of the gated process and the process improvement opportunities.

KC-135 Block 45 Mod Last 5 Produced & A/C In-Work



Last 5 Avg. 60.4

Requirement 45

As of: 15 Aug 17

A.3.8. Results. The first three aircraft produced with workflow days of 97, 118 and 93 with an average of 102.7 flow days. Some of the first changes/improvements that came out of the triage team meetings started on the third aircraft in LRIP-2. The first five aircraft in LRIP-2 flow day average was 92 days. The last five aircraft in LRIP-2 flow day average was 53 days. Overall, LRIP-2 ended with an average of 66.5 flow days. Of the 19 aircraft completed in LRIP-2, two aircraft exceeded the AoP goal of 45 days. For the aircraft being modified in FRIP-1, 26 of the aircraft have been completed with an average of 55 flow days and 5 of those aircraft have met or exceeded the AoP goal of 45 days!

Block 45 Aircraft Actual Flow Days

A/C # for 564th	JOIN	Tail #	Flow Days	Phase
1	A04	62-3526	97	Low Rate Initial Production, Phase 2 (LRIP-2)
2	A03	61-0266	118	
3	A06	58-0122	93	
4	A07	63-8018	79	
5	A08	61-0277	73	
6	A10	57-1461	77	
7	A11	62-3553	80	
8	A12	58-0055	68	
9	A13	57-1427	57	
10	A14	58-0059	52	
11	A15	63-7985	51	
12	A16	63-7979	43	
13	A17	62-3503	47	
14	A18	59-1516	64	
15	A19	63-8039	57	
16	A20	59-1461	53	
17	A21	58-0121	57	
18	A22	63-8023	55	
19	A23	61-0298	43	
20	B01	63-8034	49	Full Rate Initial Production, Phase 1 (FRIP-1)
21	B02	61-0272	51	
22	B03	62-3538	58	
23	B04	59-1501	42	
24	B05	62-3547	59	
25	B06	63-8027	54	
26	B07	59-1482	48	
27	B08	63-7996	72	
28	B09	61-0275	72	
29	B10	61-0310	53	
30	B11	59-1485	52	
31	B12	63-8026	51	
32	B13	60-0347	44	
33	B14	63-8041	41	
34	B15	62-3506	38	
35	B16	62-3505	64	
36	B17	61-0308	45	
37	B18	63-8021	55	
38	B24	59-1458	71	
39	B20	63-8029	47	
40	B22	63-7991	56	
41	B23	57-1432	54	
42	B25	62-3507	76	
43	B26	63-7982	65	
44	B27	61-0309	63	
45	B28	60-0322	51	
46	B29	60-0316		
47	B32	58-0057		
48	B31	62-3514		
49	B33	60-0351		
50	B34	62-3566		
51	B35	62-3531		
52	B36	58-0060		
53	B37	63-7993		
54	B38	62-3552		

A.3.9. Visual Display. Attached network flows, production machine, gate charts, shop aid pictures and wall walk charts.

A.3.10. Next Steps. Gates 1, 2 and 3 have been meeting or exceeding gate requirements. Gate 4 (post dock) is where most issues are occurring now. Legacy issues, parts constraints and lack of flight crew are the main reasons this gate has not been able to maintain a consistent WIP. If these issues can be resolved through CPIs, the 45 day AoP goal is very attainable. The benefits from the daily triage team are evident in the early flow days of 102.7 down to the current 55 flow days for FRIP-1. continued daily tactical management of the WIP, specifics of each aircraft, and constraint resolutions will be key to persistent success of the Block 45 modification workload.

A.3.11. Lessons learned. The tanker squadron has a unique situation in already having implemented AoP on the PDM workload. Already having the experiences of working through building a production machine, gate performance, and effectively executing continuous process improvement allowed the Squadron to take those previous lessons and implement on this workload for success. A lesson learned on the Block 45 modification planning of the workload was the need to anticipate all constraints. Even though legacy issues and flight crew availability can be a block in meeting requirements on the PDM line, we did not anticipate those same potential issues we might face on the modification work line. Also implementing a separate wall walk in the Block 45 modification work area was beneficial to focus only on process improvements in the Block 45 gates.

A.3.12. Contact Information: Bonnie Sandmann, 564 AMXS/MXDXA, DSN 884-7316.

Additional case studies are available on the AoP SharePoint site:

<https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Tools/1.2.%20AoP%20Case%20Studies%20and%20Success%20Stories>

APPENDIX – CASE STUDIES

A.4. Ogden Air Logistics Complex (OO-ALC) Strategic Planning

A.4.1. Mission Overview. The mission of the OO-ALC Business Office (OO-ALC/OBP) is to provide OO-ALC support within the functional areas of Strategic Planning, Depot Activation, and Business Development. The primary purpose of the functional areas, respectively, is to ensure strategic plans developed during the annual off-site are monitored and reported frequently at the senior levels, ensure activations are completed within stated timeframes, and to vet new workload opportunities throughout the complex for acceptance based on Technical Repair Center guidelines. Customers range from industrial partners, DoD program offices, AF supply chains, each complex within AFSC, and DoD military services. The products and services provided include partnership agreements, strategic plans and completed activations which set the stage for production machines to operate. The output of these production machines result in DoD supply chains receiving appropriate inventory able to fill worldwide requirements. The below OO-ALC/OBP METL was finalized in early Jan 2017 and agreed upon by each functional area section chief. The METL communicates the core tasks performed within each area of responsibility.

A.4.1.1. MET 1 – Manage and track OO-ALC Strategic goals and objectives

A.4.1.2. MET 2 – Develop and deploy complex business plan

A.4.1.3. MET 3 – Develop/negotiate Implementation Agreements (IA)

A.4.1.4. MET 4 – Opportunity Review Board (ORB) process

A.4.1.5. MET 5 – Establish CPI home office as support entity to OO-ALC leadership and practitioners

A.4.1.6. MET 6 – Engage with PMO, establish Depot Maintenance Activation Working Group (DMAWG)

A.4.2. Mission Essential Task for Study. The MET identified for this case study is the process to manage and track OO-ALC strategic goals & objectives. The management and tracking processes related to OO-ALC strategic goals & objectives encompass four unique AoP gates which are as follows: pre-planning, annual off-site planning, strategy development, and strategy execution. The purpose of this essential task is to ensure a forum is provided to develop organizational goals/objectives and manage plan implementation. AoP gate utilization provides the framework to coordinate the annual strategic offsite, develop the strategic planning coffee table book and strategy poster, and manage the quarterly and end-of-year updates. The application of gates allows for the continuous tracking of critical path progression solidifying alignment to AFSC strategic plans. Customers of this process include the complex commander, vice director, vice commander, director of staff, staff agency chiefs, group commanders/directors and all personnel assigned to OO-ALC.

A.4.3. Case for AoP Implementation. In Sept 2016, the process to manage and track OO-ALC strategic goals & objectives was identified for AoP implementation due to the complexity of implementation and reporting. The complexity of implementation provided an opportunity to improve upon key deliverables associated to achieving desired results not only for recently established goals & objectives but also the follow-on annual planning cycle.

A.4.4. Flow. From this section forward, the entire strategy development process will be discussed. Currently the strategy development process has four gates: Gate 0: pre-planning, Gate 1: annual offsite planning, Gate 2: strategy development, and Gate 3: strategy execution. Within each gate, specific tasks have been directly associated to gate objectives clearly identifying applicable release points. The flow within each gate (sub-gates and sub-tasks) were developed by evaluating the necessary steps ensuring a critical path milestone could be reached. Because strategic planning is an annual process the challenges to flow identification were numerous. Initially, the tasks were identified based on previous experience, to include the required number of flow days, and then confirmed as the tasks were accomplished throughout the following planning cycle. The most important lesson learned in developing the process flow was to remain flexible. Establishing a process in an administrative area which had not been previously gated, required constant evaluation and reiterations until a sound flow could be confirmed.

A.4.5. WIP. WIP within the strategy development gates is defined as the administrative requirements needed to ensure continual execution of the process. Examples include action items from previous reporting events (tracking until closure), reporting templates (stoplight/milestone charts), planning the current reporting meeting (agenda, chart development, logistics, pre-briefs, etc.) and meeting minutes. WIP was determined by assessing the required out-puts for each gate. No challenges to WIP identification were experienced. The WIP lessons learned mostly centered on the understanding that gate transfers aren't an acceptable option; WIP must be completed.

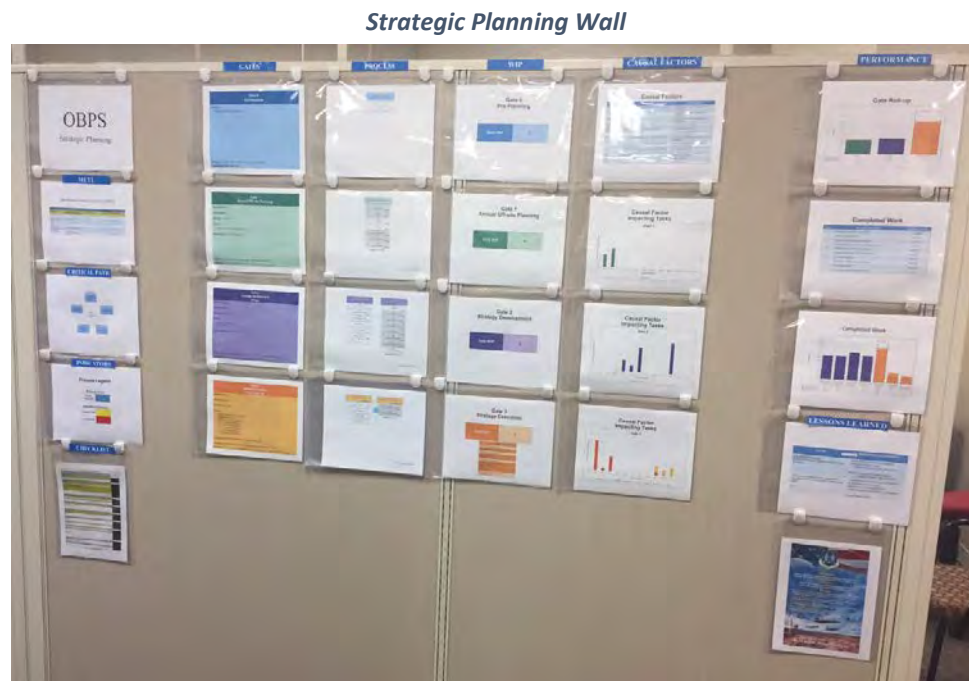
A.4.6. Constraint Identification. Two primary constraints identified throughout the process revolved around delays in leadership approval and delays in receiving data from SMEs. The delays in leadership approval for the current year goals & objectives was identified as a constraint as it caused a ripple effect resulting in additional delays of product development (coffee table book and poster) and implementation plan execution. Receiving data from SMEs is a continual constraint due to the senior grade level of SMEs who serve as the owners of the goals & objectives. One of the lessons learned was the importance of utilizing workflows to send out all tasks versus personal email accounts. The use of workflows has improved response times and enables oversight to the complex business office.

A.4.7. Constraint Resolution. In an effort to address identified constraints, several indicators were built into the strategy development gated processes. Elevation point indicators, shown in red or yellow on the AoP wall, provide insight as to when direct leadership involvement is required. In addition, flow days are monitored and tracked to visually display (bar graph metric) the timeframes representing completed work and the

overall gate processing times. Finally, causal factors impacting tasks are displayed and identify the key constraints continually impacting the gate processes. Having these key indicators displayed on the AoP wall make it easy for teammates to see where constraints arise in the processes. In addition, leadership can easily determine, by evaluating the causal factors, where they may be causing a delay in the processes. In fact, the OO-ALC/CC, during a weekly wall walk, was able to self-identify where he was driving a constraint.

A.4.8. Results. Constraint indicators have provided both short-term and long-term results. Short-term results are noticed through the immediate benefit of utilizing workflows to communicate tasks/suspense items. The benefit is related to timely responses being obtained which has improved the overall gate processing times. As mentioned above, during weekly wall walks all teammates are able to visually see where the constraints reside. As strategy development is an annual process, long-term results may not be realized until the following year when the impacts of the improvements are evaluated/documentated. The reason for this dynamic is because a single process may not be engaged again for months later even if a modification was made from a lesson learned.

A.4.9. Visual Display. The figure below shows the wall used for strategic planning wall walks.



A.4.10. Next Steps. The next step to advance the strategy development process will be to gate the strategic offsite requirements. The requirements will be visually displayed on the AoP wall as a sub-machine built within Gate 3: strategy development. In addition, as the established processes mature, the identified tasks within each gate will continually be refined.

A.4.11. Lessons learned. A well-developed visual layout depicting the information on an AoP wall is critical to understanding the gate processes. In the early developmental stages

of the strategy development AoP wall, the gates were presented vertically utilizing a process map. Between Apr-Jun 2017, an effort was made to rearrange the gates to read horizontally and color-codes were utilized to highlight gate specific information. This effort significantly increased the ability of others to immediately understand the information displayed on the AoP wall. In addition, the OO-ALC/OBP team developed a checklist identifying key AoP elements which should or could be displayed on each functional areas AoP wall. By having this tool available, teammates can easily understand what to expect to see on each wall.

A.4.12. Contact Information: Amy Mecham, OO-ALC/OBPS, DSN 586-5510.

Additional case studies are available on the AoP SharePoint site:

<https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Tools/1.2.%20AoP%20Case%20Studies%20and%20Success%20Stories>

APPENDIX – CASE STUDIES

A.5. Warner Robins Air Logistics Complex (WR-ALC) Safety

A.5.1. Mission Overview. WR-ALC/SE's mission within the WR-ALC is to enhance WR-ALC's operational capability through an on-going commitment to risk management, comprehensive inspection, adherence to Occupational Safety and Health Administration (OSHA) standards, and support of health resources in the interest of mishap prevention. WR-ALC/SE serves as the WR-ALC principal agent for advising the commander on all aspects of VPP implementation and execution. We ensure WR-ALC personnel are properly represented to achieve environmental health and safety excellence. Ground Safety's mission minimizes loss of Air Force assets and protects Air Force personnel from death/injury by managing risks on and off duty. Ground Safety executes injury prevention by conducting routine and comprehensive ground safety inspections to enforce regulatory requirements and by conducting mishap investigations to determine root causes to prevent mishap recurrence. Safety manages many associated safety programs including lock out-tag out, confined space, risk management, fall protection, hoist and crane, and electrical safety programs to ensure injury prevention. WR-ALC/SE also manages safety training, which includes supervisor safety and Unit Safety Representative (USR) training. Determining WR-ALC/SE's METLs was a struggle initially. The Safety team met with the lean team and were instructed on how to develop the METL. Initially, 23 METLs were created and prioritized. In July 2015, the team selected one METL to implement within the Complex, the Investigation Program Management Process. Mishap investigations was chosen because of how it impacts WR-ALC. At the time the complex had 53 reportable mishaps in the Air Force Safety Automated System (AFSAS). Per AFI mishap investigations are required to be completed within 30 days and ours were averaging 40+ days.

A.5.1.1. MET 1 Mishap Prevention Program

A.5.1.2. MET 2 Hazard Identification/Abatement Process

A.5.1.3. MET 3 Inspection/Assessment Process

A.5.2. MET for Study. In July 2015, the team selected its first MET to implement which was Mishap Investigations. AoP implementation was also established for the Hazard Identification/Abatement Process and the Inspection/Assessment Process.

A.5.3. Case for AoP Implementation. WR-ALC/CC's intent was clear from day one that AoP is the Complex Management Process, is non-negotiable, and applies to administrative offices. Mishap investigations were chosen because of how it impacts the entire complex. There was a significant struggle with completing mishap reports within the required 30 day time frame mandated by AFI 91-204, *Mishap Investigations*. There were 53 reportable mishaps in AFSAS at that time.

A.5.4. Flow. The flow for mishaps investigations is defined by AFI 91-204. The team initially struggled with gating the process. Historical data from the previous year was gathered and analyzed. The team determined 480 mishaps were investigated. 15 gates were initially established and after multiple reviews, it was realized the team had failed to integrate Little's Law. Once Little's Law was applied, the team was able to consolidate down to five manageable gates to measure speed and throughput. Then standard charting was initiated and monitoring of performance trends began. The team was skeptical about the AoP process and thought the constraints were in someone else's gate which the safety office didn't own. As the charts were populated and the data analyzed, it was an 'eye-opening' experience because the team realized WR-ALC/SE was the constraint. Workload was not evenly distributed amongst the safety technicians causing investigations and reports to become back-logged. In order to evenly distribute the workload two teams were established, Investigations and Inspections. This allowed us to use the 'next man up' theory to immediately take action and use the data to manage WR-ALC's investigation process. As a result, the team saw the investigation process increase in speed and throughput with less rework and late reporting. There was a dramatic decrease in the number of mishaps in the AFSAS system and within six months, mishaps in the system reduced to zero. Currently there is an average of 11 open investigations.

A.5.5. WIP. The WIP for this process is the number of incidents which are injuries, property damage, and/or illnesses reported to the safety office that require investigations and reports per 29 CFR 1904, *Recording and Reporting Occupational Injuries and Illnesses* and AFI 91-204. As discussed above, Little's Law was not applied to determine WIP and backed into it while determining our gated process. After applying Little's Law, the team was able to consolidate down to five gates and establish WIP control.

A.5.6. Constraint Identification. The major constraint was Gate 3, *Investigation*. Without the AoP process, Gate 2, *Classification* was thought to be our constraint because it was assumed the production groups or Occupational Medicine Services (OMS) were not providing the documentation needed to determine the mishap classification in a timely manner. Additionally, the safety team was skeptical about the AoP process and was convinced the late report constraint was the result of someone else. Once a gated process was established and the data was analyzed, it was determined that the safety team was taking too long investigating prior to writing the mishap report.

A.5.7. Constraint Resolution. The data immediately indicated that some safety specialists assigned to the squadrons were investigating more mishaps than others, basically overloading their plates, because not only were they conducting mishap investigations, they were conducting annual safety inspections required by AFI 91-203, *Air Force Consolidated Occupational Safety Instruction* as well. The work was not evenly man-loaded to each safety specialist; therefore, the safety specialists could not catch-up or keep-up. Instituting the 'next man up' concept allowed the team to evenly distribute investigations and inspections amongst the safety specialists. The result was greater throughput, less rework and a decline in late reporting. Also, the inspection team identified and mitigated more hazards and potential mishaps.

A.5.8. Results. When the AoP process was implemented, there were 53 reportable mishaps in WIP. The team struggled to meet the 30 day deadline to investigate mishaps, write reports, and complete AFSAS reporting. As of today, our machine's WIP is 17 of 25 allowed, the average days open for the last 10 is seven days versus a requirement of 22 days. Safety has been using the AoP process since Aug 2015 and have had huge long term results!

A.5.9. Visual Display. WR-ALC SAFETY MISHAP INVESTIGATION PROCESS:

A.5.9.1. Gate Zero – Induction

A.5.9.1.1. Means of Notification. There are various means of mishap notification. Examples include, but are not limited to: Aircraft Maintenance Operation Center (AMOC), supervisors, and record reviews. When the team are notified of a mishap the investigation process starts.

A.5.9.1.2. WIP Inducted

A.5.9.1.2.1. All Injury and property damage cases receive a tracking number (tracking number will be included on investigation documents), be inducted into our gated process, and investigated (in most cases) by a Single Investigating Officer (SIO).

A.5.9.1.2.2. Occupational illness cases are not inducted and will be investigated by Public Health officials and are entered into AFSAS by OMS as applicable.

A.5.9.1.2.3. Non-occupational illness cases are not inducted. These are cases that are clearly medical/non-occupational instances (i.e. chest pains, diabetic problems, flu-like symptoms, etc.)

A.5.9.1.3. SIO Assigned. Applicable lead or designated representative will assign SIO as required. SIO will gather information regarding the mishap (documents, photos, contacts, etc.)

A.5.9.2. Gate One – Initial Investigation. For injury or damage mishaps, assigned SIO will produce an initial investigation report (facts only) within four hours.

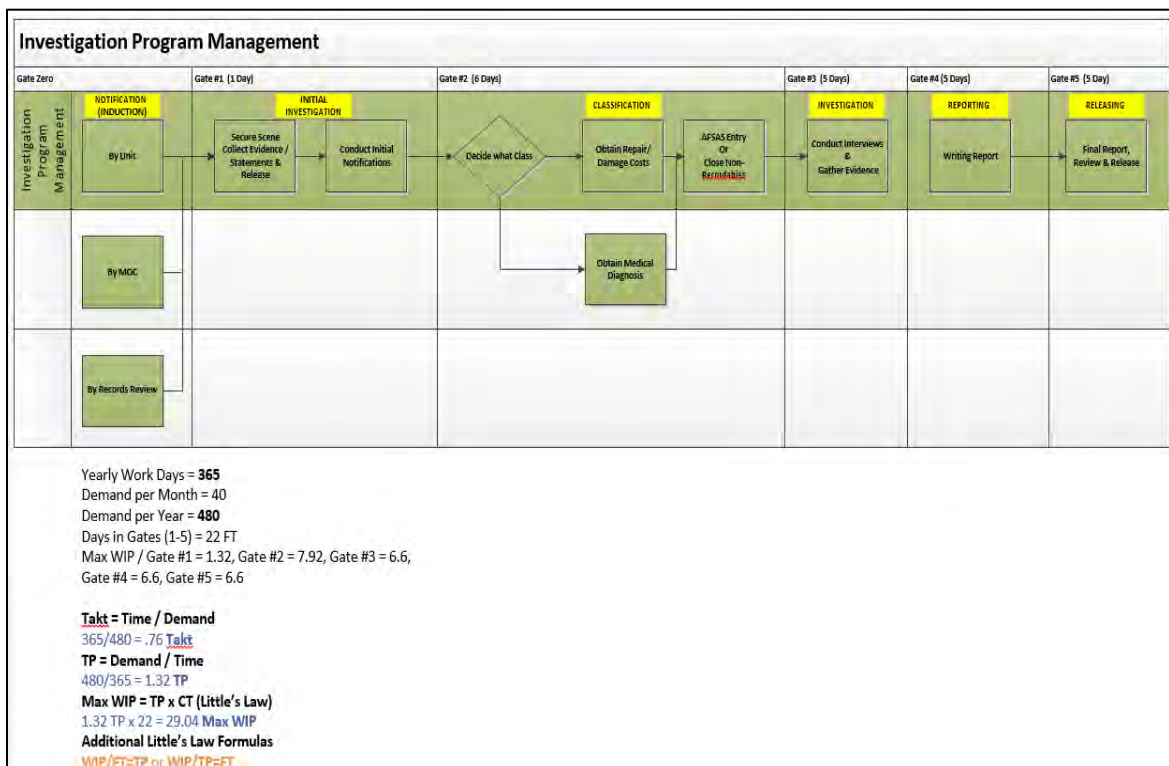
A.5.9.3. Gate Two – Classification. For injury mishaps, SIO receives injury diagnosis and documents. For damage mishaps, SIO must obtain cost information to classify mishap case.

A.5.9.4. Gate Three – Investigation. SIO completes investigation checklist, develops findings and cause factors, then develops recommended corrective actions (as required) and drafts report for review.

A.5.9.5. Gate Four – Reporting. SIO sends final investigation to Chief of Safety for review. Note: Final damage reports must have cost included. Once the Chief of Safety or designated individual gives the “go ahead,” SIO is to complete reporting in the AFSAS.

A.5.9.6. Gate Five – Releasing. Chief of Safety or designated individual will release AFSAS report.

Investigation Program Management Machine



Investigation Program Management Machine



A.5.10. Next Steps.

A.5.10.1. Safety will continue to perform weekly wall walks and analyze the data to identify and bust constraints, and re-evaluate Little's Law annually to determine the correct WIP and flow for the machine.

A.5.11. Lessons learned.

A.5.11.1. Analyzing data is critical to identifying the constraint. Initial assumptions can be wrong.

A.5.11.1.1. The safety team found that the METL process provided useful guidance to help establish the right priority of processes to tackle. Additionally, as individuals we may have the initiative and drive to excel; however, others around us who have influence on the final product need to be encouraged to get on board and “buy into” achieving timely goals.

A.5.12. Contact Information: JAMES A. HOGAN, Director WR-ALC/SE, 468-1708

Additional case studies are available on the AoP SharePoint site:

<https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Tools/1.2.%20AoP%20Case%20Studies%20and%20Success%20Stories>

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Abbreviations and Acronyms

AA - Aircraft Availability

ABSS – Automated Business Service System

ABW – Air Base Wing

ACF – Acceptance Check Flight

AFI – Air Force Instruction

AFMAN – Air Force Manual

AFPC – Air Force Personnel Center

AFPD – Air Force Policy Directive

AFRIMS – Air Force Records Information Management System

AFSAS – Air Force Safety Automated System

AFSC – Air Force Sustainment Center

AFSOC – Air Force Special Operations Command

AMOC – Aircraft Maintenance Operation Center
AO – Action Officer
AOC – Air Operations Center
AoP – Art of the Possible
AOR – Area of Responsibility
CER – Cost Effective Readiness
CoF – Complex of the Future
CPI – Continuous Process Improvement
DBR – Drum Buffer Rope
DLA – Defense Logistics Agency
DMAIC – Define, Measure, Analyze, Improve, Control
DMAWG – Depot Maintenance Activation Working Group
DoD – Department of Defense
DOTmLPF-P - Doctrine, Organization, Training, materiel, Leadership, Personnel, Facilities, and Policy
DP – Directorate of Personnel
FDB - Financial Data Base
FM – Financial Management
FRIP – Full Rate Initial Production
GMT - Gated Management Tool
GPC – Government Purchase Card
IA – Implements Agreements
ICE – Interactive Customer Evaluation
IM – Item Manager
IMS - Integrated Master Schedule
IMSC - Installation and Mission Support Center
IPV – Individual Prime Vendor
JA – Judge Advocate
JP – Joint Publication
LAIRCM – Large Aircraft Infrared Countermeasures
LGS - Logistics Directorate’s Performance Management Division
LRIP – Low Rate Initial Production
LRS – Logistics Readiness Squadron
LRU – Line Replacement Unit
MAPO – Maintenance Acquisition Program Office
MDS – Mission Design Series
METL – Mission Essential Task List
METs – Mission Essential Tasks
MGA – Major Graded Area
MIPR – Military Interdepartmental Purchase Request
MLG – Main Landing Gear
MORD – Miscellaneous Obligation Requirements Document
NAF – Numbered Air Force
OC-ALC – Oklahoma City Air Logistics Complex
OO-ALC/OBP – OO-ALC Business Office
OFPs – Operational Flight Programs

OMS – Occupational Medical Services
OO-ALC – Ogden Air Logistics Complex
ORB – Opportunity Review Board
OPR – Office of Primary Responsibility
OSHA – Occupational Safety and Health Administration
PCS - Permanent Change of Station
PDM – Programmed Depot Maintenance
PM – Program Manager
PPA-HQ - Personal Property Headquarters Activity
PPPO – Personal Property Processing Office
PPSO – Personal Property Shipping Office
QA – Quality Assurance
RCA – Root Cause Analysis
RDS – Records Disposition Schedule
RIE – Rapid Improvement Event
RIW – Requirements Identification Worksheet
SIO – Single Investigating Officer
SME – Subject Matter Expert
SPO – System Program Office
ToC – Theory of Constraints
TSP - Transportation Service Provider
UDLM – Unfunded Depot Level Maintenance
USR _ Unit Safety Representative
VPP – Voluntary Protection Program
WCD – Work Control Document
WIP – Work In Process
WR-ALC – Warner Robins Air Logistics Complex

Glossary

This glossary is intended as an explanation of terms that may be new or uncommon.

Art of the Possible (AoP) – A constraints based management system designed to create an environment for success by creating a culture of problem-solvers, defining processes (aka machines), eliminating constraints, and continuously improving. It is the framework for how the AFSC conducts business and how we strive to achieve world class results in warfighter support.

AFTO-202 – Nonconforming Technical Assistance Request and Reply. Process used in AFSC to request engineering disposition to a production process problem.

Andon – A signal used to call for help when an abnormal condition is recognized, or that some sort of action is required. (Andon comes from an old Japanese word for paper lantern).

Comfortable in Red - Refers to the willingness to set aggressive targets with the understanding the metrics will show as “red” until process throughput efficiencies improve.

Constraint – The gate with the lowest throughput rate.

Critical Path – A sequence of activities in a project plan which must be completed by a specific time for the project to be completed on its need date. The AFSC adaption of this term refers to the linkage of critical elements in a process or project that keep an asset realistically moving forward toward completion.

Drum Buffer Rope (DBR) – A schedule methodology that controls the release of work into the system. It is a pull system in the sense that when a job is completed by the constraint resource, it sends a pull signal to trigger the release of a new job into the system.

Flowtime – The average time that a unit stays in a production machine.

Implied Tasks – Actions or activities not specifically stated but which must be accomplished to successfully complete the mission.

Manloading – A systematic assignment of personnel to jobs or tasks in an efficient manner.

Maturity Matrix – AFSC method of measuring organizational maturity with regard to the adaption of principles found in the “Execution” section of the AFSC Radiator Chart.

Process Machine – Refers to the science of the process and implies that any process can be gated in order to measure throughput and focus process improvement activities.

Pull System – A system where products, materials or information is ‘pulled’ (once a demand is placed on the process step then it produces) by consumer requests through a production machine.

Push System – A system where products, material or information are pushed through a production machine based on past order history and decisions are based on long term forecasts.

Queue – Assets awaiting induction to a process. Also a WIP control tool in a gated monitoring system.

Radiator Chart – Model depicting the fundamental components of the AoP methodology.

Rapid Improvement Events (RIE) – A Lean, 6 Sigma or TOC event that allows for root cause and the development of countermeasures in less than 5 days. The preparation and implementation will occur outside of the RIE.

Road to... – Reflects the throughput-pace required for both the interest of the customer and the organization. The goal that sets the pace of the process.

Root Cause Analysis (RCA) – Tracing a problem to its origins. If you only fix the symptoms, what you see on the surface, the problem will almost certainly happen again which will lead you to fix it, again, and again, and again.

Specified tasks – Tasks directly stated in the mission, by the next higher commander, or by law or regulation.

Standard Work – A detailed, documented and sometimes visual system by which team members follow a series of predefined process steps. It is how work is accomplished and is defined by technical data, process orders, regulations, instructions, or approved checklists.

Tactical Management – An established frequent review of WIP flowing through the process machine. It focuses on the individual items of WIP flowing through the process machine rather than the process machine performance at the operational level.

Takt Time – The rate of customer demand, how often a single unit must be produced from a machine (takt is a German word for rhythm or meter).

Theory of Constraints (ToC) – **1.** Identify the system's constraint(s), **2.** Decide how to exploit the system's constraint(s), **3.** Subordinate everything else to the above decision, **4.** Elevate the system's constraint(s), **5.** Return to step one but beware of inertia WIP.

Throughput – The required output of a production machine expressed in units per time. Traditional definition based in TOC - The rate at which the system generates money through sales.

Urgency Tools – Process tools that allow an organization to react and quickly resolve constraints encountered during process execution.

Value Stream Analysis (VSA) – A method of analyzing a value stream map to determine value add process steps as well as waste.

Value Stream Map (VSM) – A method of creating a simple diagram of the material and information flow that bring a product through a value stream.

Visual Management – The use of simple visual indicators to help people determine immediately whether they are working inside the standards or deviating from it, this must be done at the place where the work is done.

Wall Walk – A recurring process-focused review to understand process machine performance, to identify constraints, and to coordinate constraint resolution.