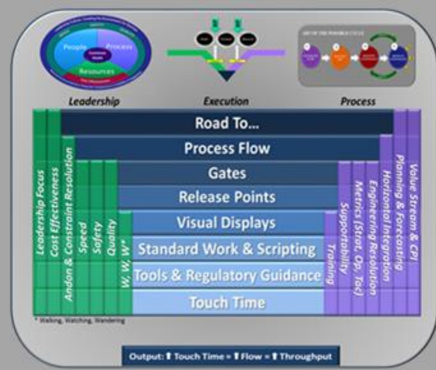
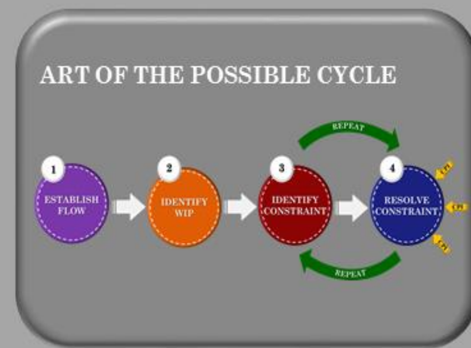
# Art of the Possible Handbook

AFSCH60-101

28 DECEMBER 2021


# 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 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 three 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 constraint that prevents us from operating better, faster, and cheaper. Once we understand the constraint, we can directly focus our resources and energy to resolve it, resulting in increased throughput. Throughput is King! It does not matter if we are conducting aircraft maintenance in one of our Complexes, or executing mission support action in one of our Air Base Wings, there are processes we must follow. By focusing on the constraint 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 will 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 meet the challenges facing our organizations so we can continue to deliver even more combat power for America.

Your Fellow Airman,

Tom D. Miller

Tom D. Miller
Lieutenant General, USAF
Commander

***BY ORDER OF THE COMMANDER***
***AIR FORCE SUSTAINMENT CENTER***

***AIR FORCE SUSTAINMENT CENTER HANDBOOK 60-101***

***28 DECEMBER 2021***

***Standardization***

***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 Form 847s 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 Instruction (AFI) 33-322, Records Management and Information Governance Program, and disposed of In Accordance With (IAW) Air Force Records Disposition Schedule (RDS) located in the Air Force Records Information Management System (AFRIMS).

***SUMMARY OF CHANGES***

Administrative changes have been made to the AFSC commander letter and the executive summary. Previous changes to this document are below. Major changes include an expanded discussion on engaged leadership and the Leadership Model, questions for maturing AoP and growing leaders, and the necessity of positive accountability. The science of throughput and Theory of Constraints (ToC) discussions have been incorporated into the requirements of the Radiator Chart to better link the application of science to the management system. Also, a chapter on managing the machine has been added to emphasize the necessity to actively monitor, understand, manage, and improve the process machine on a continuous basis.

**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 Air Force Sustainment Center Instruction (AFSCI) 60-101, *Art of the Possible,* 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.

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## Executive Summary

AoP is a constraint-based management system designed to create a workforce culture focused on efficient process execution. 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, so the process constraint can be identified and resolved through process improvement methods. This allows a robust constraint based resolution plan to be enacted to increase process throughput. Tactical process management allows issues in the process to be identified so they can be quickly resolved and eliminated to increase touch time thus improving process speed. Process speed is the key indicator that the machine is set and the culture is in place, to enable processes to reach AoP Road to Goals.

In order to be truly successful, AoP processes must focus on safety, quality and cost effectiveness in addition to speed. Speed, Safety, Quality and Cost Effectiveness represent the true north metrics that will guide our AFSC Process machines to reach their common goals and achieve world class results

This book provides the core tenets and guiding principles of AoP to ensure these concepts remain 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 constraint based management in order to attain AoP results. This will require leaders to be champions of change by identifying their burning platform(s) to rally the enterprise around common goals establish process machines managed through operational meetings, lead robust constraint resolution and personal engagement in the work area.

Ultimately, AoP is about utilizing a methodical approach to improve processes. 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-class 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. 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.

# Chapter 1

# INTRODUCTION

## 1.1. What is Art of the Possible?

1.1.1. Before we describe what AoP is, let's discuss what it is not. It is not a new "flavor of the month" process improvement initiative. It is not a passing fad that will fade into the sunset with the next command change. It is not a CPI method that is delegated to a dedicated office or team to accomplish. Instead, AoP is a universal set of best practice standards that form the AFSC management system. In accordance with AFSCI60-101, AoP will be used to govern all AFSC processes.

1.1.2. For more than three decades the Air Force, as well as industries across the globe, have been in a continuous search for better ways to do business. There has been a constant stream of new concepts that have consumed the time and attention of the industrial world. Each passing year seemed to bring the next big thing that promised to transform the way we did business. Concepts such as Total Quality Management, Lean, ToC, 6 Sigma, as well as dozens of variations and combinations of these, have been at the forefront of every organization in the Air Force. Each of these brought great promises but equally large challenges. Every new initiative brought a new vocabulary and new tools that must be learned. With them also came a growing mountain of resistance to the next "flavor of the month."

1.1.3. When the AFSC stood up in July 2012, it was a collection of individual depots and supply chain pieces operating with individualized ideas that had been developed through 30 years of innovation initiatives. This merging of supply chain functions under one center presented the opportunity to standardize business practices and adopt guiding, operating principles that would become the basis of a new culture: the Art of the Possible. AoP is not a new initiative, but a universal management system that establishes a standardized set of operating principles for the AFSC. It takes the gold standard concepts that have been learned through 30 years of experience and combines them into one language and customizes them to the work that we do in the AFSC.

1.1.4. AoP is a constraint based management system where throughput is king. AoP is based on the concept of gaining an accurate understanding of the flow of work and then locating the constraint that interrupts the flow, preventing execution of the mission. Successful mission execution is defined by achieving the common goals of the organization to include speed, safety, quality, and cost effectiveness. AoP tools simplify the process so constraints can be identified. Once the constraint is identified, specific focusing steps are used to resolve the constraint with a continuous eye on the goals of the organization.

This handbook will systematically lead the reader through the role of leadership and how it equates to success. It will then provide detailed instruction of how to apply principles and tools in managing, sustaining and improving work processes.

## 1.2. Why AoP?

1.2.1. Part of the question of why we use AoP is answered in the previous section. It is designed to stabilize the continuous introduction of new concepts and buzz words. It creates a common language and a set of guiding principles that are backed by science to direct the way we approach work and improvement of that work. 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. Daily identification and elimination of process constraints with a focus on CPI is essential for success. AoP allows the user to simplify complex processes into visible and understandable content that can be monitored and communicated with others.

1.2.2. 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. The future readiness of our weapons systems are based on two realities: our ability to obtain more readiness with the same cost and/or our ability to maintain a level of readiness with less cost. Every person in the AFSC must be cost conscious and look for ways to reduce cost. AoP drives us to greater cost effectiveness through focusing on enhanced speed, safety and quality.

1.2.3. AoP accomplishes its objectives by increasing speed. But a word of caution, speed is not about working faster, cutting corners, or taking risks. The term speed in AoP lexicon, is meant to be synonymous with efficient processes that promote throughput paced to a road to…goal (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. To achieve speed we must quickly resolve issues that affect the critical path of the process to allow the product to continue moving forward unhindered.

1.2.4. Although AoP is a management system based on scientific principles, it is nothing without engaged leadership. AoP includes developing effective leadership skills. Leadership is the fuel that drives the machine. Leadership must be engaged in understanding the health of the system and relentlessly striving to make it better through obstacle elimination. Leaders must be proactive in working within and across organizational boundaries. All stakeholders must understand the goals and be engaged in meeting those goals. It is essential that all leaders at all levels share this responsibility. Chapter 2 will provide details of what engaged leaders should be and what they should do.

1.2.5. Perhaps the best way to illustrate why we use AoP is to look at a simple example.

1.2.5.1. Let’s consider Joe who has an automotive repair shop. Joe has only one employee, himself. Joe currently has two customers who want him to repair their cars. He has a labor standards book that shows how many hours it takes to make each repair. Joe uses those standards to give his customers their price. If Joe can get the work done in the length of time allotted he makes money. If he takes longer, he makes less or could even lose money. If he can get it done sooner than the standard, he has created extra capacity so he can get additional customers or perhaps hire an additional mechanic.

1.2.5.2. Since Joe is the only mechanic it is obvious that he cannot work on more than one thing at a time. But, to make his customers happy, he brings both cars into his shop and starts work on them. Joe spends 30 minutes finding all of his tools that were not put back up after the last day's work. He works on one car for a few minutes and then moves to the next car. The first car requires a water pump, so he runs to the parts store to get one. When he gets back, he puts the water pump on the table and starts to work on the second car. This car needs a temperature switch. He again runs to the parts store to get the switch. When he gets back, he begins to put the water pump on the first car. After he gets it installed, he realizes he needs a new belt, so back to the part store he goes. It does not take a scientist to realize that Joe has a problem. Joe ultimately takes two days to repair both cars. The standard says that he should have taken four hours each or eight hours total. Joe realizes that he cannot survive if he continues to work this way.

1.2.5.3. Joe decides to start using AoP to manage his work. He begins by setting a goal for himself. His road to… goal is to have every customer's car completed in 90% of the amount of time the labor standard says it should take. That is a pretty lofty goal considering it has taken 400% on the previous two cars (16hrs/4hrs). His next step is to map out the steps in the process so that he can better understand what is involved. Once he has the flow defined, he establishes some gates (see sect. 3.4) in the process so that he can have milestones to help him monitor and communicate his progress. Included in those gates are some triggers to let him know when he needs to have his parts available. He realizes that since he can only work on one car at a time, he will only bring one car into the shop at a time. This is a concept known as Work in Process (WIP) control.

1.2.5.4. Joe soon discovers there is a serious problem. He has a constraint. His constraint is himself. In order to meet his goal, he must be working on the car all of the allotted time. How can he get parts if he needs to be working on the car the whole time? To exploit his constraint (see sect.3.3.3.1.2) he must find a way to get his parts delivered. He contacts the parts store and shares what his goal is and works out an agreement that they will deliver his parts to him within 30 minutes of order (horizontal integration). In addition, Joe understands that in order to protect his available time for the next car there are some things that must be done before the next car can come into the shop. He sets up some release points that establish all of the things (like putting his tools in place) that must be done before the next car is ready to come into the shop.

1.2.5.5. Joe has just completed a very simple application of AoP. His first pass may not result in his 90% goal but he can then use the tactical management tools to help to continue moving toward his goal.

1.2.5.6. In Joe's example, the process is simple and the solutions may readily be seen without applying the AoP methods. However, in more complex processes it may not be as obvious or the WIP may not be as easily seen as a car in a shop. **This is the reason we use AoP. It allows us to simplify and create visibility in complex systems.** AoP gives us proven principles that allow us to identify our constraint and find ways to resolve it.

1.2.6. The result of effectively applying the AoP principles is enhanced speed or throughput. Throughput is king! If we can do work within the defined target, we make money. If we can do it quicker, we increase capacity. If we increase capacity, we can, in turn, bring in more work and make additional revenue. If it takes longer than the target, we lose money and the customer is not happy. It is really that simple. The challenge comes in the complexity of the process. AoP is designed to allow us to define complex systems in simple terms that can be analyzed, communicated, and improved.

### 1.3. The Cycle:

1.3.1. As discussed in section 1.1.4., AoP is the application of a repetitive cycle of activities focused on achieving the common goals of the organization. The cycle consists of:

- Mapping the flow and location of the WIP in the system.
- Identifying the constraint in the system.
- Resolving the constraint.

1.3.1.1. Mapping the flow of the process is essential to fully understand the work content and the sequence in which things should happen. When the process flow includes the WIP that is currently in the system, it identifies where there may be problems in the flow that could indicate a bottle neck. While simple systems like our previous garage example are easily seen, more complex systems can hide a multitude of problems and opportunities in the chaos. Until there is a graphical representation of process flow and complete understanding of where the WIP is located, complex systems will hide the constraint.

1.3.1.2. Once the process is mapped and the WIP is located in the system, the areas of underperformance to the target will normally lead you to the constraint. It may initially appear that the process has many constraints, but systematically analyzing the individual situations will identify the primary constraint which is where your time and resources should be directed.

1.3.1.3. When analysis has uncovered the likely culprit, a series of focusing steps should be used to resolve the constraint. The ToC methodology gives us a roadmap of how to attack and remove a constraint (see sect. 3.3.3.4).

### 1.4. Key Ingredients for Success:

1.4.1. For any endeavor, there are specific aspects that are required for success. AoP is no different. The organization will only be successful if it is dedicated to achieving these key ingredients at every level from the top down and from the bottom up. If any of these are missing or are only given lip service, the organization will fail to achieve the results that are possible. This handbook is designed to lead the reader through an understanding of the components of AoP and why they are important. It will also give sufficient detail of how to apply these components in your organization. The structure of the remaining chapters of this handbook will follow these key ingredients for success.

1.4.1.1. Fully Engaged Leadership: Leadership expert John Maxwell states that "everything rises and falls on leadership" (Maxwell, 2007)[1]. The success of any organization ultimately resides in the underlying culture of that organization. What is culture and where does it come from? Businessculture.org defines culture as "an evolving set of collective beliefs, values and attitudes" (Businessculture.org, 2019)[2], or put another way, "the way we do things around here." If we say that everything rises and falls on leadership, we understand that culture is created as a direct output of the behaviors, values and attitude of the leaders! There is a key word in this definition of culture and that word is evolving. That means the culture is ever changing based on the behaviors, values, and attitude of the leaders. Evolving culture requires constant engagement to keep it moving in the right direction. Nothing stays the same. If leaders are not intentionally engaged to better the organization, the order of nature tells us the culture will degrade. Anything left to itself will degrade over time. **Work is required just to maintain and even more work is required to improve.** Without fully engaged leaders, any implementation of AoP or any other good thing will never be sustained, much less improved. The AoP Leadership Model, as well as practical actions to be an effective leader will be fully explored in Chapter 2.

1.4.1.2. Management System Integration: The AFSC has developed a model of the AoP management system that is commonly referred to as the Radiator Chart. The Radiator Chart is a graphical representation of the path an organization should take to apply the principles and tools of AoP. The model also shows how those principles and tools are intertwined with leadership and organizational processes. Chapter 3 of this handbook will provide detailed instruction of how and why to apply the components of the Radiator Chart to fully integrate all aspects of the management system.

1.4.1.3. Managing the Machine: Chapter 4 will provide the day to day application of leadership in managing the machine. Managing the machine is the responsibility of the leader at all levels of the organization. It will require fully engaged leaders who possess both the will and the skill to execute the mission. It will require leaders that are committed to following standard work and reaching across organizational boundaries to engage stakeholders to reach maximum potential. This handbook will provide the necessary information for the leader to develop the skill to execute the mission through intentionally and "intensely" managing the AoP machine.

1.4.1.4. Drive for Excellence: We have already discussed how anything left to itself will degrade over time. Without a dedication to specific actions and behaviors even the best process will degrade over time. The dynamics of AFSC leadership assignments and rotations make that reality even more challenging. Sustainment and Maturity are elusive characteristics of even world class organizations. Without laser focused pursuit of excellence, we will neither sustain nor improve.

1.4.1.4.1. Sustainment: Historically, businesses across the globe indicate the average lifespan of new improvement initiatives is 18 months. There are numerous factors that influence this reality, but it is a clear indication there must be robust work standards in place for leaders in order to sustain any initiative. AoP, in part, was created to help address those tendencies to change over time. However, there must be much more attention to the daily activities and standard work of leaders at all levels to counter what psychologists call the chasm. The chasm is the point where initiatives reach a critical point where they need the intense focus of the organization to prevent falling into the black hole of previous "flavor of the month" efforts. Without the continuous attention and drive, the new way will revert to previous methods or possibly cascade into chaos. Section 5.1 will provide greater detail into what standards are needed and why.

1.4.1.4.2. Maturity: AFSC has developed a Maturity Matrix to help guide progression of the journey. Every organization within AFSC should take a proactive approach to the pursuit of excellence by building on the stages of maturity in each area of the management system. Compliance to just conducting a periodic self-assessment is not the goal, but rather an honest assessment of the status of the organizational culture. Answer the question of "is that truly the way we do things here?" If not, what is the next step to achieve it? Sect. 5.2 will give greater detail into use of the Maturity Matrix and the supporting behaviors.

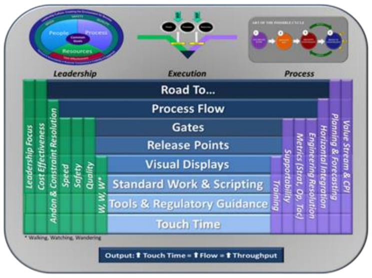
## Chapter 2

## ENGAGED LEADERSHIP

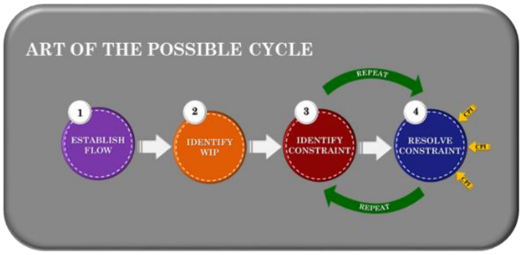
**2.1. Introduction:** In this chapter the necessity of leadership engagement in achieving AoP will be the centerpiece of our discussion. The leader is the foundation that sustainment and maturity are built upon. Leaders are the key to creating the environment for success. The AFSC leader is expected to **learn, understand, and use** AoP.

2.1.1. The Leadership Model is much more than a motivational poster to hang on the wall. It outlines the requirement of each leader to establish the common goals of their organization and realize success by synchronizing people, process and resources to achieve the mission. Every AFSC leader is expected to embrace and embody the character traits of a successful culture. They must possess the will and the skill to create accountability in themselves and in those they lead. Great leaders must be intentional about creating other leaders that also possess the will and the skill to carry on the mission.


2.1.2. The Radiator Chart will be discussed in greater detail in Chapter 3, but it is also key to the success of an AFSC leader. The components of the Radiator Chart are not just a checklist of tasks to be done, rather it allows the leader to understand their business in the greatest detail possible so they can design the best process possible. The Radiator Chart is a roadmap to removing variability and creating expectations. The expectations of the AoP machine create the source of accountability that must exist in each person. Each element of the Radiator Chart provides a building block of expectations for the workforce. The AFSC leader must understand every level of the AoP management system and seek to transfer that understanding to those they lead. The Radiator Chart provides a systematic application of AoP for the leader to follow to ensure everyone is aware of the daily expectations.




2.1.3. Lastly, the leader must be present in the daily activities of those they lead and be focused on the operation of the AoP machines within their organization. They must be constantly asking questions, assessing the success of their AoP machines, and looking for ways to improve them. They must be accountable to success and actively seek that same accountability of every other person that holds a stake in their success. Standard work for AoP management is essential and every leader at every level must be engaged in following it and assessing the effectiveness of it. Leaders must be good AoP coaches and constantly ask questions to learn and to create the thinking skills of others. Without engaged leaders, the ideals of AoP will not be achieved.



## 2.2. The Leadership Model:

2.2.1. AFSC has developed a model to help communicate the essentials a successful leader must understand and execute to achieve true AoP performance. The model represents what the culture of leadership should embody. The right leadership culture will produce an environment for success. Earlier we defined culture as: "an evolving set of collective beliefs, values and attitudes." The culture of an organization is formed by the behaviors, values, and attitudes of the leaders; the culture then influences the behaviors of each individual and the behavior of the individual determines the level of success of the mission. Leaders are the foundation for our success. Leaders are required to be fully engaged and create an environment that enables success. "Sustaining weapon system readiness to generate airpower for America" is AFSC's mission and overarching focus. Therefore, it is the duty of each leader at every level to embrace the Leadership Model and strive to understand and use it to accomplish the AFSC mission.

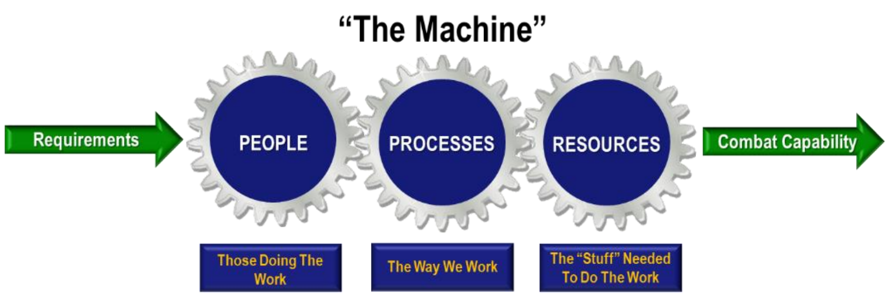
Successfully accomplishing our mission in a time of unprecedented challenges demands we achieve our full potential as we strive for AoP results. In an environment where organizations are struggling to survive, we are looking to thrive, lead, and exceed. We must provide greater military capability and 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, developing people, improving processes, and maximizing available resources. To achieve our full potential, we must start with common goals and then apply effective use of people, processes and resources to achieve quick, safe, high quality and cost-effective success of the mission. 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 AoP results. We must embrace a culture of performance that encompasses the individual, the agency, and the enterprise.

2.2.2. Leadership Model breakdown: The Leadership Model is built from the center out. The success of a leader begins with understanding and taking ownership of the common goals of the organization and then engaging the mechanisms of people, process and resources to successfully execute the mission. The mission is only executed successfully if the components of speed, safety, quality and cost effectiveness are maintained in concert with common goals. The end result of successful leadership is a culture where the mission is consistently executed and traits of Teamwork, accountability, respect, transparency, credibility and engagement are evident throughout the organization.

2.2.2.1. Common Goals: Common goals are the rallying point for everyone in AFSC. To drive behaviors that are focused on successfully executing the mission, these goals must be defined in each of the four components of a successful mission. Every organization must understand what their goals are in relation to speed (or throughput), safety, quality and cost effectiveness. If any of these components are not met, the mission is not fully successful. If the goal is not defined and understood, then success cannot be measured.

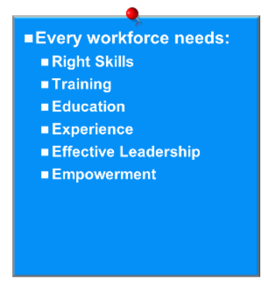

Common goals drive us to provide "best on the planet" sustainment support that is quick, safe, high quality, and at the least cost. It is imperative that both professional leaders and the professional workforce understand their specific work center goals. The role that each individual plays in meeting those goals must be clearly communicated. 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.

2.2.2.2. People, Processes, and Resources: Leaders are responsible for accomplishing a successful mission by operating a well-oiled machine of people, processes, and resources. Think of these three components as cogs in that machine (see fig. below). A leader is the operator that is constantly monitoring and adjusting the function of each cog to give the desired output; transforming a customer requirement into combat capability. The concepts of this machine will be developed in much greater detail throughout the remainder of this book.




Consider a builder who has a contract to build a house. He must first receive the requirement in a set of plans that define the details of the contract. Those plans will define the timeframe that is desired, the budget that is available and the quality of the workmanship and materials that are to be used. The builder then must secure the funding, hire the right people and determine the processes that will be used to safely achieve the desired quality. The builder then choreographs the people, processes and materials to produce a completed home for the customer within the agreed upon timeframe and budget. The same is true of any organization in the AFSC. People, processes and resources are the levers that the leader has in his arsenal to achieve the mission. The successful leader must choreograph the use of those levers to achieve the defined mission. The mission delivery must be quick, safe, of high quality and cost effective.

2.2.2.2.1. People: The strength of the AFSC lies in our dedicated, competent, and professional workforce. Without them nothing is accomplished. For this reason, leading people is an essential role of the manager in the AFSC.


2.2.2.2.1.1. A central role of a leader is to ensure those under their leadership are fully engaged in accomplishing the mission. Gallup defines engaged employees as: *those who are involved in, enthusiastic about and committed to their work and workplace*. Engaged employees do not happen by accident. The leader is responsible for communicating the goals to the workforce. Leaders must also define and communicate the role of every person in the accomplishment of those goals. The leader must provide ways for the individual process doer to understand their progress to achieving the target. The process doer needs to have the opportunity to develop skills to improve mastery of the job and to believe that they have autonomy in achieving their own career goals. The leader is responsible for empowering the employee to be successful by ensuring the needed processes and resources are in place.

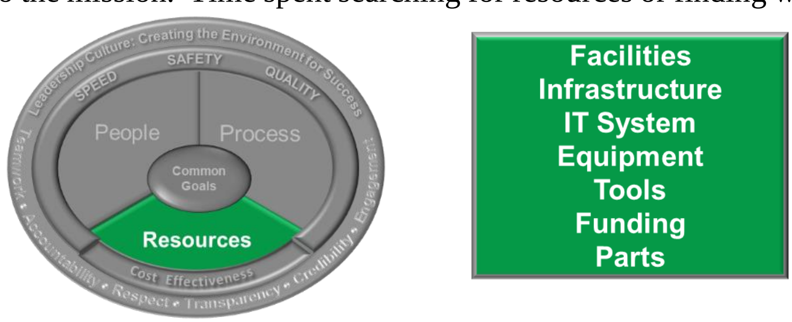
2.2.2.2.1.2. Availability of the correct number of people with the correct skill sets is elementary to success of the mission. The appropriate planning tools must be used to understand the requirement (see sect. 4.2.2.1.1.) and communicate the need through the chain of command. While complete control of this process does not always exist at every level, the leader is still responsible for actively participating in the process. They cannot just rely on the system to give them their fate.

2.2.2.2.2. Process**:** In order to have engaged employees, they must be empowered through robust processes to perform the work. Effective leaders ensure that all processes under their control or responsibility are current and complete. **Processes should be standardized to the greatest extent possible and have predictable and measurable results.** Leaders must engage direct reports in finding ways to improve their processes and be their champion to see those improvements acted upon. They must solicit the help of CPI teams or upper level leaders

where they do not have the expertise or authority to enact the improvements. Effective leaders will review the standard work of their direct reports often and observe it in action to ensure it is being followed. They must ensure all processes are viewed with the end in mind. The goal of every process is to provide value by meeting the customer requirement. If there are gaps or if the outcomes are not as expected, then the leader must recognize the constraint to reaching the goal and engage the AoP system to resolve the constraint.

2.2.2.2.2.1. Robust processes are not just a requirement for the direct report. Leaders must seek out and follow standard work for themselves. They must commit their actions to it. Where improvements are needed, they must engage the appropriate people to see that the improvements are implemented. Effective processes are not just checklists to be complied with, but are actions that will lead to success. Great leaders will be those that are seeking ways to maximize their time and the time of their employees, to creating value and achieving the common goals of the organization. Leader standard work must be living and vibrant. All processes must be reviewed continuously to ensure they are up-to-date, followed correctly, so that the processes are achieving the desired outcome.

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. To achieve true AoP, leaders must do everything possible to maximize the value of the effort that our people contribute to the mission. Time spent searching for resources or finding work arounds,




reduces speed, creates safety concerns, impacts quality, and adds to the cost of the product. In our industrial and support environment, we must ensure our workforce has the necessities to accomplish the mission safely and at the defined quality. However, the requirement for cost effectiveness may not allow for everything they desire.

2.2.2.3. Mission Execution (Speed, Safety, Quality, and Cost Effectiveness): The inner circle of the model represents the requisite components of successful mission execution. The end goal of every leader in the AFSC is mission execution. In the previous sections we discussed that success is accomplished through the application of people, processes, and resources. But how do you know when the mission is a success? The mission is only successful if the common goals in the areas of speed, safety, quality and cost effectiveness are each met. We will discuss each one briefly.


2.2.2.3.1. 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 issues to the process flow. Our workforce must feel constraint and issue elimination is a valued attribute. We must operate with the same sense of urgency to sustain critical path timelines as we do when facing mission failure. Speed is about generating throughput by application of proven scientific concepts to reduce flowtimes (see sect. 3.3.3.), Speed is enhanced when leadership embraces a safety culture, therefore, reducing injuries and damages. Speed is also achieved when attention to quality eliminates rework. Enhanced throughput will ultimately lead to improved cost effectiveness. Greater throughput will lead to better customer satisfaction, greater capacity, and enhanced support of the AFSC mission. Every day we interact with processes in our personal lives where we desire speed. We want to be served quickly and accurately. Whether it is in a drive through at the fast-food restaurant, in the waiting room of our doctor's office or in the checkout line at the grocery store, we all want to be served quickly. Our future choices are influenced by those experiences. The same is true with the AFSC. If we strive to create speed in everything we do, we will create value for every customer. Science confirms that speed is directly linked to safety, quality, and cost effectiveness. The combination cannot be separated.

2.2.2.3.2. Safety is the priority of everyone, especially the leader. Zero mishaps and zero near misses are a possibility and are to be a goal of every organization. We need to ensure everyone who comes to work for their shift goes home after their shift ready to give their best the next day. Safety is about application of the three machine components of people, processes, and resources by taking care of our people and ensuring their work environment and processes always keep them safe. A strong Voluntary Protection Program (VPP) is essential. Keeping every member of our team safe is critical to the success of our organization. Safety is also about protecting the speed, quality and cost effectiveness of our mission by protecting our equipment, facilities, and products from damage. Damage to facilities, equipment, and products are all detrimental to the mission.

2.2.2.3.3. 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. We build trust and confidence by doing our jobs right the first time. Ford Motor Company championed the mantra

"Quality is Job One." The idea this slogan represents is that production without quality is not production at all, but rather mission failure. Mistakes will happen, but we have the tools to identify and prevent repeats and take proactive steps to eliminate opportunities for error. Quality production leads to greater throughput, higher safety, and enhanced cost effectiveness. As AoP principles are applied, such as eliminating multi-tasking and reducing WIP, quality will improve.

2.2.2.3.4. Cost Effectiveness: The defense environment is changing, and a heightened awareness of cost is forcing Air Fore leadership to take an ever-mindful look into our spending. As Air Force leaders, this is a paradigm shift in the way we operate. Unparalleled declining budgets dictate the need to develop and implement cost effective solutions to reduce operating costs, specifically within AFSC. But, 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 then identify areas to reduce costs and eliminate wastes. The taxpayer and our warfighter customer are counting on us to provide available, affordable, and capable weapon systems on time and on cost. Our ability to reduce cost to sustain weapons systems will affect our ability to defend our nation. The most direct path to cost effectiveness is by intense focus on speed, safety and quality. Failure in any of these areas leads to higher costs and decreased readiness of the Air Force.

2.2.2.4. Leadership Culture: The outer ring of the AFSC Leadership Model represents the AFSC culture, along with the character traits essential for sustaining this culture. The focus on a culture of "leadership" is imperative because setting the stage for AoP results will come only through leadership focus. To put it simply: leadership matters. It is the tie that binds strategic planning with mission execution and makes it possible for the components and tenets of the Leadership Model to unite with the common goals that are needed for success. Creating the environment for success is the ultimate responsibility of leadership across the AFSC enterprise. The bottom line is that if there is teamwork, accountability, respect, transparency, credibility, and engagement, an environment for success will exist.


2.2.2.4.1. Teamwork: Cooperative and coordinated effort on the part of a group of persons acting together as a team in the interest of a common goal.

2.2.2.4.2. Accountability: Ownership of personal and organizational behavior.

2.2.2.4.3. Respect: Positive appreciation and consideration for the value of teammates demonstrated through specific actions and conduct indicative of holding them in high regard.

2.2.2.4.4. Transparency: Open and honest communication both horizontally and vertically.

2.2.2.4.5. Credibility: Believable and worthy of trust both individually and organizationally.

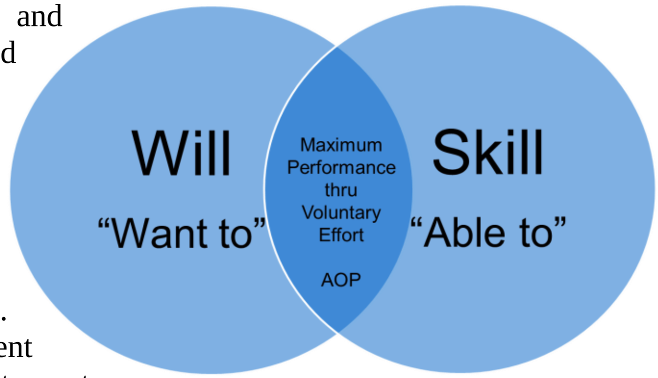
2.2.2.4.6. Engagement: Measure of an employee's emotional commitment to their leader, team, and mission.

**2.3. The Importance of Leadership:** In order to discuss the importance of leadership we need to take a deeper look at what leadership is. In this discussion we define leadership as: **the art of influencing an individual or group of people to exhibit actions and behaviors consistent with achieving common goals**. Leadership is not just a position, but the right behaviors guided by the proper mindset. The term "art" infers this is a skill that must be developed. It is much more than a paint by the numbers approach where a manager simply follows a checklist and magically becomes an effective leader. It takes application and practice as well as vision. The word "influencing" indicates the follower must be willfully doing the things that are needed rather than obeying through coercion. 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.)[3]. **Good leaders get others to do the right things the right way for the right reasons**.

In his book, *The 21 Irrefutable Laws of Leadership*, John Maxwell talks about the Law of the Inner Circle; "Nobody does anything great alone. A leader's potential is determined by those closest to him. What makes a difference is the leader's inner circle" (Maxwell, 2007 p127)[1]. A leader is only as successful as those they are leading. So how does a leader succeed? A leader must begin by managing the people, processes, and resources to achieve the mission. The leader must communicate the goals to the workforce and provide the processes and resources to empower them to accomplish the goals. However, only managing will not get you to AoP. To achieve the true extent of what is possible, people must be developed (see sect. 2.2.3.) and processes must be constantly improved to better utilize resources.

The term servant leader lends itself to best describe the attributes that a leader should have. "Traditional leadership generally involves the accumulation and exercise of power by one at the 'top of the pyramid,' servant leadership is different. The servant-leader shares power, puts the needs of others first and helps people develop and perform as highly as possible" (Greenleaf n.d.)[3]. The development of employees to leaders is essential in order to attain the AoP mindset. This development requires intentional focus. Effective leaders must be engaged. They must be engaged in managing the people, processes, and resources under their control and engaged in developing more leaders to enhance the mission. Engaged leadership is distinguished by an assertiveness to ask for what is needed for success rather than accepting status quo reactions that do not promote a "minutes matter" mentality. Engaged leadership has many forms. It includes setting expectations for support from enterprise partners by horizontally integrating the common goal across the command. It also includes setting expectations for the best effort from those within their own organizations. Leadership sets the tone for effective constraint identification, elevation, and resolution. This focus leads to the execution of efficient processes and achievement of the AoP mindset. Engaged leaders must continually motivate their organization to identify and resolve problems, in order to continue to move the mission forward.

2.3.1. Will and Skill: There are two things that must be in place for a person to sustain any behavior. First the person must have the "will" to do the thing in question. Will is the motivation or desire to accomplish an end result. Any artist or musician must begin with a motivation or desire to become good. If the motivation is strong enough, they will put in the time and effort to develop the second essential component of "skill." Sustainment of any behavior must ultimately include both. The below graphic illustrates the relationship of will and skill. A person may have skill alone, but without motivation they will not strive to use the skill. A person with desire but without skill will soon become frustrated and give up. True AoP comes at the intersection of the two. An engaged leader is that person who has the will and the skill to develop the will and skill in those they lead. For some the will comes naturally, but for most it must be encouraged and developed through relationships and intentional development. For the AFSC to achieve AoP, we must have an army of servant leaders who possess both the "will and the skill" to be engaged leaders, to be dedicated to influence those around them to be engaged employees and to develop others to become engaged leaders. Following a checklist of career development steps is helpful, but that alone does not create leaders. Rather, having a desire to see the organization and those around them, grow and develop skills needed to achieve the Common goals will lead to true AoP.




2.3.2. Accountability: While some individuals naturally have the intrinsic or internal desire to see and achieve the end state, and instinctively know what needs to be done to get there, the vast majority of the population do not fall into that category. Psychologists tell us less than 5% of the population are fortunate enough to have those intrinsic characteristics. So where does that leave the rest of us? The desire to achieve the end goal must come through accountability. The typical response to the word accountability is one of negative reinforcement (if someone does not do something then there are negative consequences to be faced). While that may get immediate results, it is not sustainable. It is not sustainable for one very natural reason. Those that must hand out the consequences do not like it any more than those receiving the consequences, so over time they will come to avoid it. Typically, when we complain about lack of accountability, we delegate that responsibility to someone else. We say things like "their supervisor does not hold them accountable" or "no one is ever held accountable." If we are applying the idea to the individual, we may say "they did not have integrity," meaning they did not hold themselves accountable. Seldom do we hear someone say, "I did not hold them accountable" or "I did not hold myself accountable," or "I lacked integrity." Effective accountability is the concept of creating sustainable accountability by requiring it in the right way. It is a way that is acceptable and sustainable to those on the receiving end as well as on the giving end. It is about voluntarily taking ownership of goals, people, processes, and resources and then expecting that same ownership by those under their leadership as well as their business partners.

2.3.2.1. Voluntary Accountability: In the book *"Propeller: Accelerating Change by Getting Accountability Right"* (Corbridge, et.al, 2019)[4], the authors give an exceptional definition of accountability. They propose that accountability is: "A personal choice to rise above one's circumstances and demonstrate the ownership necessary for achieving the desired result…" AoP gives the leader the framework to take ownership of achieving results. By taking ownership of the machine consisting of people, processes, and resources they will exhibit voluntary accountability that will lead to success.

2.3.2.1.1. To the Goals: Leaders must take ownership of the common goals of the organization. These goals include the Road to… stretch goals that will define their success as well as the daily working goals of speed, safety, quality and cost effectiveness. Leaders must understand what they are and how they apply to them and their areas of responsibility. Leaders must understand how to measure the goal and continuously know how they are performing to the goal (see sect. 4.2.1.2.2.1.). Successful leaders are constantly pursuing those goals and helping others around them to achieve the goals.

2.3.2.1.2. To the People: Leaders must be voluntarily accountable for their people and to their people. Leaders must know the burden for the level of engagement of those that work under their leadership resides with themselves. If the workforce is not engaged, it is the failure of the leader. The higher the level in the organization, the greater the responsibility. The leader must be accountable to their people by communicating the goals and ensuring that every person knows how they affect the goal, and how they are performing in regard to the goal. The leader is responsible for empowering their people by ensuring the processes and resources are supplied to make them successful in achieving their goals.

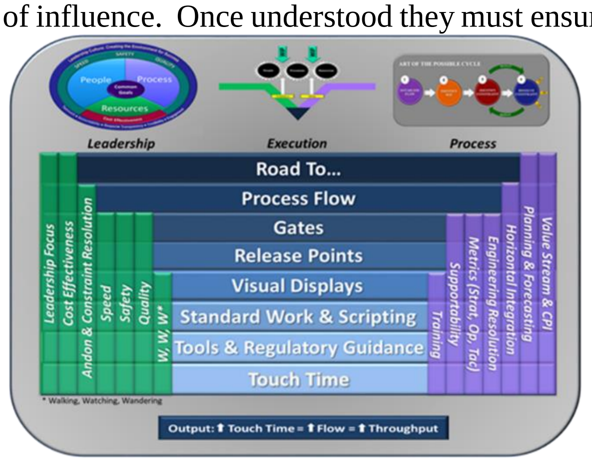
2.3.2.1.3. To the Process: The leader must take ownership of the processes that are needed to be successful. Those processes may be the standard processes of those doing the work, or it may pertain to the processes that they themselves should be following to protect the mission. Processes also include those that link the supporting partners to the mission. The bottom line is they must "own" the success or failure of processes under their control or influence. <u>It is never sufficient to assume that because processes have been documented they are being followed and are effective.</u> Every leader at every level must verify processes are in place, being followed and are achieving the desired outcome (see sect. 4.2.1.2.1.).

2.3.2.1.4. To the Resources: Leaders must do everything in their power to ensure that the resources needed are in place to support processes and people. They are responsible to make sure the proper planning is being accomplished and actions are taken to provide the resources. Are the processes robust that provide the resources? When they are not, what can be done to identify, communicate and elevate the shortcomings (see sect. 4.2.1.2.1.4.)?

2.3.3. Develop other Leaders: Earlier we discussed unique characteristics that some people have, allowing them to see what needs to be done, how to do it, and have the intrinsic drive to achieve it.  It only makes sense those people would make great leaders.  The problem is less than 5% of the population are born with those traits.  No organization can achieve AoP with only 5% of their leadership team having good leadership traits.  But there is a silver lining. While a few great leaders are born, most are developed.  People that find themselves in a place of leadership must understand they most likely are not one of the lucky 5% that inherently see and understand how to lead others.  Every leader must seek to become the best leader they can become.  Just as importantly, they must develop others to become good leaders as well.  To quote John Maxwell again, "If you develop yourself, you can experience personal success.  If you develop a team, your organization can experience growth.  If you develop leaders, your organization can achieve explosive growth" (Maxwell, 2007 p249)[1].  Explosive growth is what leads to world class performance and the essence of what an AoP mindset embodies.  In order to develop leaders a person must first develop themselves so that they can have the desire and understanding to develop others into leaders.  Developing leaders is much more than giving them assignments or sending them to class to build a resume.  It is about creating the thinking processes that enable them to become problem solvers.  It requires dedication and practice to become a developer.  Developing others is a choice. It is the ultimate application of voluntary accountability.  If a person is developing others, they are providing a legacy that will follow beyond themselves.  The following section will give practical information on how to use proven methods of leadership to not only achieve constraint resolution, but develop thinkers and leaders in the process.

**2.4. Application**:  Effective leadership boils down to two simple concepts:  1) set the expectations and 2) be present.  AoP gives the leader all the tools to understand the future and current state of the machine and communicate the associated expectations.  Being present is voluntarily taking accountability and actively demonstrating the behaviors that give results.

2.4.1. Set the Expectations:  To be successful, a leader must begin by setting expectations. They must fully understand what the expectations are for their organization and for their area of influence.  Once understood they must ensure the expectations and related goals and metrics are communicated to those they lead as well as all supporting organizations.  Without clear understanding of where the organization is going you are unlikely to get there.  The tools contained in AoP are all designed to simplify complex processes so they can be understood. The Radiator Chart, that will be discussed in detail later (See Chapter 3), provides the concepts needed to communicate the expectations.  These tools all come together to define the desired and current state so the leader can communicate what is required.




2.4.1.1. Road to Goal:  The Road to… Goal is the understanding of where the organization desires to be (see sect. 3.2.).  The leader must understand the goal and the subcomponent Common goals of speed, safety, quality, and cost.  Once these goals are fully understood the leader must adopt those as their own and communicate them to all concerned.

2.4.1.2. Process Flow: The process flow is the understanding of the work content involved in producing the product identified in the Road to… Goals (see sect. 3.3.). The work content can be translated into daily tasks that establish the work to be done.

2.4.1.3. Gates and Release Points: Gates are the buckets of work that add clarity to the work content. Gates are where the expectations of people, processes, and resources are defined to enable the leader to manage the machine. Each gate must have release points which are the checks and balances that ensure compliance to the process. Adherence to the release points helps establish the expectations for all stakeholders (see sect. 3.5.).

2.4.1.4. Visual Displays: Visual displays are designed to be a direct link to the workforce that establishes the daily/weekly expectations to reach the goal. Visual displays should allow the process doer to understand when they have had a "good day" (see sect. 3.6.).

2.4.1.5. Standard Work and Scripting: Standard work and scripting is the heart and soul of setting the expectations. The daily activities and actions that are required to produce output and to sustain the system are defined through documented procedures and processes (see Section 3.7.).

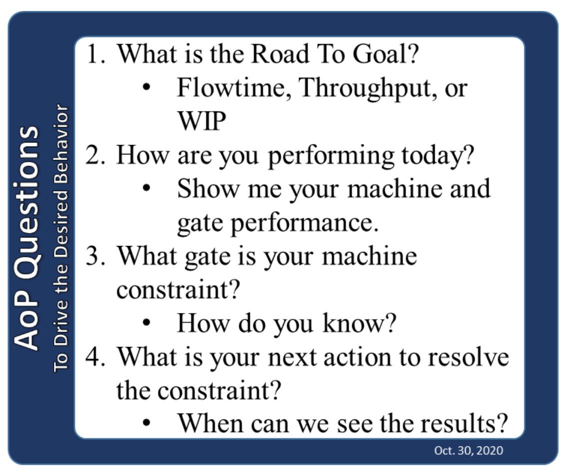
2.4.1.6. Touch Time: Touch time is all about showing the importance of maximizing each employee's available time to achieve the mission by staying on task. The daily expectations and sense of urgency are communicated to the workforce by the leader's dedication to removing barriers (see sect. 3.9.).

2.4.2. Be Present: Leadership is much more than telling people what needs to be done and then walking away and assuming that it will be done. Leaders not only set expectations, but they must validate the objective is understood, the people have the skills to accomplish the task, they have the resources needed and they have the level of engagement necessary to complete the task. This cannot be done from a distance. Leaders must observe the work (see sect. 4.2.2.2.5.) and be part of the daily improvement process. Sustainment only happens when leaders remain engaged in the process to include regular observation and feedback. To put it simply, being present is focused management of the work. Chapter 4 will give details about the specifics of managing the machine to produce the work. Other functions and programs may be used to assist in that process such as quality or safety inspections, but responsibility resides with the leader. There are many aspects to being present, but the bottom line is demonstrating accountability to the results through the machine of people, processes, and resources.

2.4.2.1. Value of Questions: A desired outcome of the leadership culture outlined in the Leadership Model is development of thinkers and problem solvers. This is the essence of developing new leaders and engaged employees. It is often said that if you give a man a fish you will feed him for a day but if you teach him to fish you will feed him for a lifetime. The same applies to AoP. If you give a person a solution you solve their problem for today, but if you teach a person to think you solve their problems for a lifetime. Like it or not, humans are inherently lazy. We will often default to asking for someone to give us a solution rather than seeking a solution for ourselves. The digital age that we live in today often exasperates this situation. On the other hand, mental engagement not only fuels creativity and solutions but it creates autonomy in the process. When people believe they have a part in the solution they will naturally have ownership in the success of the organization. **The greatest tool that we have to become true leaders is the art of asking questions.**

2.4.2.1.1. Ask the Right Questions: Leaders must become good coaches. Good coaches are able to ask the right questions to cause people to develop an understanding of the goals and develop solutions to the constraints. Even if we already know the answer, asking the question can have tremendous results. On the surface asking questions seems to be easy enough, after all we have done it from the time we were a small child. We ask questions like: How does that work? Why did you do that? What time is it? All of these questions have value, but most of the questions we ask are for our own benefit. We benefit because we grow in knowledge from the answer. While personal knowledge is a valuable side effect of asking questions, the questions of a great leader should be designed for the benefit of the person being asked. The questions should be designed to create understanding and stimulate creativity. The greatest benefit however, is when voluntary accountability is generated in the doer. When the doer develops an understanding of the goal, develops a plan to get there and takes personal ownership of accomplishing the plan. The following section is provided to give the leader a tool to guide discussions. We provide sample questions based on AoP principles that can be used to focus discussion on understanding the goals, understanding our current state, and creating solutions to barriers that prevent reaching the goals.

2.4.2.1.2. AoP Questions: AoP is designed to provide a framework to answer specific questions that will lead to understanding and behaviors necessary to achieve the mission. The leader can use the following questions to begin a conversation leading to better understanding of the AoP principles and perfecting the skills of using the tools. A standardized set of questions helps to avoid personality conflicts and the perception that people are being blamed. Additional questions are also provided to assist when a deeper understanding is needed based on the level of leadership or the current situation.




2.4.2.1.2.1. What is the Road to… Goal?

2.4.2.1.2.1.1. Where are you headed? What is your stretch goal?

2.4.2.1.2.1.2. What is the primary driver of the goal? (WIP, demand, capacity, output)

2.4.2.1.2.1.3. How is the goal driving you to future-state performance?

2.4.2.1.2.1.4. Are all enterprise stakeholders on board with the goal? Is there evidence to support this?

2.4.2.1.2.1.5. Has an Enterprise Value Stream Mapping event been accomplished?

2.4.2.1.2.1.6. Is the Road To…Goal more aggressive than the customer requirement?

2.4.2.1.3.1. **How is your machine performing today?**

2.4.2.1.3.1.1. What is your current state?

2.4.2.1.3.1.2. Can you show me your machine and performance of each gate?

2.4.2.1.3.1.3. What are the performance trends telling you? Can you show me?

2.4.2.1.3.1.4. Are there performance threats to the machine? Do you anticipate any?

2.4.2.1.3.1.5. Are enterprise stakeholders involved in issue resolution?

2.4.2.1.3.1.6. Is there an effective structure in place to provide horizontal integration where potential pitfalls are identified and solutions or workarounds are in place lead-time from impact?

2.4.2.1.4.1. What is your machine constraint?

2.4.2.1.4.1.1. How are you determining your machine constraint? (WIP, variance to target, queue, cost, quality, safety)

2.4.2.1.4.1.2. What data tells you about the primary contributors to the constraint?

2.4.2.1.5.1. What is your next step to resolve the constraint?

2.4.2.1.5.1.1. How are you using the Focusing Steps of ToC? (Leaders should be able to effectively verbalize the application of exploit, subordinate and expand/elevate) (see sect. 3.3.3.4.).

2.4.2.1.5.1.2. What CPI tools are you using to resolve the constraint? Are enterprise stakeholders involved and effectively contributing toward resolving the identified constraint or issue?

2.4.2.1.5.1.3. Are tactical issues identified and elevated? Are enterprise stakeholders involved in resolving tactical issues with the necessary urgency?

2.4.2.1.5.1.4. Do enterprise actions show value toward early strategic and tactical constraint/issue identification and resolution (effective horizontal integration)?

2.4.2.1.5.1.5. Is there evidence of horizontal integration from the way in which the enterprise views and focuses on accomplishing the process machine mission at the pace of the stated common goal(s)?

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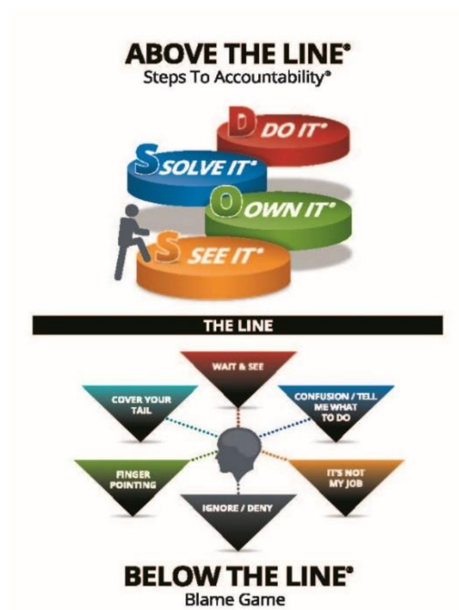
|---|
| IMPORTANT – The priority for improvement is always to be the constraint gate. Dedicated CPI resources should never be used to improve non-constraint gates if they can be used to resolve the constraint. However, the gate owner of non-constraint gates should always strive to improve their own gate and develop thinking skills of those under their leadership. |

2.4.2.2. Leader Standard Work: Leader standard work is the activities where the leader monitors, evaluates, and improves processes. It is also the most likely opportunity to apply coaching skills and develop People through asking questions. Leader standard work will be discussed in more detail in Chapter 3 and Chapter 5.

2.4.3. Stay Above the Line®: There is a fine line between voluntarily taking accountability for success and taking the role of victim. We all fall below that line at times and take on an attitude of victimization. In the areas below the line we blame others for our lack of success. As a victim we give the other party the ownership of our success or failure. It is undeniable that we must rely on others to execute our mission, but we should never allow the actions or inactions of others to solely define our mission's success or failure. In the book "Propeller," (Corbridge, et.al 2019)[4] the authors lay out a model of personal accountability that shows how we fall into the trap of victimization and the steps that must be taken to accept true accountability as a leader.



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2.4.3.1. Those who stay ***Above the Line***® **"*See It*®"** by using the AoP tools to find the constraints to achieving the goals (See Chapter 3). They **"*Own It*®"** by acknowledging the circumstances and accepting their responsibility as a leader to find a solution. Accountable leaders **"*Solve It*®"** by applying the focusing steps of ToC, using CPI, and pursuing horizontal integration to find rapid resolutions. Most importantly, above the line leaders **"*DO It*®"** by taking the actions necessary to see the solutions carried out to the end. If a supplier does not have a part that is needed, do we give up and wait until the part is available or do we pursue other avenues and alternatives and develop supplier relationships to ensure part availability in the future? If a form has not been completed properly, do we just send it back; or do we work with the customer to gather the information, understand why the information was not put in initially and then put processes in place to ensure complete information in the future? The idea of ***Above the Line***® mindset is well illustrated in the common phrase "be the change." The idea that is communicated here is each person should see where change is needed, take ownership of the situation, find a solution, and then make it happen. It is easy to see a problem. It takes an act of will to take ownership. After taking ownership, a person must put in the effort to create the environment to find a solution. Once a solution is defined then the real work starts. Make it happen! We will seldom have control over every ingredient needed to see a plan to completion. Therefore, leaders must intentionally work to create influence and use that influence to work with those below, above, and around them to see change through to completion.

2.4.3.2. Observe and Acknowledge ***Below the Line*®** Activities: Leaders must constantly be on guard to recognize when people are falling into the blame game. When they find themselves blaming others for problems, they must quickly take voluntary accountability of the situation and work to quickly resolve issues. More importantly, when they observe others exhibiting those behaviors, they must engage in asking questions to challenge behavior and reverse the mindset from victim to problem solver. These ***Below the Line*®** behaviors take many forms such as ignoring the problem, hoping it will go away, blaming others for not fulfilling their role, or possibly denying there is a problem. Many times, the blame game may not look like blame, it may look like confusion. Often people will say "just tell me what you want me to do." This indicates they have disconnected from the problem and are waiting for someone else to solve it. People will often create a narrative that buries their lack of ownership in a justification of the problem. Often the approach is to just wait and see if things will get better on their own. All of these behaviors do nothing to move the machine forward. They are an indication there is a lack of Accountability for resolving the constraint and an indication they are a victim of the system. It is the AFSC leader's responsibility to take ownership of the constraint and expect that ownership from everyone within their sphere of influence.

2.4.3.3. Horizontal Integration: Horizontal integration is the actions necessary to ensure every stakeholder is aligned properly to achieve the goal. This is quite possibly one of the most important components of successful mission execution. However, it is also one of the easiest areas to fall ***Below the Line*®**. When our suppliers or mission partners fail to deliver on our needs, it is easy to blame and make excuses. Will there be times when we cannot change the outcome? It is possible, but great leaders are those that identify the problem and take ownership to implement solutions to prevent constraints from reoccurring. Good leaders are those that are always asking themselves if they have done everything in their power to improve the situation to include involving enterprise partners in developing solutions. Great leaders are those that not only ask themselves that question but also create that expectation in everyone around them.

2.4.4. Follow Up: Persistent follow-up is the key to sustainment and long-term mission success. Without it, the best processes will deteriorate over time. Even worse, standard processes will not be fully implemented, or solutions realized. Leaders cannot assume everything is good just because there was an action plan or standard work implemented. Follow-up is the primary purpose of leader standard work (see sect. 5.1.2.). Leaders must observe and improve the work to ensure continued progress toward common goals. Consistent follow-up is the component to leadership that creates accountability, both in the leader and the follower. Many aspects of persistent follow up will be explored in Chapter 4 as we discuss managing the machine.

**2.5. Summary:** The success of every organization rises and falls in the level of engagement of its leaders. The leader is the foundation that sustainment and maturity are built upon. The AFSC leader must embrace the concepts of this chapter and must be intentional about application of the tools.

2.5.1. The Leadership Model was developed to provide leaders with a concise representation of the requirements that each leader must embody. Leaders must know and support the common goals of the organization and work diligently to synchronize people, processes, and resources to achieve the mission. Mission success must include a focus on not only speed but safety, quality, and cost effectiveness as well. Every AFSC leader is expected to embrace and embody the character traits of a successful culture. Leaders must be accountable to success and to those that create value in the machine. Great leaders also hold themselves accountable for creating other leaders that possess the will and the skill to carry on the mission and continue the fight.

2.5.2. The Radiator Chart is key to the success of an AFSC leader. The Radiator Chart establishes a roadmap of actions the successful leader can use to reduce variability and establish expectations for the workforce. The design of the AoP machine provides the expectations that is the focal point of accountability. Engaged leaders will leverage the Radiator Chart to ensure everyone is accountable to the daily expectations.

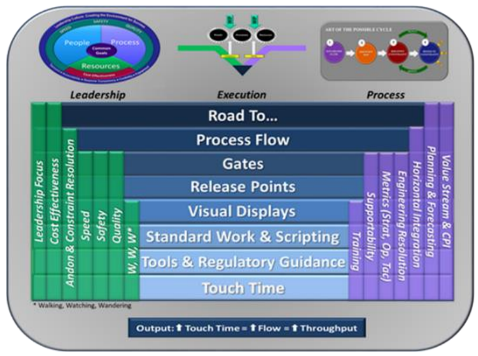
2.5.3. Lastly, the engaged leader must be intentional in the daily execution of the mission. They must be constantly asking questions, assessing the success of their AoP machines, and looking for ways to improve. Leaders must be accountable to success and actively seek accountability of every person that holds a stake in their success. Engaged leaders will seek to be good coaches and constantly ask questions to learn and to create the thinking skills of others. The success of the AFSC rises and falls with its leaders.

## Chapter 3

## MANAGEMENT SYSTEM INTEGRATION

**3.1 Management System Integration:** The AoP management system involves the relentless application of a series of essential concepts and tools integrated into a process machine of people, processes and resources. In Chapter 2 we discussed the indispensable role of the leader in achieving AoP, but every leader needs a game plan to ensure the organization moves forward in its pursuit of world class performance. The Radiator Chart was created in an effort to establish a singular sustainment "game plan" for the enterprise. Graphically represented in the figure below, the Radiator Chart is a single "game-plan" that represents the vision of how to set up and operate an AFSC process machine to achieve "world class" status and Art of the Possible results.

3.1.1. The Radiator Chart: 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 of the Radiator Chart are essential to a well-functioning AFSC process machine.




3.1.1.1. 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 elements 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 element of the chart to unite the vertical leadership and process components with those of the horizontal execution components in order to optimize the flow of products and services through the process machine.

3.1.1.2. At first glance, the Radiator Chart seems complex because it is representative of the complex business of providing readiness for the Air Force. The stacked and overlapping design signifies the interdependence of the chart elements, just like each AFSC organization is dependent on one another. **The length of each element signifies the ability and scope of influence each particular element 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. The following is a brief discussion of each component of the model. Detailed explanation of each of the horizontal execution elements will follow in the body of this chapter.

3.1.2. Horizontal Elements: There are eight horizontal elements that represent the execution elements or blueprint for setting up the machine. These are in order of strategic to tactical. Each of these will be discussed in greater detail in the following sections.

3.1.2.2. Road to… The Road to… element 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 Art of the Possible results. It includes the process of communicating the goal up, down, and across the enterprise and requires stakeholders' ownership and integration of the goal into their objectives. Most importantly, it must align directly and clearly to the customer's requirements and needs.

3.1.2.3 Process Flow: Process flow is a visual representation (or map) of the tasks required to complete the execution plan paced to the Road to… Goal. It defines the Critical Path or Critical Chain (see sect. 3.3.3.2.) and serves as the basis for creating standard work with repeatable, disciplined processes with predictable outcomes. The map of the process flow 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. Understanding and protecting the Critical Path or Critical Chain during execution is a foundational concept throughout AoP.

3.1.2.4. Gates: The term gates refers to the practice of breaking long flowtime production "machines" into "buckets" or discrete increments of work along the Critical Path/Chain with tangible ending points. Gates allow simplification of complex processes and projects into understandable and measurable buckets of work. The use of gates creates a disciplined monitoring system with a focus on Critical Path/Chain urgency. CPI efforts should be tied to improving the performance of under-performing gates.

3.1.2.5. Release Points: 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 the production flow. This includes the discipline to never release work from one gate to the next that is not supportable in respect to personnel and resources. Release points require business rules and checklists to create the culture and awareness that ensure specific actions are taken by critical points in the production process. Creating a culture that uses these rules to create the urgency necessary to elevate and resolve issues prior to the release point (and protect the Critical Path/Chain) is essential to creating the type of throughput that leads to attaining an Art of the Possible mindset.

3.1.2.6. Visual Displays**:** This is one of the elements that can answer "How do you know you're having a good day?" Visual Displays are located at the point of execution (where the process value is created) and provide information about the process or project. The information displayed should include measures of speed, safety, quality and Cost as well as the Critical Path execution of the project as applicable.

3.1.2.7. Standard Work and Scripting: Creating standard work processes through gated Scripting efforts allows Resources to be synchronized to the needs of the product/project during execution. The focus is to create repeatable processes, which lend themselves to total transparency and are designed to eliminate constraints and enable a predictive repetitive process.

3.1.2.8. Tools/Tech Data: Follows standard work and involves giving the process doer what they need. Addresses all tools required in all areas of the organization that surround and impact the process doer and the Critical Path. If this element is achieved properly the next element, touch time, will be positively affected.

3.1.2.9. Touch Time: Involves keeping hands on the product/project. Kitting of materials and information needed during execution is an example of touch time reduction efforts. Touch Time improvement is about finding anything that surrounds the process doer that can positively affect their output along the Critical Path.

3.1.3. Green Vertical Elements: These vertical elements 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 process and People. Leadership sets the tone for effective issue elevation and resolution that leads to the execution of efficient processes and achievement of AoP mindset by the organization.

3.1.3.1. Leadership Focus: Leadership is responsible for building the proper environment. Leadership must continually drive their organization to understand where the problems are and determine how to resolve those problems in order to move the organization forward. Leadership must be comfortable in the red – with a focus to stay on the Critical Path. Being comfortable in the red does not mean it is ok to miss customer requirements, but that targets should be set that continuously stretch the organization to improve. We should never be satisfied with status quo.

3.1.3.2. Cost Effectiveness: Means to measure the impact of processes and output. As your processes improve, output should increase without increasing Cost. Savings should start to be seen in the form of time and money.

3.1.3.3. Andon: Andon is a Japanese word meaning lantern. An Andon shines light on an issue and serves as notification of when a process is off the Critical Path/Chain. Refers to identifying, elevating, and resolving issues BEFORE they have a negative effect on the Critical Path/Chain of the project. Involves allowing our teammates to help us resolve issues.

3.1.3.4. Speed, Quality, and Safety: These are the three important touchstones of an AoP mindset. Speed –a focus to make our processes effective and efficient; meeting the needs of our customer in terms of products and services. Quality- because this is our reputation. Safety – because this is our responsibility to protect our people. Lead with safety and quality – speed will improve.

3.1.3.5. Walking, Watching, and Wandering (W3): Observing the 3 W's will aid in answering; "Why are people not on task?" W3 is about the leader being present in the daily activities and observing what is happening. Leader standard work, to be discussed in section 5.1.2, should encompass these behaviors. Daily leader engagement in W3 will help to reduce Walking, Watching and Wandering by the doer, which will, in turn, improve touch time and create a "Minutes Matter" mentality.

3.1.4. Purple Vertical Elements: These vertical elements are focused on the processes that enable success with the help of the enterprise. Leadership will utilize these "tools" to achieve the Art of the Possible mindset throughout their organization. These elements are not intended to just improve performance but will deliver sustained and enduring resiliency.

3.1.4.1. Value Stream and CPI: Data from established gates and release points gives you 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.

3.1.4.2. Planning/Forecasting: Good Planning translates into good Forecasts that allow the supply chain to strategically plan for the needs of the enterprise. Collaborative Planning with all functions in the supply chain (i.e. Systems Program Office (SPO), Facility Engineers, Maintenance Planning and Production, Defense Logistics Agency (DLA) etc.) translates into better Forecasts for requirements which allows a proactive approach to Supportability.

3.1.4.3. Horizontal Integration: Speaks to the increased "synergy" that is possible when all members of the process machine and enterprise adopt and work toward the Road to… Goal.

3.1.4.4. Engineering Resolution: A project or process is governed by rules, regulations and instructions that attempt to provide the necessary guidance for the process doer. Situations are often encountered that are not addressed in available guidance. When this occurs, it is essential the required guidance is given in a timely manner to keep the project moving forward on its Critical Path. Engineering must also implement a machine process to manage the variety of engineering work such as facility, equipment, process, software and other projects in order to provide speed and quality for the customer.

3.1.4.5. Metrics (Strat/Op/Tac): Metrics are the foundation of a data-driven organization and must be aligned from the strategic through the tactical levels. Metrics should be clear, actionable, and relate to Critical Path/Chain of the project/process. 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.

3.1.4.6. Supportability: Involves proactive actions to move Supportability efforts to strategic and operational 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.

3.1.4.7. Training: Focused on the process doer and linked to their tasks. Also involves Training process doers to elevate problems and needs because having what you need eliminates the push to "do what it takes."

3.1.5. Summary: The Execution Model horizontal elements represent the standard vision of how process machines across the AFSC will be setup to achieve "world-class" status. As such, these execution elements then become measurable expectations of sub organizations throughout the AFSC and the game-plan to achieving success within the AoP methodology. The remaining sections of this Chapter will give more detail about what each horizontal element represents and how it is applied.

| **Machine Setup** |
| --- |
| The first four elements of the radiator chart are focused on designing and setting up the Machine. Here the emphasis is on understanding the requirement and establishing the measures and controls required to manage the Machine. |


**3.2. Road to…Goals:** A journey of a thousand miles begins with the first step, however you must know where you are headed to begin moving in the right direction. There must be an understanding of what road the organization will be taking to the desired destination. 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 itself. External partners include the customer, suppliers and organizations that support the organization's processes. Understanding and ownership of the Road to…Goal will provide the motivation these external partners need to pace their processes to that of the organization. The next section will describe the elements of a good Road to…Goal and the necessity to effectively communicate the Road to…Goal throughout the enterprise.

3.2.1. Importance: Creating a Road to…Goal is the foundational step in the journey toward achieving an AoP mindset. Road to…Goals create a destination for the organization and its teammates enabling the path to be marked with the actions and milestones that will ultimately end in achieving Common goals. Without a Road to…Goal the organization will ultimately fall into complacency and be unprepared to respond to the needs of the future. The Road to… Goal is the vision that keeps an organization moving forward toward the Art of the Possible.

3.2.2. Criteria: The Road to…Goal must begin with the needs of the customer, but it must also include the future needs of the organization. The Road to…Goal must position both the customer and the organization for success years into the future.

3.2.2.1. The needs of the customer can include the pace of the process required to meet aircraft availability requirements, engine war readiness levels, inventory turns of high volume components or the given need date of an engineering or contract request. However, the current needs cannot be considered in isolation of future needs. The organization must always be looking forward to examine the landscape of future challenges. Is the fleet size decreasing or increasing? What is the impact of planned future modifications? Are there future changes that could impact the demand rate of any particular component?

3.2.2.2. Organizational needs should include understanding capacity requirements such as facility restrictions, future workload requirements, and the availability of personnel and equipment resources. Understanding whether capacity and resources are scarce or abundant should be reflected in the organization's Road to…Goal plan. The answer to questions such as these should constantly be examined and drive adjustments to the Road to…Goal accordingly.

3.2.2.3. All Road to…Goals should ultimately be expressed in terms of throughput or a metric that directly affects the throughput such as WIP or flowtime. The goal of every machine is to utilize the people, processes, and resources in order to transform a requirement into a product or service. That machine output is measured in terms of throughput. In section 3.3.3.1. we will discuss the effects of WIP and flowtime on throughput using Littles Law; therefore, WIP and flowtime may be a measure of the organization's Road to…Goal.

3.2.3. Common Goals vs. Road to…Goals:

3.2.3.1. As discussed in chapter 2, each leader is responsible for successfully achieving the mission. That mission is not successful unless the Common goals of speed, safety, quality and Cost Effectiveness are achieved. The Common goals are those of the organization and are essential for successful mission completion. Although the common goals are at the organizational level, they must be representative of the higher level Road to…Goal.

3.2.3.2. Road to…Goals are specific to the program or weapon system platform and must be supported by all partners regardless of organizational ties. For this reason, there must be complete Horizontal Integration across all organizations that have a role in supporting the program. The Road to…Goal should reach far beyond the present day requirement to position the organization and the customer for success. This vision of the Road to…Goal is what drives the AFSC to an AoP mindset reaching beyond just compliance to the mission.

3.2.4. Communication: Once the organization has established the Road to…Goals, they must communicate the goal, and the foundation behind the goal, to their enterprise partners. This communication is at the heart of the vertical leadership element of Horizontal Integration. **All stakeholders must be in agreement the Road to…Goal is in fact <u>the Goal</u> and all are committed to achieving it.** This concept is obvious for the common goals of performance to the mission, but less obvious for the Road to…Goal. External partners should always see the necessity to meet the common goals of the current workload, but they may not see urgency in supporting the future needs of an outside organization. However, intentional effort must be given to position both the internal and external partners to achieve future goals. Let's consider below a modern-day illustration to show the necessity of Road to…Goal communication.

The organization must communicate the "Why" behind their goals. Unless partners understand why a goal is important, how it is to be achieved, what their role is, and what is in it for them, we cannot expect them to be committed to helping our organization reach our Road to…Goal. The following sections will explore in further detail the communication requirements for the Road to…Goal.

> Consider an online retailer who currently offers 2-day shipping for their customers. They have successfully worked with their suppliers and partners to create a set of Common Goals and have established a Machine to achieve the Throughput of 2-day delivery for thousands of items. However, in order to continue movement toward their Road to…Goal of being the global online retailer of choice, they have a target of one day delivery. Performance is measured against this Road to…Goal, while continuing to execute the expected 2-day delivery. They must work with their suppliers and shipping partners to move the Machine toward one day delivery. Setting the aggressive goal, and measuring to it, allows the enterprise to reveal gaps and opportunities that would otherwise be unseen. Without intentional focus of the entire enterprise to the Road to…Goal, this result would never come to pass.

3.2.4.1. The 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 flow days, in turn, can increase the number of aircraft captured in a depot repair setting, increasing the pressure on the customer's aircraft availability goals. Changing workloads can also drive the need for improvement in administrative areas, such as the need for a more robust hiring process. A burning platform for an aggressive AoP Road to…Goal 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.

3.2.4.1.1. 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.

3.2.4.1.2. 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? On 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…Goal should consider all current and future customer requirements and reflect the customer's enterprise approach.

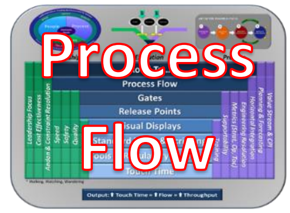
3.2.4.2. Process Machine: This communication tool is a visual representation of process flow and an understanding of the mathematical science behind the Road to…Goal. Process owners must understand the machine science and math will dictate the expected pace of the machine. The science and math used to create a particular process machine should be communicated so the enterprise understands the science and math behind the ultimate Road to...Goal. Unless all stakeholders are in agreement the process is realistic and necessary to meet the goal, they will not be engaged in protecting the flow of the machine. The tools used to develop the machine will be discussed in detail in section 3.3. (process flow).

3.2.4.3. Frame the Challenge: A challenging Road to…Goal will not be easy to achieve. Road to…Goals 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…Goal.

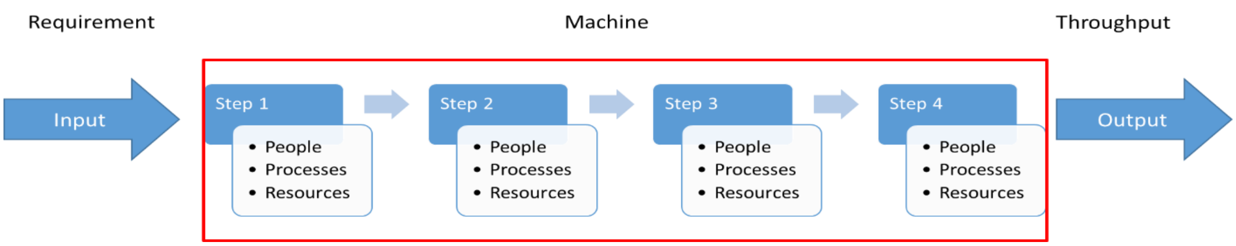
3.2.4.3.1. Framing the challenge should include comparing current flow day performance to the required future performance. Specifically state the reduction required so the enterprise understands the extent of the challenge. Later, as performance improves, and the organization moves closer to meeting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

3.2.4.3.2. 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…Goal.

3.2.4.4. Call for Action: Once the Road to…Goal has been established, and buy-in has been achieved, then the real work begins. The organization must have a call to action for all players. A strategy must be established on how the Road to…Goal will be measured, reviewed and enforced. This often proves to be the most challenging part of the process, especially when external organizations are involved. Accountability to the goal must be in place for all involved. Goals should be documented along with the roles of each stakeholder in accomplishing those goals. The communication plan and meeting battle rhythm of the enterprise should be leveraged to the maximum extent necessary to ensure progress to the Road to…Goal. Daily, weekly and monthly reviews should consistently drive actions to achieve the goal. Leaders at all levels must ensure a sense of urgency is communicated and embraced by all. Senior leaders must be engaged in asking the right questions to ensure issues and constraints are identified and are being resolved. It is ultimately the responsibility of upper level leaders to ensure all stakeholders are in agreement with Road to…Goals and are dedicated to achieve the common goals of speed, safety, quality and Cost Effectiveness of the machine.




**3.3. Process Flow:** Every organization produces their product or service through a system that utilizes people, processes, and resources to achieve their mission. In AoP terminology, we refer to this system as a machine. Every machine is made up of a sequence of tasks that must be completed on schedule in order to meet the delivery date. This may sound simple, but for complex machines, the work can quickly get out of hand and the machine will get off track. Requirements enter the machine and **FLOW** through that machine in a defined path with an expected outcome. Work is performed on the product or to the service creating value to the customer. Good flow of a machine consists of orderly and continuous movement of the work through a series of established steps to achieve a predictable output. The graphic below represents a simple machine.




Continuous, streamlined flow of work through the machine will result in maximized throughput. For the AFSC to achieve world class mission support we must have a mindset that **"throughput is King."** This does not mean we can ignore safety, quality and Cost or take shortcuts to achieve speed. Speed is achieved by improving processes, eliminating wait time, avoiding accidents, preventing quality misses, and avoiding rework. Improving the flow through the machine improves throughput and when done correctly, will also improve safety, quality and Cost Effectiveness.

3.3.1. Importance of Flow: When flow is streamlined and constraints to flow are removed, the result is greater throughput. With throughput comes reduced WIP, with reduced WIP comes reduced Resource requirements - less dock space, less shop space, less equipment, less labor Costs, and less supporting overhead. Throughput is King. Focusing on throughput and the supporting Metrics provides the mechanism that will lead to reduced Cost and increased capabilities for the Air Force. The most important result of flow is that it allows us to reach our Road to…Goals and position the customer and the organization for the future. Every AFSC organization should strive to create movement through the machine that is a steady and continuous stream. A flow that is free from disruptions, where value is being added to the product as it moves quickly through to output.

3.3.2. Disruption of Flow: All work is a process, and every process has flow. Unfortunately, there are inherent enemies that impact flow and thereby negatively impact the throughput of the organization. Each machine is a composite of numerous sub-processes; each with its own set of issues that potentially impact throughput. It is easy to imagine how issues can compound to drastically reduce the success of the organization. There is a common adage that states you cannot get better until you admit you have a problem. The same holds true to improving the throughput of the machine. We must understand these potential issues exist so we can recognize them and take the appropriate action to protect the flow of the machine. The enemy takes many forms and can attack from all directions. The following paragraphs will discuss some of the most prevalent issues that work together to reduce our success. Some are obvious, but some are not; however, if we acknowledge they all exist, we can better develop a plan for a counter attack.

3.3.2.1. Process Constraints: The first enemy to flow that we will discuss is that of process constraints. Imagine a garden hose with water flowing through it. The hose along with the faucet, and the spray attachment on the end of the hose constitute the machine. A single component of that machine is the determining factor that governs how much water can be delivered to the plant. That limiting factor is called the constraint. It may be the faucet, the size of the hose, a kink in the hose, or the nozzle size of the sprayer. In order to maximize the amount of water provided to the plant, the gardener must analyze the machine to determine what needs to be adjusted to provide more water. If the hose is kinked, opening the nozzle wider will not provide any improvement to the flow. The kink must be removed before flow will improve. This example may seem overly simple, but every machine has a constraint or weakest link that must be resolved before throughput will improve. The tools of AoP allow us to identify those constraints that disrupt the flow. In section 3.3.3.4. we will discuss a systematic methodology to resolve constraints, but the first step to improvement is understanding there is a constraint in every process/machine and we must find it before we can improve.

3.3.2.2. Parkinson's Law: Parkinson's Law states "the time it takes to perform a task will expand to fill the time allotted." If you give me two days, I will take two days, even if I could do it in a half day. We do not typically like to admit this enemy exists. No one wants to admit they waste time or drag out the work. This is a reality of human nature. We are all guilty, and it is a huge enemy to rapid and continuous flow through the machine.

3.3.2.3. Student's Syndrome: The Student Syndrome says typically there are other priorities, and the tasks wait to be started close to the deadline. This is another reality of human nature we may not like to admit, but is very real. To understand where the name comes from, think about the high school student that has an essay paper due on Friday. The student knows they can normally write an essay in about an hour. Throughout the week they have many activities going on, but they know they still have plenty of time to complete the paper. Finally, on Thursday night there is no more time available, so the student begins the paper.

3.3.2.4. Natural Causes: No system is perfect, and every system has some natural variation where things do not go as planned. For example, we may find more discrepancies during an inspection than what we expected, aging systems may break more than we thought, and troubleshooting or debugging may take longer than we thought. There may be funding shortfalls, we may not have sufficient information, or the right proficiency level to complete the work quickly. In other words, things will not go as planned (Murphy's Law exists) leading to delays. Delays in one part of the system can cascade and flow will get disrupted. These disruptions to flow are intrinsic to any system and are not easy to remove. Therefore, in any system some intrinsic disruptions to flow will cause some delays.

3.3.2.5. Self-Inflicted Causes: In real world systems, a majority of flow disruptions are due to the way we react to and manage the natural delays. When things get delayed and we start missing our commitments (deadlines), there is pressure to start or release work sooner in order to meet deadlines. When we induct work too early, or before it is supportable, work piles up in front of Resources resulting in wait times (i.e. the flow is getting blocked). As wait times increase, and things get delayed, more work becomes urgent; as a result there are priority conflicts and Resources start multi-tasking. As queues build up the same Resources (crews, teams, etc.) are now "spread thin" over more jobs. As a result, each job gets fewer Resources than needed and therefore takes longer. Also supporting personnel and partners are required to work more issues and deal with shifting priorities. The net impact of multi-tasking, priority conflicts and spreading thin is that it takes much longer than planned and the productivity of resources is low, which results in more delays than when we started. This vicious cycle of delays leads to more delays is shown below:


3.3.2.6. The pressure to induct work before it is supportable comes from an assumption that we must keep everyone actively employed, and "the sooner we start, the faster we can finish." Unfortunately, when there is limited resources or capacity, starting work sooner increases the amount of Work-in-Process (WIP) in the system. High WIP leads to long wait times, priority conflicts, firefighting, multitasking and spreading resources thin, which leads to increasing delays and poor throughput. WIP is the enemy of FLOW.

3.3.3. Dealing with Disruptions: When we consider all the inherent enemies to flow, it may seem like a no-win situation. Constraints and natural variations in work cause delays and our reactions cause even more delays. The good news is there are principles and actions that drastically improve flow and make positively managing the machine more achievable.

3.3.3.1. Define the Flow: In order to resolve a constraint, it must first be *visible*. In order to be visible, the flow must be well defined and documented. For complex machines, complete visibility can only be achieved through detailed mapping of the flow. Every aspect of the flow must be identified and thoroughly documented. Graphical displays should be created to allow quick communication of the flow and where WIP is located and how that compares to where it should be located (see sect. 3.3.3.3.1.1. on how to calculate target WIP). The following must be defined in order to adequately monitor the flow of work through the machine.

3.3.3.2. Work Sequence: The first step of defining the flow is to determine the sequence of work that must be performed. This is essential to ensure a quality product is produced and to understand the progress of the work through the machine. Work requirements must be reviewed, and the process doers and enablers must be engaged, to ensure the sequence of work is logical and efficient. The work sequence should be captured in the appropriate data systems and displayed graphically, as necessary, to communicate expectations (see sect. 3.6. for further information on visual displays).

3.3.3.2.1. Critical Path: The Critical Path is the sequence of dependent tasks that result in the longest flowtime from start to finish. The key is tasks on the Critical Path are *dependent*, meaning one must be completed before the next can begin. Understanding the Critical Path of the project allows the organization to prioritize which tasks require a greater focus. Those tasks falling along the Critical Path directly impact the ability of the organization to complete the project on time. If any task on the Critical Path is delayed or underperforming, it becomes an issue to on-time delivery. Management of flow using Critical Path is common for complex long duration machines with many tasks and resource requirements. Understanding and documenting the Critical Path should be accomplished using the following steps.

3.3.3.2.1.1. List the Steps: As with any methodology used to manage the flow of a machine, Critical Path begins with listing all tasks required to complete the requirement.

3.3.3.2.1.2. Estimate the Durations: The duration of every task should be identified and documented.

3.3.3.2.1.3. Capture Dependencies: All task dependencies should be captured and documented. Even if tasks are not on the Critical Path, determine where they will eventually impact the Critical Path if not completed. Resource requirements should not be considered when determining dependencies. In other words, the fact that Joe typically does two tasks on the Critical Path and he cannot work on one until he completes the first, does not create a process dependency. Dependencies should be defined by work sequence not individual skill sets. Proper analysis of tasks on the Critical Path can help identify tasks that can be performed concurrently and moved off the Critical Path. This can help to shorten the Critical Path and thereby increase throughput.

3.3.3.2.1.4. Determine the Milestones: Define the major phases of work, or major transition points in the flow. These may eventually become the criteria for the machine gate structure to be discussed in section 3.4.

3.3.3.2.1.5. Once all this information is collected and documented, the process flow can be observed, analyzed and managed to protect the delivery performance of the machine. When an issue is determined to be a constraint to the Critical Path, the ToC Focusing Steps discussed in section 3.3.3.4 should be used to resolve the constraint.

> **Note**
>
> The Critical Path can change during execution. If tasks that are not on the Critical Path get delayed, they may eventually impact the Critical Path. Resource availability may also impact the Critical Path causing it to be delayed.

3.3.3.2.2. Critical Chain: Another approach, known as Critical Chain Project Management (CCPM), is often applied to low volume, high touch-time project environments. Examples include aircraft depot maintenance that can be considered a project and involve many steps (pre-dock, disassemble, inspect, repair, assemble, rig etc.) with each step having significant variability.

3.3.3.2.2.1. Critical Chain methodology considers variability in the project tasks and resource dependencies. Under CCPM, projects are planned differently. Instead of trying to get a precise estimate for each task (which drives inflated estimates), CCPM asks people to plan each task aggressively, then add a buffer at the end of the project and at the end of concurrent (feeder) paths. Building a project this way allows us to create an aggressive plan with explicit buffers.

3.3.3.2.2.2. CCPM also operates differently during execution. Tasks are full kitted, and resource loaded. People are NOT asked for completion dates; instead, they are asked to complete the job as fast as possible without compromising quality and safety, and report back once the task is complete. Then the next task will be assigned. Meanwhile, the next task in queue is prepared with a Full Kit. This allows the fastest and most efficient execution. At the end of each day, a rough estimate is given for the work remaining to examine how much of the buffer has been consumed. If too much buffer is consumed, the manager has to develop a buffer recovery plan. Instead of worrying about each task, the manager is focused on making decisions to recover the buffer. This is called Buffer Management.

3.3.3.2.2.3. The CCPM approach can be effective at addressing resource constraints and in countering some of the common enemies of flow such as Parkinson's Law and Student Syndrome.

3.3.3.3. Rules of Flow: In order to help address many of the common enemies of flow, a set of principles and actions have been established. These principles are referred to as the Rules of Flow. If these principles are followed closely it will greatly enhance the organization's opportunity for success.

3.3.3.3.1. WIP Control: Hopefully, by now, you have noticed the theme of WIP control running through the discussion of flow. It bears repeating *excessive* WIP is the enemy of flow. WIP leads to priority conflicts, resource depletion, multi-tasking, long wait times, firefighting, and overall poor throughput. Healthy machines must define the correct amount of WIP that should be in the system, and determine where that WIP should be located. In section. 3.4, we will discuss the formation of gates, and WIP control in those gates, but for now, just consider those gates a subset of the overall flow of the machine. The same rules for WIP will apply.

3.3.3.3.1.1. Little's Law: In order to control WIP there must first be an understanding of what the correct amount of WIP should be. For simple processes that may be an intuitive solution, but for more complex process machines one must grasp the concept of Little's Law before the methodology behind WIP calculation 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.

3.3.3.3.1.1.1. Why is Little's Law important? It is the basis for distributing WIP and setting target days throughout the process machine with an even flow from induction to output. 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 rate of output of a process machine expressed in units per time (for example units per month). 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. The equation can also be expressed in terms of the desired target as shown below:

WIP = Throughput x Flowtime.

Throughput is the required rate of output of a process Machine expressed in units per time (for example units per month). 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.

$$WIP = TP \; x \; FT \qquad TP = \frac{WIP}{FT} \qquad FT = \frac{WIP}{TP}$$

3.3.3.3.1.1.2. 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, or both. For the purposes of an AFSC process machine, we will modify Little's Law to include the concept of takt time.

3.3.3.3.1.1.3. 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…Goal. For example, a takt time of 10 days means the process machine must produce one unit every 10 days. Mathematically, it is the reciprocal of throughput as defined above. Takt time is determined by dividing the available time (AT) by the required output (RO) in that amount of time (expressed in units of time).

$$\boxed{Takt\ Time = \frac{AT}{RO}}$$

3.3.3.3.1.1.4. 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

$$37units/365days = \ 0.1\ units/day$$

The takt time would be 365 days divided by 37 units which equal to a takt time of 10 days.

$$365days/37units = 10\ days/unit$$

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) with a demand of 30 patients per day. The takt time is then calculated:

$$600min/30patients = 20\ min/patient$$

In other words, the doctor cannot average more than 20 minutes with each patient to meet the requirement of treating 30 patients per day. The AFSC modified version of Little's Law then becomes:

$$\boxed{Flowtime = WIP\ x\ Takt\ time}$$

3.3.3.3.1.1.5. When designing a process machine, two of the three variables in Little's Law must be defined. As an example let's assume there is a Road to…Goal for a process machine to produce 64 aircraft per year with a limited WIP of only 23 aircraft. The production output requirement of 64 aircraft per year is defined by the future state customer requirement. The WIP target is defined by a) the customer (in this case the Aircraft Availability requirement) or b) an internal goal to reduce Cost and create capacity. The takt time is calculated by dividing days available by the required output in that available time.

$$365\ days \div 64\ units\ = 5.7\frac{days}{unit} = Takt\ Time$$

Every 5.7 days this machine must output an aircraft. Flowtime then equals WIP x takt time.

$$23\ units\ x\ 5.7\frac{days}{unit} = 131\ days$$

This process machine must perform at a speed (flowtime) of 131 days to output 64 aircraft per year, while maintaining a total WIP of only 23 aircraft.

| Available Time (Days) | Required Output | Takt (Days) | | |
|---|---|---|---|---|
| 365 | 64 | 5.7 | 23 | WIP |
| | Req'd Flowtime (Days) | | 131 | Cal. Days |

Caution:

Application of Little's Law does not have a cause and effect relationship to Process performance. It is only a mathematical equation that shows the relationship of the variables in a steady state process. It provides the basis to calculate the foundational levels for the process Machine and expresses the mathematical representation of the Road to…Goal. Progress toward the Road to…Goal is measured against this calculated target.

3.3.3.3.1.1.6. Through the above example you can see how the parameters of the process machine are designed based on a future state Road to…Goal. The resulting flowtime target is now understood and the organization must do everything possible to achieve improvements in the process to achieve that goal.

3.3.3.3.1.1.7. 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 the physical space 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.

3.3.3.3.2. Release Only Supportable Work: The Release Control element of Rules of Flow communicates the discipline to only start work when it is fully supportable. Release Control, as discussed here, is the "leadership resolve" to follow the criteria and demand discipline to the concept. Release Control is focused on ensuring the process is fully supportable, and everything needed for work is available before being released to the doer. For a production process, this means all skills, parts, tools, materials and tech data are on hand, or there is high confidence it will be available prior to the need date. For an administrative process, this may mean all data is complete and all funding is available. AFSC machines having everything fully supportable with adequate personnel (with right proficiency levels & skills) parts, tools, equipment, work documents, troubleshooting tech data etc. before starting work on the job can significantly reduce flowtime. Full Supportability is a key enabler of low WIP. Once we control WIP, it is important to release work only when fully supportable. Complete Supportability provides everything needed at the point of execution/use, generating one overall start action and one stop action; thus, eliminating multiple starts and stops to gather parts and tools.

Tax Example

When completing tax returns it is more beneficial to gather all the information needed before beginning. The taxes cannot be completed until all the information is available. It may seem beneficial to begin the filing process prior to receiving all the pertinent documents such as W-2s, Mortgage interest reports or donation receipts. This requires certain steps to be skipped and increases the likelihood of omissions or errors. In the end, the return cannot be submitted until all documentation is available and all steps completed. Having all the needed documentation in hand reduces the time required to complete the process, improves Quality, and reduces frustration.

DIY Example

Imagine starting a do-it-yourself home improvement project. Is it better to have all the tools, parts and material on hand before you start, or would you prefer to make multiple trips to the home improvement store after you begin? Extra trips have a significant impact on the flowtime of the project. On the other hand, having everything ready before starting the job enables us to finish the job quicker with better Quality and much less frustration.

3.3.3.3.3. Release of Work to a Synchronized Plan: When tasks are fully supportable, and have passed all of the business rules for Release Control, they should be loaded with the appropriate personnel to accomplish the job as quickly as possible. The work should be assigned based on the daily scripted work plan and priorities. Following a disciplined flow of work will allow the synchronization of enterprise resources to execute the plan. All players in the process should be in tune with the daily plan and maximize utilization of resources to meet the expectations. Proper assignment of work minimizes multi-tasking and allows the doer to Focus and Finish the task before moving on to the next task. Not only does this enhance the speed of the machine, but it greatly enhances the quality of the product. The opportunity for quality escapes are minimized by eliminating starting and stopping and creating fewer handoffs.

3.3.3.3.4. Quick Issue Resolution: Quick issue resolution is foundational to the AoP management system. Without quick resolution of constraints and issues, the rest of the tools within AoP are meaningless. When issues arise that impact WIP levels, they must be dealt with quickly. When constraints affect the Supportability of the task, they must be resolved. If personnel issues prevent proper resource loading, then find ways to resolve the constraint. AoP is about using the tools to discover constraints and then resolving them quickly. Quick issue resolution is the desired outcome of the Leadership Model. It is the job of every leader at every level. Leaders and supervisors should make frequent contact with process doers throughout the day to identify issues and ensure prompt resolution. While leaders may use the resources available to them to resolve issues and constraints, they cannot just delegate the responsibility to others. If quick issue resolution is not carried out with a sense of urgency, the other components of the Rules of Flow are just irritations that stop the flow while we wait for things to get better. AoP is designed to uncover issues and constraints; however, failing to follow the Rules of Flow only hides issues and constraints and prevents them from being resolved. If we lower the water in a pond to find where the stumps are, it only makes sense to remove the stumps before we refill the pond. Those that observed the stumps may remember where they are, and be able to navigate around them, but everyone that comes behind will continue hitting the stumps.

Quick Issue Resolution is foundational to the AoP business model. Without quick resolution of constraints and issues, the rest of the tools within AoP are meaningless. It is the job of every leader at every level. If Quick Issue Resolution is not carried out with a sense of urgency, the other components of the Rules of Flow are just irritations that stop the flow while we wait for things to get better. In addition, WIP control DIRECTLY impacts Quick Issue Resolution. Lower WIP lowers the number of issues to be resolved making Quick Issue Resolution achievable

3.3.3.4. ToC Focusing Steps: In the book "The Goal" (Goldratt et.al. 1997)[5] the author lays out the foundation behind the ToC approach to process improvement and creation of flow. ToC establishes a series of Focusing Steps that are used to eliminate constraints to flow. These steps will apply to every process, both production and administrative. The premise of ToC is processes act much like a chain that is only as strong as their weakest link. The weakest link in any operation is described as the constraint, which prevents the output of the entire system from meeting the desired performance. The constraint is usually identified as the process or shop that has the most WIP queued upstream, or the most heavily loaded process or shop in the system. The utilization of ToC requires all CPI resources to be focused on the constraint. Just as opening the nozzle wider will not improve flow if the garden hose is kinked, CPI efforts that do not attack the constraint, will not improve the overall system performance, and could actually make the entire system perform less effectively. The five basic and sequential steps for proper application of ToC are described below.

3.3.3.4.1. 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 due to poor performance.

3.3.3.4.2. 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 3.3.3.1.4, Expand the constraint below). If People resources are the constraint, then having all parts, tools and materials available to maximize their touch-time on the process will create the most value for the customer.

3.3.3.4.3. 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. Support functions must also be subordinate to the constraint. Competing priorities must be resolved so supporting resources can devote time and energy to protecting and resolving the constraint. This is another area where Horizontal Integration is necessary so that all stakeholders have a clear understanding of the common goals.

3.3.3.4.4. Expand or Elevate the Constraint: Most constraints will be resolved by the time step three has been completed, but in some cases it may require elevation of the problem. Expansion of the constraint is elevating the output of the limiting process, Resource or shop until overall system performance can be met, or until another constraint 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.

3.3.3.4.5. 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) or it may be time to re-evaluate the Road to…Goal (see sect. 3.2.) for the future.

**NOTE:**

These five Focusing Steps are the foundation of a constraints-based management system. The application may be more direct in some Processes than in others, but they all use the same premise to approach flow:

1) Identify the constraint.

2) Exploit the constraint to get the most you can out of it.

3) Make all other Processes and Resources subordinate to the constraint.

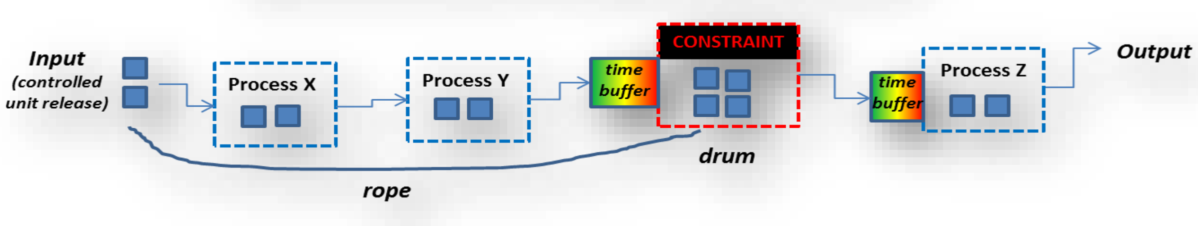
4) (If it hasn't been solved by that point) Find ways to Expand the capacity of the constraint.

5) When the constraint is resolved move on to the next constraint.

3.3.3.5. Release Control Methods: The following are common methods for managing the release of work into the process machine.

3.3.3.5.1. 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,

DBR Demonstrated in a Simple Production System



ensuring the constraint is not 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 (see sect. 3.3.3.3.1.1.) to determine the appropriate flowtime, WIP, and takt relationships, but the overall process machine is synchronized via the DBR system.

3.3.3.5.1.1. 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.

3.3.3.5.1.2. 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)

Laundry Example:

One of the simplest and most practical examples of DBR is laundry in a home setting. 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.

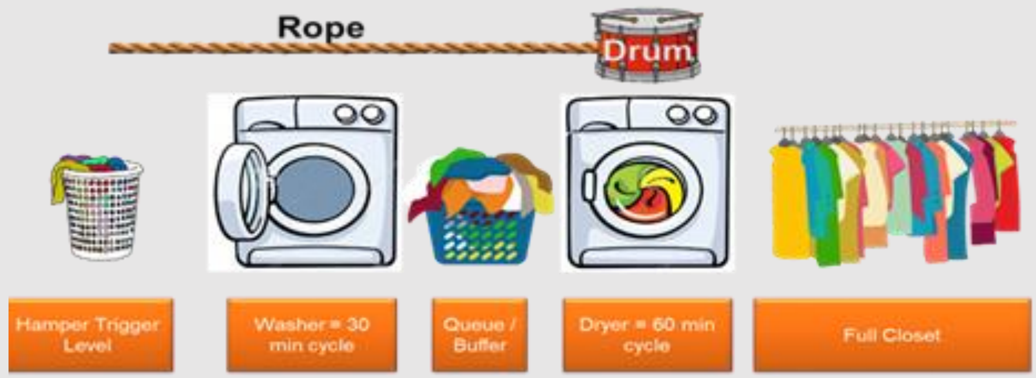
In this laundry example, individuals need a way to 1) prevent stock outs from occurring and 2) respond when a stock out is imminent in order to prevent the stock out from occurring. The first step is to examine and understand the process. In this case, dirty laundry is collected in the hamper. Items from the hamper 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.

The clothes in the hamper represents customer need. Once the clothes are placed in the hamper, they have been inducted into the laundry Machine and therefore become WIP.  There are only a limited number of clothes available so if WIP is high there are less clothes available in the closet. Reducing the WIP reduces the chances of a stock out of clothing, consequently forcing the firefighting mode.


The goal of AoP would be to reduce the WIP by adding process discipline and thereby provide better support the customer. In order to do this we apply the five ToC Focusing Steps discussed previously. The first 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 (the drum). In order to create the necessary flow through the process it is necessary to exploit the Constraint.

Laundry example continued

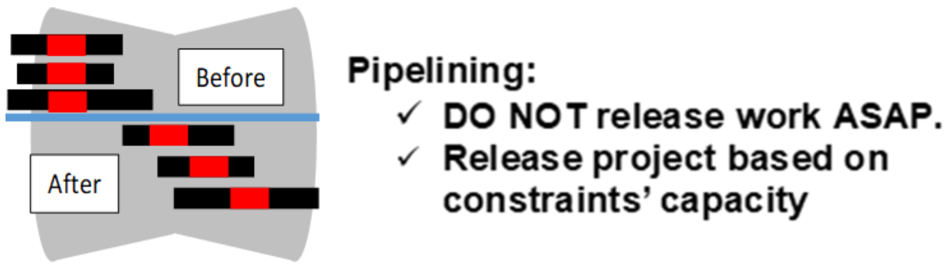
In order to provide clothes for the dryer the washer must operate, but it is subordinated to the dryer to the extent it only provides enough clothes to keep the dryer operating. Washing loads of clothes and piling clean, but wet, laundry in front of the dryer will result in clothes that are mildewed and in need of washing again (rework). Since the washer only takes 30 minutes to complete, it has excess capacity and will finish sooner than the dryer. This results in a buffer for the dryer. This is both a time buffer (it finishes 30 minutes ahead of the dryer) and a material buffer (clothes are ready to put in the dryer when needed).




In this case, the process discipline instilled by exploiting the constraint and subordinating other Processes and Resources to the dryer should eliminate 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 may be necessary to preclude stock outs! We should resist the tendency to purchase more clothes to solve the problem. Without Process discipline, more clothes would eventually lead to more WIP and eventually reoccurring stock outs and more firefighting.

3.3.3.5.2. Pipelining: Pipelining is similar to DBR in that the work is released based on the most limited resources or capacity of the constraint. However, Pipelining is typically applied to projects rather than piece work. The metering is like traffic lights releasing cars onto an interstate. Instead of the most limited resources being spread over multiple projects, the projects must be staggered so the most limited resources can complete a project as quickly as possible and move to the next. Other gates or process doers may even be idle because, as we know, the constraint or most limited Resources will determine the throughput of the machine, and the machine cannot go any faster than the constraint can produce. If Resources are idle because they are not part of the constraint, they should be used to make the work prior to the constraint fully supportable! As the Greek philosopher Aristotle (and our AoP Rule of Flow number two insinuates) said, “Well done is half begun!” These Resources, which might be considered idle, can actually help the organization make great progress on the projects.

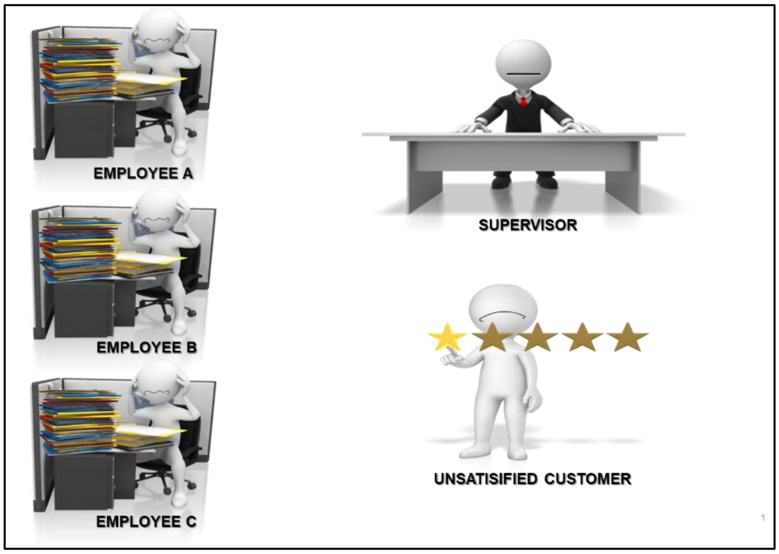
When multiple projects are being worked at one time, the flow of all projects can be pipelined, and the pipeline managed in accordance with machine WIP control rules. Pipelining is a highly effective work release and management tool for project environments.



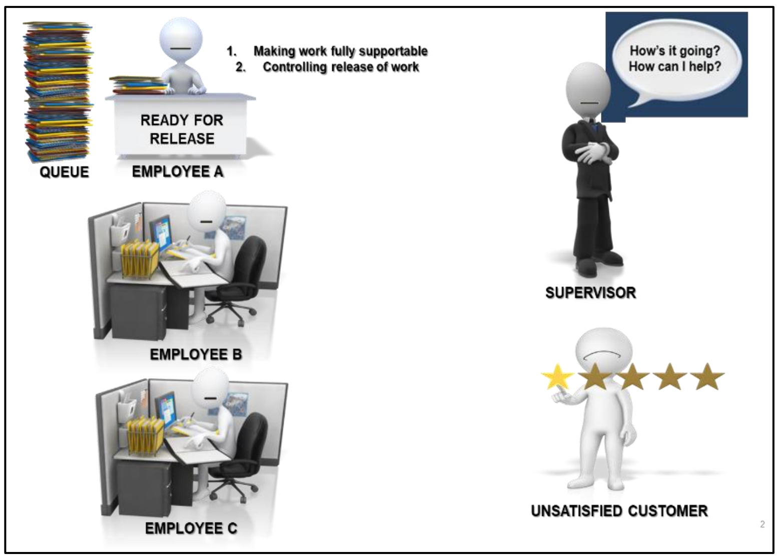

3.3.3.5.3. Focus and Finish (Simplified DBR): Focus and Finish is a means of controlling WIP to prevent process doers from inherently taking on more work than can be efficiently managed so projects can be completed in a timely fashion. Focus and Finish prevents inefficient multi-tasking from occurring 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.

3.3.3.5.3.1. In the Focus and Finish flow approach, all WIP is held in a queue and we assign only one to five projects at a time to each person. The bandwidth of the person is the constraint. Process doers should focus only on those projects released to them, and finish them, before we assign the next one out of the queue. The release criteria is the rope that subordinates the incoming work to the constraint. While the projects sit in queue, we can exploit the bandwidth of the worker by having an expert look at the projects, 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?). If queues are growing it may be necessary to expand or elevate the constraint. This approach is applicable to a wide range of processes. Any process assigned to individuals or small teams with relatively small number of tasks or short duration touch time can be managed by a Focus and Finish machine. The graphics below depict a Focus and Finish machine; before, during and after implementation.

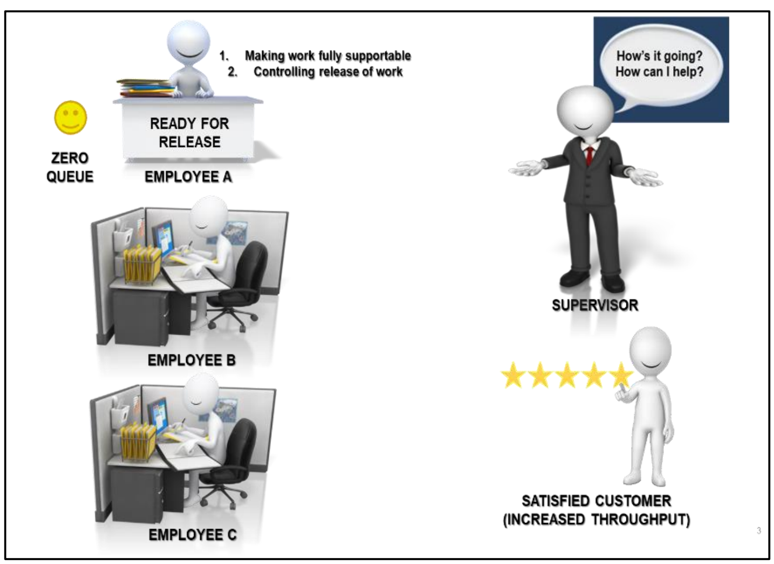
Before




During




After



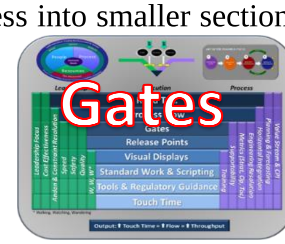
3.3.3.6. Development/Security/Operations (DevSecOps) is a technique designed to create rapid development and delivery of software specific projects by removing constraints or barriers between organizations that have traditionally been viewed as separate functions.

3.3.3.6.1. DevSecOps is AoP as it is Theory of Constraints-based and incorporates the tenants of AoP including Rules of Flow. DevSecOps is a software engineering culture and practice that aims at unifying software development (Dev) and software operation (Ops). Additionally, DevSecOps employs processes with robust security, authorization mechanisms, and continuous runtime monitoring of operational software. The main characteristic of the DevSecOps movement is to strongly advocate automation and monitoring at all steps of software construction, from integration, testing, releasing to deployment and infrastructure management.

3.3.3.6.2. Modern software development techniques employ DevSecOps processes and are focused on rapid frequent delivery of software to the user. DevSecOps takes an iterative and incremental approach to software development. Iterations are standard, fixed length time boxes, typically 2-4 weeks in length. DevSecOps teams iteratively execute the software development lifecycle within these time boxes. Increments consist of multiple iterations and can result in a potentially releasable product. DevSecOps development is often contrasted with traditional or waterfall development, where large projects are planned up front and executed against that plan. Delivering production capable code every iteration or increment requires the DevSecOps team to account for this accelerated pace.

3.3.3.6.3. DevSecOps teams conduct daily standup meetings where they perform tactical management of their work. DevSecOps teams conduct Wall Walk retrospective meetings, problem solving workshops, and innovations iterations to identify and resolve issues and operational constraints. DevSecOps aims at shorter development cycles, increased deployment frequency, and more dependable releases in close alignment with business objectives. Further, DevSecOps values frequent user feedback and engagement at every iteration. In addition to fostering shorter lead times, DevSecOps focuses on making work visible, limiting WIP, reducing batch sizes, reducing hand-offs between teams, and the identification and elimination of constraints and waste.

**3.4. Gates:** With long flowtime machines, it is critical to break the process into smaller sections or gates. This provides increased transparency into the performance of the machine, enables more timely issue identification-elevation-resolution, and ensures optimum performance of the overall machine. Gates create a common language to help communicate the status of the machine and issues that affect throughput to enterprise stakeholders.




3.4.1. Gating is the grouping of similar work within a process machine's overall flow. 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.

3.4.2. The application of Little's Law is just as critical to the design of these individual gates as it is to the overall process machine design. Let's look at the production machine that was discussed in section 3.3.3.3.1.1.5. concerning Little's Law. Here the machine is further broken down into gates.

| Available Time (Days) | Required Output | Takt (Days) | Gate 1 (Pre-dock) | Gate 2 (Inspect Dock) | Gate 3 (Structures) | Gate 4 (System Ops) | Gate 5 (Post Dock) | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|
| 365 | 64 | 5.7 | 2 | 3 | 10 | 3 | 5 | 23 | WIP |
| | Req'd Flowtime (Days): | | 11 | 17 | 57 | 17 | 29 | 131 | Cal Days |

3.4.3. In this example, the overall flowtime is broken down into five separate gates. Defining the WIP in each gate is an iterative process that will depend on the physical constraints of the system and/or the amount of work to be accomplished within each gate. In some cases, the WIP will be determined by constraints such as dock space, or machine availability. In other cases, the WIP may be calculated using Little's Law based on the targeted flowtime determined through process analysis. Keep in mind the gate flowtime for your future state machine may seem unattainable relative to current performance, but it is critical to properly pro-rate the required overall WIP across the entire machine. The defined WIP within the gates determines the required flowtime performance for that gate. As noted above, defining a WIP of 2 in the "Pre-Dock" gate leads to a required flowtime performance of 11.4 days (flowtime=WIP x takt or 2x5.7=11.4). Remember, the sum of the WIP in each gate cannot exceed the total WIP threshold of 23 in this example.

3.4.4. 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 handoffs 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 machine, but do not need to detail every sub-process or sub-task within the specific gates. It is also important to ensure the gates are not so long 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.

3.4.5. Below is an example of a machine with predefined WIP targets for each gate. Little's Law is used to determine the flowdays for each gate. Observe in the graphic how WIP and takt time are used to determine the flowday target.

**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 |

Note:

Process Machines with long flowtime present a unique challenge and may need to be broken down into smaller challenges or sub-Gates within each overall process Machine Gate.

3.4.6. The following is a gated machine example in an administrative area. The Safety Office typically processes 480 accident reports per year. AFI requires completion in 30 days. The team gave themselves a buffer of eight days and set an internal AoP Road to…Goal of 22 days. There are five gates in the investigation machine. The team determined how the 22 days would be broken down in each gate based on analysis of the process. Using Little's Law the WIP was calculated for each gate based on the target flowday goal.

| 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 |

3.4.7. Little's Law calculations often lead to WIP targets that are fractions. This raises the question of how WIP is handled when it is a fraction. If you round down, the flowday requirements will decrease, and when you round up, the flowday requirement will increase. Round up or down according to the mathematical data. In our example, Gate 1 has a WIP of 1.3. This means 30% of the time, the WIP will be above one so it makes sense to round down in this scenario. In our example, Gate 2 has a WIP of 7.9. This means 90% of the time, the WIP will be above seven so it makes sense to round up in this scenario.

3.4.8. 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. If you are not monitoring the system, you are failing.

Focus should be on the Processes in each gate, not the challenges of each unit of production (individual items should be monitored as part of the tactical management system). 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. Gated machines become the basis for capturing the Metrics that must be communicated "from the shop floor to the Chief's door."

**3.5. Release Points:** Release Points are well defined criteria and associated business rules that govern the boundaries established for the gates. These boundaries should not be abstract, but rather should be solid un-compromisable and documented rules. In section 3.3.3.3.2. we discussed the necessity of Release Control to create discipline in the machine flow. This section further reinforces that discipline through expanding the need for well-defined and documented process controls. It is about the corresponding criteria and business rules the organization's leaders must create to govern the decision making process. Having firm release points with associated business rules is key to maintaining the most efficient flow of product and projects moving through AoP machines. Release Points are the mechanism to create the process discipline necessary to see rapid improvement and world class performance. Process discipline within the gated process instills both the mindset and the resolve to not pass work and problems to later gates. 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.


3.5.1. Meeting structure should be established to support the use of release points. Leaders must dogmatically enforce release points and utilize the established meeting structure to provide the enforcement. Failure to adhere to defined release point criteria only hides issues and constraints and encourages workarounds and behaviors that are detrimental to machine performance.

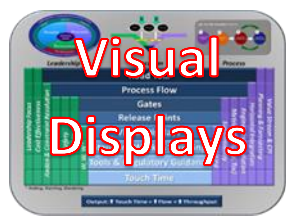
3.5.1.1. WIP Limits: In the previous section we discussed the perils of high WIP and how to use Little's Law to calculate what the WIP targets should be. Work should not be released into the machine, or from one gate to the next, if it will violate the WIP limits; thereby resulting in multi-tasking those resources.

3.5.1.2. Travel Work: Travel work is work that should have been completed in a prior gate but is allowed to travel to a subsequent gate. Work should not be traveled from one gate to the next. Effort should be made to minimize traveling work to avoid the negative impact to the process machine. Traveling work is typically allowed to accommodate a schedule or timeline, but in actuality, slows down the flow in subsequent phases of the Critical Path. Too much traveling work puts undo pressure on the subsequent gate and can be the primary cause of not completing the gate on time. It increases the WIP level for those downstream and leads to confusion. Traveling work causes multi-tasking and hides the visibility of the constraint.

3.5.2. Gates should be designed with concrete 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. 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.

3.5.3. 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.

3.5.4. 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 can 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.




**3.6. Visual Displays:** Information is power. The power comes from the ability to share information that leads to better effectiveness and success of the organization. In today's computer driven world, we have information at our fingertips. However, information that is not relevant or shared with the correct people is powerless. Visual displays are intended to be a practical method to communicate the relevant information needed by the process doer.

3.6.1. Visual displays are a graphic depiction of the process map or machine flow and include a visualization of information covering speed, safety, quality, and Cost Effectiveness as applicable in the work area. Visual displays should be process doer-centric; allowing everyone to understand their role, especially as it relates to the Critical Path/Chain of execution. In addition, displays identify execution along the Critical Path and pinpoint existing and/or emerging issues for resolution as well as allow transparency in the process. Visual displays should provide the process doer with the answer to the all-important question: **"Are you are having a good day?"** Visual displays should provide the process doer with the daily expectations as well as the level of effectiveness. If the process doer is not regularly reviewing the display, the displays are ineffective.

**Empower the Process Doer:**

The first four elements of the Radiator Chart were focused on defining the machine. We are now transitioning into the tactical execution portion of the management system. The last four elements are focused on empowering the process doer to be effective and efficient.

3.6.2. In order to be effective, communication has to fill a need. Information for the sake of information can overwhelm and lead to non-value-added activity. For the purpose of AoP, visual displays are intended to help the process doer, or the process support team, understand process status, the daily requirements, and performance to those requirements. Visual displays also provide information to help managers and senior leaders understand the overarching process status. Effective shop floor communication is most effectively accomplished via visual displays located in the work area, while dashboard type documents are effective to communicate overarching information to managers and senior leaders.

3.6.3. Some basic elements that should 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 more effective information delivery. Information must be accurate in order to be useful.

3.6.4. AFSC leaders should continuously evaluate the visual displays in use in their organization. Leaders should regularly visit the visual displays and assess their effectiveness. There are simple ways to understand if visual displays are effective rather than just a display to meet an inspection requirement or a talking point for tour groups. If a display is meeting the intent, it will meet the following expectations:

3.6.4.1. Process doers review it often and rely on it to understand the expectations of the day. A few questions to randomly selected personnel in the applicable area will reveal if visual displays are being used to govern daily expectations.

3.6.4.2. All information will be current and will readily communicate the status of the machine. Is it behind, on track or ahead of schedule? If this cannot be readily determined, the display is not being used as intended.

3.6.4.3. Are constraints identified? Visual displays should communicate any issues or machine constraints that are limiting performance. This information should include what the problem is, who is working it and when a solution is expected. Regular review by leadership will reveal if the correct sense of urgency exists to create an AoP mindset.

### 3.7. Standard Work and Scripting

3.7.1. Doer Standard Work: Normal daily operations should be controlled by standard work. In a production environment standard work takes the form of technical documentation such as Tech Orders (TOs), process Orders (POs), drawings, Work Control Documents (WCDs), etc. In an administrative environment standard work may be an AFI, checklists, desktop procedures or continuity documentation. The leader should always evaluate their processes through the eyes of a new employee. Is there a document that can be given to a new employee to perform the job? If not, there is an area of opportunity to improve the organization by developing standard work. Standard work creates flow in the process because it reduces the opportunity for quality misses or safety problems. It empowers the doer to perform the work, rather than searching for answers to their questions. Standard work is HOW we do the work. No employee should ever have to ask how to do the task. All value producing processes should have standard work documented and controlled.


3.7.2. Scripting: The process flow discussed in (section 3.3.) provides the overarching plan, and establishes task dependencies, in order to determine the Critical Path of the schedule. Scripting is the next iteration of process flow in that it looks at subsets of the flow and determines the sequence of events at a level more relative to the process doer. Scripting is the ORDER in which work is accomplished and communicates the sequence of events on a more finite level. A script is a visual representation of dependencies that communicate to the doer the agreed upon order of steps within a process. The process can be an entire gate, a specific repair task, or a complex portion of an administrative process.

3.7.2.1. 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 people, processes, and resources to be synchronized to the flow of work. The focus is to create repeatable processes in order to reveal constraints and enable a predicted, repeatable outcome. 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.

3.7.2.2. Synchronization can occur when discipline has been instilled with regard to following the sequence of steps. 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 and collaborative effort.

3.7.3. Leader Standard Work: Leader standard work is the most critical element of sustainment and maturity of a management system. History indicates the average lifespan of new business initiatives is only 18 months. While there are many contributing factors to this rapid death rate, most agree the primary reason is lack of leader standard work. Without care and feeding, a plant will die. Without nurturing, a young child will struggle to develop into the best person they can be. Without oversight and continuous improvement, the best management system will slowly cease to execute. Leader standard work is the methodology an organization must use to ensure the continued execution of all standard work, and the fuel for continuous improvement that will lead to maturity and world class performance.

3.7.3.1. Leaders must develop standard repeatable processes within their organization that are designed to assess and improve the process flow. Standard work for leaders must be incorporated into the daily battle rhythm. Without intentionally assessing and improving the machine, leaders will struggle to see sustainment of the machine flow and improvement will be almost impossible. First line leader's standard work will focus primarily on the accomplishment of the daily requirement and adherence to the standard work of the doer. This focus must include front line support functions. The standard work of more senior leaders must focus on adherence to, and effectiveness of, standard work of other leaders under their influence.


**3.8. Tools and Regulatory Guidance:** This section involves the availability of all approved Tools and guidance needed to accomplish the task. In order to achieve AoP results, the organization's leaders must ensure everything needed to accomplish the work is identified, and readily available. Streamlining access to the Resources needed to perform the required tasks improves throughput, increases quality, reduces the chances for injury and reduces the overall Cost of business. Process doer standard work (as discussed in section 3.7.1.) is included, but this also encompasses anything needed to protect the Critical Path/Chain. When the process doer is provided all the Tools and guidance needed to accomplish the task, he or she is able to stay on task, and not be distracted by having to search for what is needed. This will directly improve the amount of touch time a process doer has on the process at hand.


**3.9. Touch Time:** Touch time is the culmination of the application of all the previous levels of a mature machine. If you recall our discussion about the Focusing Steps of ToC in section 3.3.3.4., you will remember the second step is to exploit the constraint. The application of the touch time element in the Radiator Chart is the exploitation of our number one resource, people. The goal of AoP is to constantly improve the process flow by eliminating the constraint. We never want personnel to be the constraint because we have not done everything possible to empower the process doer to do the work.

3.9.1. We normally think of exploitation of people as a negative concept, but that is the opposite of the idea of increasing touch time. We do not want to exploit people by forcing them to work long hours or in harsh conditions. Neither is the goal to compel people to work harder and faster. These conditions ultimately lead to behaviors that are contrary to the organization, such as taking short cuts which lead to safety and quality failures. Exploiting the process doer is about removing the things that create waste in the process. It is about empowering the process doer to expend their energy on creating value for the customer rather than chasing parts or searching for information. Kitting has been shown to have tremendous positive impact on the touch time of the process doer. Just as the surgeon in the operating room has everything they need at their fingertips; we should strive to have everything the process doer needs to fulfill their task or mission at their fingertips. Maturity in the areas of visual displays, standard work, tools, materials, and documentation will increase the amount of touch time that is experienced.

3.9.2. CPI initiatives focused on the process will uncover opportunities for touch time improvements. Leaders who show a sense of urgency in empowering greater touch time will pass that same sense of urgency to process doers. This mindset will establish a culture of problems solvers and will result in an AoP mindset.

## Chapter 4

## MANAGE THE MACHINE

**4.1. Introduction:** In Chapter 2 we discussed the necessity of having a fully engaged leader. In Chapter 3 we discussed the elements of a well-designed machine and guidance for the leader to design that machine. Now, in Chapter 4 we will bring the two together to create a sustainable and effective management method. Creating a well-balanced and well-designed machine following the execution elements of Chapter 3 is essential, but just checking off the boxes of the Radiator Chart is not sufficient to achieve AoP performance. A fully engaged leader must embody the Leadership Model to be accountable to the machine and to achieving the goals of the organization. Continuous and intentional management of the process machine is necessary to keep the machine operating to its intended purposes.

4.1.1. What, How, and Why: In his book "*Start with Why,*" (Sinek, 2011)[6] Simon Sinek discusses a model he refers to as the Golden Circle. This model is intended to show the components of what defines an organization: what they do, how they do it, and why they do it. We will follow the structure of the model to define the machine management process. We will cover:

4.1.1.1. What is required to effectively manage a machine?

4.1.1.2. How to successfully manage the machine using the tools available,

4.1.1.3. And, most importantly, why it is vitally important leaders are fully engaged in managing their machine.

4.1.2. Management Levels: Within the construct of what, how, and why we will break each component into the levels of management that must exist. Machine management falls into one of three levels: strategic, operational, and tactical. Each level is essential for the leader to embrace.

4.1.2.1. Strategic: Manage the goals with a focus on the future.

4.1.2.2. Operational: Manage the processes with a focus on constraint Resolution.

4.1.2.3. Tactical: Manage the product, project, or service with a focus on throughput.

**4.2. Leader Expectations:** Every leader, at every level, must embrace the concepts of the Leadership Model to design a world-class machine and manage it each day. This section will address what leaders are to be concerned with at each level of machine management, how they can accomplish it using the tools they have available to them, and why they must make themselves accountable to the machine through intentional management.

4.2.1. What: What are the key elements for the successful management of the machine? This section will discuss the key things leaders must ensure are in place to implement, sustain, and improve AoP in their organizations.

4.2.1.1. Strategic: Strategic management is an intentional view of the current requirement with the future in mind. What are the current needs of the customer, as well as the organization? What are the future needs of the customer? What are the future workload requirements for the organization? What do we need to do to prepare ourselves for the future? What stakeholders need to be involved for future success?

4.2.1.1.1. Road to…Goal, Common Goals and Horizontal Integration: In Chapter 2, we discussed the role of the leader in identifying the common goals of the organization and ensuring those goals are clearly defined and communicated to every stakeholder in the machine. In Chapter 3, we expanded this idea to include a focus on the Road to…Goal that positions the organization for the future. To be successful, leaders must ensure the Road to…Goal and common goals are common to every stakeholder. We typically refer to this as horizontal integration. Horizontal integration of enterprise stakeholders is essential for success. If the mission partners do not share the same goals as the machine owner, they will never view meeting those goals as a top priority.

4.2.1.2. Operational: The goal of operational management is to ensure processes are in place and functioning to create throughput in the machine. Operational management should never focus on the status of individual products or service requirements but instead, focus on the health of the system and all supporting processes. Under operational management, we will discuss four key outcomes that are the conceptual foundation for success. Without an intentional focus on achieving these objectives, the goal of world-class performance will not be achieved. We will also discuss key focus areas embedded in a constraints-based management system such as AoP. Leaders at every level must be involved in operational management, but the percentage of time spent will vary based on the level of leadership. For more senior leaders, most of the daily focus will be primarily on operational management. By contrast, first-line supervisors should devote a smaller percentage of their time on operational management and a greater percentage to tactical management.

4.2.1.2.1. Key Objectives: There are four basic objectives that operational management must achieve. A healthy operational management system will have a management structure in place to ensure each of these objectives is met.

4.2.1.2.1.1. Ensure Processes Are in Place: The first focus of operational management is to ensure the machine is designed using the Radiator Chart format described in Chapter 3. Just as any quality product begins with sound design, AFSC machines must also begin with a solid design. However, beyond the deliverables of the Radiator Chart, all machines are made up of a multitude of supporting processes. It is the leader's responsibility to assess where process standards are needed, and take the appropriate actions to establish standard work. This must include doer standard work and standard work for leaders at all levels. Standard work was discussed in Chapter 3 as a primary requirement of machine design, but operational management goes beyond initial design to require the machine and supporting processes are continually evaluated for sufficiency. Some supporting processes may appear to be tactical, meaning execution of the process has a direct impact on the movement of product or services through the machine; however, oversight of those processes is an operational management requirement.

4.2.1.2.1.2. Ensure Processes Are Being Followed: It is also a primary responsibility of the leader to ensure all processes are being followed. Leaders must take personal accountability to observe processes in action and confirm the process is being executed according to the standard. Leaders must create an environment of accountability, so everyone knows the importance of following all standard work. Without the personal Accountability of the leader to the processes under their control, they cannot assume those under their leadership will be accountable. Without a system of checks and balances, processes will change over time, or will cease to be followed. Organizations should develop a method to objectively measure compliance with the standard processes in place.

4.2.1.2.1.3. Assess Processes for Effectiveness: Confirming standard work is in place and being followed is only the starting point of operational management. The leader must be accountable to the machine to identify constraints or areas where standard work is failing to give the expected outcome. A machine is a map of the workflow consisting of the interface of people, processes, and resources to the machine throughput. Any time the gears of the machine fail to work properly, effective operational management will identify the constraint and take decisive action to resolve it. This includes, not only gate constraints, but supportability issues that impact touch time of the doer.

4.2.1.2.1.4. Ensure Configuration Control That Supports Rapid Change: When constraints are identified, the leader must utilize the ToC Focusing Steps to rapidly resolve it. When the Focusing Steps identify the need to change the machine structure or process standards, leaders must be accountable to rapidly engage the configuration control process to effect that change. All standard work must have a sound configuration control policy established to prevent processes from changing over time, or being replaced by the next well-meaning leader. Without configuration control, standard work ceases to be standard. If we expect processes to be maintained, followed and improved, we must have a dynamic and responsive configuration control process focused on rapid improvement. The greatest impediment to an improvement mindset is delayed results and uncertainty in the outcome.

4.2.1.2.2. Key Focus Areas: The intent of operational management is monitoring, enforcing, and improving the machine. Certain principles are core to the AoP mindset, and as such must be embedded into the daily focus. Each of these focus areas is essential to achieve true AoP performance. Each area of focus should be addressed through the lens of the above outcomes. Every AFSC organization should have established processes and policies to ensure leaders understand, and are actively pursuing these principles.

4.2.1.2.2.1. Understand the Current Machine Performance: The overarching idea behind this principle is that every leader must know the true performance of their machine. They must know every meaningful aspect of performance such as:

- Where is the WIP?
- What are the trends?
- Is the machine meeting customer demand?
- Are the assets/projects on track to the Critical Path?
- Are there any issues threatening the Critical Path of machine assets/projects?
- Are we meeting the common goals of speed, safety, quality, and cost-effectiveness?
- Are we tracking to the Road to…Goal?

Every leader must ensure everyone in their sphere of influence has well-established processes in place to continually understand the performance of their machines.

4.2.1.2.2.2. Enforce the Rules of Flow: The first priority for operational management of the machine should be to implement and enforce the Rules of Flow. The Rules of Flow are effective measures to combat the common causes to disruption of flow. If these rules are followed closely, most problems with throughput will be resolved. The Rules of Flow attack common process constraints even if those constraints cannot be readily determined.

- Control WIP: Organization leaders must ensure solid processes and business rules are in place to control active machine WIP. Whether the machine is a gated process or a focus and finish machine, well-defined business rules must be in place to manage the active WIP to defined WIP targets. The organization must instill the discipline to utilize release points as a lever for controlling active WIP. As discussed in section 3.3.3.3. concerning Rules of Flow, WIP control is essential to minimize disruption to flow, minimize multitasking, and increase machine throughput.
- Release Only Supportable Work: AFSC leaders must make Release Control a priority in their operational management of AoP machines. As previously discussed under Rules of Flow, Release control is the discipline required to only begin fully supportable work. When work is fully supportable at the point of release, flow times are reduced, and multi-tasking is reduced, which facilitates higher touch time. Release control should demand the highest level of execution in processes that facilitate supportability of a product. Without effective Supportability processes, release control will only be a source of frustration as we wait and hope for things to get better. Another compelling benefit of release control is it requires a sense of urgency to resolve issues, do the necessary prep

work, and implement the measures for forward-looking supportability measures. Leaders must establish and enforce the necessary policies and processes to ensure compliance with business rules. When it becomes prudent to violate these rules, there should be checks and balances in place to guarantee informed decisions.

• Assign Work According to the Synchronized Plan: Once WIP is under control, and the work is known to be supportable, it now has to be assigned. But how the work is assigned is vitally important. It must be assigned based on a synchronized plan. What is a synchronized plan? First, a detailed plan for the short and long term must be in place. The plan will provide a proper work sequence and priorities for accomplishing the work. This plan is to be based on the method of management chosen for the work to include Critical Path, Critical Chain, Drum-Buffer-Rope, pipelining, or focus and finish. Once the plan is established, it must be synchronized. In other words, everyone that has a role in executing the plan must know the plan and be advised as it changes. Only then does it become a synchronized plan. In the AoP vernacular, we call these synchronized plans scripts. Scripts provide visibility of the collaborated, synchronized plan for a gate, or portion of the overall process. Now everyone will know when to provide information, parts, and services to the machine based on the scripted synchronized plan.

• Quick Issue Resolution: Leaders must ensure their organization has robust processes and procedures in place to facilitate the rapid resolution of issues affecting the movement of work through the machine. Issues, as discussed here, are different from constraints to the machine. Issues refer to situations that hinder movement of the work through the machine but are not systemic. Issues may be tactical because they affect the movement of individual products or services through the machine; however, the management of the processes to support issue resolution is operational. Organizations must ensure issue resolution processes are in place, are being used, involve enterprise stakeholders as appropriate, and ensure processes are effective. Quick issue resolution processes should include a defined mechanism to elevate problems when the existing processes consistently fail to support the work plan, or as necessary to resolve the problem.

4.2.1.2.2.3. Know the Constraint: When organizations strictly follow the Rules of Flow, many constraints will be resolved and throughput will increase. However, if a true constraint does exist, well defined processes following the Rules of Flow will help to uncover the process constraint. In more complex machines, the determination of the constraint gate is only the beginning of understanding the constraint. A constraint gate is not the actual constraint, but where the constraint lies. Analysis of the constraint cannot end there. A gate, or major phase of the machine, is a process in itself, and every process has a constraint. To resolve the constraint gate, the leader must be able to drill down to discover where the true constraint lies. The constraint gate is a process with process flow. Every process has a constraining resource that limits throughput. True constraint identification is essential for successful operational management leading to AoP results.

> *Note:*
>
> Constraints are systemic machine or process bottlenecks that hinder throughput. Constraints are not one-time issues that affect the movement of individual items.

4.2.1.2.2.4. Resolve the Constraint: Once the process owner has determined the True constraint, every effort must be made to quickly resolve it. CPI tools and process mapping events can be used to define the true constraint and actions to resolve it. Leaders must engage CPI resources and tools such as the Practical Problem Solving Method (PPSM) to exploit the constraint by offloading, finding parallel tasks, or removing waste that affects the constraint. If teams embrace the application of the ToC Focusing Steps, it will help focus the actions needed to rapidly create throughput. Exploitation of the constraint resource is always the first step. CPI actions focused on exploitation will have the most rapid return on investment. Typical problem solving often jumps to expanding the constraint rather than doing everything possible to increase touch time or machine run time. Leaders should challenge actions directed at expanding the constraint as the first step. Hiring more people or buying additional equipment are not actions to exploit the constraint but rather expand or elevate the constraint. The exploitation of the constraint is normally the easiest and quickest avenue to achieve throughput. But, perhaps, more importantly, it demands accountability of the process owner because those actions are normally within their control. To support the effective execution of the exploitation step, senior leaders must ensure policies support and empower the process owners to achieve those actions; otherwise, policies become the constraint to machine improvement. Nothing causes disengagement, and removes accountability quicker than policy roadblocks (actual or perceived) to otherwise good ideas.

4.2.1.3. Tactical: Tactical management is the execution of processes and standard work intended to affect the progress of individual items through the machine. The dictionary describes tactical as actions that happen at the battlefront. Tactical management is the actions that provide the interface between people, processes, and resources and the work that generates throughput of the machine. Leaders, process doers, and support function personnel must strive to faithfully execute the processes that have been designed to facilitate the daily performance of work. Process control should be considered part of the operational management system, but the execution of those processes is tactical.

4.2.1.3.1. Key Objective: The key objective of tactical management is rapidly moving units of work through the machine to achieve throughput targets. Although throughput is the objective of tactical management, the common goals of safety, quality, and cost effectiveness can never be ignored because each is critical to successful mission execution. Failure to achieve safety, quality, and cost goals equate to mission failure.

4.2.1.3.2. Key Focus Areas: Just as with operational management, there are key focus areas organizations must ensure are consistently executed to achieve the intended objective. If daily attention is given in these areas, tactical execution will be successful. In essence, tactical management is setting the expectation through work assignments and then providing the process doer what is needed to do the work efficiently.

- Supportability of the Work: Supportability refers to ensuring the process doer has everything needed to perform the task before, or at, the time it is started. In production environments, numerous processes are designed to make every task supportable. Without faithful execution of these processes, the flow of work will stumble and throughput will suffer. Tactical management entails the strict execution of these processes to ensure the process doer has what is needed, when it is needed at the point of execution. Supportability processes cover numerous functional areas and skillsets; therefore, high levels of collaboration are essential for success.

- Assignment of Daily Work: First-line supervisors are expected to make daily assignments based on the scripted, synchronized plan, and the Rules of Flow. The supervisor must know the status of the machine and project to make assignments to protect the Critical Path and accomplish the work as quickly as possible. Work assignments must work hand in hand with supportability execution to ensure support functions and process doers are synchronized to the same goals. For this reason, daily work assignments pertain to both process doers and enablers. The entire organization must assign work in accordance with the plan. Doers are assigned to work on tasks in priority order until there are no doers left to assign (if more work than doers). It is essential all work is fully loaded with personnel which means the maximum number of people are assigned to the work before the next task is made available for assigning doers. Loading a task with the optimum number of personnel enables the task to be completed as quickly as possible, and frees up personnel to be assigned to the next task quicker. This results in more focus because less activity is open and in work. This is essentially WIP control at the process doer level.

- Quick Issue Resolution: By now, it should be obvious there is a common thread running through the heart of AoP. Quick issue resolution is a foundational concept that creates world-class performance. Tactical management is about rapidly pulling together all of the people, processes, and resources in the execution phase of the machine, to include enterprise partners when an issue is beyond the scope of the process owner to resolve. When effective processes are in place, tactical management should be simple execution of the processes. When issues arise, they must be resolved quickly. Quick resolution enables people to accomplish the assigned work as quickly as possible. Also, quick resolution signals the importance of throughput and fosters employee engagement. If processes fail to give the intended outcome, feedback to the operational management system should be part of the process.

4.2.2. How: This section is intended to provide an understanding of how the leader at any level can access the standard tools, meetings, and processes available to them to achieve the desired objectives. It is not intended to provide detailed instructions on how to carry out every component of machine management. The tools in this section are not exhaustive, but, hopefully, will give the reader examples of actions that can be used to achieve the objective. Each organization will vary in the application of processes; therefore, the leader must gain an understanding of what processes their organization has in place and apply those to effectively manage their process machines.

4.2.2.1. Strategic: AFSC has many strategic management and planning processes that play a role in defining the common goals of the organization, and the Road to…Goals that must be met to position the organization for the future. No one process will provide the complete answer to the common and Road to…Goals, but, in combination, the organization should be able to define their strategy and goals to build a clear case to support buy-in from their business partners through the horizontal integration process.

4.2.2.1.1. Strategic Management and Goal Setting: The following types of processes are examples of existing opportunities that can be leveraged to provide the information to adequately build a realistic strategy and the defendable goals of the organization. Goals cannot just be created out of thin air, but must be built on a strong foundation in order to provide the confidence needed to motivate the process doers and enablers of the organization.

4.2.2.1.1.1. Mission Essential Task List: The first step to successful strategic management, and defining the goals of the organization, should consist of developing a list of Mission Essential Tasks (METs). It is important organizations have a clear understanding of their mission and thereby do not pursue efforts that are not value-added to the organization.

4.2.2.1.1.2. Existing Forecasting and Planning Processes: The following are all standing and recurring processes that must play a part in strategic management and goal setting, and often involve horizontal integration:

- Requirements Review Depot Determination (R2D2)
- Logistics Requirements Determination Process (LRDP), AF Manual 63-143
- Annual Budgeting Cycle
- MilCon Planning

• Source of Repair (SOR) Requests

4.2.2.1.1.3. Performance Review and Special Considerations: Every organization should look at their current state, as well as their desired future state as they develop their strategic plan. The following should be considered in the establishment of common and Road to…Goals:

• Facility Constraints

• Customer Requirements

• Desired Opportunity for Future Workload

• Aging Aircraft Projections

• World Events

Action plans to achieve the goals should also include the following:

• Throughput Performance

• Staffing Levels

• Quality Performance

• Safety Records

• Cost Performance

4.2.2.1.2. Horizontal Integration: Once the Road to…Goal and common goals have been defined, the organization must communicate those goals to all stakeholders. Section 3.2.4. lays out the requirements of effectively communicating the machine goals to all stakeholders. The below processes are available formats to accomplish horizontal integration and obtain buy-in from all mission partners:

• Enterprise Value Stream Mapping

• Process Improvement Events

• Process Machine Reviews (all levels)

• Supportability Reviews

• Planning Reviews

• Issue Resolution Meetings

• Routine Scheduled Partnership Meetings

4.2.2.2. Operational: Operational management should be the primary focus of leaders throughout the organization. Every machine is a process made up of many more processes. Therefore, operational management is a systematic method of managing those processes. Organizational leaders should strive to utilize every opportunity available to observe, assess, and improve those processes. This section will discuss some of the processes, meetings, and structures that can be used in managing the machine processes.

4.2.2.2.1. Wall Walks: Wall Walks are the pivotal element of organizational management. Wall Walks are intended to be the first line of machine improvement. A Wall Walk is a recurring process-focused review to understand process machine performance, identify constraints, coordinate constraint resolution and identify actions to improve machine performance. Wall Walks enable organizational learning and require involvement at all levels. Wall Walks are not a briefing to leadership and are not tactical level management for the process team. Wall Walks are action-oriented reviews of the overall machine health. As your organization grows in its AoP journey, the Wall Walks will mature and include deeper analyses.

4.2.2.2.1.1. 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, and actions to achieve those opportunities for its respective gate. The goal is to depict information relevant to the overall machine health.

4.2.2.2.1.2. 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 concerning mission objectives, and holds personnel accountable for meeting performance expectations.

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

4.2.2.2.1.4. Wall Walks must include all enterprise teammates and subject matter experts to resolve gaps and use PPSM to improve processes. Enterprise teammates should also be present during Wall Walks 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.

4.2.2.2.1.5. 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.

4.2.2.2.1.6. 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.

4.2.2.2.2. Staff Meetings: Standing meetings are perhaps the most accessible opportunity to engage in operational management. The culture of the organization should develop around ensuring the Rules of Flow are being followed. When the Rules of Flow are followed closely, the constraint will normally be resolved even if it could not be completely defined. In addition, the Leadership Model should be used as a filter to address the health of the machine in terms of speed, safety, quality and cost effectiveness.

4.2.2.2.3. Major Graded Area (MGA) Reviews: The MGAs of Leading People, Improving the Unit, Managing Resources, and Executing the Mission align very well with the structure of the Leadership Model. The MGA reviews of the organization can be utilized to resolve the constraints affecting common goals. Each constraint must be resolved by leveraging the areas of people, processes, and resources to achieve the common goals of the mission.

4.2.2.2.4. Daily Battle Rhythm: Every organization should develop a daily battle rhythm of activities and meetings to protect the execution of standard work by preventing it from being replaced by other pressing issues. People will always act in a fashion they perceive to be in their best interest. If the organization does not have a daily battle plan, with appropriate checks and balances in place that require operational management, other issues will take priority.

4.2.2.2.5. Walking, Watching, and Wandering, (W3) In section 3.1.3.5. we discussed the vertical leadership element in the Radiator Chart referred to as W3. The objective of W3 is direct observation of what is going on in the work area to prevent process doers from W3. Leaders must create time in their day to get out and see the processes in action. W3 is not just about walking around to make sure everyone is working, but about gaining understanding and creating positive accountability. If leaders are never present to check in on the execution, how will they know if processes are being followed, or if they are functioning as intended? Without personal accountability to standard work, people will default to what is easiest for them, and what they perceive will meet their immediate needs. W3 by leaders is the most effective way to prevent W3 by the process doer. W3 by the process doer is counterproductive to the machine and can be countered if the leader has firsthand knowledge of the processes and status of the work.

4.2.2.2.5.1. W3 is not about creating compliance through intimidation, it is about seeing, asking questions, and listening to the answers. In section 2.4.2.1.2., we introduced a set of questions that are designed to create discovery and a mindset of problem-solving. These questions use the principles of AoP to require people to understand their common goals, and have a sufficient understanding of their machine, to know what is limiting the achievement of those goals. Leaders should make asking these questions part of their daily routine.

**AoP Questions**
To Drive the Desired Behavior

1. What is the Road To Goal?
   - Flowtime, Throughput, or WIP
2. How are you performing today?
   - Show me your machine and gate performance.
3. What gate is your machine constraint?
   - How do you know?
4. What is your next action to resolve the constraint?
   - When can we see the results?

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4.2.2.2.5.2. The above questions focused on understanding and improvement. Now we will introduce a second set of requirements that are tailored to the Rules of Flow discussed in section 3.3.3.3. The following questions focus on the execution of the business rules designed to protect flow. Leaders must require the Rules of Flow are followed, and the best way to accomplish this is to verify by asking questions.

4.2.2.2.5.3. Rules of Flow:

**Is the Machine Following Rules of Flow**

1. WIP Control?
2. Release Only Supportable Work?
   - Release only supportable work IAW a plan (no cherry-picking)
3. Assignment of Work Based on the Synchronized Plan?
4. Quick Issue Resolution?

1. WIP Control

□ *<u>Are you controlling the number of items in the machine so processes and individuals are not being multitasked and spread thin?</u>* This is the most challenging concept. Conventional thinking is that it is better to make SOME progress on every item versus personnel-loading and focusing and finishing a limited number of items.

2. Release Only Supportable Work

□ *Is work being released only when it is fully supportable?* Release work only when it is supportable. Strive to know the complete condition of the item and ensure everything needed to complete the next gate is available, or will be available, before it is needed. Supportability includes personnel and equipment resources. If all work from the previous gate is complete, but the next gate is not supportable, complete the gate and put the asset in Queue.

3. Assign Work Based on the Synchronized Plan

□ *Are all mission partners/stakeholders synchronized with the plan so supportable work can always be provided when assigned?* Individuals are to be assigned to items/tasks in priority order until you run out of people. At this point do not start any additional work until those assigned tasks are completed. Ensure each task and item is fully personnel-loaded so the doer can focus and finish before moving to the next job/item. This will avoid spreading people across multiple items.

□ *Is there a scripted plan? If so, is it being followed?* Work should be assigned according to the scripted plan. Maintaining this discipline is a challenging concept. Following a scripted plan is the key to synchronizing resources to a plan.

4. Quick Issue Resolution

□ *What is your process for resolving issues quickly?* Ask for evidence that it is followed and is effective. The process should include enterprise partners as appropriate.

□ *How do you ensure the constraint gate is the priority over non-constraint gates?* There should be evidence of process improvement or other exploitation steps involving the constraint gate.

4.2.2.3. Tactical: Tactical management is the daily execution of the processes designed to create movement through the machine. Throughput is created by ensuring work is supportable, personnel are assigned according to the scripted plan, and issues are resolved quickly. The processes below are presented as examples of actions that directly affect the movement of work. The oversight of the processes to ensure effectiveness is an operational management concern; but execution directly affects the movement of work and, therefore, is tactical.

4.2.2.3.1. Beginning and End of Shift Team Meetings: Daily tactical management starts at the point tasks are assigned to the process doer. Task assignment should include a discussion of the status of the project, along with the current day's goals and objectives to frame the urgency of accomplishing the current day's tasks. Everyone should know how their tasks fit into the synchronized plan.

4.2.2.3.2. Project Team Meetings: The project team consists of all the doers and enablers responsible for the execution and progress of a particular asset or project. This team discusses the progress of the project to the script, noting any problems or resulting changes in the sequence of work activities required to keep the project moving forward along its Critical Path.

4.2.2.3.2.1. Issues noted during the project team meeting are evaluated for their effect on the Critical Path. Issues that are likely not to be resolved before their impact on the Critical Path are elevated to the next level. This elevation must include a description of what the impact to the Critical Path will be, when the impact will occur, and a description of the critical elements of the issue along with details of the efforts that have been undertaken thus far to resolve the issue. The project team should also discuss what actions need to occur to recover any time lost on the Critical Path – thus attempting to keep the project on schedule to the organization's Road to…Goals.

4.2.2.3.3. Daily Execution Meetings: The daily execution or production meeting is led by the machine owners and is attended by the level of supervision of those participating in the project meetings. This meeting discusses each asset or project in the context of its relation to where it is, compared to where it should be along its Critical Path. This meeting is the receiver of the information concerning Critical Path issues that have been elevated from the project team. The supervisors of the project team members relay this information in this meeting. This meeting is also attended by members of supporting organizations to allow those organizations to receive the issue information and engage in dialogue that leads to the ultimate resolution of the issue. This is also an essential meeting for constraint team members to attend – allowing them to quickly react to issue information and report any actions being taken.

4.2.2.3.4. Andons: Andon is a manufacturing term originating in the Toyota Production System referring to a mechanism to notify management, maintenance, and other workers of a quality or process problem. Andon is the Japanese word for "lantern" and the term is representative of illuminating the problem. In its traditional manufacturing context, an Andon identifies an issue and stops the production line until that issue is resolved. In AFSC, the concept has been slightly adapted to apply to the AFSC environment where it identifies an issue that impacts or potentially impacts the Critical Path and calls the enterprise team to action for quick response.

4.2.2.3.4.1. Traditionally an Andon is associated with a delay. An issue or Andon is a potentially negative situation, but the result should be a collaborative effort to understand and resolve the root cause of the delay. 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 is lost. The desired response needs to be conditioned by focusing positive efforts on a shared "Road to…Goal" rather than attributing blame. Andon is not a verb. It is not something that one organization does to another in a state of duress! Therefore, Andons must be clearly communicated across organizations, as well as up and down the chain of command, without emotions becoming involved. Effective use of two tactics, focused communication, and transparency are required to promote this culture.

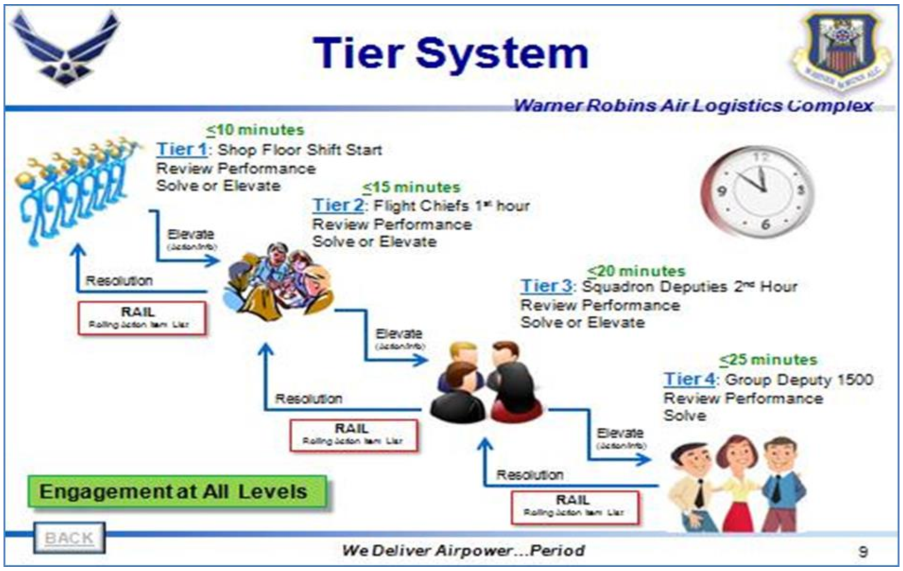
4.2.2.3.4.2. The first tactic, focused communication requires the Andon to explicitly state what help is needed, by whom, and describe the impact to the machine. Requests for support must be crafted to target the individual or organization that is expected to assist, and scoped to explicitly articulate the support requested. This tactic is required to articulate exactly the support required by the next level when an issue is elevated. Focused communication is also utilized when the supported organization requests Subject Matter Experts (SMEs) from supporting organizations for the resolution effort to meet and determine short and long-term resolution actions.

4.2.2.3.4.3. The second tactic, transparency, provides visibility of the Andon to all levels of the organization. The issue resolution process is the mechanism utilized by all stakeholders to eliminate obstacles to AoP performance. This tactic is necessary to ensure these stakeholders have a common site picture of the health of the machine. When an issue is elevated, transparency allows the next higher level to review an issue without an explicit request for support. Transparency has a push component, which includes activities such as including Andons in project and machine review meetings. It also includes a pull component, which includes activities like allowing stakeholder access to an Andon visibility tool.

4.2.2.3.4.4. Communication begins with the stakeholder. Any stakeholder in the AFSC production machine has the right and responsibility to identify issues. While the process doer may have the first awareness of some issues, supporting organizations may be in a position to identify other issues early. For example, a DLA employee might recognize a key parts shortage in advance, or a program office engineer might unearth a technical risk that will require mitigation. Again, communicating these discoveries to the correct organization promptly could alleviate the need for an Andon during process execution, and allow for the development of acceptable workarounds or expedited delivery in advance of Critical Path impact.

4.2.2.3.4.5. Most organizations have had success in utilizing a tiered communication approach to managing their processes. This approach allows Andons to bubble up to the highest tier and possibly identify group-wide trends of certain issues. A tiered communication process also helps keep track of Andons until they are resolved, providing visibility of issues to senior management.

4.2.2.3.5. Tier Meetings: Many organizations across the AFSC have adopted a formal meeting alignment approach known as the Tier System. The figure below depicts the basic Tier System process that begins at the shop floor (Tier 1) and culminates with group leadership (Tier IV) daily. Similar to the Project Team Meeting alignment approach discussed previously, the Tier System is based on the script in place at the process doer level. The tier approach also incorporates speed, quality and safety metrics, monitors output, elevates issues, and keeps machine goals in front of everyone – from process doers, to support organizations, to leadership – daily.




4.2.2.3.5.1. Including the process doers in the Tier System gives those doers ownership in solving issues and changing processes to meet organizational Road to…Goals. This process is repeated at the flight (Tier II) and squadron (Tier III) levels. This commitment to daily process reviews through all organizational tiers sends the message of the importance placed on improving process performance to gain the desired throughput (speed).

4.2.2.3.5.2. Tier meetings encourage problem-solving at every level, creating a problem-solving synergy that goes beyond the capabilities of even the wisest and most experienced lone process manager. A fundamental component of the tiered approach is the inclusion of a scripted flow diagram for each meeting level of the system. This Script ensures the meeting dialogue is centered on the process and its issues at each meeting level. Placing the focus on the process removes emotions and allows discussion to concentrate on resolving process issues. The tier approach also provides a systematic, standardized format to allow issues and Andons to be communicated and/or elevated to the next level. In the Tier System, unresolved Andons are placed on the Recurring Action Item List (RAIL) and persist at the Tier IV level until they are resolved.

4.2.2.3.6. Visual Displays: Effective tactical management includes effective visual displays at the point of work. In a complex project environment, the visual display may focus on a portion of the flow such as a particular gate, while an environment with many small, quick turn assets or projects will focus on progress of a mix of items. In either case, the displays should reflect information that is important to the process doer and support team to understand what is currently in work, what will be worked next, and what issues could impede the progress of the Critical Path to be relevant. Simplistically displaying this information to promote ease of updating (and thereby promoting accuracy) is key to a successful Visual Display.

4.2.3. Why: In his book "*Start with Why*" (Sinek, 2011)[6], Simon Sinek explores the fact that unless a person or an organization knows *why* they are doing something they are unlikely to do it with enthusiasm or dedication. Anyone that has raised a child knows that from an early age, everyone wants to know why. When you ask a toddler to pick up their toys, they ask, "Why?" "Clean your room," "Why, Daddy?" "Eat all of the food on your plate," "Why, Mama?" We also know eventually the default answer of "because I said so" ceases to be effective. Adults may not always ask the question, but unless we know "why," we are unlikely to be engaged in the activity and even less likely to repeat it. Expecting the workforce to consistently perform the work just "because we said so" is not realistic. This section is about creating an understanding of why it is essential for the leader to actively manage the machine. When leaders fully embrace the "why" of daily and continuous machine management, they will be able to create the "WHY" for those doing the work. Without embracing why it is important to manage the machine, leaders will not see value in improving the process, and the workforce will not connect their purpose to the purpose of the organization.

4.2.3.1. Every car owner knows to keep their vehicle running well, and providing years of reliable service, certain things must be done to maintain it. The oil must be changed regularly. The tires must be rotated and replaced when required. Fuel must be put in when needed. All of these actions are elements of managing the transportation machine. We understand when action must be taken because we are constantly engaged in managing the machine. The metrics of the machine tell us when it is time to act. We listen for noises, and watch the indicator lights that tell us something is not right and warrants a trip to the mechanic. We watch the odometer to know when it is time to rotate the tires or change the oil. The fuel gauge tells us when we should find a gas station. The AFSC process machines are no different. The leader/manager must continuously watch and listen to the heartbeat of the machine to know when something is not right so adjustments can be made. Just as any car (regardless of quality) that is ignored will quickly begin to fail, the best-designed machine will quickly fall into disrepair if it is left to itself.

4.2.3.2. We understand that cars cannot perform their own maintenance, so we naturally know the owner is responsible for those actions. However, in the case of a process machine, that may be less clear. After all, machines are made up of people, processes, and resources and those people should be able to manage their machines, right? We indeed manage our daily affairs continuously. We make decisions and take action in response to a constant barrage of demands. Each day we manage our time and actions based on one simple reality: **We will always do what we perceive to be in our best interest at the moment.** The problem is, what is in our best interest may not always be in the best interest of the machine or the organization.

4.2.3.3. Let's look at a very simple example. Suppose two employees attend an event on a weeknight and get home very late. The next morning the alarm goes off and they roll over and hit the snooze. While lying there, they think about what they need to do at work that day. One employee does not know what he will be assigned that day. He doubts anyone would miss him if he didn't go to work. His supervisor rarely comes around, and he seldom has the material he needs, so he just does the best he can each day. Consequently, he does not think he has a real impact on the daily outcome of the machine. As you might imagine, he calls in sick for the day. On the other hand, the other employee's supervisor is very engaged in managing their machine; therefore, the employee knows that if she is not there, the work on the Critical Path will not get finished and the flowdays of the machine will be extended. She understands the work she does is very important, and directly affects the Road to…Goal. As you might imagine this employee gets up and comes into work. The difference between the two is what they perceive to be in their best interest. The first believes staying in bed is in his best interest. The second believes making a real contribution to the output of the organization is in her best interest.

4.2.3.4. In scenarios like the one we just discussed; we might be tempted to say the second employee has more integrity than the first. Most people want to make a difference and they want to believe what they do is important. Therefore, integrity could be described as holding one's self accountable for what one believes is important. What we desire is for someone to have personal accountability to the goals of the organization. The challenge then becomes, how to cause the goals of the organization to be important to the individual. We cannot expect someone to be concerned about achieving goals they do not believe are important. Personal accountability does not result from having some arbitrary level of integrity; it comes from understanding 'why' what you do is important. It is not about integrity; it is about leadership creating a culture of personal accountability. It is the role of leadership to design a machine that will provide the feedback necessary to know how it is performing and to be fully engaged in communicating the health of the machine to the workforce and enterprise partners. Leaders must be accountable to the machine (people, processes, and resources) and take steps to manage and improve. Without this continuous management of the machine, the process doers will not understand why it is important to do what they are asked to do. They will become disengaged and the machine will inevitably go into disrepair.

4.2.3.5. Tactical Tendencies: The daily management of a process machine involves an intentional focus on both tactical and operational management. Strategic management activities may only occur occasionally or on a set schedule, but operational and tactical must occur continuously. While both are required in the daily management of the machine, operational management is often lacking. We tend to manage everything from a tactical level and provide much less attention to operational management. We often refer to it as firefighting. This approach may fix the current problem, but it often causes significant problems with machine design. Tactical management results in finding workarounds that often become standard practice. Tactical management is essential but must be balanced with healthy operational management. AoP tools and structure are designed to achieve both, but often operational meetings focus on individual tail numbers or specific parts problems rather than identifying process constraints. Operational meetings are not to fix item-specific problems, but to identify and address systemic constraints. Tactical meetings should focus on item-specific issues and operational meetings should focus on the effectiveness of the machine and its processes. Leaders must actively counter tactical thinking tendencies and instill an operational mindset.

4.2.3.6. Behavior Science: To understand why people default to tactical thinking rather than operational focus, we must answer the question of "why people do what they do?" Earlier we discussed that people do what they believe to be in their best interest; but what influences that belief? The first piece of the puzzle is found in the inference that something in our best interest will lead to a positive outcome. A positive outcome is certainly the starting point, but it is not sufficient to explain reality. If we did everything that would lead to a positive outcome, we would always say "no thank you" to that slice of cake we know will derail our diet. However, reality tells us people often succumb to a sweet delight knowing it is not in the best interest of their long-term health. To fully understand why we do what we do, there must be an understanding that the most powerful factors in our behavior are related to time and certainty. How soon will I see the result, and how likely is it to occur? If you combine a positive outcome with immediate and certain consequences, the person is highly likely to execute the action in question. If the outcome is positive, but it is unlikely to happen, or will happen sometime in the future, the person becomes much less likely to perform the task. In this case, the person will choose another action that will give an immediate and certain outcome that is perceived to be positive. That is why we choose the cake over our diet because cake gives an immediate and certain pleasure, while dieting (although it will have a positive result) gives a future outcome that is significantly uncertain. Immediate and positive results give pleasure or a sense of accomplishment.

> The most powerful factors in human behavior are time and certainty. How quick will I see the outcome and how certain am I that it will happen?

4.2.3.6.1. How does this apply to tactical management versus operational management? Most AFSC leaders have a limited amount of time available to them. If we had unlimited time and energy, we would eventually do everything we knew would have a positive outcome. However, with limited bandwidth, we must make choices on which action to take. Leaders will not choose to engage in operational improvement if they do not believe the effort will see results soon. When a manager focuses only on tactical efforts, he/she is normally focusing on what they believe will give positive results and in a relatively short amount of time. Getting an asset or project completed quicker gives a sense of accomplishment and often is reinforced by praise from senior leaders. Therefore, tactical thinking meets all the criteria to drive behavior: it gives positive results, the results are believed to be certain, and it will be effective in relatively short order. On the other hand, focusing on process improvement normally does not meet any of those criteria. In a tactically focused culture, there is little recognition built into the system to provide positive reinforcement for process-focused behaviors. It is typically something people do not like to do, so the process itself is not positive. The leader may not truly understand the problem, or they do not believe anything will ever be done about it, so the outcome is uncertain. At best, the results are somewhere in the future. It is no wonder when posed with a choice, people will almost always default to tactical management discussions rather than focusing on operational improvement. When standard processes do not fulfill the intended outcome, people will pursue actions perceived to be immediate and certain, and will ignore the standard processes.

4.2.3.6.2. Managers and senior leaders must extend an intense focus on creating a culture of operational management. Expectations must be set to require an operational focus and desired behaviors must be reinforced by senior leaders. Without dedicated management of the machine through all levels, strategic through tactical, the machine will not improve, and disruptions to flow will result in tactical firefighting. The effect of intentional management of the machine will create a culture of voluntary accountability. Accountability must exist throughout the machine at every level, not just tactical. When senior leaders are accountable to drive improvement and demand operational management, it leads to middle managers gaining personal accountability to the processes. As first-line supervisors and process doers see a rapid resolution to process constraints, it results in positive accountability in the daily work. In short, everyone begins to believe operational management is a positive behavior, and that it brings certain and rapid action.

4.2.3.6.3. The outer ring of the Leadership Model communicates a leadership culture that delivers an environment where process doers and leaders at every level can be successful. The Leadership Model requires every leader to be actively engaged in managing the machine. Managing the machine creates expectations for those within the machine to execute and improve. That will only happen through positive and personal accountability. Positive accountability is where people voluntarily accept the role of a problem solver. It is not a result of an arbitrary measure of personal integrity but is the result of systematic management. Management where the expectations are communicated, the progress is measured, the results are communicated, and success is celebrated. If leaders at every level are personally accountable to the machine, those below them will be accountable as well.

4.2.4. Create Bandwidth: We have already stated we typically have limited bandwidth when it comes to doing our daily job, much less the necessary time it takes to improve. When we are stretched, we default to what we know and what gives us a sense of accomplishment. Tactical thinking and firefighting are typically the things that give us that sense of accomplishment because they have immediate and positive consequences. In a hectic work environment, it is hard to see how leaders can create extra bandwidth. It may not be easy, but it is necessary. Author, Derek Sivers once said “The hours don’t suddenly appear. You have to steal them from comfort.” (*Where to Find the Hours to Make It Happen* | Sivers, 2019)[7]

Comfort is fighting fires and letting the processes fend for themselves. Comfort is expecting everyone else to manage the machine while we attend meetings and create reports. Comfort is hiding behind "reasons" and blaming others for our problems. Leaders must be unyielding in looking for opportunities to steal minutes from the comfort zone so they can apply their energy to manage the machine. Leaders must embrace their "WHY." They must understand why it is essential to manage the machine to create accountability in the process, in themselves and in everyone they influence. Machine management is the key to allowing the process doer to understand their impact on the machine. When employees understand "why" what they do is important it will lead to improved employee engagement and greater success.

**4.3. Summary:** Managing the machine is the most essential component of the implementation and execution of AoP. Without it, the principles of the Leadership Model and the elements of the Radiator Chart are just empty words and meaningless activities. Managing the machine is where accountability is created. It is where people see the importance of what they do and how it affects the throughput of the machine and the success of the organization. Every leader at every level must choose to be accountable for their role in the mission. Leaders must observe the processes under their influence and ensure every person under their scope of influence understand the importance of what they do. Processes must be in place; they must be carried out and they must be effective. If leaders fail to ensure active machine management is carried out, people will revert to what they know and the way it has been done in the past. Tactical firefighting will be the norm and inevitably the design of the machine will be compromised.

4.3.1. What: Successful machine management consists of three levels (strategic, operational, and tactical). Each level focuses on essential aspects of machine health and has key elements that define the level of management. Strategic management sets the goals and establishes the expectations for success. Operational management ensures processes are in place and effective. Operational management is the most elusive of the three, but without it, the machine will never mature and will eventually degrade. Tactical management is where the daily issues are resolved, and intentional and intense actions are required.

4.3.2. How: Leaders must not only understand what should be done, they must understand how to apply the tools available to them. Application of the tools requires intentional effort and focus. Every leader has a responsibility to be actively engaged in every level of management. These responsibilities cannot be delegated or ignored. The leader must be accountable for learning how to apply the tools effectively and ensure others within their influence understand how to apply the tools as well.

4.3.3. Why: The most important part to successful machine management is understanding why it is important. It is essential to understand every aspect of machine flow and performance; because, without it, you cannot see the constraints, and more importantly, you cannot communicate expectations to the workforce. If the leader does not fully embrace the importance of active machine management, the desired outcome of AoP will not be realized. There is an old adage that says, "We will always find time to do what we want to do." Or said another way, "We will always find time to do what we think is important." If we do not embrace the importance of active machine management, other activities will always take its place. However, the greatest impact of failing to manage the machine is the process doer will not understand the importance of their role and, consequently, will not be able to see the fruits of their labor. When people cannot see the importance of their task, other non-value-added activities will take its place.

# Chapter 5

## PURSUIT OF EXCELLENCE

**5.1. Pursuit of Excellence:** The objective of AoP is to create a culture of dissatisfaction with the present and an aspiration for that which is beyond our current reach. Excellence is the reality of being all that we can be, both as an organization and as individuals. It means being the best provider of products and services available. The majority of this handbook has been directed to AFSC leaders; because excellence in the AFSC will only be realized through excellence in its leaders. Leaders determine the culture of the organization, and the culture of the organization ultimately determines the level of success that will be achieved.

5.1.1. Sustainment: AoP provides tools that allow us to define our current processes in ways that address common issues and provide the data needed for continuous improvement. The Radiator Chart provides the structure for a management system that will lead to excellence. However, that excellence will only be achieved if there is a steadfast focus on sustaining the work that is put in.

5.1.1.1. Standard Work: Sustainment has many enemies, but lack of standard processes is the beginning of failure. Without a standard there is no measure of performance or success. If processes are not standard, they cannot be sustained because there is no baseline to be built upon. Without standard processes, every disruption to flow will impact the way the process is carried out. When standard processes are not maintained, every change of leadership is an opportunity for change in the processes. This change may take place because the new leader has a different idea and wants to do it a different way, or it may be because they focused on other priorities and, therefore, there is no oversight of the processes. Do not misunderstand, change is not bad, unless it is not leading toward the Road to…Goals. Change should be about building on standardized processes through incremental improvements with a continuous focus on finding the breakthrough solution that will provide rapid movement toward the Road to…Goal. Organizations should continuously seek that one thing, that if was in place today, would fundamentally change the success of the mission.

5.1.1.2. Continuous improvement is expected, but without a standard, change creates a moving target that prevents the measurement of success. Without a recipe, how can we recreate a childhood favorite meal? Without standard processes how will the next leader know what works and what doesn't? Change to a family recipe may lead to disappointment; change to processes without a structured approach to achieve the Road to…Goal will lead to frustration and confusion. Without standardization with checks and balances, the process will inevitably change over time, eventually requiring a reset. Every time processes are changed without a logical explanation or reason, the workforce becomes disengaged and disillusioned with leadership.

5.1.2. Leader Standard Work: In Chapter 2, we introduced the concept of leader standard work as the avenue where leaders can assess the health of their organization and develop other leaders. In Chapter 3, we expanded the idea as a critical element in designing a sustainable machine. Now we will answer the question of why leader standard work is critical to sustainment.

5.1.2.1. We all have experienced a new initiative that began with much fanfare and activity. New processes were put in place. New posters and banners were printed and placed in conspicuous places. In many cases, improvements were realized only to disappear within a couple of years or sooner. The posters may still be in place, but the processes have ceased to exist or have been replaced by something new. Why does this happen? Lack of leader standard work is the primary culprit of not sustaining improvements. Our tendency is to create a better way, implement it and then walk away and assume people will continue to follow the better way. This approach does not work! In the *Steps to Accountability®* model we introduced in Chapter 2, we identified the final step as *Do it®*. Unfortunately, we normally consider implementation of an idea as completion of the path to improvement. However, implementation should only be considered the beginning of the effort. The work is not complete until it is sustained. Organizational tendency throughout the business world is to implement a "good" solution and then move on to the next good thing. Without leader standard work in place to sustain and improve the processes they will cease to exist within months.

5.1.2.2. Implementing new improvements without Leader standard work in place to ensure the processes are maintained, is comparable to an army taking a hill in battle only to move on to the next hill and allow the enemy to move back in to the area just won. Without focused execution of standard work at every level of leadership, the ground that was won through hard fought battles will be surrendered back to the enemy. We cannot expect our workforce to be engaged if they are continually asked to retake the same hill every few months.

5.1.2.3. Leader standard work will be different for every level of leadership because the processes they are trying to sustain are different. Standard work for a squadron director should be primarily focused on ensuring the flight chief is following their standard work and consistently applying the Focusing Steps, and managing their machine. For a first line supervisor, the standard work should focus primarily on ensuring the tactical processes are followed, and the work is being supported and accomplished.

5.1.2.4. Everyone desires to work in their comfort zone. Our comfort zone is the area where we know what to do and what the expected outcome will be. When we work in a new process, we are working outside our comfort zone. Leaders must ensure the new way is maintained long enough that it becomes the new comfort zone. If people are left alone without reinforcement in the new way, they will quickly resort back to the old way and the old comfort zone.

5.1.2.5. Leader standard work is necessary to ensure new processes that are established to implement the management system, and to resolve constraints, stay in place long enough to become the normal method of operation.

## 5.2. Maturity:

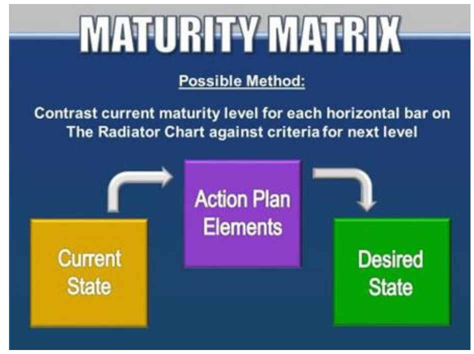
5.2.1. Introduction: Sustainment is essential, but it is only the first step to becoming a world class organization. Once a unit implements AoP, using the principles described throughout this handbook, and institutes the necessary standard work to sustain, then a journey begins toward a true AoP culture. AFSC has devised a way to measure progress along that journey. The Maturity Matrix was created in an effort to measure the transformational progress towards world-class performance envisioned by the 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…Goal to process doer level touch time. Using the matrix, units across AFSC may self-assess using a common standard. The Maturity Matrix establishes a 1 through 5 grading scale for each execution element of the Radiator Chart (each of the eight horizontal elements). This grading scale defines stages of maturity evolving from initial set-up (1-2), to institutionalization (3-4), to the ultimate goal of establishing a world-class organization (5). Shown below is one page of the Maturity Matrix as it relates to one element of the Radiator Chart:

| | 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<br><br>Goal communicated vertically up to all levels within Complex / Directorate / Wing organization<br><br>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<br><br>Stakeholder metrics and leadership objectives aligned to Complex / Directorate / Wing metrics and objectives<br><br>Significant Progress on Road To Goal with incremental goals achieved<br><br>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<br><br>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 |

Road to…. Maturity Matrix

5.2.2. 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.

5.2.3. 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; 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.




5.2.4. 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?

5.2.5. 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.

5.2.6. 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/_layouts/15/WopiFrame.aspx?sourcedoc=/sites/22197/AoP/SiteCollectionDocuments/Tools/3.%20AoP%20Maturity%20Matrix/Maturity%20Matrixv2.pptx&action=default

## Chapter 6

## GETTING STARTED

**6.1. 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, safety, and cost effectiveness. 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.

6.1.1. 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.

6.1.2. 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.

6.1.3. 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.

6.1.3.1. 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.

6.1.4. 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.

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

6.1.5.1. Review the squadron/division mission statement and identify and prioritize specified and implied tasks. Specified tasks are those tasks explicitly 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.

6.1.5.2. From the list of specified and implied tasks, identify essential tasks. The criteria of essentiality are whether the unit mission can be accomplished without the task being performed to the standard.

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

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

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

6.1.5.6. 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.

6.1.5.7. 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.

**6.2. 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 an 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.

**6.3. Step 3: Set Up the Machine.** Use the Radiator Chart to build a process machine for the selected METL task.

6.3.1. Determine the Road to…Goal for the Machine (sect. 3.2.).

6.3.1.1. What is the customer requirement?

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

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

6.3.1.4. What are the throughput requirements of the machine?

6.3.1.5. Conduct horizontal integration (sect. 4.2.2.1.2,.).

6.3.2. Define the Flow of the Machine Process (sect. 3.3.).

6.3.2.1. What is the work sequence?

6.3.2.1.1. Define the Critical Path/Critical Chain.

6.3.2.1.1.1. List the steps.

6.3.2.1.1.2. Estimate the durations.

6.3.2.1.1.3. Capture dependencies.

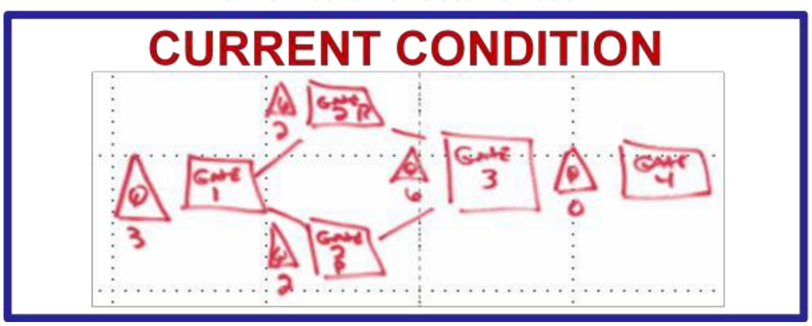
6.3.2.1.1.4. Define the milestones.

6.3.2.1.2. Observe the process.

6.3.2.1.2.1. Go see the work in action at the place where the value is created.

6.3.2.1.2.2. Your eyes do not lie, your ears will.

*Current Condition Documentation*



6.3.2.1.3. Draw out the process. It does not have to be pretty. Capture the WIP levels and locations.

6.3.3. Establish Gates (sect. 3.4.).

6.3.3.1. Break complex processes down into smaller groups of work.

6.3.3.2. Define the WIP for each gate.

6.3.3.2.1. Calculate WIP using Little's Law (sect. 3.3.3.3.1.1.).

6.3.4. Define the Release Points (sect. 3.5).

6.3.4.1. Define the criteria for releasing work from one gate to the next.

6.3.4.2. Establish the business rules for controlling the release of work.

6.3.4.3. Create A to Z checklists to document all work was completed and conditions were met for release.

6.3.5. Establish Visual Displays (sect. 3.6.).

6.3.5.1. Create meaningful, process doer-focused, visual displays depicting the relevant portion of the process.

6.3.5.2. Ensure visual displays communicate speed, safety, quality and cost metrics (as applicable) as well as process status.

6.3.5.3. Ensure visual displays provide an opportunity to capture process issues.

6.3.6 Apply the Rules of Flow (sect. 3.3.3.3.).

6.3.6.1. Control WIP.

6.3.6.2. Release only supportable work.

6.3.6.3. Assign work according to a synchronized plan.

6.3.6.4. Practice quick issue resolution.

**6.4. Step 4: Manage the Machine.** (Chapter 4)

6.4.1. Operational Management (sect. 4.2.2.2.).

6.4.1.1. Wall Walks (sect. 4.2.2.2.1.).

6.4.1.1.1. Visual representation of the machine.

6.4.1.1.2. Monitor WIP levels.

6.4.1.1.3. Monitor gate performance.

6.4.1.1.4. Identify and resolve constraints.

6.4.2. Tactical Management (sect. 4.2.2.3.).

6.4.2.1. Daily meetings.

6.4.2.2. Daily work assignments.

6.4.2.3. Quick issue resolution.

**6.5. Step 5: Mature the Organization.**

6.5.1. Complete implementation of the Radiator Chart (sect. 3.7-3.9.).

6.5.2. Mature the standard work (sect. 5.1.1.).

6.5.3. Develop leaders who believe and practice AoP (sect. 5.1.2.).

# Chapter 7

## Conclusion

**7.1.** The AFSC is a $16B enterprise – it is big business. This business is not rocket science, but it is complex – it is an intertwined, complicated machine with a lot of moving parts. "Seat of your pants" management techniques will not lead to success. Success cannot be personality driven, meaning that it cannot rest in the skills of one individual. Leadership and success must be tied to a methodology and focused on processes. Leaders move and rotate to different assignments; therefore success cannot be sustained if there is not a systematic approach to managing the machine.

**7.2.** Although disciplined processes are the foundation to AoP, it does not lessen the necessity for fully engaged leadership. Leaders at every level of the organization must voluntarily take accountability for the principles of AoP. They must empower their people with dynamic processes and needed resources to achieve the mission. They must embrace the "need for speed" while ensuring quality, safety and cost effectiveness are never compromised. The common goals must be understood, embraced, and communicated to all within the leader's scope of influence. Good leaders will not only be engaged in the intentional management of the machine, but will develop other leaders that will carry on the mission when they are no longer around.

**7.3.** Every organization must develop well designed machines that follow the integrated components of the management system depicted by the Radiator Chart. The machines must have a predictable output and must be measurable through every step of the process. These machines must be managed with a sense of urgency that demonstrates a "minutes matter" mentality. Strategic management must ensure targets are set for success of the customer and the organization far into the future through challenging Road to…Goals that are horizontally integrated throughout the enterprise. Every machine must be operationally managed to ensure the processes are in place, effective, and followed to ensure sustainment and continuous improvement. And all units of work must be tactically managed to ensure continuous movement through the machine resulting in real-time, rapid resolution of issues affecting the movement of daily work.

**7.4.** The AFSC must create a culture of *believers*. This starts with setting the vision for the future, and backing up that vision by focusing on well-defined processes and continually improving to allow organizations to efficiently obtain that vision. Believe in the vision. Believe in the value of the AFSC people. Believe in the need to focus on processes. Believe in the power of involving the enterprise. *Believe in the AFSC Way*.

**7.5.** However, belief by itself is not enough. Belief without action does not equate to success. Leaders must take personal accountability for putting the contents of this handbook into action. They must personally practice the principles presented so that belief is transferred to Skill and repetition of skill becomes habit. True Art of the Possible will only be achieved when its principles become habit for everyone in the command!

# APPENDIX A – CASE STUDIES

## A.1. AFSC Logistics Directorate's Performance Management Division (LZZ) Non-Technical Special Projects

A.1.1. Mission Overview. AFSC/LZZ 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/LZZ's customers are Air Force leaders at the center, complex, wing, and center staff levels. Some products are reported up to AFMC/CC and Headquarters Air Force (HAF). When AFSC/LZZ embarked on implementing AoP, division leadership reviewed its specified and implied tasks in order to define its METL. The AFSC/LZZ METL is made up of six METs. These are:

A.1.1.1. Administration – Workflow, SOCCERs, and Action Officer (AO) Management.

A.1.1.2. Non-Technical Special Projects.

A.1.1.3. Recurring Center-Level Reviews.

A.1.1.4. Tool Development.

A.1.1.5. Metric & Data Reporting.

A.1.1.6. Analysis & Studies.

A.1.2. Non-Technical Special Projects. One of the primary tasks AFSC/LZZ 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.1.2.1. Case for AoP Implementation. Special projects assigned to AFSC/LZZ 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/LZZ set out to implement AoP on its non-technical special projects workload.

A.1.3. Special Projects Flow. While each special project has a unique implementation timeline, there are common steps across all special projects. The AFSC/LZZ 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/LZZ had the privilege of visiting the Air Force Special Operations Command (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.

A1.3.1. 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.1.3.1.1. Identify the Lead Stakeholder. This is the leader or customer for whom AFSC/LZZ 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.1.3.1.2. Define the Problem. The inventor Charles F. Kettering stated "a problem well-stated is a problem half-solved" (Charles Kettering Quotes. (n.d.). BrainyQuote.com)[8]. 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.1.3.1.3. 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.1.3.1.4. Workload Balancing. Before the project is assigned to an AO, the AFSC/LZZB 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.1.3.1.5. Release Point: Assign to an AO. The final step of Gate 1 is for AFSC/LZZB to assign the project to an AO.

A.1.3.2. 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.1.3.2.1. Validating project definition. AOs should meet with all stakeholders necessary to ensure they understand the problem and desired end state.

A.1.3.2.2. 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.1.3.2.3. 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.1.3.2.4. 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.1.3.2.5. Release Point: Leadership Approval of Plan. When leadership approves the plan, the project is released from Gate 2 into Gate 3.

A.1.3.3. Gate 3: Project Execution

A.1.3.3.1. 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.1.3.3.2. Re-plan as necessary. If new requirements or changes occur, the plan may need to be adjusted or redone.

A.1.3.3.3. Provide status updates through appropriate leadership level. The AO should keep leadership informed on the progress of the project.

A.1.3.3.4. Release Point: All Tasks Complete. Once the plan is complete and all milestones have been achieved, the project progresses to Gate 4.

A.1.3.4. Gate 4: Reporting

A.1.3.4.1. 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.1.3.5.1. 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.1.3.5. Gate 5: Documenting

A.1.3.5.1. Document project results. The AO should document the products of the project along with any approval documentation.

A.1.3.5.2. 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.1.3.5.3. Close project. Upon archiving all the project documentation the project is closed.

A.1.3.5.4. Release Point: Branch Approval.

A.1.4. 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 assessed as a large project due to the high level of direction.

A.1.4.1. Large projects are defined as those that will take more than a year to complete.

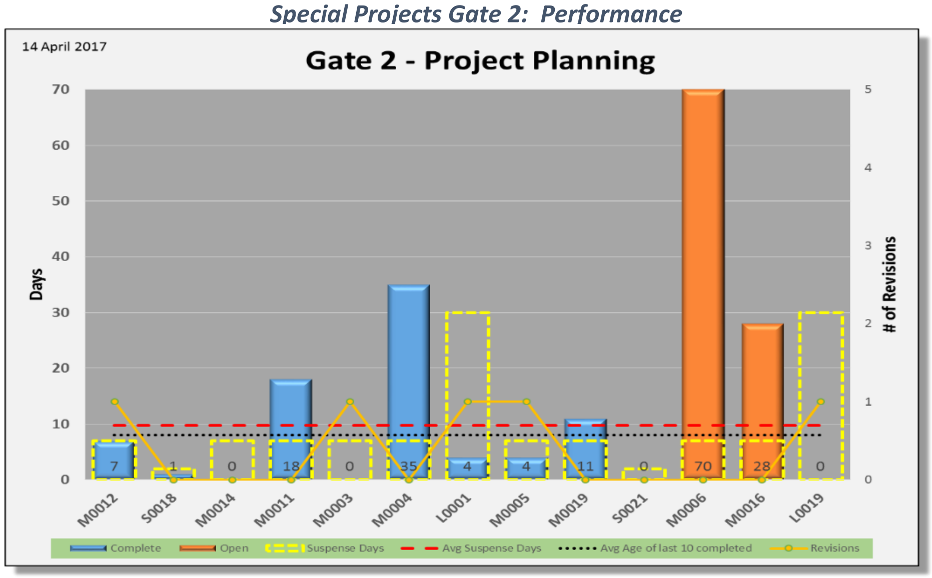
A.1.4.2. Medium projects are defined as those that will take more than a month but less than a year to complete.

A.1.4.3. Small projects are defined as those that will take more than a week but less than a month to complete.

A.1.5. Constraint Identification. Constraining gates are identified as the gate with the lowest throughput; 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.1.5.1. 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.

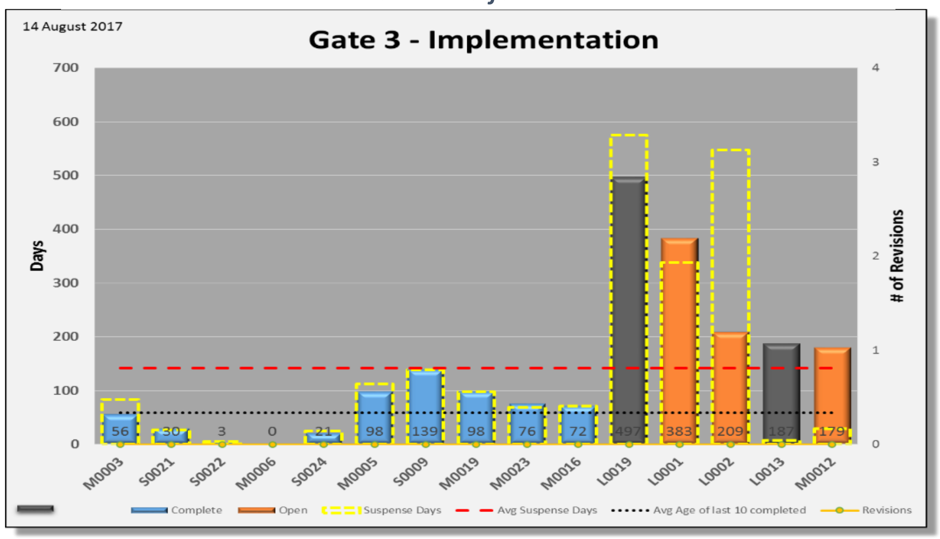
*Special Projects Gate 2: Performance*




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 seven 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.

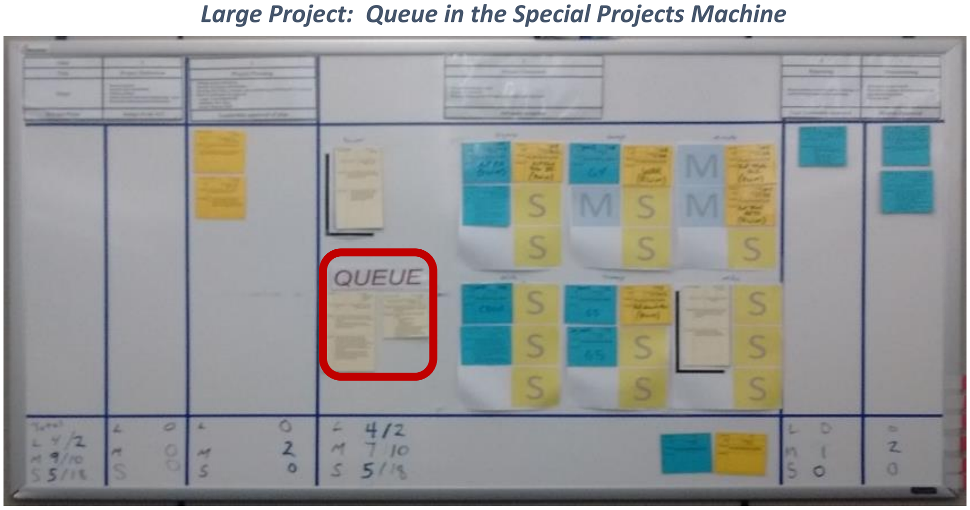
A.1.5.2. Current Constraint. As of the writing of this case study, Gate 2 performance has improved but Gate 3 data shows an alarming trend. While nine of the last 10 projects to complete Gate 3 have done so on time, the open projects reveal a growing problem. See the figure below.

*Gate 3: Performance*




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.1.6. Constraint Resolution. AoP has served its purpose by identifying the current constraint in AFSC/LZZ'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.1.6.1. 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/LZZ 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/LZZB 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/LZZ 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/LZZ 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.1.7. Visual Display.  The AFSC/LZZ 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.1.7.1. The surrounding charts are in counter clockwise order from the top left:

A.1.7.1.1. The Leadership Model.

A.1.7.1.2. AoP implementation approach, or the five steps for implementing AoP.

A.1.7.1.3. AFSC/LZZ METL.

A.1.7.1.4. AFSC/LZZ AoP burn down plan.

A.1.7.1.5. Gate performance charts for Gates 1-5.

A.1.7.1.6. Principles of flow.

A.1.7.1.7. Gate time and quality targets assessment chart.

A.1.7.1.8. Road to…Goal.

A.1.7.2. The machine flow and WIP are portrayed on the magnetic board at the center of the wall.

A.1.7.2.1. Gates are displayed as columns from left to right.

A.1.7.2.2. 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.

***Example: Special Project Card***

| | | | |
|---|---|---|---|
| Project #: | A004 | AO: | Michelle Jackson |
| ECD: | 31 Mar 17 | Lead Stake-holder: | 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<br>• Develop format<br>• AoP SME vetting approach<br>• Distribution approach<br>• QC approach<br>• Schedule | | |

A.1.7.2.2.1. Large projects are visually portrayed on 3” x 6” beige cards.

A.1.7.2.2.2. Medium projects are visually portrayed on 3” x 3” blue cards.

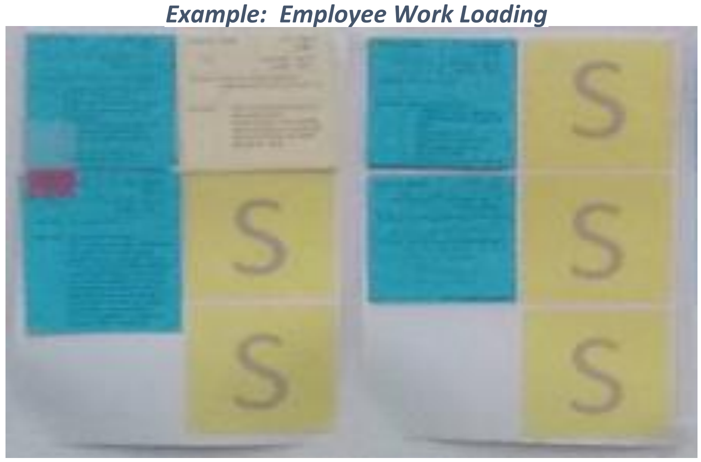
A.1.7.2.2.3. Small projects are visually portrayed on 3” x 3” yellow cards.

A.1.7.2.3. Employee Capacity Model. One area where administrative work can be different from production workload is the area of manloading and multi-tasking. 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.1.7.2.4. 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.1.8. Next Steps. AoP is never finished. AFSC/LZZ continues to work on its special projects machine to both resolve its current constraint and to improve the machine itself. Current efforts include:

A.1.8.1. Continuing to develop AOs in order to increase large project capacity.

A.1.8.2. 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.1.9. Lessons learned. AFSC/LZZ continues to learn daily from its use of AoP. Several key lessons stand out as worth sharing across the center.

A.1.9.1. 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.1.9.2. 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.1.9.2.1. 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.1.9.2.2. TSP area of WR-ALC contributed the idea of engineers having a set capacity to work projects. This was used to develop the AFSC/LZZ Employee Capacity Model.

A.1.9.2.3. 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.1.9.3. 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.1.9.4. 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.1.10. Contact Information: Scot Doepker, AFSC/LZZB, DSN 674-0092.

**Additional case studies are available on the AoP SharePoint site:**
**https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Forms/AllItems.aspx?RootFolder=%2Fsites%2F22197%2FAoP%2FSiteCollectionDocuments%2FTools%2F5%2E%20AoP%20Case%20Studies%20and%20Success%20Stories&FolderCTID=0x012000DAB383134B80214DA2915E65CA1D21A9&View=%7BD14873CF%2DA051%2D4026%2D9BDB%2D9A133FA658AB%7D**

## APPENDIX A – CASE STUDIES

### A.2. Mission Essential Task for Study: 309th Aerospace Maintenance and Regeneration Group (AMARG) METL: Component Reclamation.

A.2.1. Mission Overview. 309th AMARG is located at Davis-Monthan Air Force Base, Ariz. and recognized as a one-of-a-kind specialized facility within the Department of Defense (DoD). It's also the largest aircraft storage facility in the world and considered a National Airpower Reservoir! The lack of rainfall and hard caliche-based, high alkaline soil makes AMARG ideal for long-term storage and reclamation of aerospace assets, utilizing 2,600 acres of desert to store more than 3,000 aerospace vehicles, 6,000 engines, and 300,000 production tooling line items.

The 577th Commodities Reclamation Squadron (CMRS) executes a portion of AMARG's mission by removing aircraft parts for the services and government agencies. CMRS is often tasked to quickly harvest critical parts for the AOR, proving its "surge" capability in response to urgent warfighter needs.

A.2.1.1. Case for AoP Implementation.
CMRS' Reclamation Flight was deemed optimal for implementation of Art of the Possible (AoP) due to its variable workload and environment. Daily part pulls can widely vary from one to hundreds. Part complexities can be as simple as the removal of a bolt to removal of an oversized wing. Specialized support equipment, engineering specifications, and 80 Mission Design and Series (MDS) aircraft further affect the highly variable workload.

A.2.2. Flow. The Item Manager (IM) or System Manager (SM) in the Program Office submit prioritized orders through the AFSC's supply wings based on customer needs:

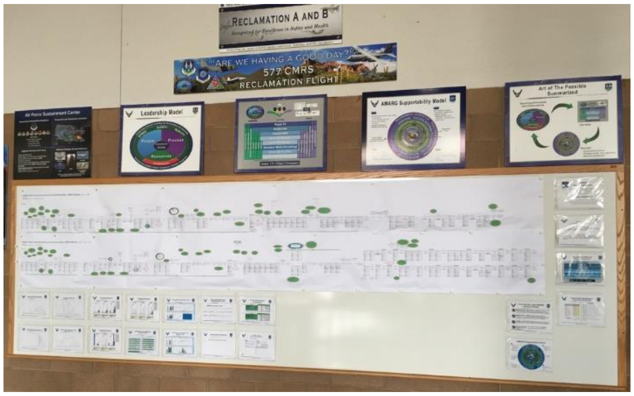
Priority 1-3, the highest priority, includes Mission Impaired Capability Awaiting Parts (MICAP) and Global War on Terror (GWOT) parts request. AMARG's goal is to ship these parts to the AOR in 2-3 workdays.
Priority 4-8 and 9-15 are worked in order of precedence, but subject to complexity. The chart below reflects priority flow days per part (per Air Force Materiel Command Instruction (AFMCI) 23-111):
AMARG's priority reclamation is based on three degrees of complexity. The following are general, examples of each:
Low: An instrument easily removed from a cockpit panel, requiring minimum time to clean, bench check, package, and ship.
Medium: A structural fitting requiring aircraft jacking or special tools/equipment to effect removal, but is relatively simple to clean, inspect, package and ship.

High: A wing that requires heavy equipment/ballasts to accomplish the removal, construction of aircraft support modules and extensive packing and crating work to prepare it for shipment.

| MILSTRIP Priority | Degree of Parts Removal Complexity | | |
|---|---|---|---|
| | *Low* | *Medium* | *High* |
| | **Category A Requests** | | |
| Priority 1-3 | 1 to 5 days | 6 to 9 days | 10 to 14 days |
| Priority 4-8 | 5 to 8 days | 9 to 12 days | 13 to 18 days |
| | **Category B Requests** | | |
| Priority 9-15 | 18-30 days | 31 to 45 days | 45 to 60 days |

A.2.3. WIP and Constraint Identification. Nine process machines were created after assessing both priority and degrees of complexity, immediately providing a new lens to reveal challenges. The combination of the Road to…Goal, future state process map, nine-machine construct and the gate performance charts, provided the Flight with information to prioritize constraints into Event Driven Plans (EDPs). EDPs were visible at each of the tier levels, enforcing a level of accountability, urgency, and engagement.

A.2.4. Constraint Resolution. Visual displays are embraced throughout CMRS, from color coding to standard work displays, to Andon stack lights and tier boards. Tier boards at each level are used for wall walks and tactical management. The squadron level tier 3 board is less tactical but strategic. The flight board is the tier 2 board (see figure). Tier 1 boards are at the employee and supervisor level. Tier 1 boards are employee centric. Standard cascading metrics are aligned from the tier 1 board through to group level tier 4. All tier boards convey flow, WIP, gate performance and traits of "having a good day."




A.2.5. Constraint Resolution. The visual displays work hand-in-hand with the established tier process. Tier 1 incorporates a quick stand-up meeting approach to review yesterday's gate performance, plan for today, look ahead for tomorrow to ensure shop is postured for success, overall status, escalation of issues, employee ideas/problems and countermeasures, and communication of relevant information. Daily schedulers and Tier meetings set a strict focus with effective communication controls between the reclamation crews, scheduling and supporting shops within the process. The daily battle rhythm provides a 3/5/10 and next-day look ahead and keeps all shops in-the-know. The combination of visual displays, wall walks and tier meetings has considerably improved communication effectiveness and created a common focus within the reclamation flight.

AMARG business system changes included color coding customer requests based on priority level. Additional features included which planner is working a particular request, reducing assignment delays and prioritization. Programmed thresholds indicated whether CMRS needed to exercise loans and borrows, or if overtime was needed to quickly expedite customer requests. Business rules and a management approach were established and standardized, minimizing variations. Working with reclamation production, release points were set at the end of the admin gate to minimize false starts due to unavailable resources; i.e., equipment, tools, slings, missing or unclear requirements.

A proactive scheduling cell was formed to minimize the impact of workload diversity and variation in work. This includes capitalizing on concurrent operations, scheduling each of the shops within the reclamation process to their capacity, and implementing a synchronous representative position that focuses solely on flow. Visual controls were put in place throughout the reclamation process to trigger schedulers and production personnel of their next actions.

In reclamation production, business rules such as adjustable work hours were implemented to minimize the variable work environment impacted by weather. Right-sized AGE sub-pools were placed strategically in the desert to provide reclamation crews with required equipment, significantly reducing delays.

Visual controls such as red, blue and grey containers were implemented in the reclamation processing line. Reclaimed parts are placed in colored bins according to priority levels, a cue for employees to prioritize processing.

Disruptions in flow prior to packaging and shipping are mitigated by implementation of standard work and release points after discovering trends of incorrect or missing paperwork accompanying parts.

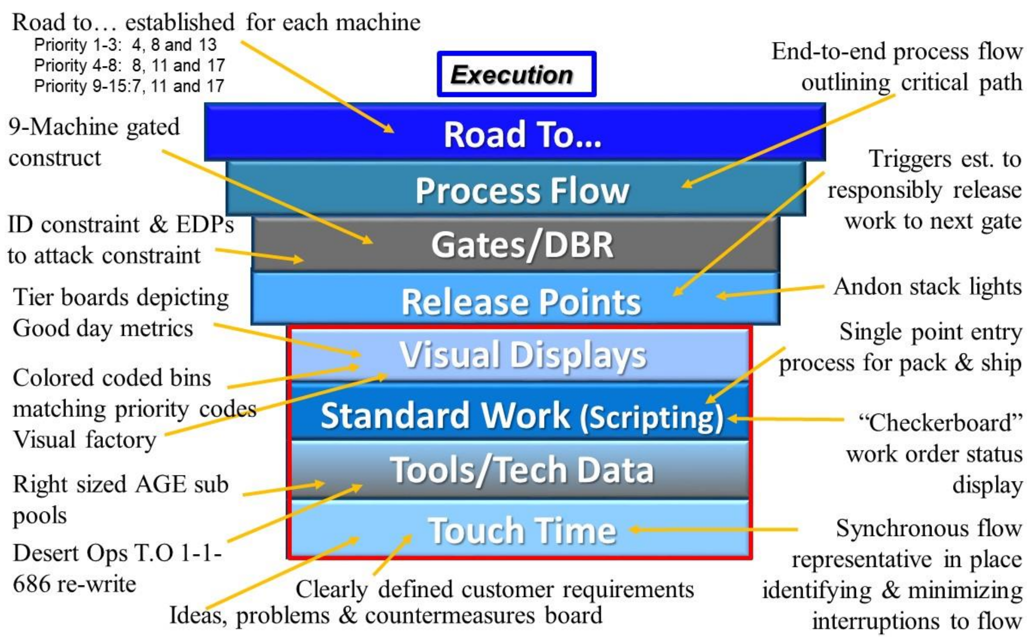
A 5-S campaign and process flow improvement were initiated to address a constraint in packaging and shipping. Excessive WIP, past dues, disorganization, and running out of packing boxes were addressed through simple visual controls. A Kanban system was implemented to set standard min/max levels and establish a proactive re-order point.

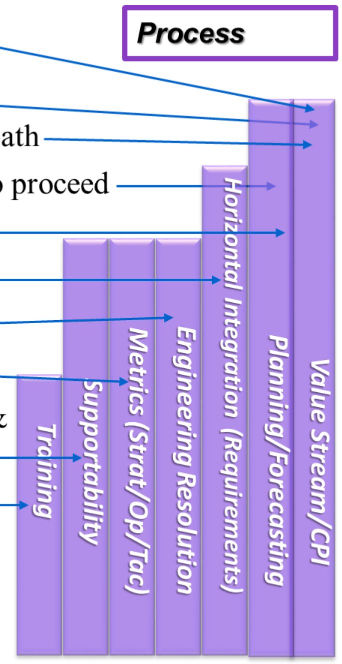
Andon stack lights were implemented to alert personnel (based on color of light) for help. Standardized shipping lanes were established based on priority, destination, and shipping type. A single entry point was established to eliminate extraneous parts from arriving without paperwork.

A.2.5.1. Results. Implementation of AoP in CMRS provides a foundation for future success and indicates how it can be applied to benefit unpredictable, high volume, highly variable workload environments and streamline AMARG’s Component Reclamation Mission Essential Task (MET), as indicated by the following table reflecting process improvements from July 2019 through July 2020.

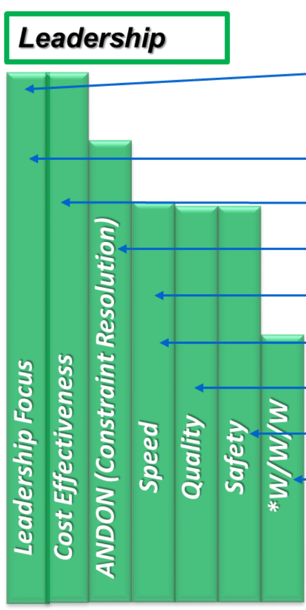
| | July 2019 | Road To Goal | July 2020 | Improvement |
|---|---|---|---|---|
| **Priority 1-3 (days)** | | | | |
| Simple | 9 | 4 | 3 | 67% |
| Medium | 9 | 8 | 5 | 44% |
| Complex | 18 | 13 | 10 | 44% |
| **Priority 4-8 (days)** | | | | |
| Simple | 39 | 7 | 4 | 90% |
| Medium | 33 | 11 | 6 | 82% |
| Complex | 39 | 17 | 17 | 56% |
| **Priority 9-15 (days)** | | | | |
| Simple | 62 | 7 | 9 | 85% |
| Medium | 76 | 11 | 75 | 1% |
| Complex | 56 | 17 | 14 | 75% |
| **Lead time (consolidated)** | 29 | | 10 | 66% |
| **Quality Pass Rate** | 88.3% | 95% | 99.9% | 13% |

**Summary of initiatives aligned to AoP radiator chart model:**






- Current & Future State Enterprise Value Stream Map
- Comprehension of our critical path
- Knowledge of constraints; never compromise critical path
- 3/5/10 & next day look-ahead process; earn the right to proceed
- Enhanced customer requirement definition process
- Common focus; All schedulers attend daily Tier 2
- Andon, constraint and escalation process
- Std cascading metrics; accountability / transparency
- Customer centric look ahead process led by planning & scheduling with emphasis on flow
- Right skilled; competency at all levels




- Engaged leadership *(Visits, Comm. Briefs, Coaching, Mgt by walking around, Audits, etc)*
- Common Focus
- Financial metrics (IDL, Efficiency, OPMD, EVM, etc)
- Andon, constraint escalation and resolution process
- Urgency; customer and employee centric
- 3/5/10 and next day look-ahead process
- Strong Quality focus; wash & inspect all parts
- Weekly Supervisor SAP and Safety walk
- Leadership visibility & coaching

A.2.6. Next step. Committed to continuing its AoP journey CMRS will focus next on maturity of its processes. This includes adhering to business rules, implement implementing an effective communication and feedback process to further drive a culture of problem solvers and a CPI mindset. Following these steps will focus on refinement of the tier meeting effectiveness and visual display boards to clearly convey "are we having a good day?" metrics and mature how we look at metrics, flow, and constraints. To address agility and meet customer needs, CMRS is continuing to hone the effectiveness of the 3/5/10 and next day look ahead process.

A.2.7. Lessons learned. The fragility of AoP. An environment for success encompasses the understanding that sustaining the gains made along the AoP journey requires constant monitoring and preventative maintenance to prevent slippage.

A.2.8. Contact information: Jose (Joe) Chacon, MXDSM, DSN 228-8496

# APPENDIX A – CASE STUDIES

## A.3. OO-ALC – 583d Missile Maintenance Squadron (MMXS), Rivet MILE Legacy

A.3.1. Mission Overview. The mission of the 583 MMXS is to provide Air Force Global Strike Command (AFGSC) and Air Force Nuclear Weapons Center (AFNWC) with on-site depot maintenance in support of the Intercontinental Ballistic Missile (ICBM) missile wings. The primary purpose of the 583 MMXS is to perform Programmed Depot Maintenance (PDM) of all Minuteman III (MMIII) Launch Facilities (LF) and Launch Control Centers (LCC) spread across three states and three different missile wings. The 583 MMXS maintains three Geographically Separated Units (GSU) to support the missile wings at their location. As the MMIII weapon system continues to age, the work performed by the 583 MMXS to keep the LF/LCCs operational is critical to our nation's defense. The below 583 MMXS METL communicates the core tasks performed within squadron.

MET 1 – MMIII Launch Facility Programmed Depot Maintenance

MET 2 – MMIII Launch Control Center Programmed Depot Maintenance

A.3.2. MET for Study. The MET identified for this case study is the MMIII Launch Facility PDM. PDM includes repairing water leaks and associated corrosion, component servicing in and around the LF, equipment inspections, repair or replacement of Missile Stabilization System (MSS) components, and repair or replacement of worn hoses and ducts throughout.

A.3.2.1. Case for AoP Implementation. AoP was implemented in the squadron in 2017 with a bottom up approach where each GSU went through a trial and error phase to see what worked and what didn't for their location. In 2019 the decision was made to standardize the process flow across the GSUs using critical chain methodology. The three GSUs came together at Hill AFB to discuss best practices and map out the flow for PDM.

A.3.3. Flow. Prior to 2019, the PDM process was segmented into three gates with all the on-site maintenance performed in Gate 2. This approach did not lend well to constraint identification or true measurement of task performance. The new gated process consists of seven gates with the on-site time measured over five gates, each having defined task flow requirements. Gates 1 and 7 capture the production support time between induction and beginning maintenance as well as from maintenance completion to final sell. Gate 1 improvements have allowed the production support team better control over parts and material supportability which allows the technicians to have what they need when they need it. The flow of Gates 2-6 are scripted to maximize manpower and support equipment availability which has helped significantly reduce overlapping requirements on the minimal available resources.

A.3.4. WIP. WIP is negotiated with AFGSC a year in advance to reduce impact to nuclear capability. Ideal WIP is three LFs per wing which means nine LFs in work overall. Each GSU has three PDM teams and a fourth team that are available to work tasks that are outside the PDM requirements. The production support team manages WIP very closely to ensure the Master Production Schedule is accomplished on time.

A.3.5. Constraint Identification. Constraints are captured throughout the process and trended to identify the main constraints to the process and weed out the one offs. All members of the team understand the importance of their role to identify, document, analyze, monitor and bust constraints. Constraints are discussed during Wall Walks at the individual GSUs and communicated up to the Squadron when assistance is needed. Due to the age of the weapon system the largest constraints to LF PDM surround the availability of parts, material and support equipment necessary to complete all required tasks.

A.3.6. Constraint Resolution. Resolution at the lowest level possible is always the goal. When this is not possible constraints are elevated through daily tier meetings and Wall Walks at the GSUs up to the Wall Walk board at the squadron. If a constraint becomes a work stoppage, the Andon process is utilized to get immediate action. This flow of information has increased engagement from leadership and enterprise partners to bust constraints.

A.3.6.1. Results. Using CCPM and standardizing the LF PDM process has led to greater cross talk and sharing of best practices between the three GSUs. Constraints that have been plaguing the 583 MMXS for years are starting to break free. Enterprise involvement is at an all-time high.

A.3.7. Visual Display (picture of Wall Walk board).


A.3.8. Next Steps. Further development of the Wall Walk boards and trend analysis at the squadron level move away from just looking at lagging indicators of what has happened, to looking for leading indicators of potential constraints.

A.3.9. Lessons learned. Consistency is key to constraint identification. Without a standardized flow it is almost impossible to identify true constraints.

A.3.10. Contact Information: Cade Andersen, 583 MMXS/MXDPH, DSN 586-3570.

## A.4. 523 Electronics Maintenance Squadron (EMXS) RF Shop Production Machine

A.4.1. Mission Overview: The 523 EMXS Mission is to safely and consistently produce high quality Electronic Avionics and Flight Control products to meet customer and warfighter requirements on time, at best value.

MET 1: F-16 Radar System Programmed, un-programmed depot level repair and modification workload with safe, reliable, and defect-free aircraft. The MET supports MGA 4, Execute the Mission.

MET 2: Planning/Target Development. MET supports MGA 1, Managing Resources.

MET 3: Personnel/Workforce Development. MET supports MGA 2, Leading People.

MET 4: Assets/Parts Acquisition Management. MET supports MGA 1, Managing Resources.

MET 5: Administrative Controls. MET supports MGA 3, Improving the Unit.

A.4.2. MET for Study. Electronic Component Overhaul and Repair. Specifically, RF Shop, F-16 Radar System is the identified task for this study. The RF Shop is the sole source of repair on this workload that directly supports the Air Force and qualifying Foreign Military Sales (FMS) countries to enable combat ready warfighter for national defense. As of 1 October 2018, the APG 68 antenna had 7460 Mission Incapable, Awaiting Parts (MICAP) hours, 36 MICAP incidents, 43 Backorders (BO) and 1 Delayed Discrepancy Requisition (YBQ). The Modular Low Power Radio Frequency (MLPRF) had 38 BO's with 25 missed On Time Delivery (OTD) shipments.

A.4.2.1. Case for AoP Implementation. With the Mission Capable 80% (MC80) initiative in place to reach an 80% RO fill rate, the Radar Systems throughput needed to increase to fill the multiple BOs and reduce WIP. This was being directly affected by equipment/processes such as the Advanced Intermediate Shop (AIS) test station, Intermittent Fault Detection Isolation System (IFDIS), and Fire Control Radar Antenna Test System (FCRATS) Range as well as constraints with Point of Use (POU) and supply chain processes.

A.4.2.1.1. The crisis or opportunity that drove AoP implementation.
The burning platform of zero BOs. BO burn down plan to reduce MICAP hours, a CPI event on POU, as well as open communication with supply chain/program office to increase part availability for the technicians to increase OTD were planned out.

A.4.3. Gates. The RF shop uses a 4 gate flow process consisting of:

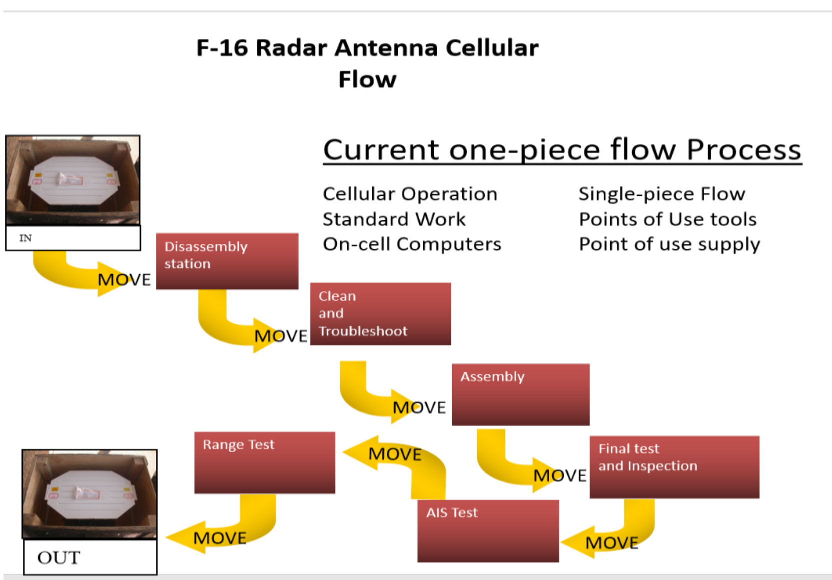
Gate 1 Initial: Incoming visual inspection, verification of asset P/N and S/N, and removal of any access panels.

Gate 2 Repair: Verify test station software/hardware currency, troubleshoot test/repair (IFDIS testing if require), removal and installation of parts as required, secondary Foreign Object Damage (FOD) inspection, replace access panels if removed.

Gate 3 Final Test: Final testing procedures completed.

Gate 4 Final Inspect: Final visual inspection, Line Replaceable Unit (LRU) cleaning/painting, affix proper labels, markings, and final out-processing.

The gates identify how the RF machine flows in regards to time/hours in the shop. The RF machine as a whole can be seen as a Drum Buffer Rope process beginning and ending with the Execution and Prioritization Repair Support System (EXPRESS). EXPRESS is a system that gathers data by using a number of different sources to determine what repairs can and should be made. The customer forecast or funding requirements along with EXPRESS is the "drum" of the process and the capacity or "M" switch is the "buffer" that sets the WIP. WIP is throughput times the flowtime (Littles Law). Where the RF machine is a repair process the flowtime of an asset can vary opposed to say an overhaul process and can affect the throughput in each gate. However, an average WIP can be set to ensure there are enough assets throughout the process to keep the machine moving at a steady pace while EXPRESS maintains this level. As an asset finishes Gate 4 and is out-processed, that is the signal or "rope" to bring another asset into the shop at the front of the line for the machine to begin the process again. Constraints such as parts issues, equipment downtime, and training of technicians all affect the speed of the machine, so the quicker these constraints are identified and corrected along the way, the more efficient the machine runs.




A.4.4. WIP. Due to the 50 MLPRF's that were brought in on the 206 to be tested and used as serviceable parts the WIP for the shop did increase in October 2018. As the shop worked through the assets and identified Low Noise Assembly (LNA), sample data Circuit Card Assembly (CCA), and Ribbon Cable Assemblies this enabled the flow of the process machine to increase throughput and reduces Awaiting Parts (AWP) percentage.

A.4.5. What we did to address the constraint.
By using the five focusing steps of ToC and leaderships adherence on managing resources, communication, and leading our technicians to improve processes highlighted the true constraints within the RF machine.

The majority of issues in the RF machine were due to parts availability. Gate 1 was identified to be the constraint in the machine flow, as identified with the lack of throughput. Parts such as the 68 LNAs a CCA in the MLPRF that has a 40% replacement factor. Carcass constraint and parts shortages such as Receiver Protector (RP) and Stalo Assembly sent AWP for parts constraints, due to sporadic shipments coming from the manufacturer.

The Azimuth and Elevation Compensator and Power Amplifier (Az/EI) has a replacement factor of 15% on all upgraded antennas. All antennas needing an Az/EI went into AWP for the entire FY-19 timeframe. There were no repair contracts in place for the Az/EI for all of CY-18 and CY-19 until the Northrup Grumman contract of five per month began in January 2020. There were 62 antennas in AWP for the Az/EI as of 1 January 2020 when the Northrup repair contract began.

In an effort to improve a constraint that was preventing the shop from executing the mission with the 68 APG antenna mechanical modification upgrade kit, a CPI event was initiated. The RF Point of Use parts usage was not reporting correctly due to a kitting issue. Because the parts were stock listed as a kit, individual usage was not captured. Essentially, the POU only had eight items available for use and many additional parts that met the POU criteria and could be added. The CPI team met with members of DLA and identified what parts of the antenna met the cost and availability criteria and could be stocked in the RF POU. This CPI event essentially quadrupled the parts readily available to technicians from 8 to 32.

Constant communications with supply chain, IMs for the MLPRF and antenna due to low NRO contributed to managing resources. IMs provided EXPRESS over-rides to allow more WIP to flow into the RF Shop. Due to the Uniphasors contracts long lead times the antenna IM approved a 206 to induct all F condition antennas to pre-screen and identify all antennas with serviceable Uniphasors. These Uniphasors had to meet specific criteria such as:
-Having the proper date stamp
-Electronics functioning in serviceable condition
-Passed all air leak check TO specifications.
All antennas that failed to meet these criteria were returned to supply in G condition, so they would not be put back into supply and stay separated from all F condition assets that had not been inspected.

The IM for the MLPRF approved a 206 to test and tear down 50 MLPRF’s to be used as donor parts and alleviate carcass constraints on multiple CCA in the MLPRF. The LNA, Sample Data CCA, and Back Plane Assembly were at a carcass constraint with 60 total MLPRF’s in

AWP until this 206 was fulfilled. IFDIS testing was required to test all 50 MLPRF Ribbon cables, as there are over a thousand test points on the MLPRF Ribbon Cable Assembly that could be potentially bad or intermittently faulty. IFDIS can test 1024 test points for intermittent faults by cooling to - 40 degrees Celsius and heating to + 120 degrees Celsius while vibrating at a force of up to three G's.

IFDIS

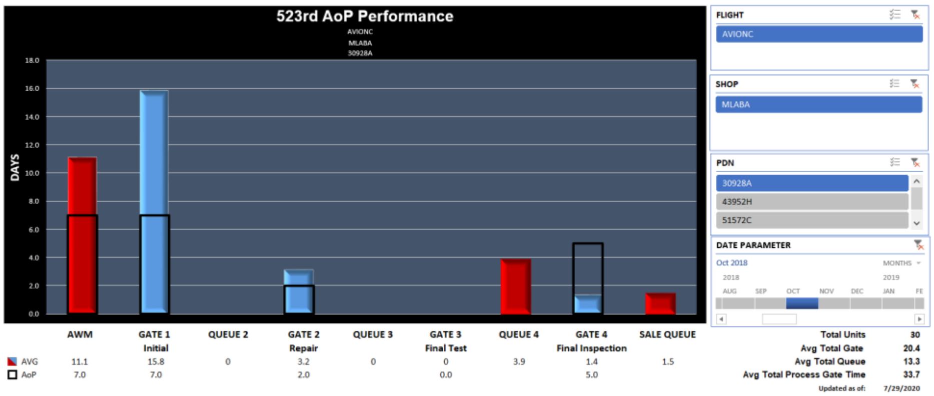

Uniphasors are a set of four phase shifters that have a replacement factor of 38% on all antenna repairs. Uniphasors are required when an antenna is upgraded per Time Compliant Technical Orders (TCTO). Uniphasors were unprocurable during FY-19 and greatly slowed the flow of the antenna. Uniphasors continue to be a parts constraint due to manufacturing flaws and lack of availability due to lapse in contracts and manufacturers inability to fulfill shipments. Hurley Inc. has only fulfilled a quantity of 30 out of a contract for 300 Uniphasors. Hurley Inc. provided an Estimated Delivery Date (EDD) of July 2020 that just got delayed again until December 2020.

22 Oct 2018 the RF shop had 49 antenna BOs 3 MICAPs and 3 YBQ's with an RO Fill Percentage of 48%. Initiated BO burn down plan, hit the MC-80 goal of 80 % RO Fill % and zero BOs and zero MICAPs in April 2019. By June 2019 the RF shop exceeded the MC-80 requirements with zero antenna BOs and 118% RO fill percentage.

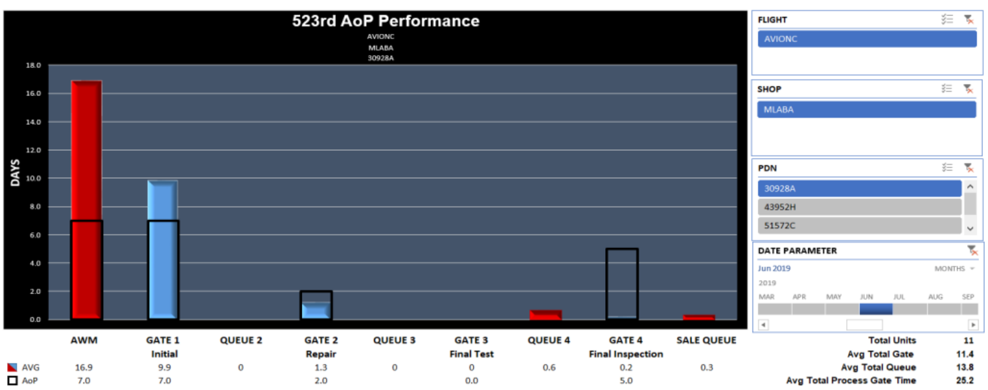
A.4.6. Results. The RF Shop sold 337 antennas of the 355 Master Production Schedule (MPS) planned antennas for FY-19 with an OTD of 95 % and a 95% Actual MPS shipment rate for the antenna workload. The RF Shop sold 409 MLPRF's of the 355 MPS planned MLPRF's for FY-19 with an OTD of 96 % and a 96% Actual MPS shipment rate for the MLPRF workload.

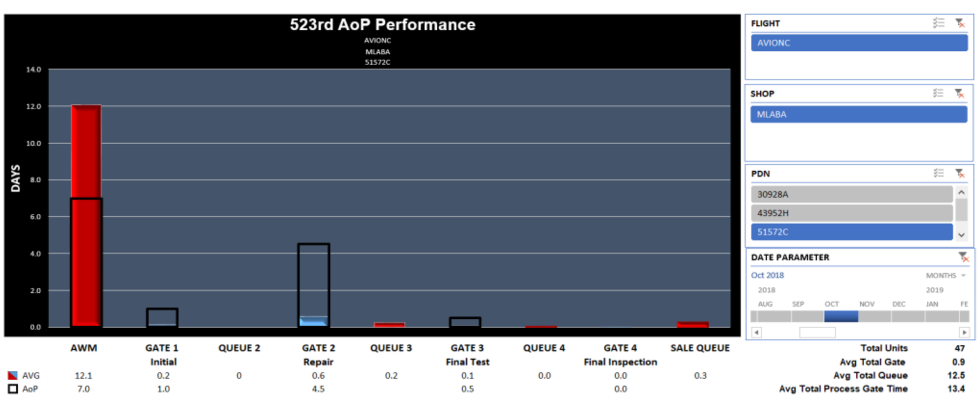
A.4.7. Visual Display.

Gate Chart: A gated process developed for all WCD in the 523. The antenna and MLPRF were the first assets to receive the newly developed gated WCD's and were used as a sample to track the gate times as well as increases/decreases in shop WIP and flow time.

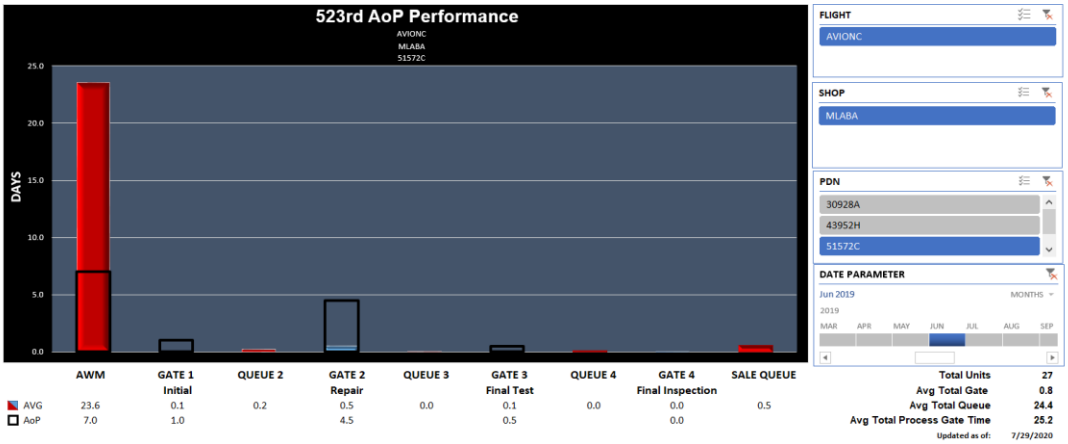



For the antenna Gate 1 completion time decreased from 15.8 to 9.9 hours. Gate 2 similarly decreased from 3.2 to just 1.3 hours. Gate 4 Queue time dropped significantly as did Gate 4 as a whole.

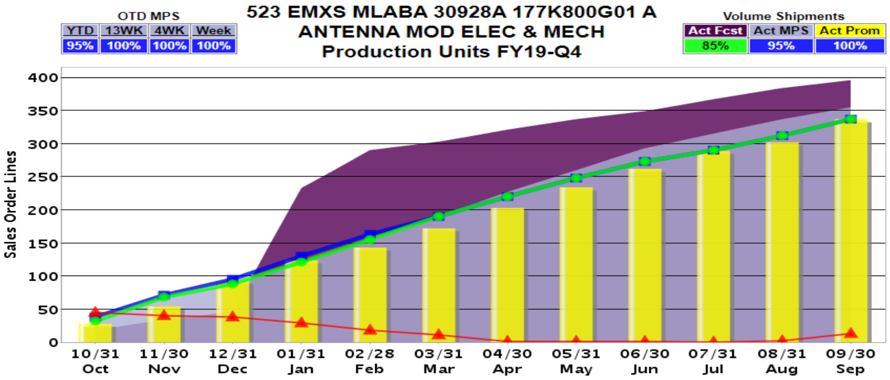



For the MLPRF Awaiting Maintenance (AWM) time dropped almost in half from 23.6 to 12.1 hours. Gate 1 stayed relatively the same while Queue 2 time dropped to zero. Gate 2, through the end of the process stayed relatively the same.




Antenna OTD FY-19

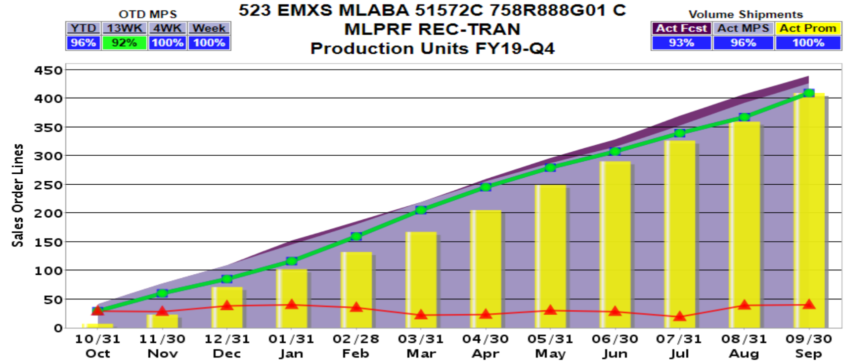



| | 10/31 Oct | 11/30 Nov | 12/31 Dec | 01/31 Jan | 02/28 Feb | 03/31 Mar | 04/30 Apr | 05/31 May | 06/30 Jun | 07/31 Jul | 08/31 Aug | 09/30 Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cust Fcst | 18 | 34 | 46 | 233 | 290 | 303 | 321 | 337 | 349 | 367 | 384 | 396 |
| MPS Plan | 32 | 68 | 88 | 121 | 155 | 191 | 227 | 260 | 293 | 315 | 337 | 355 |
| SO Prom | 28 | 54 | 93 | 124 | 143 | 172 | 203 | 234 | 262 | 289 | 302 | 337 |
| Act Ship | 38 | 71 | 95 | 130 | 163 | 190 | 220 | 248 | 273 | 290 | 312 | 337 |
| OTD Ship | 32 | 68 | 88 | 121 | 155 | 190 | 220 | 248 | 273 | 290 | 312 | 337 |
| OWO | 44 | 42 | 52 | 42 | 30 | 50 | 46 | 36 | 19 | 23 | 36 | 73 |
| F Cond | 111 | 103 | 90 | 93 | 92 | 67 | 54 | 66 | 57 | 65 | 66 | 34 |
| NRO Qty | 5 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Back Orders | 45 | 40 | 38 | 29 | 18 | 11 | 1 | 1 | 1 | 0 | 2 | 13 |
| A Cond | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 21 | 17 | 0 | 0 |
| RO Percent Filled | 48 | 28 | 34 | 35 | 39 | 67 | 86 | 100 | 119 | 89 | 65 | 58 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MPS Plan Non-Cum | 32 | 36 | 20 | 33 | 34 | 36 | 36 | 33 | 33 | 22 | 22 | 18 |
| Act Ship Non-Cum | 38 | 33 | 24 | 35 | 33 | 27 | 30 | 28 | 25 | 17 | 22 | 25 |

*Cust Fcst & MPS Plan include unplanned units based on original SO promise dates.

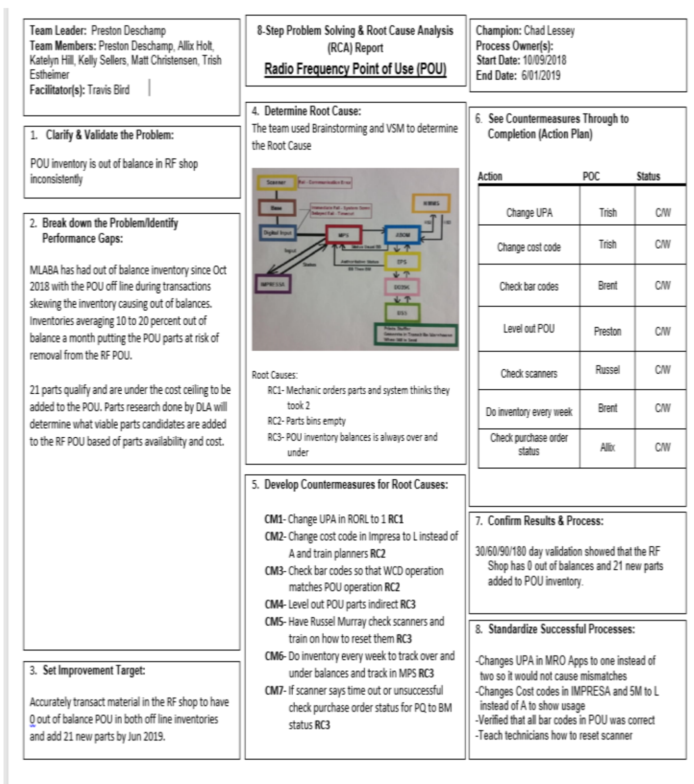
MLPRF OTD FY-19




| | 10/31 Oct | 11/30 Nov | 12/31 Dec | 01/31 Jan | 02/28 Feb | 03/31 Mar | 04/30 Apr | 05/31 May | 06/30 Jun | 07/31 Jul | 08/31 Aug | 09/30 Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cust Fcst | 41 | 77 | 109 | 152 | 185 | 219 | 259 | 296 | 328 | 369 | 407 | 439 |
| MPS Plan | 41 | 77 | 109 | 145 | 180 | 219 | 255 | 287 | 315 | 352 | 392 | 426 |
| SO Prom | 7 | 23 | 71 | 102 | 132 | 167 | 205 | 249 | 290 | 326 | 359 | 409 |
| Act Ship | 29 | 60 | 85 | 116 | 159 | 205 | 245 | 279 | 307 | 339 | 367 | 409 |
| OTD Ship | 29 | 60 | 85 | 116 | 159 | 205 | 245 | 279 | 307 | 339 | 367 | 409 |
| OWO | 29 | 23 | 27 | 25 | 39 | 16 | 24 | 38 | 38 | 30 | 31 | 53 |
| F Cond | 197 | 204 | 209 | 207 | 181 | 188 | 178 | 170 | 184 | 193 | 191 | 157 |
| NRO Qty | 0 | 0 | 6 | 8 | 11 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| Back Orders | 29 | 28 | 38 | 40 | 35 | 22 | 23 | 30 | 28 | 19 | 39 | 40 |
| A Cond | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RO Percent Filled | 59 | 52 | 53 | 47 | 45 | 59 | 56 | 60 | 48 | 51 | 54 | 44 |
| MPS Plan Non-Cum | 41 | 36 | 32 | 36 | 35 | 39 | 36 | 32 | 28 | 37 | 40 | 34 |
| Act Ship Non-Cum | 29 | 31 | 25 | 31 | 43 | 46 | 40 | 34 | 28 | 32 | 28 | 42 |

*Cust Fcst & MPS Plan include unplanned units based on original SO promise dates.

A3's: Below is the A-3 for the CPI Event for the RF POU.



**Team Leader:** Preston Deschamp
**Team Members:** Preston Deschamp, Allix Holt, Katelyn Hill, Kelly Sellers, Matt Christensen, Trish Estheimer
**Facilitator(s):** Travis Bird

**8-Step Problem Solving & Root Cause Analysis (RCA) Report**
**Radio Frequency Point of Use (POU)**

**Champion:** Chad Lessey
**Process Owner(s):**
**Start Date:** 10/09/2018
**End Date:** 6/01/2019

1. **Clarify & Validate the Problem:**

POU inventory is out of balance in RF shop inconsistently

2. **Break down the Problem/Identify Performance Gaps:**

MLABA has had out of balance inventory since Oct 2018 with the POU off line during transactions skewing the inventory causing out of balances. Inventories averaging 10 to 20 percent out of balance a month putting the POU parts at risk of removal from the RF POU.

21 parts qualify and are under the cost ceiling to be added to the POU. Parts research done by DLA will determine what viable parts candidates are added to the RF POU based of parts availability and cost.

3. **Set Improvement Target:**

Accurately transact material in the RF shop to have 0 out of balance POU in both off line inventories and add 21 new parts by Jun 2019.

4. **Determine Root Cause:**
The team used Brainstorming and VSM to determine the Root Cause

Root Causes:
RC1- Mechanic orders parts and system thinks they took 2
RC2- Parts bins empty
RC3- POU inventory balances is always over and under

5. **Develop Countermeasures for Root Causes:**

**CM1**- Change UPA in RORL to 1 **RC1**
**CM2**- Change cost code in Impresa to L instead of A and train planners **RC2**
**CM3**- Check bar codes so that WCD operation matches POU operation **RC2**
**CM4**- Level out POU parts indirect **RC3**
**CM5**- Have Russel Murray check scanners and train on how to reset them **RC3**
**CM6**- Do inventory every week to track over and under balances and track in MPS **RC3**
**CM7**- If scanner says time out or unsuccessful check purchase order status for PQ to BM status **RC3**

6. **See Countermeasures Through to Completion (Action Plan)**

| Action | POC | Status |
|---|---|---|
| Change UPA | Trish | C/W |
| Change cost code | Trish | C/W |
| Check bar codes | Brent | C/W |
| Level out POU | Preston | C/W |
| Check scanners | Russel | C/W |
| Do inventory every week | Brent | C/W |
| Check purchase order status | Allix | C/W |

7. **Confirm Results & Process:**

30/60/90/180 day validation showed that the RF Shop has 0 out of balances and 21 new parts added to POU inventory.

8. **Standardize Successful Processes:**

-Changes UPA in MRO Apps to one instead of two so it would not cause mismatches
-Changes Cost codes in IMPRESA and 5M to L instead of A to show usage
-Verified that all bar codes in POU was correct
-Teach technicians how to reset scanner

A.4.8. Next Steps. Uniphasors will be a game changer when they are received/approved. The Receiver Protector (RP) contract (Herley Inc) is for 10 per month and started in December 2019 A contract with Northrup Grumman for the AZ/EI Power Compensator was implemented for a quantity of five per month starting 1 January 2020.

It was clear that without parts to repair the antenna and MLPRF the RF machine was not going to successfully reach the Road to…Goal of zero BOs. Effective communication with supply chain along with the 206's allowed the bottlenecks of the process to resume, improving speed of the shop. Cross training technicians to perform more phases of the F-16 Radar system. The RF shop had 11 people and due to effective production hours flexed up to 13 as of 1 January 2019.

A.4.9. Contact Information: For more information on this case study, please contact: Tarra Heywood, 523 EMXS, DSN 586-6389, Jeff Cummings, 523 EMXS, DSN 777-1774 or Kelly Sellers, 523 EMXS, DSN 586-3810.

## APPENDIX A – CASE STUDIES

### A.5. 309 CMXG F-35 Canopy Machine.

A.5.1. MET for Study: For this study, the F-35 Canopy Machine supports 309 CMXG Mission Essential Task which is to provide overhaul and repair supporting the DoD Supply Chain. The machines purpose is to induct unserviceable F-35 canopies, disassemble them into their sub-components, repair or replace any damages found, re-assemble the canopy, test the final assembly, and return it to the DoD supply chain. In the case of the F-35, the final customer is multiple US military service branches and partner nations who utilize the F-35 platform.

A.5.2. Case for AoP Implementation: OO-ALC/309 CMXG was chosen as the first organic repair capability for the F-35 canopy partnering with the Joint Program Office (JPO) and Lockheed Martin. AoP Implementation was chosen out of absolute need. MICAPs from field units began to rise due to shorter than expected performance life and the canopy manufacturer was unable to increase production to keep up with the demand from the field and active production line simultaneously. Additionally, the shop wasn't producing canopies at a consistent rate, leading to longer than expected flow days and sporadic deliveries. Compounding these issues is the looming future requirement of roughly 3.5 times more canopies than currently overhauled and repaired as the F-35 shifts into sustainment.

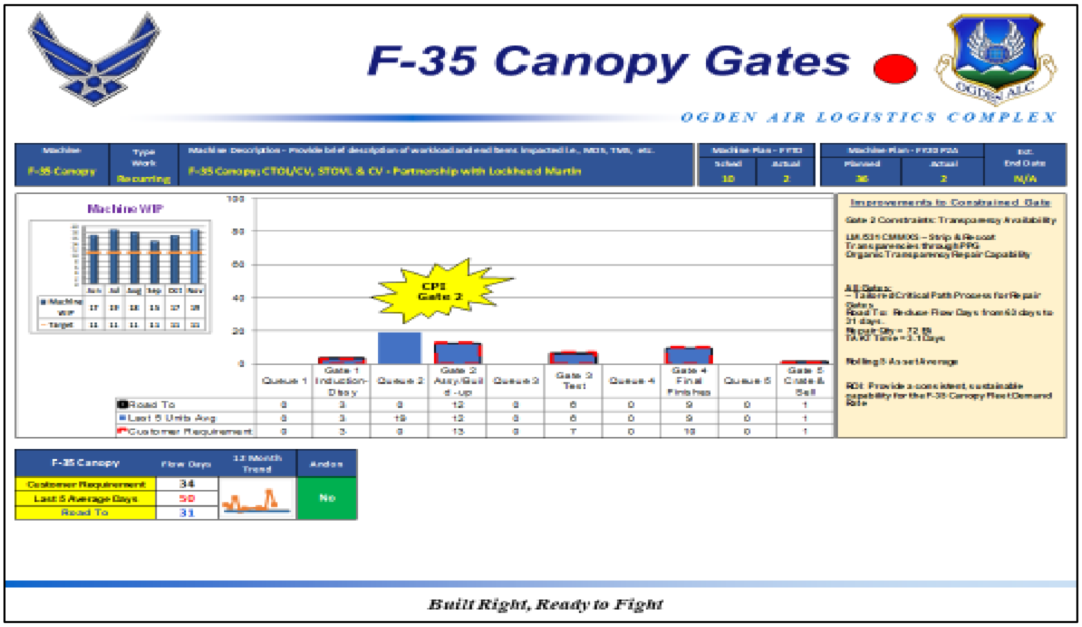
A.5.3. Flow: Asset flow was developed using a process review team which value stream mapped with enterprise partners and outlined all critical processes and support resources needed at each step. The team identified the future customer requirement and established flow by sequencing the process steps along the critical path. The next step was to identify WIP and where the WIP should be located in the machine's processes. Gates were defined using takt time and natural break points in the overhaul and repair process. There are 5 gates which include Gate 1 - Induction/Disassembly, Gate 2 - Assembly/Buildup, Gate 3 - Test, Gate 4 - Final Inspection/Finishes, and Gate 5 - Crate/Sell.

Challenges and lessons learned were (1) fully understanding what process steps would be linear/concurrent throughout the machine flow. (2) How to control WIP & release control. (3) Only assigning work based on the synchronized plan. (4) Resolving constraints QUICKLY!

A.5.4. WIP: Products that flow through the machine are three different configurations of F-35 canopies which include Conventional Takeoff and Landing (CTOL), Conventional Takeoff and Landing Carrier Variant (CTOL/CV), and Short Takeoff Vertical Landing (STOVL). Work in progress was determined using a takt time release, fully understanding the customer requirement, available work hours, and gate timelines/release points which drove the team to fully understand the sum of the cycle time per gate divided by the takt time release = staggered WIP per gate.

Challenges and lessons learned were (1) maintaining the staggered WIP in each gate to takt time. (2) Releasing work to takt time and working to the synchronized critical path.

A5.5. Constraint Identification: As with anything in AoP, once the process has been mapped, gated constraints are easy to identify. Simply look for the bottlenecks, trended gate performance and WIP/Queue. In the case of our machine, the constraint was clearly evident in Queue/WIP prior to Gate 2, Assembly/Buildup. The reason for the constraint was there were not enough canopy transparencies being provided by the supplier to keep the machine running and assets could not be assembled due to the part constraint.




Challenges and Lessons learned were (1) trend data of gate performance early in the machine stand up. (2) WIP management. (3) The team developed a better understanding of not only current constraints but also predicting what constraints lie ahead – Maturity of team increased by using the constraint based management system!

A.5.6. Constraint Resolution: Once identified, the enterprise team used the ToC focusing steps of (1) identifying the constraint – Gate 2 Queue. (2) Exploiting the constraint – In this case, exploiting, subordinating, and expanding the constraint enabled stake holders to identify a second source of repair for the transparency strip & recoat process during the Gate 1 process step. During this step, the transparency was removed and provided to another vendor creating a pull system from the vendor back to the machine.

This constraint couldn't be solved by the shop alone. It also required program office personnel to work with the government partnered suppliers and focusing on increasing canopy production and ensure timely deliveries of transparencies.

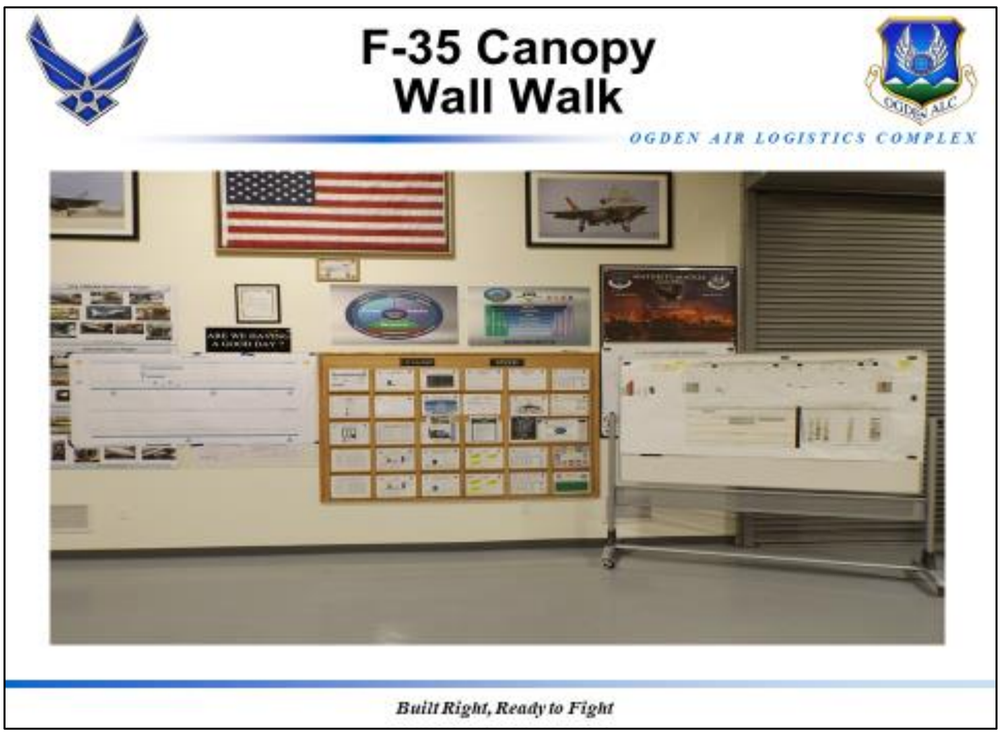
A.5.6.1. Results: The Road to…Goal was to meet a 30 day flow time.
Short Term - The results of the needed transparencies arriving from the multiple sources on time, drove the F-35 Canopy Process Machine total flow days from 63 day to 31 days. This enabled the depot to meet the field's canopy supply needs.

Long Term results was a true indicator of machine processing time that allows for the standup of duplicate machines to meet the 3.5X increase of future requirements.

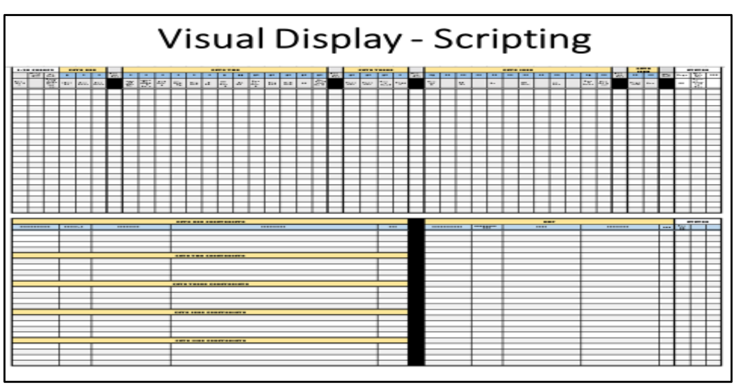
A.5.7. Visual Display: The F-35 Canopy Wall Walk depicts the operational level machine performance to include process mapping, trending gate performance and tactical level daily scripting using magnets to define WIP and progress.

Visual displays also show speed, safety, and quality measures for the overall machine and even at the tactical level for each configuration on F-35 canopy.

Visual display of the CPI activity are included to communicate to all stakeholders on constraints and constraint resolution with get well dates.




Visual Display of the daily scripting by gate – magnets are used and moved daily to show progress, WIP (upper portion) and gate constraints and resolution are depicted on the lower portion.



A.5.8. Next Steps: The next steps for the F-35 Canopy Operational Machine is to continue to use AoP to identify process health. Additionally, as the F-35 shifts more from production to sustainment, the shop will be able to accurately identify what resources and quantities of those resources it needs to increase production.

A.5.9. Lessons learned: AoP is an amazing management tool that takes all of the guesswork out of process problem solving. You can quickly identify where bottlenecks in the process are even if you aren't familiar with the process.

A.5.10. Contact Information: Capt Garrick Warren, 531 CMMXS/DO, DSN 586-1929

## APPENDIX A – CASE STUDIES

### A.6. 76 SWEG Mission Planning

A.6.1. MET for Study. The MET identified for this case study is the 76 SWEG MET to provide best value software and hardware engineering solutions. Specifically, the B-52 Mission Planning (MP) software development project will be discussed. MP software is used operationally for flight planning, enhanced route editing, weapon planning, generation of combat mission folder materials and avionics flight software and mission data transfer to a Data Transfer Cartridge (DTC). The purpose of this project is to ensure the software is designed, developed, tested, and delivered to operational users.

A.6.1.1. Case for AoP Implementation. The B-52 MP software development project was selected for AoP implementation due to the complexity involved throughout the software development lifecycle, and the number of external stakeholders involved. The MP enterprise has a high number of stakeholders due to the many individual components which are all integrated into a single Mission Planning Environment (MPE) release. For the B-52 MP team, there are over 30 components requiring integration, with many of these components being developed by different organizations. This makes communication between the B-52 MP team and other organizations crucial to ensure timely integration and minimal schedule delays. One organization's schedule delay or a communication failure between stakeholders for an interface change has the potential to significantly impact scheduled releases, ultimately delaying needed capabilities to the warfighter. As well, unlike many AoP implementations, software development work is unique every time. In spite of that uniqueness, AoP, when combined with Agile and DevSecOps methodologies, provided an opportunity for the B-52 MP team to improve their software development processes resulting in quicker software deliveries to the warfighter.

A.6.2. Flow. The process flow for the B-52 MP project came from the Agile software development methodology already used by the team. In Agile, work moves, in order, through the following phases:

- **New** – Work has been identified.
  - In this phase, work will be broken down into smaller, more manageable pieces.
- **In Progress** – The work has been broken down and is in development.
  - In this phase, the design and development work will take place.
- **In Review** – The work is ready for others to review.
  - In this phase, other members of the software development team will review the quality of the work which was done.
- **Ready For Test** – The work has been reviewed and is ready to be tested.
  - In this phase, the work will be tested to ensure it operates as a user would expect it to.
- **Done** – The work has been completed.

These phases of work were identified as the gates for the B-52 MP project. In Agile software development, work is broken down from high level requirements into individual units of work. For the B-52 MP team, this breakdown of work goes from a Requirement to Features to Product

Backlog Items (PBIs) to Tasks. Through experimentation, the B-52 MP team has found that the most beneficial way to track their work was at the PBI level. PBIs are the level of work a team expects to complete each Sprint and are tracked through the previously discussed gates. For the B-52 MP team, this means a PBI was an amount of work expected to be completed in under two weeks. Above the PBI level, there was not enough insight into the status of the work and the states were constant for too long to be useful. On the other side, below the PBI level, items were changing too rapidly to be useful. Tracking of their PBIs allowed the teams to see work moving through the process and quickly identify their constraints. This breakdown also helped to resolve some of the complexities involved with software development. By having more manageable units of work, developers were able to focus on making small, incremental software changes which would build up the overall software.

A second benefit as a result of the team's analysis of their workflow was the ability to more easily identify work waiting on external stakeholders. When the team had work which could not begin until an external dependency was resolved, they created a new piece of work to be tracked as an external issue. Looking at those items individually gave the team the ability to demonstrate how long an issue had been active and the impact it was having on development to external developers.

A.6.3. WIP. For the B-52 MP Agile software development team, WIP is defined as the items within the In Progress, In Review, or Ready For Test (RFT) gates discussed previously. This means that when discussing WIP, only PBIs are considered.

The team opted to incorporate WIP management by implementing WIP limits within their teams. Their WIP was limited to one PBI in progress per developer at a time. This ensured the team did not overload their process and would be able to complete more of their items during their two-week sprints. Developers were not prevented from pulling additional work within a Sprint, so long as they had completed their first PBI before beginning work on another.

A.6.4. Constraint Identification. Through the tracking of their flow and WIP, teams within the B-52 MP development project began identifying ways to improve touch time on developing the actual software. Some of the constraints the team identified include:

- Time spent updating developer machines.
    - The team noticed every time a machine required an update, every developer and tester on the project would be unable to work for at least half a day. Across the 40 engineers and scientists on the project, that amounted to over 20 days' worth of lost productivity, not including the three to four days it took another developer to set up and test the new development environment.
    - This constraint was made apparent by tracking the team's WIP. When upgrades and patches were required, all WIP would be stagnant while the developers were performing the updates. This would occur multiple times during the team's development cycle, which made it apparent this was a constraint which would need to be addressed.
- Time spent running test cases on software builds which were not working.
    - The testing team found that often they would waste time creating an installer, updating a machine, and running tests on a build which was fundamentally broken.

This resulted in the testers taking several hours to build the machine, only to find out they needed to go back to the developer to fix an issue. The issue would be compounded, as often a developer would begin work on another PBI while waiting for testing to be completed. This resulted in inefficient multitasking, as developers would have to go back to previous tasks and mentally re-engage in the previous task after an issue was found.
    - This constraint was identified by observing the flow of WIP. Each time a build was found to be broken, the associated PBI was moved from Ready to Test back to In Progress. By tracking the number of times items which required rework after being marked ready for testing, the team was able to see the need to address the high number of broken software builds.
- Time spent running various quality assurance tools.
    - Every time a developer checked in code to be integrated with the main set of software, multiple tools were required to be run on the new software to ensure it meets quality standards. The team found they were being unproductive while waiting for tools (such as Fortify Static Code Analysis or Unit Tests) to be completed. This problem was compounded when multiple software tools required running. If a developer was not paying attention, it was easy for software to be ready for the next step and to be forgotten, resulting in even longer delays.
    - This constraint was identified based on reviewing the cycle time for the In Review gate and analyzing the time WIP was waiting for quality tools to be run.
- Time spent waiting for software to be reviewed.
    - Part of the process for software development is to have team members review software which was written, before it can begin testing. After a developer checked in code, they would often have to wait several days before enough of their team had reviewed the new code. Similar to the issue with testing that was identified above, developers would often begin working on other tasks while waiting for teammates to review their code. Inefficient multitasking would occur when a developer had to stop work on a new task to revisit an issue in previously written code.
    - Similar to above, this constraint was identified by looking at WIP buildup in the In Review gate. Analysis of the time it took between when code was ready to be reviewed and when other developers commented and approved the changes showed a high amount of lag for most items in the In Review gate.

Between these four constraints, along with several others which were identified, the developers were spending a significant amount of time manually doing administrative or non-value added work, as well as engaging in inefficient multitasking.

A.6.5. Constraint Resolution.

- Time spent updating developer machines.
    - This first constraint was resolved using Virtual Machines (VMs) as their development environment. The team utilized tools available to create checkpoints during the VM creation process which allowed for quicker updates and patching. This lowered the time needed to create a new development environment from two to three days, to around one day, on average. In addition, by utilizing VMs, developers were able to update in a significantly shorter amount of time, typically

around one hour, rather than 6. This time savings came from the ease of updating and quicker download times associated with using the VMs.
    - Across all developers, resolving this constraint gave approximately 22 days' worth of available touch time back to the team, each time an update was required.
- Time spent running test cases on software builds which were not working.
    - The solution to this constraint required multiple improvement events. First, the team identified a need for automated user interface testing. A software tool was purchased which could exercise the user interface of the MP software and identify common issues which would indicate a build was not going to be successful. The team developed automated tests which would create a basic B-52 route and add common weapon drops within the MP software. Through doing this, the tool could alert a developer when a build did not pass the tests, indicating it was a bad build which needed to be updated.
    - The second step to resolving the constraint was to get the automated tests to run as part of the software build process, without intervention from a developer. This required integrating the automated tests into the software build pipeline, by creating a virtual machine, installing that machine on a remote computer, and then running the automated tests. By conducting each of these steps, a developer would be notified shortly after checking in code whether they had introduced a bug that was causing the software to break.
- Time spent running various quality assurance tools.
    - This constraint was resolved similar to the previous constraint. Updates were made to the build pipeline so that each required software quality tool would run automatically as soon as a developer checked in their code.
    - By integrating the quality tools directly into the build pipeline, developers received much quicker feedback on the quality of their code. This helped to prevent the issues found where a developer's code would have issues that were not found for hours to days after they had checked it in.
- Time spent waiting for software to be reviewed.
    - The solution for this constraint was much simpler than the other identified constraints. The team found the main cause of code waiting to be reviewed was that their teammates did not know they had a review waiting on them. The team added a display to their team-level dashboard which showed how many items were in review and what the status of each review was. This allowed team members to see when code was waiting to be reviewed and also showed the developer when their teammates had responded. This dashboard was shown at the team's daily meetings and was also available to each developer at their desk. The tactical management of software reviews increased the throughput of reviews significantly.

A.6.5.1. Results. The results for the constraints identified above provided both immediate short term results, as well as continuing long term results. Despite the significant amount of time spent learning and developing some of the solutions, each of them has proven to be well worth the investment. As the team has implemented these DevSecOps principles into their daily workflow, greater throughput has been shown and developer's touch time has been significantly improved.

A.6.6. Visual Display. For all of their visual displays, the B-52 MP software teams utilized integrated dashboards available within Microsoft Azure DevOps. Each team was using Visual Studio, also developed by Microsoft, which provided a simple way to have automatically updated charts and metrics to view. Multiple dashboards were used depending on the purpose for the review. For tactical management at the team level, each team was given autonomy to view what they found the most important. Figure 1 shows an example of a team-level dashboard.

The second level of dashboard utilized was for the teams' wall walks. This level of dashboard shows more of the trending data, such as velocity, cycle times, burn-up/burn-down, and cumulative flow. Figures 2 and 3 show an example of a wall walk dashboard which was utilized.

A third level of dashboard utilized for the project, was the sprint review dashboard. At the end of every two week Sprint, the teams have a meeting with the B-52 Program Office to show what was accomplished and discuss the current status of the project. This meeting gives the customer an opportunity to discuss changes they would like to see earlier in the project, as well as reprioritize future work for the team to accomplish. Figure 4 shows an example of a Sprint Review dashboard.

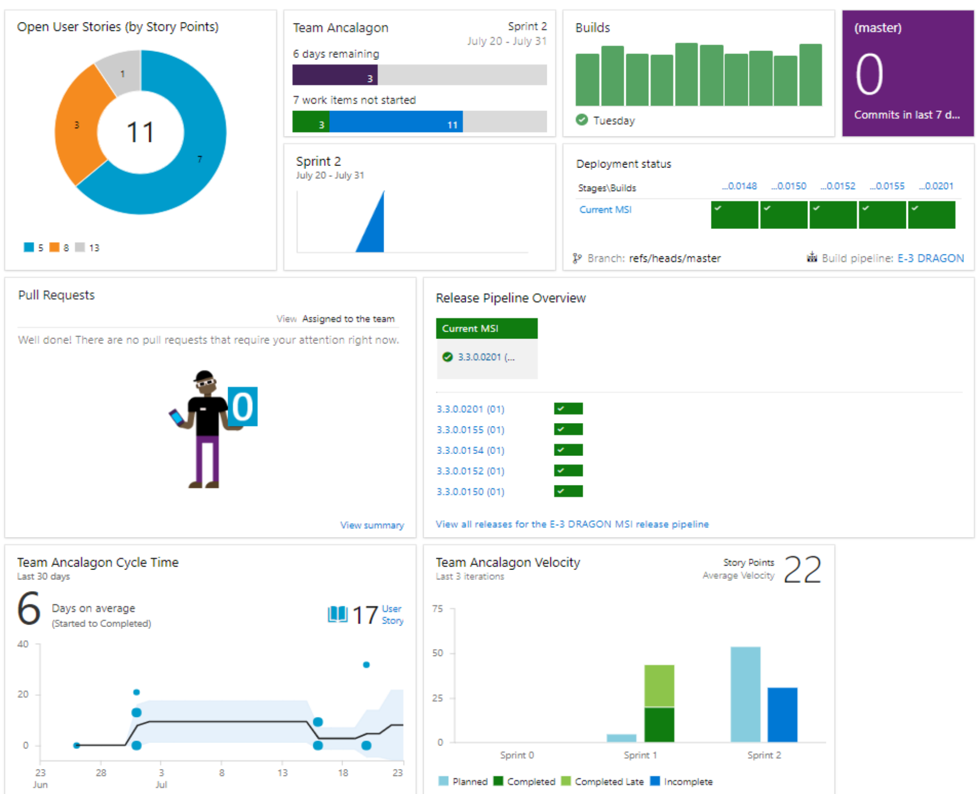



Figure 1: Team-Level Tactical Dashboard

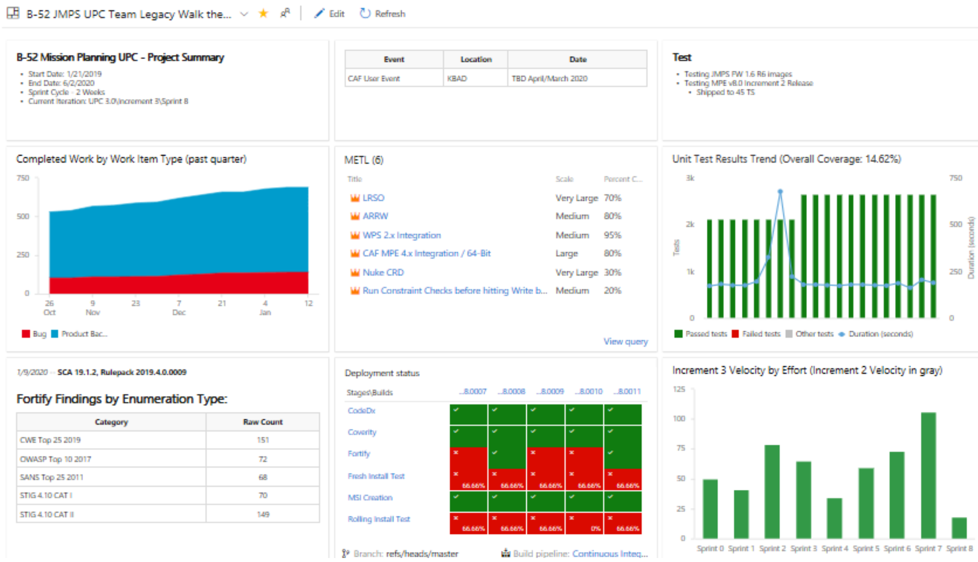



FIGURE 3: WALL WALK DASHBOARD

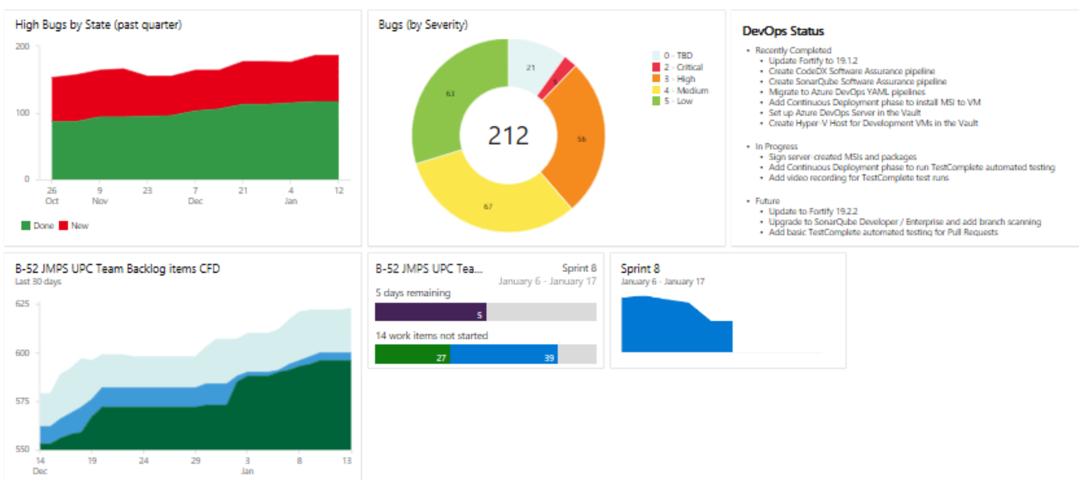



*Figure 2: Wall Walk Dashboard*

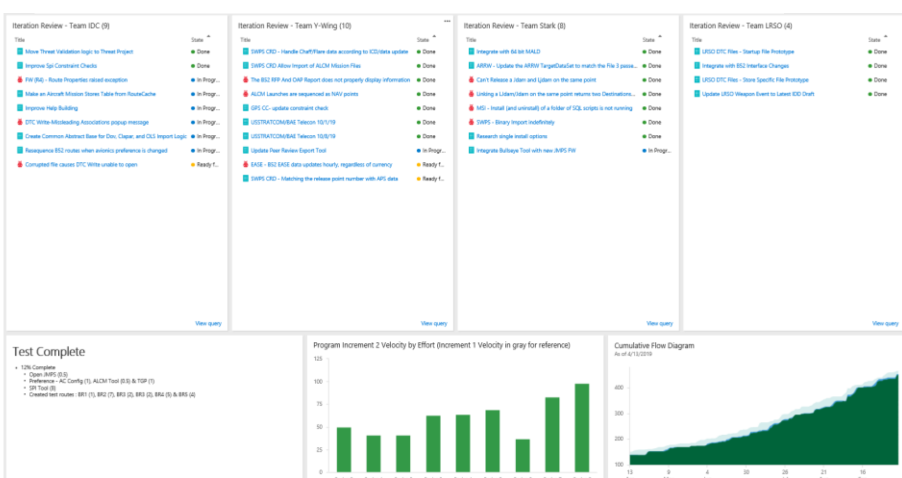


FIGURE 4: CUSTOMER-LEVEL SPRINT REVIEW DASHBOARD

A.6.7. Next Steps. In spite of the many accomplishments and improvements already realized, the team is continuing to grow in its implementation of AoP, through utilizing DevSecOps principles. The team has identified multiple improvement ideas, a few of which are listed below for future implementation.

- Integration with the MP Cloud Development Environment.
- Implementation of further automated build pipeline improvements, such as containerization of build events.
- Alignment of other 557 SWES MP development projects (such as B-1, E-3/E-8, and E-3 DRAGON) to the same development environment to enhance communication and sharing of lessons learned between teams.
- Improved metrics within automated dashboards to aid continued identification of constraints.
- Integration of all 557 SWES projects within a Tableau dashboard to aid identification of common squadron constraints.

A.6.8. Lessons learned. Throughout the development of the B-52 MP AoP implementation, the team learned a lot about how AoP and their existing Agile and DevSecOps practices lined up. Table 1 summarizes some of the ways the team identified their current process and AoP inherently lined up. AoP provided a framework to allow teams to identify their constraints quickly and empowered the team to find resolutions. The team would encourage other groups to be creative in their implementation of AoP and use its flexibility to work in their area.

TABLE 1: AOP TERMS TO B-52 MP INTERPRETATION

| AoP Term | B-52 MP Agile Software Development Interpretation |
|---|---|
| Flow | The movement of PBIs from New to In Progress to In Review to Ready for Test to Done |
| Gates | The different states work can be in – New, In Progress, In Review, Ready for Test, and Done |
| Operational Meeting | The end of Sprint meetings with the customer to discuss current project status and future work. |
| Release Points | The established Definition of Done which allows a developer to say their code change is ready to be reviewed, ready to be tested, or done. |
| Tactical Meeting | The 15-minute, daily team meeting to discuss what was accomplished the previous day, what will be worked the next day, and what constraints each team member has. |
| Touch Time | The time a developer spends coding. Work such as project management, reporting, procurement, requirements analysis, and reviews are not considered to be part of touch time. |
| Visual Displays | The automated dashboards the team uses to see current Sprint status, conduct wall walks, or show current project status to customers. |

| | |
|---|---|
| WIP | The work PBIs which have moved past the New state, but are not considered Done yet. |

When looking to identify constraints, be sure to consider all tasks. Be sure not to ignore tasks which seem to be vitally important, because there could always be a simpler or more streamlined way to approach it.

A.6.9. Contact Information: Tyler Moudy, 557 SWES/MXDPC, DSN 622-7223

# APPENDIX A – CASE STUDIES

## A.7. OC-ALC TF33 Engines

A.7.1. MET for Study: Provide repair and overhaul of whole engine, module, and propulsion exchangeables.

A.7.1.1. Case for AoP Implementation. OC-ALC generated 50 two-level maintenance (2LM) TF33 engines in FY18 meeting only 52% of the customer requirement of 96 2LM engines. This reduced War Readiness Engine (WRE) levels, and the critical level of serviceable TF33 engine supply quantity on hand, for the E-8, B-52 and E-3 aircraft. These reduced supply levels posed a threat to the warfighters' ability to accomplish their mission if not resolved. The team recognized the need to apply AoP methodologies across the TF33 enterprise to include exchangeables, supportability, overhaul and delivery of TF33 engines. Collectively, organizational leadership for DLA, Air Force Life Cycle Management Center, Engine Program Management (AFLCMC/LP), 448 Supply Chain Management Wing (SCMW), 421 SCMS, 848 SCMS, 546 Propulsion Maintenance Squadron (PMXS), 547 PMXS, 548 PMXS, OC-ALC/AS and OC-ALC/OBW made the decision to conduct an Enterprise Value Stream Mapping event (EVSM), with the goal of identifying and prioritizing issues within the TF33 engine overhaul process. The enterprise team started the improvement process with a Suppliers-Inputs-Process-Outputs-Customers (SIPOC) exercise in Oct 2018. This exercise reviewed the end to end process, from requirement generation to engine delivery, identifying 15 critical, enterprise-wide processes that were pre-mapped prior to the Jan 2019 EVSM. The EVSM allowed an enterprise review of those processes and issues, and developed a prioritized set of follow-on events and action items aimed at a collaborative, enterprise improvement effort.

A.7.2. Flow. The 2LM engine overhaul process was adjusted as a result of EVSM. The following is the post EVSM flow process. The 2LM engine overhaul process is divided into four gates encompassing engine induction, disassembly, repair, assembly and test. The repair process, represented as a material queue prior to engine assembly, is broken into four micro gates as individual parts and components make their way through repair back shops before being "kitted" for engine assembly.

A.7.2.1. Gate 1: Categorization and Borescope Inspection. The goal of this gate is to understand the condition of the engine based on external and internal inspections prior to engine disassembly. As a result of the EVSM, the results of these inspections are reviewed collaboratively with PMXG production, planning, PMXG process engineering, AFLCMC/LPS cognizant engineering, quality assurance, and engine records personnel in order to determine specific repair actions to adequately complete engine overhaul. This nine workday, 13 calendar day process is represented on the Gate 1 waterfall visual display.

| Gate 1 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CAT/BS | | | | | | | | | | |

A.7.2.2. Gate 2: Disassembly. The engine is disassembled into sub modules and individual parts and turned in to the Production Logistics Support (PLS) Center for processing and individual piece part ordering. This twelve workday, 17 calendar day process is represented on the Gate 2 waterfall visual display.

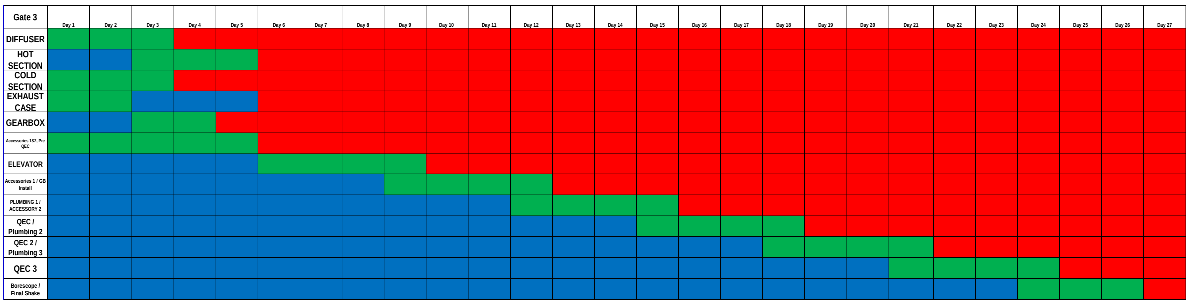
| Gate 2 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 | Day 11 | Day 12 | Day 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QEC / PLUMBING DIS. | | | | | | | | | | | | | |
| PLUMBING / QEC / DIS. | | | | | | | | | | | | | |
| GRBX DISASSEMBLY | | | | | | | | | | | | | |
| ELEVATOR DISASSEMBLY | | | | | | | | | | | | | |
| EXHAUST DISASSEMBLY | | | | | | | | | | | | | |
| COLD DISASSEMBLY | | | | | | | | | | | | | |
| HOT DISASSEMBLY | | | | | | | | | | | | | |

A.7.2.3. Material Queue-PLS Kitting and Back Shop Repair. The PLS completes ordering of replacements for non-serviceable, non-repairable parts and routes submodules to PMXG back shops for further disassembly and repair. The back shop process is managed through four micro-gates that include submodule disassembly, kitting, submodule assembly and final inspection and records update. These micro-gates are represented on the Back Shop Micro-Gate Waterfall visual display.

| Gate 1 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 | Day 11 | Day 12 | Day 13 | Day 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DISASSEMBLY | | | | | | | | | | | | | | |
| RECORDS | | | | | | | | | | | | | | |
| **Gate 2** | | | | | | | | | | | | | | |
| KITTING | 1 2 | 3 4 | 5 6 | 7 8 | 9 10 | 11 12 | 13 14 | 15 16 | 17 18 | 19 20 | 21 22 | 23 24 | 25 26 | 27 28 |
| | 29 30 | 31 32 | 33 34 | 35 36 | 37 38 | 39 40 | 41 42 | 43 44 | 45 | | | LATE OVER 10 DAYS | | |
| | | | | | | | LATE OVER 10 DAYS | | | | | | | |
| **Gate 3** | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 | Day 11 | Day 12 | Day 13 | Day 14 |
| INSPECT/ALLIGN/BAKE/BUILD | | | | | | | | | | | | | | |
| INSTALL BLADES/RIVETS | | | | | | | | | | | | | | |
| **Gate 4** | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 | Day 9 | Day 10 | Day 11 | Day 12 | Day 13 | Day 14 |
| BALANCE | | | | | | | | | | | | | | |
| CMM/FINAL | | | | | | | | | | | | | | |
| SCHEDULING REVIEW | | | | | | | | | | | | | | |
| RECORDS | | | | | | | | | | | | | | |

Serviceable parts and submodules are delivered to the engine PLS for engine assembly kitting. The kit status is tracked using the Material Queue Kitting Waterfall visual display.

A.7.2.4. Gate 3: Assembly. Once submodules and parts are supportable, kits are released to Assembly Gate mechanics for engine assembly. Quality assurance, PMXG process engineers and AFLCMC/LPS cognizant engineers are available throughout the assembly and final inspection process as needed. This twenty-six workday, 37 calendar day process is represented on the Gate 3 waterfall visual display.




A.7.2.5. Gate 4: Test Cell. During this eight calendar day process, assembled engines receive a rigorous test procedure with heavy involvement from PMXG process engineering. Once testing is complete, the engine is wrapped, prepped and shipped to the customer.

A.7.3. WIP. Prior to the EVSM event, the FY20 WIP target for TF33 engines was 30 total in work with a target of not more than 12 engines in the Material Queue Gate. In reality, 12 disassembled engines was not enough WIP to keep the engine Assembly Gate fed at a constant WIP of nine engines due to the time necessary to develop and execute repairs as a workaround to supportability issues in the PMXG back shop. The team recognized an increased buffer stock of disassembled engines was necessary to improve the release cadence to Assembly Gate. Using Little's Law, the team calculated a buffer of 19 disassembled engines was necessary to improve the release cadence to Assembly Gate. Once kitting improvement actions described in paragraph 1.5.4. were realized, the kitting process made significant improvements toward achieving the 2LM process takt-time release goal of four days – meaning a completed kit for engine assembly needs to be released every four days. The excess queue in the TF33 machine meant flow days could not accurately reflect if the machine was improving. Monitoring the takt time release cadence to the Assembly Gate became the measure of success – because it was the key to improving overall throughput.

A.7.4. Constraint Identification. During the EVSM, the team identified 867 constraints. Of those constraints, 803 were classified as Just Do Its (JDI) and assigned action officers. The remaining 64 were determined to be too complex for a JDI and would require 24 future follow on events to address them. The top constraints centered on enterprise actions and processes required to address part availability and supportability for an aging engine fleet. Champions, process Owners, and Team Leads were assigned for each event and problem statements constructed. The follow on events were scheduled at a rate of one per month, in order of highest impact. The follow on action methodology allowed improvements to be worked in a transparent manner with all enterprise partners maintaining the key objective of understanding the process interrelationships and impacts of one process on the other.

A.7.4.1. Non-conforming Material Review Parts: PMXG's electronic Non-conforming Material Review (eNCMR) Board database manages the process of obtaining permission from cognizant engineering to expand technical serviceable data limits or authorize a work around repair to save and reuse parts. This process did not reliably or repeatedly create a demand signal to trigger the supply chain to contract sources for new or repaired parts, thus perpetuating the parts availability/supportability problem. Thirty-seven percent of the incomplete Assembly Gate kits were waiting for a part going through the eNCMR process – adding an average of 37 days to the Material Queue.

A.7.4.2. Demand Signal: In addition to the eNCMR demand signal issue, other PMXG processes were found to be creating demand signal issues, including a break down in the process to send Demand History Adjustments (DHAs) to DLA.

A.7.4.3. Kitting: Many issues contributed to the kitting process being unable to fill Assembly Gate kits by need dates. Among these: kit carts were not laid out in a manner that highlighted missing parts; parts were lost due to the disorganized layout of kitting cage; part non-supportability; the required volume of kit carts were not available to maintain the necessary WIP levels to meet demand. System training inconsistencies in key personnel were identified and a process to work constrained assets was not standard nor reliable.

A.7.4.4. Challenges: One of the primary challenges from the EVSM was organizational resource capacity. Each of the follow on events required the attention of many of the same people resources. The subsequent events and action items generated from the follow on events required the attention of these same people. Time was needed to implement the action items from the events in order to realize real change.

A.7.5. Constraint Resolution. All of the constraints identified at the mapping events were consolidated onto one newspaper stored on a share point site as a living document to allow all partnership POCs to update and filter the status of their action items. Action item status fed into graphs and charts for simple, standard information allowing complete visibility between all partnerships and the chain of command. A newsletter tab is created for each follow on event on the main newspaper so all updates were accomplished in one place. The action items for sub events were added to the appropriate organization's tab on the newspaper. Monthly enterprise-wide meetings were held with leadership to update the status of the action items for each organization within the partnership and follow up events.

# Newspaper

*These JDIs are from the Original EVSM in January and do not reflect the Follow On or combined total JDI numbers
*Rate of change APR: 86.74% to 89.27% total increase of 3%

## MASTER EVENT NEWSPAPER

Current as of 6 MAY 2020

| | 2019 TF33 PROCESS IMPROVEMENT EVENTS IN WORK AND IN QUEUE | | | | | | % Closed 89.27% |
|---|---|---|---|---|---|---|---|
| | Org/Event Type | TEAM LEAD(S) | In Queue | In Work | Completed | Total | % Comp. |
| 1 | 546 PMXS | JP Wood | 0 | 8 | 320 | 328 | 97.56% |
| 2 | 548 PMXS | Justin Hottle | 1 | 11 | 198 | 210 | 94.29% |
| 3 | 547 PMXS | Glenn Marcatos | 0 | 16 | 70 | 86 | 81.40% |
| 4 | MXDE | Andy Noble | 13 | 19 | 21 | 53 | 39.62% |
| 5 | 448 SCMW | Hinson, Rodgers | 0 | 3 | 41 | 44 | 93.18% |
| 6 | LPS | Angela Parmer | 0 | 0 | 30 | 30 | 100.00% |
| 7 | DLA | Christoper Scott | 0 | 0 | 15 | 15 | 100.00% |
| 8 | Complex OBW | Matt Adair | 0 | 0 | 9 | 9 | 100.00% |
| 9 | Complex ASD | Vince Plumlee | 0 | 0 | 5 | 5 | 100.00% |
| 10 | Events | | 3 | 3 | 17 | 23 | 73.91% |
| 12 | Rolled-up | | 11 | 5 | 48 | 64 | |
| 13 | Total Constraints | | 28 | 65 | 774 | 867 | |

3

# Box Score

Current as of 6 MAY 2020

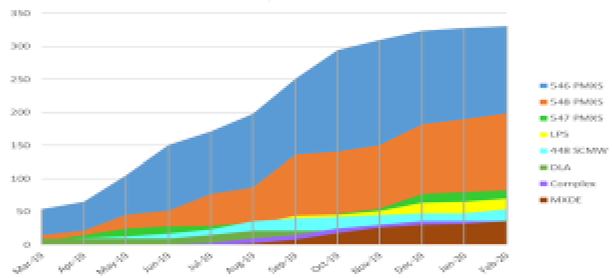
| | Event Name | Action Items | Action Items Complete | 546 | 548 | 547 | MXDE | MXDS | Complex OBW | Complex EN | Complex ASD | SCMW | LPS | DLA | AFSC-EN | Events |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MRB | MRB EVSM | 43 | 41 | 0 | 7 | 9 | 16 | 0 | 0 | 0 | 1 | 1 | 4 | 0 | 0 | 5 |
| | MRB Lack of Standard Process | 6 | 5 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| | MRB Engineering Best Practices | 10 | 6 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 1 | 0 |
| | X - Account | 26 | 15 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 15 | 5 | 0 | 1 | 0 |
| Demand Signal | Demand Signal Event | 76 | 76 | 2 | 6 | 3 | 3 | 0 | 0 | 10 | 3 | 12 | 25 | 4 | 0 | 7 |
| | Demand Signal DDE-DHA | 9 | 8 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 3 | 1 | 0 | 1 | 0 | 0 |
| | Propulsion Engineering Requirements | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 |
| | Propulsion Parts Sourcing | 27 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 8 | 0 | 6 |
| T.O. | T.O. Gap Event | 11 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | T.O. Work Spec | 9 | 8 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| TTR | TTR Event | 19 | 14 | 0 | 1 | 4 | 2 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 7 | 0 |
| TOTAL JDIs | | 239 | 197 | 12 | 14 | 22 | 31 | 1 | 2 | 12 | 12 | 29 | 56 | 14 | 10 | 23 |
| TOTAL Complete | | | | 12 | 14 | 19 | 24 | 1 | 2 | 12 | 10 | 25 | 46 | 7 | 4 | 20 |
| % Complete | | | 82% | 100% | 100% | 86% | 77% | 100% | 100% | 100% | 83% | 86% | 82% | 50% | 40% | 87% |

4

## TF33 Team Completed Action Items

Total: 1106 Complete: 971 Percent Complete: 88%

Total Complete Action Items



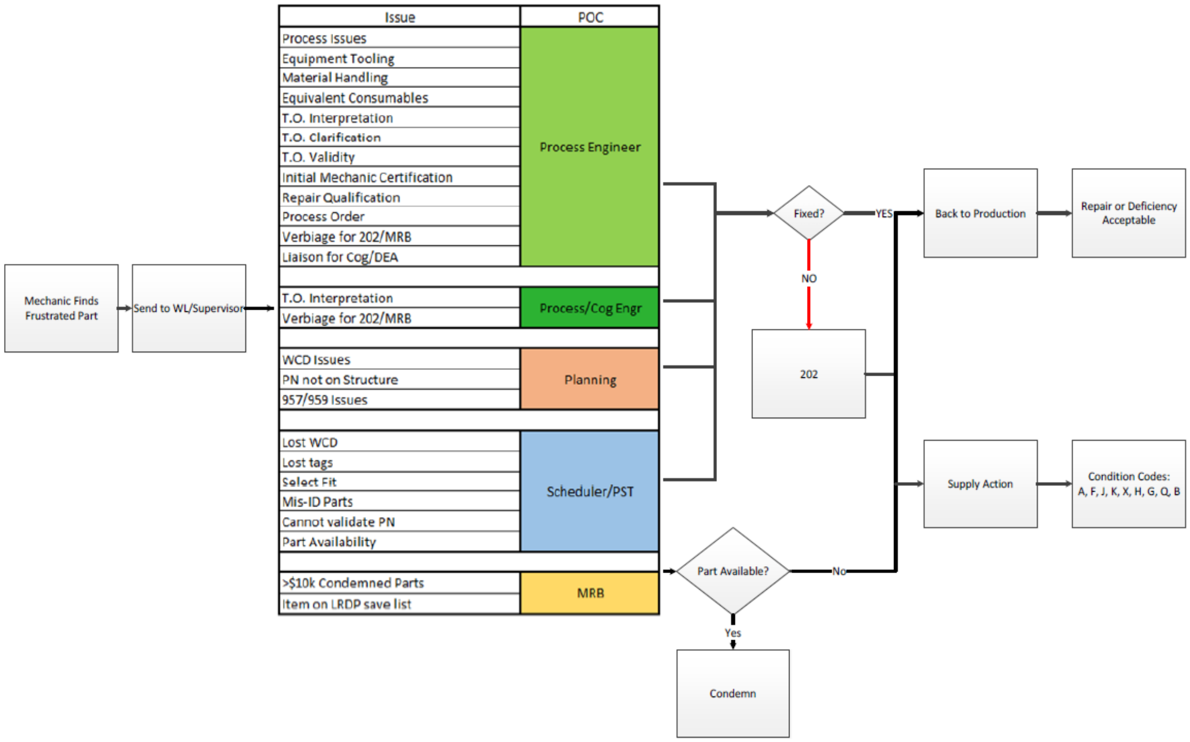

| | 546 PMXS | 548 PMXS | 547 PMXS | LPS | 448 SCMW | DLA | Complex | MXDE | Rolled Up Constraints | EVENTS | Total | Update Date | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mar-19 | 54 | 15 | 5 | 9 | 8 | 9 | 1 | 0 | 0 | 0 | 101 | 30 day update | 9% |
| Apr-19 | 65 | 22 | 15 | 9 | 10 | 9 | 1 | 0 | 0 | 1 | 132 | 90 day update | 12% |
| May-19 | 105 | 46 | 25 | 12 | 13 | 9 | 1 | 0 | 1 | 4 | 216 | 120 day update | 20% |
| Jun-19 | 151 | 52 | 28 | 12 | 17 | 9 | 1 | 0 | 8 | 4 | 282 | 150 day update | 25% |
| Jul-19 | 171 | 77 | 29 | 14 | 23 | 15 | 3 | 0 | 8 | 4 | 344 | 180 day update | 31% |
| Aug-19 | 198 | 87 | 34 | 30 | 38 | 21 | 10 | 2 | 8 | 4 | 430 | 210 day update | 39% |
| Sep-19 | 251 | 137 | 38 | 44 | 40 | 21 | 15 | 8 | 19 | 5 | 578 | 240 day update | 52% |
| Oct-19 | 294 | 141 | 47 | 46 | 42 | 21 | 25 | 18 | 19 | 18 | 671 | 270 day update | 61% |
| Nov-19 | 310 | 151 | 55 | 51 | 45 | 21 | 30 | 26 | 29 | 24 | 742 | 300 day update | 67% |
| Dec-19 | 324 | 182 | 77 | 64 | 48 | 21 | 36 | 30 | 29 | 26 | 837 | 330 day update | 76% |
| Jan-20 | 328 | 190 | 80 | 65 | 48 | 21 | 36 | 32 | 45 | 35 | 880 | 360 day update | 80% |
| Feb-20 | 331 | 199 | 83 | 70 | 54 | 21 | 38 | 38 | 48 | 37 | 915 | 390 day update | 83% |
| Mar-20 | 332 | 199 | 88 | 72 | 60 | 21 | 38 | 39 | 48 | 37 | 932 | 420 day update | 84% |
| Apr-20 | 332 | 212 | 89 | 76 | 66 | 22 | 42 | 45 | 48 | 37 | 969 | 480 day update | 88% |

*MXDS completed 1 of 1 not reflected on this graph, added to total complete count

*JDI 961 complete, N/A on assigned Org, not reflected on this graph, added total complete count

5

A.7.5.1. Material Review Board (MRB): To address the issue of timely dispositions, the team designed and implemented an MRB Decision Tree tool to standardize the way PMXG communicates issues on frustrated parts with engineering. This tool provides complete and accurate information to allow cognizant engineers to make timely dispositions and created an enterprise-wide collaborative process. The tool was a good first step, but a second pass MRB event was necessary based on data errors with submissions to the MRB Decision Tree tool. As a result of the second pass MRB event the MRB Decision Tree tool was revised to assist in reducing the quantity of invalid MRB submissions. The event also inserted the supply chain further to the left in the process to allow supportability assessments to be completed and reduce the need for resources to be expended on assets that met supportability thresholds. The volume of non-conforming assets in this process provided the data to drive the hire of additional Designated Engineering Authority (DEA) engineers to expedite engineering disposition turn-around time of these items.




A.7.5.2. Demand Signal: In response to overwhelming evidence of demand signal issues, new Demand Data Exchange (DDE) and DHA processes were created to feed into 448th SCMW and DLA existing processes. A new FHZ DHA process was created to send missed demand signals to 448 SCMW in an auditable database. Training was created and delivered by the complex Aerospace Sustainment Division (ASD) for PMXG Production Support Technicians (PSTs), Schedulers, and Planners as well as the 848th Supply Chain Management Group's (SCMG) IM, Equipment Specialists (ES), and Logisticians to learn the new processes. Finally, a communication loop was created between the PMXG, 448 SCMW, and DLA to ensure an accurate signal is sent and received.

A.7.5.3. Logistics Requirements Determination Process for Propulsion (LRDP-P): Created the LRDP-P, a collaborative process with standardized business rules for assessing parts and non-part element supportability, determining the actions required to increase supportability, develop roles and responsibilities for functions across multiple organizations, and measurements to determine if the process is working. The LRDP-P team is a strategic resource that identifies potential shortfalls, resolve and/or develop workarounds plans to mitigate production work stoppages. Using the Supply Chain Mitigation Process (SCMP), identify potential workarounds in a tiered approach. Starting with a Supply Chain Level 1 (SC1) checklist, the owning supply chain looked for workarounds within their own control. Once the SC1 Checklist is complete, the Depot Supply Chain Management (DSCM) team member will determine if there is still a supportability gap or if SC1 mitigated the gap. If there is still a gap, the DSCM team member will engage with the maintenance planner to trigger the Supply Chain Level 2

(SC2) checklist. The maintenance planner will use the SC2 checklist to identify workarounds within their control. If the planner is able to identify workaround options, the options will be returned to the owning supply chain and a collaborative determination of the gap will be mitigated. If a gap still exists, the DSCM team member will engage with the cognizant engineer organization to trigger the Supply Chain Level 3 (SC3) checklist. If the engineer identifies any potential workarounds, the options are returned to the owning supply chain and a collaborative determination as to the length of the gap the collective workarounds mitigate. All workaround options are input into the supportability tool and supportability colors adjusted IAW the business rules.

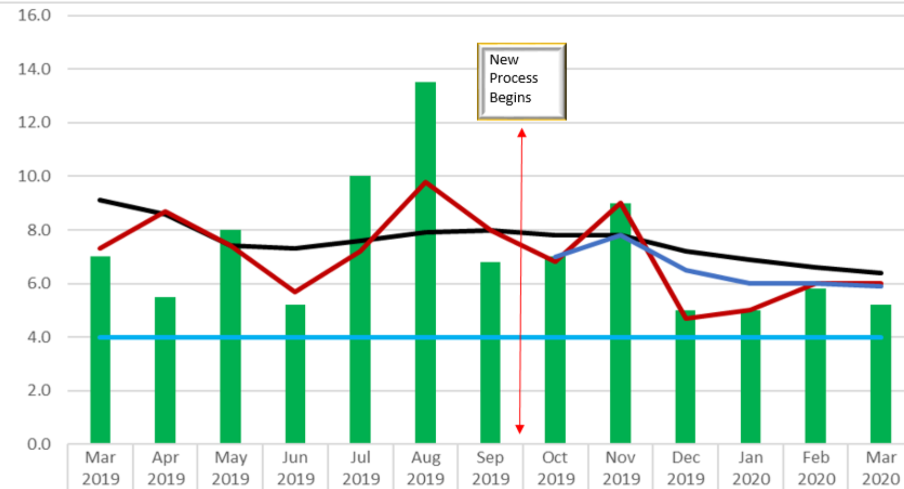
A.7.5.4. Kitting:

A.7.5.4.1. Personnel: PSTs did not have end-to end visibility of the kitting process. Prior to the Kitting EVSM, PSTs were working in silos with no standardized processes. Action items from the event created standardized, auditable business rules, script charts, and order forms. A Material Queue Waterfall chart was created to mirror the production floor Gates 1 through 4 charts for full visibility of kit status throughout the lifecycle of the kit (see 1.7.4). One primary PST and one backup were assigned to each style of kit cart (see 1.7.11). Prior to the Kitting EVSM, material queue averaged 150 flow days. After the action items were fully implemented, the material queue average dropped to 55 days with part supportability.

| PLS Flight Chief: | | | | | | |
|---|---|---|---|---|---|---|
| TF33 PLS | Material RCCs: MEPABA, MEPACA, MEPALA, MEPAVA, MEPANA | | | | | |
| Supervisor: | | | | | | |
| Lead: Subassembly | | | | | | |
| Lead: Final Assembly | | | | | | |
| Kit Cart: | Primary PST: | Phone Number: | Backup PST: | Phone Number: | Expediter Helper: | Phone Number: |
| QEC 1 (Final Assembly) | | | | | | |
| QEC2 (Final Assembly) | | | | | | |
| Plumbing 1 (Final Assembly) | | | | | | |
| Plumbing 2 (Final Assembly) | | | | | | |
| Elevator (Final Assembly) | | | | | | |
| Gear Box (Subassembly) | | | | | | |
| Exhaust (Subassembly) | | | | | | |
| Cold Section (Subassembly) | | | | | | |
| Hot Section (Subassembly) | | | | | | |
| Diffuser (Subassembly) | | | | | | |
| | | | | | | |
| Sheet Metal | | | | | | |
| RNI/Speedline | | | | | | |

A.7.5.4.2. Kit and Kitting Cage Layouts: The layout of the kitting cage did not have the full WIP capacity necessary to meet takt or allow parts to be adequately secured.

The team created an ingenious and affordable shelving design to allow full WIP capacity in a secured location. Kit carts were designed with foam shadow inlays for each part, providing a visual cue of parts needed to complete kit. As of March 2020, kits are releasing to Assembly Gate at a takt time average of six days with an AoP goal of four days.



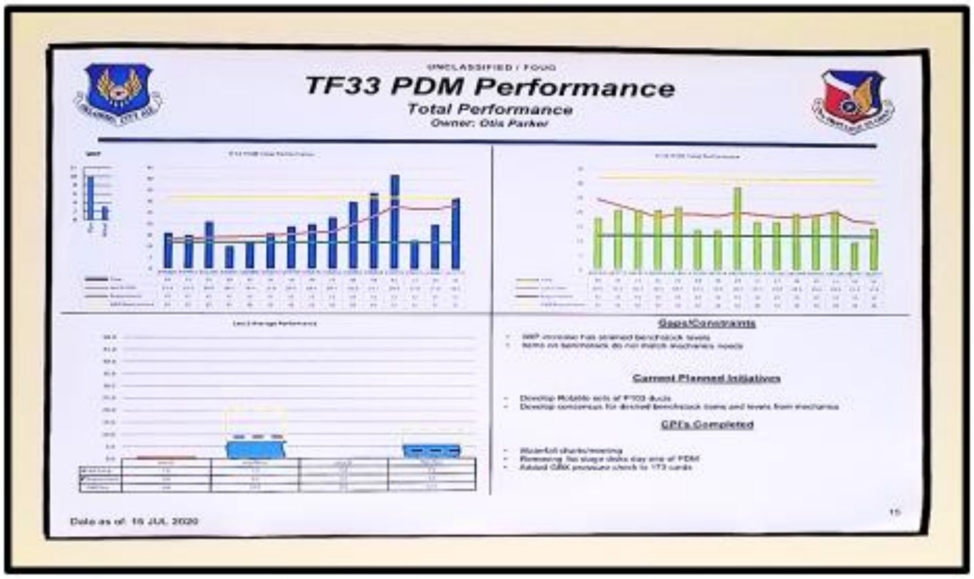

| | Mar 2019 | Apr 2019 | May 2019 | Jun 2019 | Jul 2019 | Aug 2019 | Sep 2019 | Oct 2019 | Nov 2019 | Dec 2019 | Jan 2020 | Feb 2020 | Mar 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Current Performance | 7.0 | 5.5 | 8.0 | 5.2 | 10.0 | 13.5 | 6.8 | 7.0 | 9.0 | 5.0 | 5.0 | 5.8 | 5.2 |
| AOP Goal | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Rolling Average | 9.1 | 8.6 | 7.4 | 7.3 | 7.6 | 7.9 | 8.0 | 7.8 | 7.8 | 7.2 | 6.9 | 6.6 | 6.4 |
| Last 6 Average | 7.3 | 8.7 | 7.4 | 5.7 | 7.2 | 9.8 | 8.0 | 6.8 | 9.0 | 4.7 | 5.0 | 6.0 | 6.0 |
| Since New Process | | | | | | | | 7.0 | 7.8 | 6.5 | 6.0 | 6.0 | 5.9 |

A.7.6. Results: In 2018, FY19 predictions and indicators for TF33 WRE was as low as -19 due to part supportability issues that would have led to grounded aircraft and an impact to mission capabilities. Due to the efforts of the enterprise in the EVSM, follow-on events, and action item close outs, the impact to WRE was mitigated and never fell below -3. Improvements include; new gate to categorize engine work spec, scripts for every gate, identification of parts BOs are identified within three days of engine disassembly, core team establishment to work BOs and constraints to critical path, BO reviews identifying constraints to DLA and Air Force supply chain enabled workarounds to be worked immediately when needed, new order sheets and kit carts made production shop more efficient and ordering of material more accurate, establishment of reclamation line provided source of constrained materials, this is just to name a few of the extraordinary actions that it truly took the entire enterprise to accomplish. Though the production environment continues to be constrained by part supportability and challenges keep coming, TF33s has been able to continue production avoiding catastrophic consequences to our war fighter through enterprise focus on mechanic centric process and CPI efforts to find a better way.

A.7.7. Visual Display:

A.7.7.1. 546th Walk the Wall

**TF33**
**Walk The Wall**
**PDM**




**TF33**
**Walk The Wall**
**Speedline, RNI, 2LM, Gate 1**

TF33
Walk The Wall
Gate 2, Gate 3, 2LM Queue, Gate 4


A.7.8. Next Steps: The enterprise team continually reviews the data from the process machine as well as data from their newly established collaborative processes to determine opportunities for conducting second pass EVSMs to reduce variation, improve standardization and communication. They also continue to look across other organizational value streams for opportunities to share and implement these new key processes and improvements.

A.7.9. Lessons Learned: Cross-collaboration is key for success, all stakeholders need to be involved from the very beginning. Full enterprise involvement prevents work in silos and allows groups to see how their actions impact groups farther down the chain and can ensure actions do not have a negative impact on those groups. Organizations must agree to have complete transparency and a willingness to discuss and resolve the issues identified in the process reviews. Leadership needs to be heavily involved to have a cohesive enterprise-wide team with frequent, open communications in order to provide encouragement from the chief's door to the shop floor. Unified enterprise level leadership provides laser focus onto constraint resolution and enables enterprise-wide organizational learning and improvement.

A.7.10. Contact Information: 76th PMXG, Joshua Dobbs, DSN 334-4812

## APPENDIX A – CASE STUDIES

### A.8. 567th AMXS B-1 Journey

A.8.1. MET for Study. MET 1; Execute B-1B PDM/UDLM, repair, overhaul, and modification workload with safe, reliable, and defect-free aircraft. The MET supports MGA 4, Execute the Mission. MET 1 purpose is to provide 100% organic depot level maintenance supporting 62 B-1s at 3 separate main operating bases across the nation. Performing depot level Maintenance Repair and Overhaul (MRO) workload on the B-1 every 60 months, provides the SPO, and AFGSC, with B-1 aircraft ready to support world-wide contingency operations anytime and anywhere as needed.

A.8.1.1. Case for AoP Implementation. In March 2018, the first in a series of TCTOs were released, that drove significant hours of unplanned emerging requirement workload to the depot. From 2018 to current, a total of 24 TCTOs were released for action. B-1 program Full Scale Fatigue testing and subsequent findings from a test article at Boeing Washington necessitated the B-1 SPO engineering directorate to issue a succession of 30, 60, 90, and 180 day safety TCTOs to expedite the required urgent repairs of the 62 aircraft fleet. Because all 24 TCTOs were depot level requirements, the 567 AMXS was called to dispatch Depot Field Team (DFTs) to the three main operating bases while also scripting unplanned workload into the current PDM and Integrated Battle Station (IBS) production lines at OC-ALC. During 2018-2019 the 567 AMXS had DFTs on the road working these TCTOs for 300+ days of the year for both years. At any given time, more than thirty 567th sheet metal and aircraft technicians, roughly 12% of the available workforce, were on DFT assignments at Dyess, Ellsworth, and Edwards AFBs. This loss of available workforce to PDM and IBS production lines, although necessary to meet customer requirements at each of the main operating bases, impacted the 567$^{th}$ overall product flow. The impacts ranged from a low at the beginning of TCTO releases at 158 days, to an average of 212 days, an increase of 54 days. Given this new challenge of incorporating emerging and unplanned tasks into the PDM process flow, it was important for 567 AMXS to ensure they were using all elements of AoP to mitigate current/potential impacts.

A.8.2. Flow. Project process flow was developed using a Statement of Work (SOW) provided by SPO engineering that detailed work requirements and step-by-step process procedures. Using the SOW, a Validation/Verification (Val/Ver) process was completed on at least two aircraft prior to release of the actual safety TCTOs. During the validation/verification process, production mechanics, ES, engineers, and supervisors worked side-by-side to ensure a well scripted and clearly defined TCTO was established including scripted work requirements. Since the Val/Ver process is accomplished on aircraft currently in-work, overall flowdays increased day-for-day, based on the work content and duration of the Val/Ver. After the validation/verifications were completed, the 567th planning section, working in collaboration with production, crafted a well-defined script and associated network to be used during both the current PDM and IBS process. Scripting the TCTO workload into the current process machine began with identifying the optimal concurrency advantage. In PDM, Gate 2 (Access/Inspect Gate) was identified as the optimal insertion of the TCTO scripted work. In

IBS, most of the TCTO's could be worked concurrently with planned IBS workload throughout the in-dock process but had to be completed prior to operational checks in Gate 4B. Challenges impacting flow related to scripting insertion of safety TCTO's were primarily due to timing associated with the release of individual TCTOs. If the TCTO was released after the optimum time in the flow, loss of concurrency occurred resulting in extended flow in both in-dock (See Figure 1) and post dock. In some cases the insertion point resulted in rework requirements. When loss of concurrency was experienced, the 567th developed work plans to reduce flow using targeted overtime as needed and increased use of third shift to maximize capacity of operations on those aircraft.

A.8.3. WIP. The 567th has two primary production lines each with maximum WIP requirements. For PDM, the maximum WIP requirement is 6, and for IBS, the maximum is 7. Each production line has an individual process machine. For PDM, the incoming takt is 28 days, and for IBS is 35 days. Takt was developed based on a 365 day calendar availability, and scheduled input requirements set by the B-1 SPO. With the known input requirement, input takt, and targeted maximum WIP, a process machine that included 5 gates with basically, 1 WIP allowed in each of the first four gates along with a maximum of two in Post Dock. For IBS, gates are dissimilarly sized due to the nature of the work associated with the modification program but do maintain a WIP of one throughout the in-dock gates, and two in Post Dock. Based on the maximum WIP allowed for each line, the combined maximum WIP in post dock was set at four: two PDM and two2 IBS. Prior to the release of the 24 TCTO's, all IBS gates met and/or were below AoP targets. PDM in-dock gates were steadily trending down towards AoP with three of the four, at or just above AoP targets. After the steady release of the TCTOs beginning in March of 2018, in-dock WIP and Post Dock WIP steadily increased due to the unplanned emerging requirements associated with those TCTOs and the loss of concurrency advantages on any aircraft in the flow that had already completed Gate 2.

A.8.4. Constraint Identification. A number of constraints identified were directly associated with the unplanned emerging requirements associated with the safety TCTO's. There were also some known constraints that were simply amplified due to the increased work requirements created by associated TCTO insertion. Because this workload had never been accomplished on a B-1, the defects associated with the work caused an increase in technical resolution requirements, i.e. Air Force Technical Order (AFTO) form 202, *Request for Engineering Resolution,* being submitted, and a resulting increase in delays associated with getting a complete total technical resolution. A significant rise in the number of 202's submitted resulted in the need for OEM involvement formally known as a Technical Inquiry (TI). The need for TI resulted in an increase of approximately 30 days per inquiry. The delays directly resulted in a day-for-day slip to the PDM and IBS lines. Additionally, these TCTO's drove significant increases in unplanned parts requirements resulting in an additional 30-45 day increase in "awaiting parts" delays. Most of these delays were the result of "never before ordered parts" that were non-stock listed and required expedited surplus buys through DLA and the 406th SCMS Part Number Supply Support Request (PNSSR) processes.

A.8.5. Constraint Resolution. In every case, constraint resolution was the result of an effective use of urgency tools such as Andon notification, Special Handling 202 submission, and increased communication to our support services counterparts, i.e. NDI, paint, weld, local manufacture. Andon submission of issues directly impacting the critical path of aircraft are submitted to ensure enterprise awareness and targeted actions by the appropriate OPR is completed to prevent and/or mitigate constraint delays. Special Handling 202's are submitted to rally the engineering and production teams to work through specific engineering issues causing critical path delays or having potential for doing so. Effective communication at all levels was and continues to be the driving force of success in constraint resolution. Communication and collaboration between all stakeholders including DLA, SCMW, DSCM, SPO Engineering and Logistics, and CMXG backshops are critical to ensuring expedited constraint resolution for each tactical constraint. During this period, two primary constraints were and continue to be sluggish engineering decisions and parts availability. Primary lessons learned for both constraints has been the effective use of urgency tools, i.e. "being a demanding customer", and an increased level of understanding in the non-stock listed process associated with PNSSR surplus buy requirements and the need to keep the 406$^{th}$ Supply Chain Management Squadron well informed of continuing changes.

A.8.5.1. Results. In March 2018, PDM flow day performance was 157.6, just 12 days from the PDM AoP goal. After release of the TCTO's, a steady increase of flowdays was experienced driving an increase to 222 days in June 2019. It was then, the 567$^{th}$ initiated the EDP. The goal of the EDP was to reduce overall flow days by 60 days and return PDM performance to where it was in early 2018. After a series of enterprise-wide CPI events targeted at known constraints caused by the unplanned variation, a reduction of 22 days or 30% to the EDP target of 60 was realized in December 2019.

A.8.6. Visual Display. Figure 2, provides a visual display of the "mini-machine" used specific to TCTO workload and is tailored based on TCTO requirements. The machines are developed in collaboration with production, planning, scheduling experts and coordinated by the 567$^{th}$ Master Scheduler. The mini-machines are updated daily by the aircraft scheduler and briefed daily at tail team meetings. In addition to tail team meetings, these mini-machines are included in weekly fixer, execution, and performance review briefings. Where workload can be scripted into an existing production machine, i.e. PDM and IBS, gate charts are used for measuring gate performance and WIP. In addition to standard gate charts, the 567$^{th}$ developed a daily scripting tool (see Figure 3) enabling tracking and easy identification of constraints associated with each task.

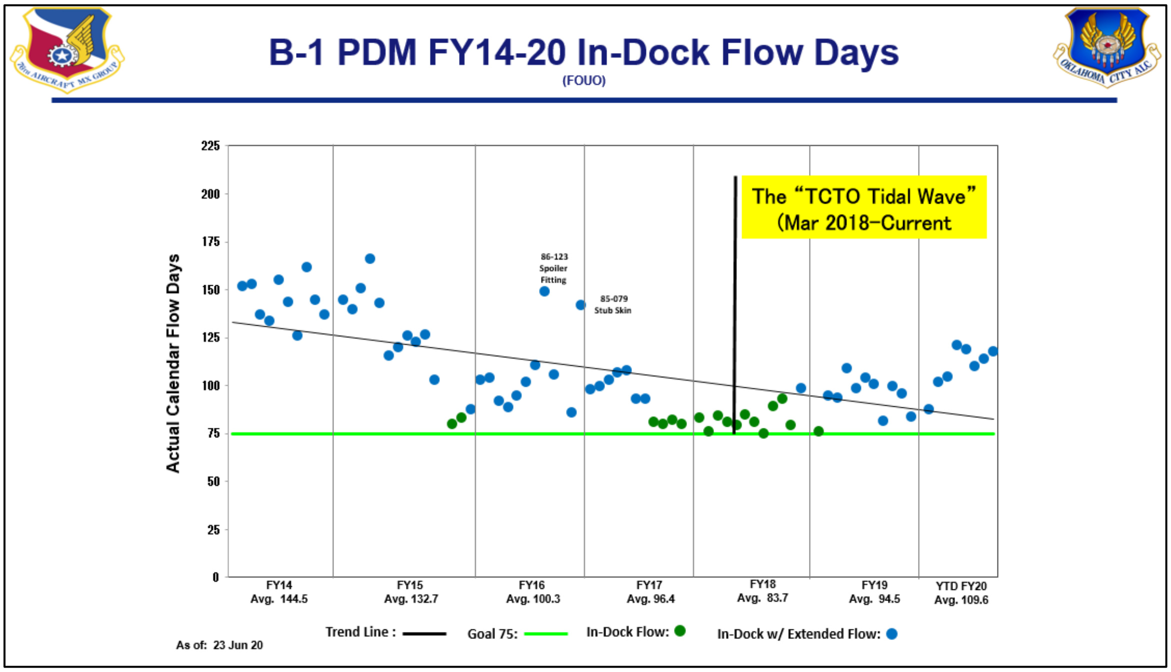
A.8.7. Next Steps. Because of the variation thrust into both the PDM and IBS lines by these 24 unplanned TCTOs, flow days and WIP increases resulted in under performance to quarterly requirements. The 567$^{th}$ went under an EDP in October 2019. Since then, the 567$^{th}$ has under taken 14 targeted improvement events directly focused at constraints associated with both the manner in which TCTO's were planned and released as well as the logistics element associated with parts identification. The 567$^{th}$ most recently completed a comprehensive Gate 2 task content review of the current workload. Currently, Gate 2 has 9,857 hrs loaded to the gate, more hours than gate 1, 3, and 4 combined. The comprehensive review identified and resulted in 24 actionable items to improve overall gate performance and work content completion. The next event scheduled for the EDP journey, is the Gate 2 rescripting event. The event is targeted primarily at re-scripting and gating the new FY-21 production machine requirements. The PDM machine will be substantially changing by the decision reducing fleet size from 62 to 45.

This reduction will drive changes in total yearly input requirements from 12 to 9 and input takt changing from every 28 days to 41 days with an overall AMREP increasing from 187 to 249. All gates will subsequently change and rescripting will be necessary. After the Gate 2 rescripting event is complete, gates, 3, 4, and 5 will be completed as well. A new PDM process machine has already been developed and approved (See Figure 3).

A.8.8. Lessons learned. Throughout this process, AoP discipline has been the driving force in mitigating known constraints and reducing potential constraints from impacting critical path issues throughout the process machine. Adherence to script discipline and buy-in by all enterprise partners is critical to the overall success of the machine. Celebrating small successes along the journey is important as well. Recognizing accomplishments of process owners and supporting organizations furthers the maturation of an organizational culture that embraces AoP tenants. Inclusion and complete transparency in process constraints whether they are associated with an actual PDM/IBS process machine, an outside process such as TCTO development from the SPO enterprise, or non-stock listed surplus buy processes within the PNSSR/406 SCMS are instrumental in driving a AoP culture that understands both tactical and strategic impacts to depot line effectiveness when variation to a scripted process is introduced. Quickly scripting processes that encompass concurrency to its fullest potential and allow the flexibility to "plug and play" in the overall machine has been the biggest single contributing factor allowing the 567$^{th}$ to mitigate overall flow day impact to the customer and keep aircraft availability at required levels.

A.8.9. Contact Information: Rodney C. Shepard, 567 AMXS/CL, 405-734-0221, DSN; 334-0221.

# B-1 PDM In-Dock Flow Day Chart




# B1 Mini-Machine

| Phase | Scheduled Start | Scheduled Completion | Actual Start | Actual Completion |
|---|---|---|---|---|
| Defuel/Sump/Mop/Depuddle and open wings | 13-Jan-20 | 14-Jan-20 | | |
| Move to 3102 | 15-Jan-20 | 15-Jan-20 | | |
| Shore aircraft (when required TCTO 1673/1B109/1B110) | 15-Jan-20 | 15-Jan-20 | | |
| Start all task required for the aircraft (TCTOs 1653/1666/1667/1679) | 15-Jan-20 | 15-Jan-20 | | |
| TCTO 1653 AA pull slats on L/H wing/VS pull panels for R/H wing | 15-Jan-20 | 17-Jan-20 | | |
| Paint strip L/H wing | 17-Jan-20 | 17-Jan-20 | | |
| TCTO 1679 Panel Removals | 16-Jan-20 | 17-Jan-20 | | |
| TCTO 1679 Nutplate Strip removals | 17-Jan-20 | 19-Jan-20 | | |
| TCTO 1653 AA pull slats on R/H wing/VS pull panels for L/H wing | 19-Jan-20 | 21-Jan-20 | | |
| Paint strip R/H wing | 21-Jan-20 | 21-Jan-20 | | |
| TCTO 1653 Removing wrap around skins, frames and webs | 17-Jan-20 | 22-Jan-20 | | |
| TCTO 1679 Hole preperation | 20-Jan-20 | 20-Jan-20 | | |
| TCTO 1679 Hole measurement | 21-Jan-20 | 22-Jan-20 | | |
| TCTO 1679 Off aircraft existing nutplate strip atlerations | 21-Jan-20 | 26-Jan-20 | | |
| TCTO 1653 Fuels removes slat cans and drain plugs | 23-Jan-20 | 23-Jan-20 | | |
| TCTO 1653 NDI BHEC drain holes/SEC slat can cutout | 23-Jan-20 | 23-Jan-20 | | |
| TCTO 1679 NDI Leading Edge tab holes | 23-Jan-20 | 24-Jan-20 | | |
| TCTO 1622/1B109 VS-Remove tunnel panels | 23-Jan-20 | 23-Jan-20 | | |
| TCTO 1666/1B143 VS remvove tunnel panels | 23-Jan-20 | 23-Jan-20 | | |
| TCTO 1622/1B109 VS-Remove frames | 23-Jan-20 | 24-Jan-20 | | |
| TCTO 1666/1B143 VS remove frames | 23-Jan-20 | 24-Jan-20 | | |
| TCTO 1679 Ream/Cold work leading edge tab holes | 24-Jan-20 | 26-Jan-20 | | |
| TCTO 1653 Fuel restores slat cans and drain plugs | 3-Feb-20 | 25-Jan-20 | | |
| TCTO 1622/1B109 AA/AG remove fuel lines and bleed air duct | 25-Jan-20 | 25-Jan-20 | | |
| TCTO 1666/1B143 AG remove fuel lines | 25-Jan-20 | 25-Jan-20 | | |

## Daily Scripting Tool

**86-0097 D** Gate Day: 2 of 25 Flow Max 145 Flow Days 23

**Dock 2** AMREP Date: 11-Dec-20 AMREP 187 12.30%

| Gate 1 | Gate 2 | Gate 3 | Gate 4 | Gate 5 |
|---|---|---|---|---|
| 08-Jun-20 | 29-Jun-20 | 24-Jul-20 | 18-Aug-20 | 12-Sep-20 |

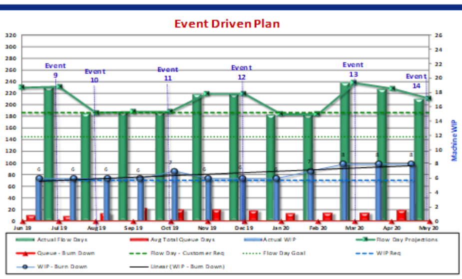
| | Day | Operation | Proj ST | Start | CW | Proj CW |
|---|---|---|---|---|---|---|
| G: 2 | 2 of 5 | AA Remove Jack Panels | 29-Jun-20 | 29-Jun-20 | | 03-Jul-20 |
| G: 2 | 2 of 5 | VS panel removal | 29-Jun-20 | 24-Jun-20 | | 03-Jul-20 |
| G: 2 | 2 of 9 | VS WBD AUSS Inspection Bldg 9001 | 29-Jun-20 | 29-Jun-20 | | 07-Jul-20 |
| G: 2 | 2 of 12 | VS 1B109 | 29-Jun-20 | 25-Jun-20 | | 10-Jul-20 |
| G: 2 | 2 of 12 | VS 1B143\1666 FIF Dorsal Longeron | 29-Jun-20 | 25-Jun-20 | | 10-Jul-20 |
| G: 2 | 2 of 25 | VS 1B136\1653 FWD Spar Inspection | 29-Jun-20 | 24-Jun-20 | | 23-Jul-20 |
| G: 2 | 1 of 1 | JE Strip TK 2A and 2B O-Rings | 30-Jun-20 | 24-Jun-20 | | 30-Jun-20 |
| G: 2 | 1 of 1 | AG TK 1 and TK 5 Inspection | 30-Jun-20 | 30-Jun-20 | | 30-Jun-20 |
| G: 2 | 1 of 1 | AG TK 3-6 Inspection | 30-Jun-20 | 30-Jun-20 | | 30-Jun-20 |
| G: 2 | 1 of 2 | AA Remove Tow Panels | 30-Jun-20 | 30-Jun-20 | | 01-Jul-20 |
| G: 2 | 1 of 4 | AA Remove Misc Panels | 30-Jun-20 | 30-Jun-20 | | 03-Jul-20 |
| G: 2 | 1 of 4 | VS 1673 | 30-Jun-20 | 25-Jun-20 | | 03-Jul-20 |
| G: 2 | | AG TK 2 Inspection | 01-Jul-20 | | | 01-Jul-20 |
| G: 2 | | JE Remove FWD DSO, AWT VS Inspection | 01-Jul-20 | | | 01-Jul-20 |
| G: 2 | | AA 1B109 Remove Bleed Air Line | 01-Jul-20 | | | 01-Jul-20 |
| G: 2 | | AA Remove Spindle Bearings | 01-Jul-20 | | | 01-Jul-20 |
| G: 2 | | AG TK 6 Inspection | 01-Jul-20 | | | 02-Jul-20 |
| G: 2 | | AA Strip Stinger Bay | 01-Jul-20 | | | 02-Jul-20 |
| G: 2 | | RM 1B109/1B 143 Waveguide Removal | 01-Jul-20 | | | 02-Jul-20 |
| G: 2 | | AA 1653 AA pull slats on L/H wing/VS pull panels for R/H wing | 01-Jul-20 | | | 03-Jul-20 |
| G: 2 | | JE Gen4 Harness Install | 02-Jul-20 | | | 03-Jul-20 |
| G: 2 | | JE Gen1 and GEN2 Harness Install | 02-Jul-20 | | | 03-Jul-20 |

## B-1 Event Driven Plan

UNCLASSIFIED//FOUO

# OC B-1 PDM 'Road to'… …Event Driven Plan

As of 9 June 2020




High **Major Event - 14**

Name of Major Event: Gate 2 - Work Content Review

Benefit/Outcome: (Quantify) Reduction in Gate 2 Flow Days. Maximize concurrency of work and reduce where practical hours loaded to gate.

C/W: 22 May 2020 Results: Every 30 days

POC: Jerry Osborne/Michelle Blair

High **Major Event - 15**

Name of Major Event: Gate 2 – Target Scripting at Critical Path Drivers

Benefit/Outcome: (Quantify)
- Reduction in carry over hours transitioning to subsequent gates

ECD: 24 Jul 2020 Results: Every 30 days

POC: Jerry Osborne/Michelle Blair

High **Major Event - 16**

Name of Major Event: Gate 3- Work Content Review

Benefit/Outcome: (Quantify)
- Reduction in Gate 3 Flow Days as well as improved balancing of indock work content

ECD: 28 Aug 2020 Results: Every 30 days

POC: Jerry Osborne/Michelle Blair

**Overall Goal: Reduce Overall Flow Days by 60 Days**

## APPENDIX A – CASE STUDIES

### A.9. 406 SCMS Technical Order Management and Editorial Operations

A.9.1. Mission Overview. The 406 SCMS/GUEE-Tinker is responsible for standardizing, streamlining, issuing procedures and guidance, and executing commodity TO sustainment and management functions for the 448 SCMW, AFLCMC, AFNWC, and the Air Force Petroleum Agency (AFPET). TO Management was identified in August 2017 to be a Mission Essential Task (MET) during the 948 SCMG's annual goals and objectives scrub. The implementation of the AoP began October 2017 and continues today in a steady state environment.

A.9.1.1. Technical Order Management and Editorial Operations. The Technical Order Management Agency (TOMA) within the 406 SCMS at Tinker AFB is responsible for TO acquisition, sustainment, format, publishing, storage, distribution, and archiving TOs and related technical data in accordance with Air Force Policy Directive (AFPD) 63-1/AFPD 20-1, *Integrated Life Cycle Management*, AFI 63-101/20-101, *Integrated Life Cycle Management*, AFMCI 21-301, *AFMC TO System Implementing Policies*, Air Force Materiel Command Manual (AFMCMAN) 63-1202, *Air Force Material Command Engineering Technical Assistance (ETAR) Process*, TO 00-5-1, *AF Technical Order System*, *AFMC Technical Order System Procedures*, TO 00-5-3, *Air Force Technical Order Life Cycle Management*, Military Standard (MIL-STD)-38784, *Manuals, Technical: General Style and Format Requirements*, and all other Technical Manual Specifications and Standards (TMSS).

A.9.2. MET for Study. The TO Management and Editorial Operations organization receives, tracks, manages, and executes the AFTO Form 252, *Technical Order Publication Change Request (PCR)*, as an official form to direct TO updates. The AFTO Form 252 provides word-for-word direction on any update needed to be incorporated or revised within the TO. The TO Manager screens all AFTO Form 252s to ensure required data is current and complete, properly coordinated, and includes all recommended changes for the next TO update. In addition, the TO Manager submits packages for updates to the editorial function for Standard Generalized Markup Language (SGML) tag structure and state-of-the-art graphic designs. Subsequently, the TO Manager submits the approved updated package for distribution to the AF maintenance community, both field and depot users.

A.9.2.1. Case for AoP Implementation. In December 2016, the 406 SCMS/GUEE-Tinker TOMAs received an unforeseen, significant increase of AFTO Form 252s resulting in a workload spike due to a 76 CMXG reset. The new incoming AFTO Form 252s were exceeding the output capacity. The overall surge of AFTO Form 252s had increased to an alarming rate of over 900 units resulting in an anticipated catchup date of December 2020. This was an unacceptable completion date, and a process revamp needed to be implemented. The 948 SCMG and the 848 SCMG established a working group to tackle the staggering issue with backlogged AFTO Form 252s. In October 2017, the team utilized AoP tools to establish a comprehensive TO Process Machine.

A.9.3. Flow. A cross organizational Integrated Process Team (IPT) was tasked to define the process flow and identify the constraints impeding the flow of the PCRs through the process machine. The team established Road-to-Goals, gates and sub-gates, defined daily production and stretch goals, and used constraints based management to increase the process flow. Gates were defined as Gate 1, New PCR Acceptance, Gate 2, Lead Editor Technical Manual Information System (TMIS)/Contenta TO Prep/Research, Gate 3, AFLCMC Robins-Integrated Data for Maintenance (IDM) Prep, Gate 4, Robins-IDM Import, Gate 5, Editing Operations, Gate 6, ES Pre-Pub Review, and Gate 7 as the Completed Output. The challenges encountered during the development of the TO Process Machine included initially establishing too many gates for evaluation and the lack of an automated information tool to extract concise data points. Lessons learned were to consolidate gates where possible and establish an assertive automated process to obtain accurate data for each defined gate.

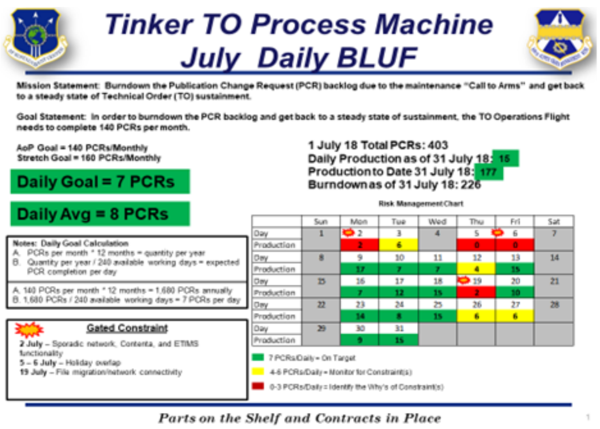
A.9.4. WIP. Through AoP principles and utilizing Little's Law, the 406 SCMS/GUEE team was able to identify the 930 AFTO Form 252s across the machine to capture the WIP. There were set entry/exit criteria for each gate, which ensured accurate transfer of work from one gate to the next. A collaboration between the TO Manager, Editor, and ES utilizing various products (AFTO Form 252s, TOs) and tools (Enhanced Technical Information Management System (ETIMS), TMIS, and Robins-IDM) allowed for a better process flow and ensured that no gate contained more WIP than necessary.

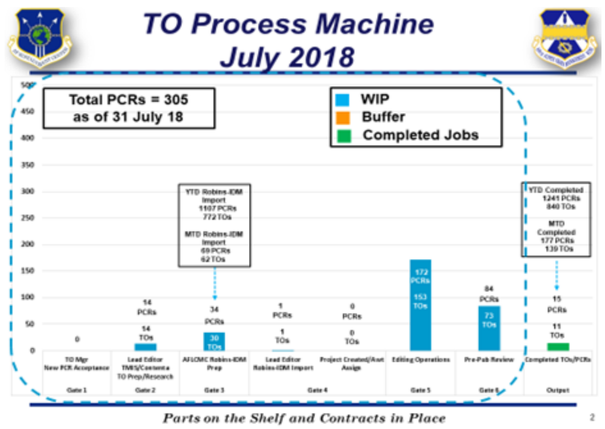
A.9.5. Constraint Identification. Over the lifecycle of the 406 SCMS/GUEE's AoP wall walk, there were three constraints identified. The first constraint encountered was a significant increase of AFTO Form 252s flowing into Gate 2, Team Lead Technical Manual Information System (TMIS)/Contenta TO Prep/Research, exceeding the throughput capacity to the next TO process gate. Once solved, the team found the next constraint to be Gate 3, AFLCMC Robins-IDM Prep, who fell short in supplying a required amount of TOs, starving the process machine. Finally, the 406 SCMS/GUEE team discovered that Gate 6, ES Pre-Pub Review, had no internal TO review process timelines, triggering a delay in the finalization and TO distribution.

A.9.6. Constraint Resolution. An assembled TO team conjointly resolved Gate 2's constraint within a one-week timeframe by swiftly executing/transferring workload to the next gate. To resolve Gate 3's constraint, the TO team partnered with AFLCMC/LZP at Robins setting an aggressive delivery schedule. In addition, because the 406 SCMS/GUEE team was able to quantify and present their issues, Robins was able to bring on additional contract resources to sufficiently feed the TO Process Machine and meet delivery demands. Gate 6's constraint resolution involved an internal/external assessment on the Pre-Pub Review process driving a leadership directed policy to enhance the response time from the ES community.

A.9.6.1. Results. Utilizing the AoP tools, a TO backlog surge downsized from 930 to 226 PCRs, equating to a 76% decrease in total backlog in 10 months. This implementation improved the overall catchup timeline by one year. In addition, an external agency turn time improved from 21 days to 8 days, improving monthly output from 100 PCRs to 230 PCRs per month. These combined efforts provided a result remedying a projected long term backlog. The current steady state management of the machine is allowing the team to control the amount of output despite fluctuations of machine input. The team is now postured to embrace and easily handle a spike in PCR workload. In addition, due to the COVID-19 pandemic, the machine hasn't experienced or been impacted by a reduction in production during situational telework.

A.9.7. Visual Display. The 406 SCMS/GUEE-Tinker TO wall walk displays a comprehensive machine with Road-to-Goals, gates, and sub-gates to address AFTO Form 252 workload. Visual images demonstrate how the flow, WIP, and gate performance are measured within the TO Process Machine. Due to the COVID-19 pandemic driving a situational telework environment, a Daily Bottom Line Up Front (BLUF) chart is virtually distributed to the stakeholders on a daily basis. (Wall Walk charts and daily BLUF provided separately).




A.9.8. Next Steps. The next steps were to continue socializing the TO Process Machine with internal/external agencies to provide world class support for the warfighter. In addition, the team recalibrated the machine to realign the daily goal and averages creating a firm steady state throughput. From October 2018 until present, the team continues to apply AoP tools along with Little's Law to define the TO steady state process machine, maintaining oversight of tactical management via weekly wall walks, monitoring production goals and WIP. After completing the workload spike, the team faced the challenge of standing down from a ramped up production culture to a steady state. By monitoring the machine, the team determined what areas could be drawn down and was able to modify the production output from an average of 100+ PCRs per month down to 80 PCRs to retain a good, constant flow of approximately 220 PCRs in the WIP at all times to preclude starving the machine. Today sustainment performance of processing routine PCRs in an average of 60 days against the AFMC 365-day standard. The team is now equipped to accept and accommodate future workload spikes.

A.9.9. Lessons learned. Constant communication and transparency among all stakeholders are the keys to success. Don't panic - - keep the machine simplified; minimize gates to a manageable level. Another key factor is to not allow emotions to drive decisions. Focus on the metrics. Let the data steer you towards the constraints making adjustments when necessary and adding resources where needed.

A.9.10. Contact Information: Vicki Bowen, 406 SCMS/GUEE-Tinker, DSN 852-9694, vicki.bowen@us.af.mil.

## APPENDIX A – CASE STUDIES

### A.10. 406 SCMS Part Number Requisition (PNR) Support

A.10.1. Mission Overview. The 406 SCMS serves all 448 SCMW supply chain managers as the focal point for all matters concerning Wing Supply Plan Operations and Technical Data Operations functions. Responsible for standardizing, streamlining, issuing procedures and guidance, and executing supply plan operations functions including provisioning, cataloging, loan control for Government Furnished Property/Government Furnished Equipment/Government Furnished Material (GFP/GFE/GFM), packaging test and design, traffic management, explosive certification/verification, Item Level Supply Assignment (ILSA) and PNR support. In August 2017, because of the 948 SCMG's annual goals and objective scrub, the 406 SCMS established METs. The implementation of the AoP across the squadron began in October for our different METs.

A.10.1.1. PNR Support Study. AoP for the PNR Support process began in December 2017. The Part Number Office (PNO) within the 406 SCMS is responsible for expediting the 1348-6 Non-Stocklisted/Part Number Requests (NSL/PNR) process in effort to balance and deliver responsive and resilient support to the depot/field warfighter.

A.10.2. MET for Study. The PNO provides support for those items, which for a variety of reasons, have not been cataloged with a national stock number and therefore have zero stock on the shelves. The field or depot customer submits a request for support of a NSL item to the part number IM via a DD form 1348-6, *DOD Single Line Item Requisition System Document*. The DD 1348-6 is then entered into the PNSSR System and forwarded to the appropriate ES for disposition. The disposition may include using a substitute part, using the next higher assembly, getting a part from AMARG, purchasing a part from a vendor or having the part manufactured at the depot. In the event we have three demands in 180 days in accordance with AFMCMAN 23-501V1, *D035A, D035B, and WHSL Module Data Sub-Systems,* the ES will consider getting a national stock number assigned.

A.10.2.1. A.10.2.1. Case for AoP Implementation. The 406 SCMS started taking over the Part Number Requisition support function from the 635th Supply Chain Operation Wing (SCOW) in May 2013 after a 2012 workload review and manpower study, which disbanded all Combat Support Offices (CSOs) at Robin, Hill and Tinker AFBs. Robins and Tinker implemented the PNO process in Dec 2014 with Hill acting as the centralized buying activity. Robins and Tinker took over their own buys in Oct of 2017. Metrics identified the following goals for PNRs were not being met:

- PNR with disposition other than procurement/local manufacture: MICAP goal eight hours - non MICAP goal 30 days
- PNR with disposition for procurement on GPC: MICAP goal seven to 14 days if stock on hand with vendor – Non MICAP goal is under 60 days
- PNR with disposition for procurement on Contract: MICAP goal between 45-60 days – non MICAP goal not to exceed 60 days

- PNR with disposition of Organic Manufacture (Field only) MICAP goal 45-60 days – non MICAP goal not to exceed 60 days

In December 2017, the three locations determined to work together and utilize AoP tools in order to establish the Part Number Requisition Process Machine.

A.10.3. Flow. A cross-organizational IPT was tasked to define the process flow and identify the constraints impeding the flow of the PNRs (1348-6s) through the process machine. The team established Road to Goals, gates and sub-gates, defined daily production and stretch goals, and used constraints based management to increase the process flow. The teams originally started with 12 gates as part of the leadership charts for the OPS-X briefings. Through efforts of the IPT, gates were combined and reduced to the 6 gates (0-5) being used today. Gates were defined as Gate 0-Input, NSL/PNR Requests, Gate 1, PNO Research, Gate 2, Tech Disposition, Gate 3, PNO Buy Process, Gate 4, Buyer/Vendor, Gate 5, NSL/PNR Resolution (by other tech disposition or local purchase/local manufacturing. The challenges encountered during the development of the PNR Process Machine included initially trying to figure out what gates to have in the process, not having ownership or control of certain steps within the process and how that would overall effect our goals. The initial gates established were Gate 1 through Gate 5 but during the storming/forming sessions of going through the steps of the process, the team realized that there were many 1348-6s that didn't make it into the machine but were still part of the process and goals. Hence, the team added Gate 0 to capture those that do not go through the process machine but are resolved through other means. Lessons learned were to consolidate gates where possible and establish an assertive automated process to obtain accurate data for each defined gate.

A.10.4. WIP. Through AoP principles and utilizing Little's Law, the PNO team was able to identify every PNR across the machine to capture the WIP. There were set entry/exit criteria for each gate, which ensured accurate transfer of work from one gate to the next. Even though PNO does not own every gate of the process, collaboration between stakeholders and having ownership of the PNSSR system, helped in ensure the PNRs continued to flow through the process.

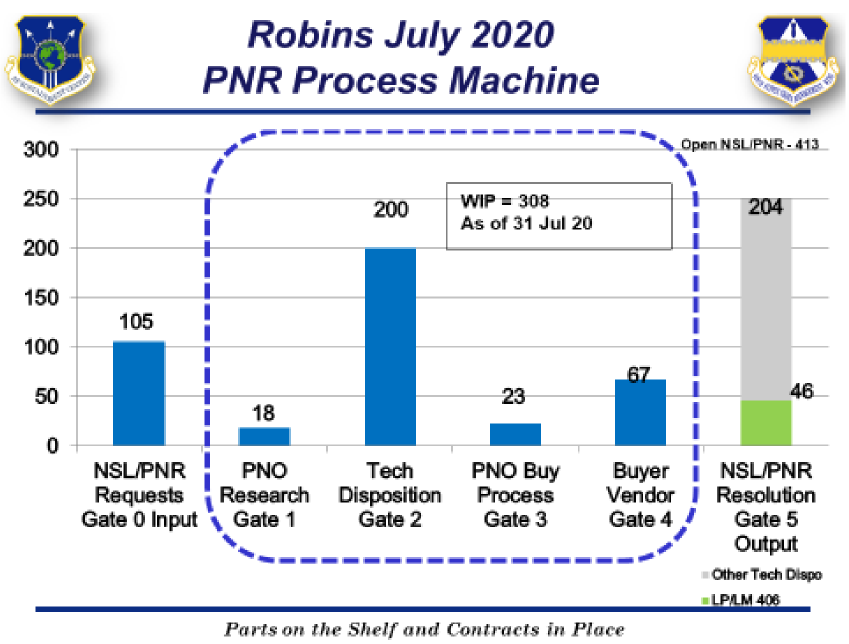
A.10.5. Constraint Identification. In Jan 2018, the 406 SCMS established the PNR AoP to address the ongoing constraints that were identified as we standardized our process. The resolution of PNR requirements was averaging between 90 – 180 days due to the lack of clearly identified roles and responsibilities among the different stakeholders in the process which included AF PSTs/Planners, DLA Aviation, Field Logistics Readiness Squadrons (LRS), ESs and engineers (EN). There was no clear reporting of long lead-time delays within Gate 2 technical disposition for ES/EN review. We had no formalized elevation process to resolve vendor procured PNRs or depot manufacture constraints. We received an enormous number of part number requisitions with bad data/lack of information from requestors that increased our WIP. Moreover, the team identified a critical need to track PNR demand history for the purpose of increasing stock listing actions to ensure sustainable support.

A.10.6. Constraint Resolution. Through gaining visibility of PNRs across the process machine within the further development of the PNSSR system, the number of days to process a PNR decreased tremendously. Overall averaged WIP was decreased by 43% from 2018 to 2019.

Stakeholders within the process were held accountable for their part of the process. PNO Teams collaborated with ES/EN communities to establish guidelines for processing AFMC Form 202, nonconforming technical assistant request, for PNRs. The team gained buy in for new 202 Rules of Engagement that stated planners would initiate the 202 in accordance with technical disposition from the ES as required. This resolved a four plus month stalemate with planners and their supervisors at Robins AFB. The teams also established a monthly cadence with depot customers for review of PNRs sitting in Gate 0 that lacked required information or were not going to be submitted for processing, thus facilitating mass deletions of invalid requests. Gate 4, Buyer/Vendor, now allows for identification of problem vendors and facilitates the ability to report issues to senior management those issues for their involvement when needed.

A.10.6.1. Results. Utilizing the AoP tools, we gained visibility of an average of 3000+ PNRs in the process machine. The teams resolved 5,625 PNRs across three locations from Mar-Aug 2018. The Robins team was able to reduce their Gate 0 by 57% (823 to 353) through cleanup of incomplete PNRs. Across all locations, the team was able to execute \$2.9M: accomplished 1,699 Government Purchase Card (GPC) purchases (to include 374 MICAPs) and 78 Purchase Requests (PRs) (including 10 MICAPs) to provide 1053 parts to depot maintenance and field customers. In 2019, the PNO team had a visibility average of 1700 PNRs across the process machine. They resolved 9309 PNRs across three locations (Oct 2018-Aug 2019) and executed \$3M: accomplished 1,677 GPC purchases, 38 PRs and 48 local manufacture requests to provide 1,904 parts to depot maintenance and field customers.

A.10.7. Visual Display. The PNR Wall Walk displays a comprehensive machine with Road to Goals, gates, and sub-gates to address the PNR workload. Visual images demonstrate how the flow, WIP, and gate performance are measured within the PNR Process Machine (Robins –Wall Walk Chart along with Constraints Gate Comparison Chart are below).



## Part Number Requirements Constraint Gates Comparison

| | Gate 0 Jan 18 | Gate 0 Jul 20 | Gate 2 Jan 18 | Gate 2 Jul 20 |
|---|---|---|---|---|
| Robins | 779 | 105 | 400 | 200 |
| Tinker | 370 | 227 | 95 | 63 |
| Hill | 212 | 72 | 551 | 151 |

**Robins - Gate 0 decreased by 674 PNRs; Gate 2 decreased by 200 PNRs**
**Tinker - Gate 0 decreased by 143 PNRs; Gate 2 decreased by 32 PNRs**
**Hill – Gate 0 decreased by 140 PNRs; Gate 2 decreased by 400 PNRs**

*Supplying Warfighter Dominance* 1

A.10.8. Next Steps. The next steps are to continue socializing the PNR Process Machine with internal/external stakeholders to provide the best support for the warfighter. In addition, the team will continue the feedback loop on the process machine to realign the daily goal and averages creating a firm steady state throughput.

A.10.9. Lessons Learned. Constant communication and transparency among all stakeholders are the keys to success. Improvement never stops! Always be open to learning new ways of doing things and out of the box thinking. Do not panic - - keep the machine simplified; minimize gates to a manageable level. Let the data steer you toward the constraints making adjustments when necessary and adding resources where needed.

A.10.10. Contact Information: Dallas Voorhies, 406 SCMS/GULAC-Hill, DSN 586-5599, dallas.voorhies@us.af.mil; Sherry Haney, 406 SCMS/GULAC-Robins, DSN 468-3057, sherry.haney.1@us.af.mil; Ann Polesky, 406 SCMS/GULAC-Tinker, DSN 852-9722, ann.polesky@us.af.mil.

## APPENDIX A – CASE STUDIES

### A.11. 78th Air Base Wing (ABW) Nonjudicial Punishment Program and Discharge Program

A.11.1. MET for Study. 78 ABW/JA chose the Nonjudicial Punishment Program and Discharge Program as the METs for this case study. The programs' customers and beneficiaries are Air Force units at Robins AFB.

A.11.1.1. Case for AoP Implementation. The nonjudicial punishment and discharge programs were chosen for this case study because they have processing times driven by AF guidance which are measurable. The programs' processing times are compiled and reflected in Automated Military Justice Analysis and Management System (AMJAMS) (a repository for military justice case file information) and used to study how efficiently and effectively units are processing their nonjudicial disciplinary actions and administrative separations. At the time of AoP implementation, average processing times at Robins AFB for these programs were not meeting the goal times outlined in AF guidance.

A.11.2. Flow. AF guidance outlines certain requirements, to include time considerations, which was useful in developing the process flow and gates for that flow. Those time requirements helped our office know how to structure the gates. For instance, nonjudicial punishment guidance, AFI 51-202, has a goal metric for when nonjudicial punishment should be offered, which is, within 21 days from discovery of the offense. Our office created a gate to capture that gate in the process work flow.

A.11.3. WIP. The WIP for the nonjudicial punishment process is an Article 15, with accompanying paperwork. Specifically, Article 15s are captured on AF Form 3070, which reflects a process that requires offer, service, response, punishment, and appeal. The WIP for the discharge process is the administrative separation paperwork. Administrative separation houses various administrative steps, including but not limited to, notification, response, discharge and service characterization recommendations.

A.11.4. Constraint Identification. The difficulty with the implementation of AoP to the nonjudicial punishment and discharge processes is that, unlike a maintenance or manufacturing process that involves consistent variables in a repetitive process, there are many unknown variables that can occur throughout these processes because each case is unique and involve cooperation and participation from other agencies. For instance, if during the course of processing a nonjudicial punishment, the member becomes unavailable for personal reasons (i.e. mental health, family emergency, etc.), the process often hits a standstill until the member becomes available. Similarly, if a unit fails to include certain documents when submitting the discharge package to Military Personnel Flight (MPF), MPF will not process the package until those exclusions are resolved. These types of constraints offer a certain unknown variation that are challenging but can be clearly identified and improved with implementation of AoP.

A.11.5. Constraint Resolution. The gates help identify where constraints occur in the process; we brief these constraints to commanders at the Status of Discipline meetings. The dissemination of this information helps us and our commanders understand at what gate the WIP becomes a constraint. Because the process involves multiple agencies, our agency cannot unilaterally improve the process; improvement requires transparency, accountability and buy-in from all stake-holders.

A.11.5.1. Results. Since implementation of AoP to our nonjudicial punishment program (quarter 3, 2019), and after removing outliers, our average processing times have been within the goal metric (39 days) outlined by the Air Force every quarter thereafter. Our average processing time fell from an average of 50 days to approximately 37 days. Since implementation of AoP to our discharge program (quarter 3, 2019), our average processing times did reach the goal metric (30 days) in quarter 1, 2020. The decline in average processing times happened as follows: 54 days (quarter 3, 2019); 43 days (quarter 4, 2019); 29 days (quarter 1, 2020). However, in the subsequent quarter (quarter 2, 2020), we saw average processing times jump back up to an average processing time of 49 days, which we suspect is due to the impact of the global pandemic. The average at the end of 2020 was 40.5 days. The 39 day target was missed due to one case being in Gate 1 for 107 days.

A.11.6. Visual Display. A simple visual display of the gate charts is used for tactical management and to monitor the machine.

A.11.7. Next Steps. Due to COVID, our office and other agencies involved in the nonjudicial punishment and discharge processes, have primarily migrated to an electronic transmittal process. We are mindful of the impact this may have on processing times after monitoring them from a different working environment. By the end of CY20, we have seen processing times improve almost to the level of pre-COVID.

A.11.8. Lessons learned. After four quarters, AoP implementation on these METs appears to be successful. At some point, the improvement will plateau, but AoP will remain a useful tool for monitoring and identifying the constraints in the programs so we can address and adjust as necessary.

A.11.9. Contact Information: Major Teah Lambright, 78 ABW/JA, DSN 497-45829.

## APPENDIX A – CASE STUDIES

**A.12. 574th Commodities Maintenance Squadron (574 CMMXS) Supplies Repaired and Overhauled Components for Aircraft**

A.12.1. MET for Study. The 574 CMMXS supplies repaired and overhauled components for aircraft undergoing depot maintenance in 402nd Aircraft Maintenance Group (routed assets) and for the 78 LRS and DLA managed Air Force supply system (Managed Items Subject to Repair (MISTR) assets). These components primarily support C-5, C-17, C-130, F-15, and E-8 aircraft and undergo various structural and composite material repair and overhaul processes. This case study highlights the streamlining of the business processes, managing those operations in transitioning from twenty-one individual AoP machines into two METs: MET 1 – Repair and Overhaul of Routed Assets & MET 2 – Repair and Overhaul of MISTR Assets and the governing AoP fundamentals.

A.12.1.1. Case for consolidating machines. In late August 2020 the performance indicators for 574 CMMXS were all in the red. Asset flow days were exceeding customer agreements, WIP was high, earned hours were 30% below fiscal targets, and indirect time exceeded budget (even accounting for COVID-19 effects). The team looked to AoP fundamentals to assess the current state and develop an improvement strategy.

A.12.1.1.1. The initial approach to gating the processes was to create 21 machines for all of the product lines. The work content of operations was characterized by twenty-one machines and each contained multiple products and types of products. For example, one machine contained routed and MISTR rudders for F-15, MISTR elevators for F-15, and routed and MISTR C-130 leading edges. Another contained routed and MISTR C-130 scoops, MISTR C-130 hatches, and routed and MISTR C-130 ramps. This was both confusing to manage and difficult to measure. The visuals were cumbersome and the data was difficult to analyze.

A.12.1.1.2. Twenty-one machines made it difficult to understand the METs and common goals were confusing to those within the squadron and with customers and partners. Input and induction targets varied by month across all the machines and throughput varied without controls or feedback loops.

A.12.1.1.3. WIP was difficult to quantify across twenty one machines and had gradually increased to troublesome levels.

A.12.1.1.4. Synchronization required excessive management bandwidth. With so many machines to monitor, creating a synchronized plan and ensuring supportability was a confusing and cumbersome process.

A.12.2. Flow. The process engineering team worked with production shops and planners to improve the machine design. The 21 product lines were consolidated into two METs (MET 1 – Routed Assets, MET 2 – MISTR Assets). The team created a visual depiction of the machines enabling the team to see WIP targets and gate structure. The visuals highlighted the need for streamlining to a standard gate structure to help control WIP and control the release of supportable work. This led to a standard 5 gate structure for all products and implementing targets for inspection complete and total technical resolution. While flow day targets still vary by product line depending on the work content, the gate structure is the same: induct, disassemble & inspect, repair, build up, final. This simplification improved the ability to manage WIP and ensure a synchronized plan is established for each asset entering repair.

A.12.3. WIP. With the simplified machine design, common goals were established with customers for both METs. These goals helped improve the Road to…Goals and refine appropriate WIP levels. The Commodities Maintenance Team (CMT) executes standard work for WIP and supportability management at the shop level. These teams release supportable work into the shop and work to resolve or elevate constraints.

A.12.4. Constraints. The simplified machine design quickly identified the Repair Gate as the constraint. Using the focusing steps we next exploited the constraint to get the most work out of it. This meant first prioritizing resources in inspection to ensure only supportable work was released into the Repair Gate. All of the additional work we were performing in the Repair Gate is now done prior to entering repair. Ordering parts and materials and answering engineering requests is accomplished prior to repair to prevent waiting and down time in the Repair Gate. We also subordinated asset inductions to the Repair Gate throughput to maintain WIP level. We will continue monitoring performance and apply additional focusing steps as we progress.

A.12.5. Results. Flow days are decreasing; people are becoming more engaged in the process. The new process makes it easier to control WIP. Routed assets are meeting flow day requirements for the first time in over a year. The process is becoming less variable and constraints are becoming more obvious. The team expects to see continued improvements and flow day reduction with constraint resolution and therefore continued improvements in consistently meeting common goals.

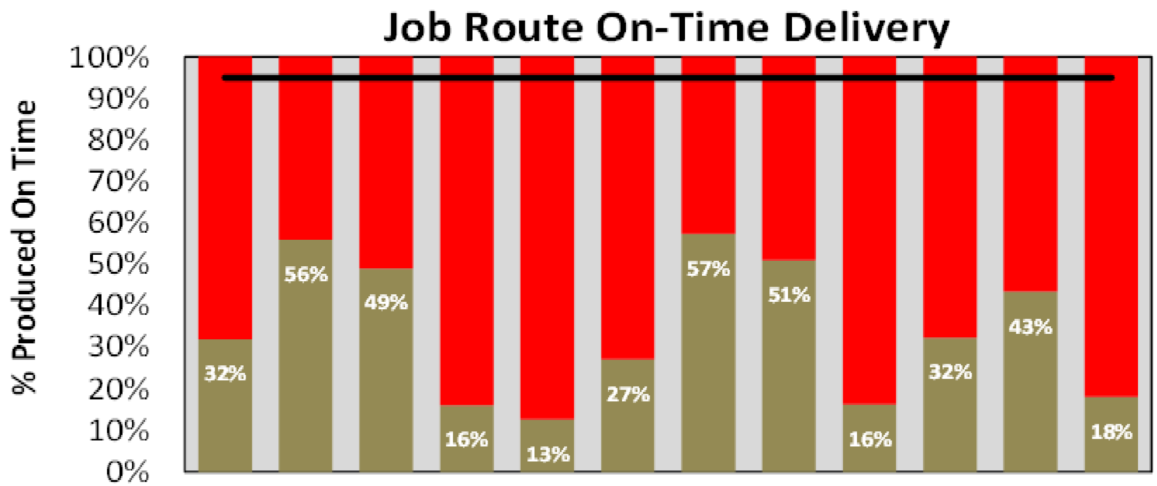
A.12.6. Next Steps. The team is currently running the system. The streamlined system is easier to manage and more engaging for the team. The team is able to take ownership of the performance gaps and find ways to solve problems to positively impact the common goals.

A.12.7. Lessons learned. Simplifying the machines helped manage the process.

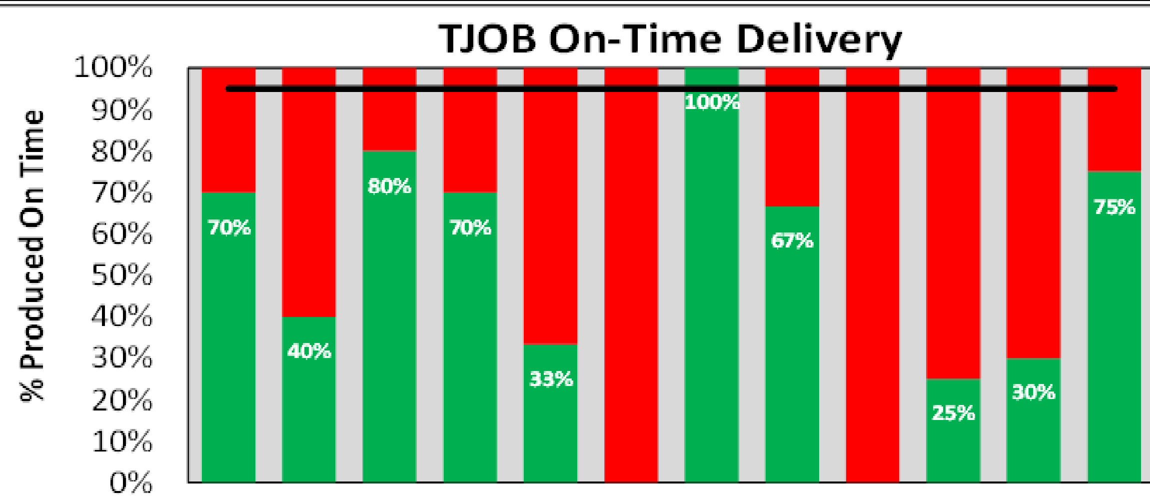
A.12.7.1. Too many machines make the operations management task cumbersome and confusing. Simplifying helped identify the constraints and focus improvement efforts.

A.12.8. Contact Information: Joshua A. Campbell, 574 CMMXS/CL, 478-319-0433, DSN; 497-2617.

**574 CMMXS Current State On-Time Delivery Data**




| | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Late | 32 | 26 | 25 | 42 | 69 | 78 | 35 | 24 | 31 | 21 | 65 | 118 |
| On-Time | 15 | 33 | 24 | 8 | 10 | 29 | 47 | 25 | 6 | 10 | 50 | 26 |
| %On-Time | 32% | 56% | 49% | 16% | 13% | 27% | 57% | 51% | 16% | 32% | 43% | 18% |
| Goal % | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% |



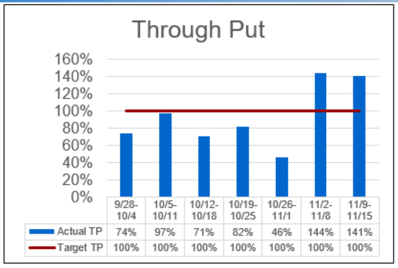

| | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Late | 6 | 6 | 2 | 3 | 2 | 1 | 0 | 1 | 3 | 9 | 7 | 2 |
| On-Time | 14 | 4 | 8 | 7 | 1 | 0 | 5 | 2 | 0 | 3 | 3 | 6 |
| %On-Time | 70% | 40% | 80% | 70% | 33% | 0% | 100% | 67% | 0% | 25% | 30% | 75% |
| Goal % | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% | 95% |

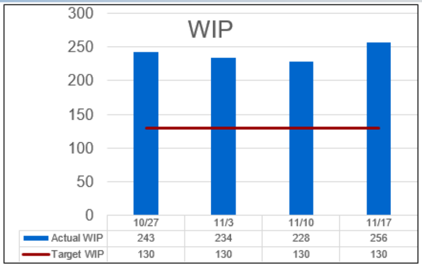
## 21 Product Lines

# MET 1 and MET 2

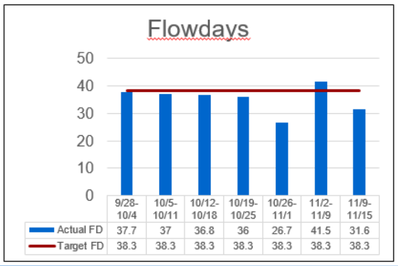
## MET 1 – Routed Assets

Warner Robins Air Logistics Complex




**High Drivers**

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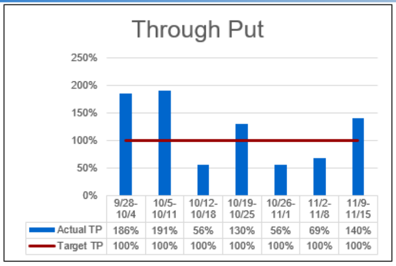
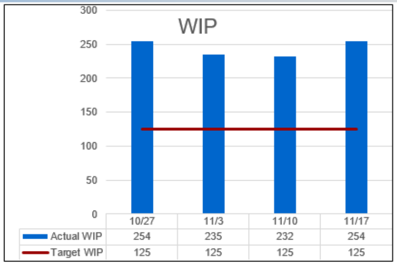
1

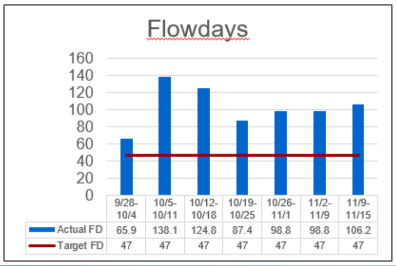
## MET 2 – MISTR Assets

Warner Robins Air Logistics Complex




**High Drivers**

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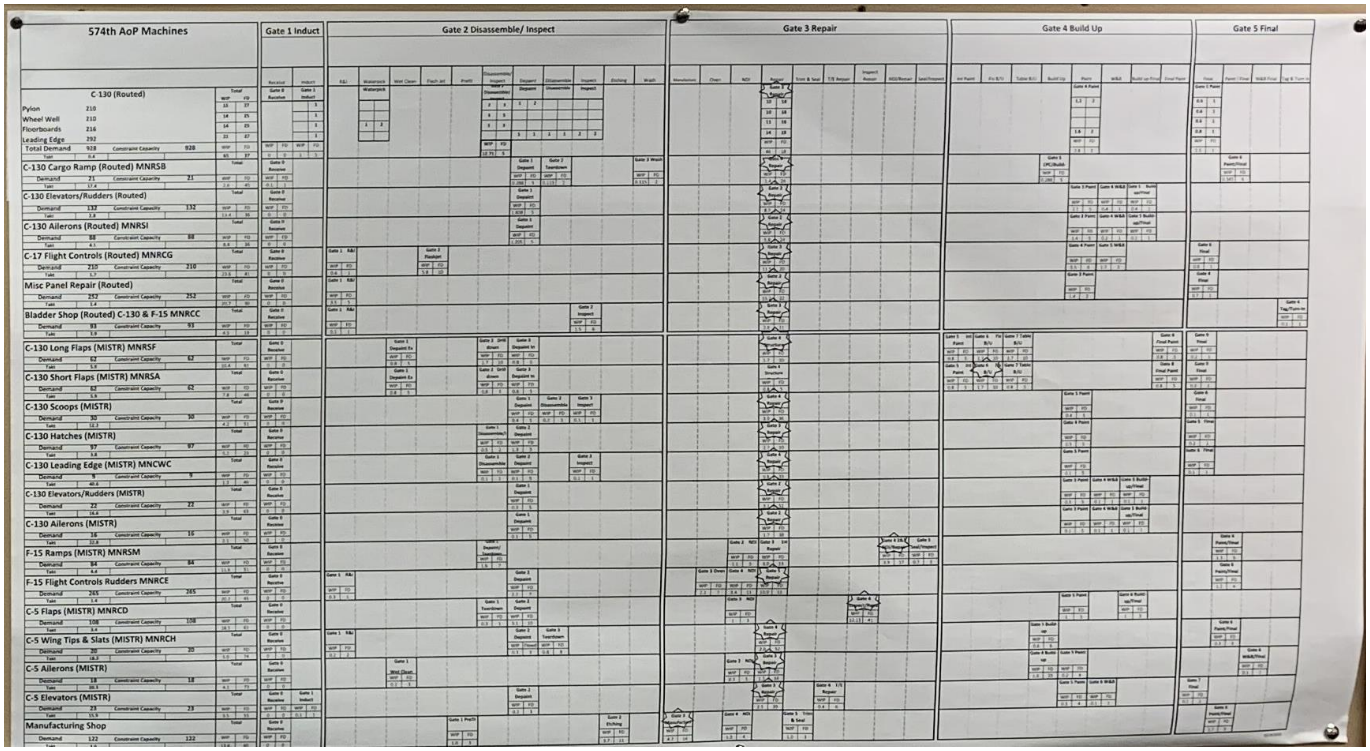
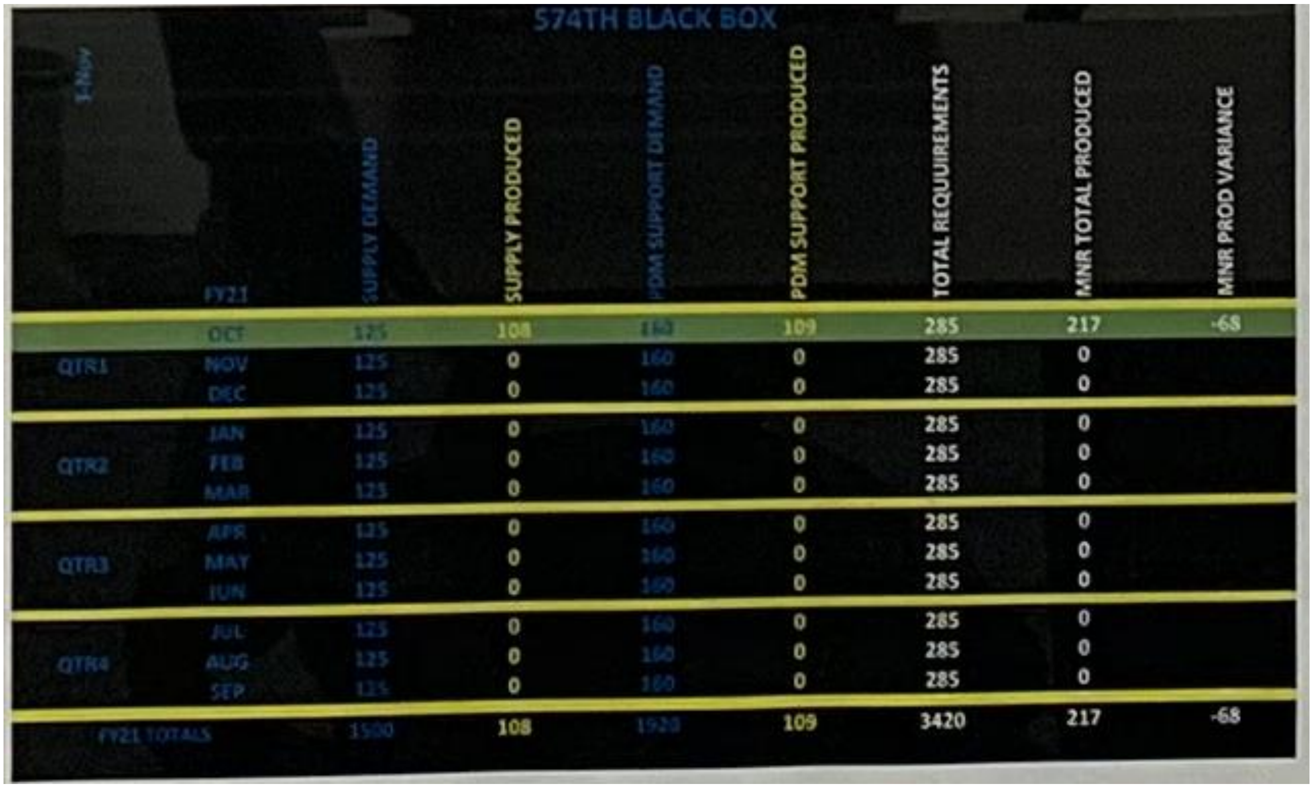
2




**The Black Box Goal**



574TH BLACK BOX

1-Nov

| | FY21 | SUPPLY DEMAND | SUPPLY PRODUCED | PDM SUPPORT DEMAND | PDM SUPPORT PRODUCED | TOTAL REQUUIREMENTS | MNR TOTAL PRODUCED | MNR PROD VARIANCE |
|---|---|---|---|---|---|---|---|---|
| | OCT | 125 | 108 | 160 | 109 | 285 | 217 | -68 |
| QTR1 | NOV | 125 | 0 | 160 | 0 | 285 | 0 | |
| | DEC | 125 | 0 | 160 | 0 | 285 | 0 | |
| | JAN | 125 | 0 | 160 | 0 | 285 | 0 | |
| QTR2 | FEB | 125 | 0 | 160 | 0 | 285 | 0 | |
| | MAR | 125 | 0 | 160 | 0 | 285 | 0 | |
| | APR | 125 | 0 | 160 | 0 | 285 | 0 | |
| QTR3 | MAY | 125 | 0 | 160 | 0 | 285 | 0 | |
| | JUN | 125 | 0 | 160 | 0 | 285 | 0 | |
| | JUL | 125 | 0 | 160 | 0 | 285 | 0 | |
| QTR4 | AUG | 125 | 0 | 160 | 0 | 285 | 0 | |
| | SEP | 125 | 0 | 160 | 0 | 285 | 0 | |
| FY21 TOTALS | | 1500 | 108 | 1920 | 109 | 3420 | 217 | -68 |

## Synchronized Schedule CMT Script

# 574 CMMXS CMT

** PRODUCTION CONTROLLER WILL MANAGE SHOP PRIORITIES AND CONTORL WIP **

### Production Controller

1) TIER 1 Brief priorities:
   a) ANDONs
   b) LDMS MS vs actual
   c) What items are exceeding (or will shortly) exceed flow days… Why?
2) Good Day metrics (if Monday brief previous week):
   a) Previous day and today
   b) Week ahead (are we postured to meet our target?)
3) 5 Day and 10 Day Look Ahead:
   a) What work is on the shelf and what are the priorities?
   b) What work is on the way?
   c) What ECDs within 10 days need to be adjusted today?
   d) Does any assets need to be placed in official AWP
4) WIP control INCOMING:
   a) Check parts / WCD's for supportability, good stamps, correct call outs, prints or 202's, material, equipment
   b) Provide ECDs for WIP in work and in queue and look ahead starts
5) WIP control OUTGOING:
   a) Ensure stamps and dates are legible / place on the outgoing shelf
   b) Schedule for pick up

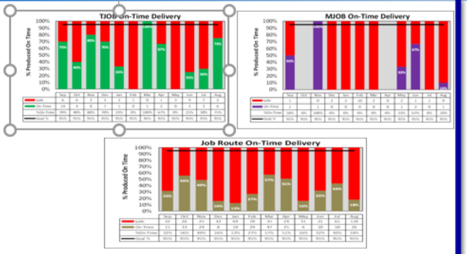
### Production Supervisor

6) TIER 1 Brief priority:
   a) FLEX
7) Plan for supportable work:
   a) Manloading plan
   b) Schedule confidence
8) Unsupportable WIP / Down Equipment:
   a) Delay in LDMS
9) Daily Priorities:
   a) Review late ROUTED assets AND shoe tags
   b) MICAP Status
   c) Open 202's
10) QUESTIONS / HELP NEEDED:
   a) Does Production Controller need anything from Production Supervisor?
   b) Does Production Supervisor need anything from Production Controller?

# 574 CMMXS Event Driven Plan

## 574th CMMXS Squadron Event Driven Plan

*Warner Robins Air Logistics Complex*




High

**Major Event - 1**

**Name of Major Event:** WIP Control

**Benefit/Outcome:** Controlling WIP in the machine to increase throughput and reduce flow days.
**Method:** 100% Machine Design – Gate Standardization
- ❑ WIP Identified
- ❑ Takt
- ❑ Constraint buffer design

**Method:** Forecast Monitoring
- ❑ M constraints and fixer rules
- ❑ Aircraft rules

**ECD:** Dec 2020 **Targeted ROI:** Reduce Flow Days by 30%
**Results:** **Event Owner:** Flight Chief

High

**Major Event- 2**

**Name of Major Event:** CMT

**Benefit/Outcome:** The CMT meetings will increase flow by identifying and eliminating constraints and improving supportability by managing/ controlling WIP.
**Man:** Script Deployment
**Method:** Monitoring
**Man:** Coaching
**Machine:** Critical Path Board Design
**Machine:** Wall Walks

**ECD:** Dec 2020 **Targeted ROI:** 100% WIP Control/ Reduce Flow Days by 10%
**Results:** **Event Owner:** EPSC, TA, and Flight Chiefs

High

**Major Event- 3**

**Name of Major Event:** OAJ Machine

**Benefit/Outcome:** Creating an OAJ machine will reduce the number of OAJ.
**Machine:** Identify vacant RCC
**Machine:** Design a machine
**Machine:** Forecasting the work load
**Machine:** Create visual displays

**Overall ECD:** Jan 2021 **Targeted ROI:** Eliminate OAJs by Oct 2021
**Results:** **Event Owner:** Flight Chiefs

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## Attachment 1

## GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Additional references and reading material can be found at the following link: https://cs2.eis.af.mil/sites/22197/AoP/SiteCollectionDocuments/Forms/AllItems.aspx?RootFolder=%2Fsites%2F22197%2FAoP%2FSiteCollectionDocuments%2FTools%2F1%2E%20%20Guidance%20and%20Additional%20Reading&FolderCTID=0x012000DAB383134B80214DA2915E65CA1D21A9&View=%7BD14873CF%2DA051%2D4026%2D9BDB%2D9A133FA658AB%7D

***Prescribed Forms***

DD Form 1348-6, *DOD Single Line Item Requisition System Document*

AF Form 847, *Recommendation for Change of Publication*

AF Form 3070, *Record of Nonjudicial Punishment Proceeding*

AFTO Form 252, *Technical Order Publication Change Request*

AFTO form 202, *Request for Engineering Resolution*

***Abbreviations and Acronyms***

**2LM** – Two Level Maintenance
**ABW** – Air Base Wing
**AFB** – Air Force Base
**AFGSC** – Air Force Global Strike Command
**AFI** – Air Force Instruction
**AFIMS** – Air Force Information Management System
**AFLCMC** – Life Cycle Management Center
**AFMC** – Air Force Material Command
**AFMCI** – Air Force Material Command Instruction
**AFNWC** – Air Force Nuclear Weapons Center
**AFPD** – Air Force Policy Directive
**AFPET** – Air Force Petroleum Agency
**AFRIMS** – Air Force Records Information Management System
**AFSC** – Air Force Sustainment Center
**AFSCI** – Air Force Sustainment Center Instruction

**AFSOC** – Air Force Special Operations Command
**AFTO** – Air Force Technical Order
**AIS** – Advanced Intermediate Shop
**AMARG** – Aerospace Maintenance and Regeneration Group
**AMJAMS** – Automated Military Justice Analysis and Management System
**AMXS** – Aircraft Maintenance Squadron
**AO** – Action Officer
**AoP** – Art of the Possible
**AOR** – Area of Responsibility
**ASD** – Aerospace Sustainment Division
**AWM** – Awaiting Maintenance
**AWP** – Awaiting Parts
**Az/EI** – Azimuth Elevation Compensator and Power Amplifier
**BLUF** – Bottom Line Up Front
**BO** – Backorder
**CCA** – Circuit Card Assembly
**CCPM** – Critical Chain Project Management
**CMMXS** – Commodities Maintenance Squadron
**CMRS** – Commodities Reclamation Squadron
**CMT**- Commodities Maintenance Team
**CMXG** – Commodities Maintenance Group
**CPI** – Continuous Process Improvement
**CSO** – Combat Support Offices
**CTOL** – Conventional Takeoff and Landing
**CTOL/CV** – Conventional Takeoff and Landing Carrier Variant
**DBR** – Drum Buffer Rope
**DDE** – Demand Data Exchange
**DEA** – Designated Engineering Authority
**DevSecOps** –Development/Security/Operations
**DFT** – Depot Field Team
**DHA** – Demand History Adjustment
**DLA** – Defense Logistics Agency
**DoD** – Department of Defense
**DOTmLPF-P** – Doctrine, Organization, Training, materiel, Leadership, Personnel, Facilities, and Policy
**DSCM** – Depot Supply Chain Management
**DTC** – Data Transfer Cartridge
**EDD** – Estimated Delivery Date
**EDP** – Event Driven Plan
**EMXS** – Electronics Maintenance Squadron
**eNCMR** – electronic Non-conforming Material Review
**ES** – Equipment Specialist
**ETIMS** – Enhanced Technical Information Management System
**EVSM** – Enterprise Value Stream Mapping
**EXPRESS** – Execution and Prioritization Repair Support System
**FCRATS** – Fire Control Radar Antenna Test System

**FMS** – Foreign Military Sales
**FOD** – Foreign Object Damage
**GFE** – Government Furnished Equipment
**GFM** – Government Furnished Material
**GFP** – Government Furnished Property
**GLSC** – Global Logistics Supply Chain
**GPC** – Government Purchase Card
**GSU** – Geographically Separated Unit
**GWOT** – Global War on Terror
**HAF** – Headquarters Air Force
**IAW** – In Accordance With
**IBS** – Integrated Battle Station
**ICBM** – Intercontinental Ballistic Missile
**IDL** – Indirect Labor
**IDM** – Integrated Data for Maintenance
**IFDIS** – Intermittent Fault Detection Isolation System
**ILSA** – Item Level Supply Assignment
**IM** – Item Manager
**IMS** – Integrated Master Schedule
**IPT** – Integrated Process Team
**JDI** –Just Do Its
**JP** – Joint Publication
**JPO** – Joint Program Office
**LCC** – Launch Control Center
**LDMS** – Lean Depot Maintenance System
**LF** – Launch Facility
**LG** – Logistics Directorate
**LGS** – Logistics Directorate's Performance Management Division
**LNA** – Low Noise Assembly
**LRDP** – Logistics Requirements Determination Process
**LRDP-P** – Logistics Requirements Determination Process for Propulsion
**LRS** – Logistics Readiness Squadron
**LRU** – Line Replaceable Unit
**MC80** – Mission Capable 80%
**MDS** – Mission Design Series
**MET** – Mission Essential Task
**METL** – Mission Essential Task List
**MGA** – Major Graded Area
**MICAP** – Mission Impaired Capability Awaiting Part
**MIL-STD** – Military Standard
**MILE** – Minuteman Integrated Life Extension
**MISTR** – Managed of Items Subject to Repair
**MLPRF** – Modular Low Power Radio Frequency
**MMIII** – Minuteman III
**MMXS** – Missile Maintenance Squadron
**MP** – Mission Planning

**MPE** – Mission Planning Environment
**MPF** – Military Personnel Flight
**MPS** – Master Production Schedule
**MRB** – Material Review Board
**MRO** – Maintenance Repair and Overhaul
**MSS** – Missile Stabilization System
**NSL/PNR** – Non-Stock Listed/Part Number Request
**OC-ALC** – Oklahoma City Air Logistics Complex
**OO-ALC** – Ogden Air Logistics Complex
**OO-ALC/OB** – OO-ALC Business Office
**OPR** – Office of Primary Responsibility
**OTD** – On Time Delivery
**PBI** –Product Backlog Items
**PCR** – Publication Change Request
**PDM** – Programmed Depot Maintenance
**PLS** – Production Logistics Support
**PMXG** –Propulsion Maintenance Group
**PMXS** –Propulsion Maintenance Squadron
**P/N** – Part Number
**PNO** – Part Number Office
**PNR** – Part Number Requisition
**PNSSR** –Part Number Supply Support Request
**POU** – Point of Use
**PO** – Process Order
**PPSM** – Practical Problem Solving Method
**R2D2** – Requirements Review Depot Determination
**RDS** – Records Disposition Schedule
**RF** – Radio Frequency
**RFT** – Ready for Test
**RO** – Requisition Objective
**RP** – Receiver Protector
**SCMG** – Supply Chain Management Group
**SCMS** – Supply Chain Management Squadron
**SCMP** – Supply Chain Mitigation Process
**SCMW** – Supply Chain Management Wing
**SCOW** – Supply Chain Operations Wing
**SGML** – Generalized Markup Language
**SIPOC** – Supplier Input Process Output Customer
**SM** – System Manager
**SME** – Subject Matter Expert
**S/N** – Serial Number
**SOCCER** – Senior Officer Communication and Coordination Electronic Resource
**SOR** – Source of Repair
**SOW** – Statement of Work
**SPO** – System Program Office
**STOVL** – Short Takeoff Vertical Landing

**SWEG** – Software Engineer Group
**TCTO** – Time Compliant Technical Order
**TMIS** –Technical Manual Information System
**TMSS** –Technical Manual Specifications and Standards
**TO** – Technical Order
**ToC** – Theory of Constraints
**TOMA** –Technical Order Management Agency
**UDLM** – Unplanned Depot Level Maintenance
**Val/Ver** – Validation/Verification
**VM** – Virtual Machine
**VPP** – Voluntary Protection Program
**W3** – Walking, Watching, and Wandering
**WCD** – Work Control Document
**WIP** – Work In Process
**WR-ALC** – Warner Robins Air Logistics Complex
**WRE** – War Readiness Engine
**YBQ** – Delayed Discrepancy Requisition

***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.

**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.

**Common Goals** – Organizational goals that should be understood and shared across the organization. Common goals should include goals for speed, safety, quality and Cost Effectiveness.

**Constraint** – Systemic machine or Process bottlenecks that hinder throughput.

**Constraint Gate** – The gate with the lowest throughput.

**Continuous Process Improvement (CPI)** – The focus of continuously improving the flow of work through the organization using a combination of tool sets such as: Lean, 6-Sigma, and ToC.

**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.

**Kanban** – A system to set standard min/max levels and establish a proactive re-order point.

**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.

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

**Quick Issue Resolution** – The rapid identification and resolution of one time issues that affect the movement of individual items through the machine.

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

**Personnel Loading** – A systematic assignment of personnel to jobs or tasks in an efficient manner.

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

**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 <u>how work is accomplished and is defined by technical data, process orders, regulations, instructions, or approved checklists.</u>

**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 on 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 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.