The Way Ahead

John Posner, Brigadier General, USAF
Ronald C. Ritter, PhD, USAF

Senior leaders across the Air Force have repeatedly stated that they cannot emphasize enough how important it will be to make AFSO thinking an integral part of every airman's daily routine.

On behalf of Secretary of the Air Force, Michael B. Donley, welcome to this special Air Force Smart Operations (AFSO) edition of the *Air Force Journal of Logistics*. We hope you will take the time to review some—if not all—of the articles outlining exciting and important AFSO initiatives happening across the Air Force.

If you are short on time, take a peek at our short article entitled, "Air Force Smart Operations – Here to Stay," which gives you a quick look at the genesis and future of AFSO. Hopefully that will entice you to read on and get your colleagues interested in learning more about Smart Operations.

As we look to the future, senior leaders across the Air Force have repeatedly stated that they cannot emphasize enough how important it will be to make AFSO thinking an integral part of every airman's daily routine. Therefore, on behalf of the Secretary of the Air Force, we will continue to facilitate AFSO efforts across the Service and we look forward to working with as many of you as we can.

AFSO didn't make airpower—it just makes it better.

As one Airman recently said, "AFSO didn't make airpower … it just makes airpower better." To maximize that effect, AFSO

Why AFSO21

- **Exciting.** Because these AFSO efforts involve the creativity and innovation of enthusiastic Airmen from every corner of the Service.
- **Important.** Because the work these Airmen are doing each and every day is helping to make a great Air Force even better. It's establishing a firm cultural foundation to keep the US Air Force the best in the world as we enter a future where the only certainty is the inevitability of increasingly complex threats to our national security and challenges to our vital interests around the globe.

must become part of the normal daily battle rhythm of the United States Air Force—we're depending on your help to make that a reality. So pitch in and feel free to let us know what exciting and important things you're doing for the Air Force today.

What Every Airman Should Know About AFSO

- Is in every airman's DNA
- Is necessary to the future success of the Air Force
- Provides a way to function effectively—even in a resource-constrained environment
- Exists for the sole purpose of helping Airmen strengthen mission capability
- Is critically dependent on *your* individual participation

AFSO Senior Leadership

Brigadier General John Posner is the Director, Air Force Smart Operations, Office of the Secretary of the Air Force, Washington, DC. He is responsible for developing and coordinating the Air Force's AFSO21 transformational efforts. These activities include program design, management of the AFSO21 central team, development of core supporting initiatives in change management, training material, knowledge, and performance tracking. He also plays a direct role as advisor and continual process improvement mentor to senior Air Force leaders.

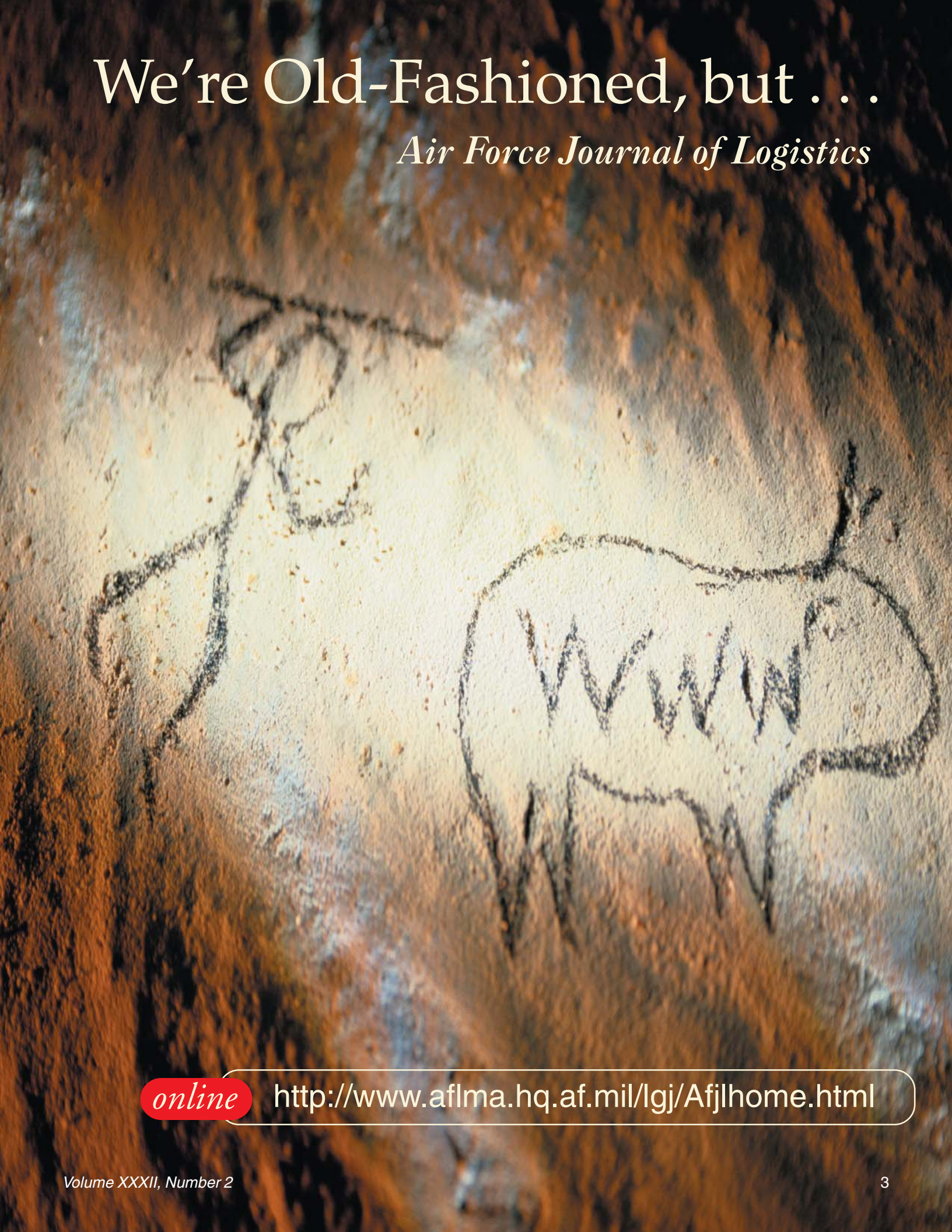
General Posner was commissioned in 1980 upon graduation from the US Air Force Academy and has served in a variety of training and operational assignments in the F-16, F-15, and T-37. He completed a tour on the Air Staff, working in numerous positions to include the Deputy Chief of Staff for Air and Space Operations Issues Team. He served on the Joint Staff as the Deputy Chief, Asia-Pacific Division (J5), and was later assigned to the Secretary of the Air Force staff as senior military assistant to the Under Secretary. General Posner commanded the Battle Staff Training School, Hurlburt Field, FL; the 363d Expeditionary Operations Group, Prince Sultan Air Base, Saudi Arabia; and the 27th Fighter Wing, Cannon AFB, NM. Prior to his current assignment, he served on the Joint Staff as Deputy Director for Operations - Operations Team One at the National Military Command Center. He is a command pilot with nearly 4,000 hours, including more than 200 combat hours.

Dr Ronald C. Ritter, a member of the Senior Executive Service, is the Special Assistant for Air Force Smart Operations to the Secretary of the Air Force, and Deputy Director of the Air Force Smart Operations Office, Washington, DC. He is responsible for developing and coordinating the Air Force's AFSO21 transformational efforts. These activities include program design, management of the AFSO21 Central Team, development of core supporting initiatives in change management, training material, knowledge, and performance tracking. He also plays a direct role as senior advisor and continual process improvement mentor to senior Air Force leaders.

Dr Ritter is a 1988 graduate of the University of Miami. He was selected as a Rhodes Scholar in 1988 and completed his doctor of philosophy degree from the University of Oxford. He spent more than 3 years in Botswana conducting field research with that country's government. He has spent the last 12 years in operations-related consulting at McKinsey and Company, a management consulting firm advising leading companies on issues of strategy, organization, technology, and operations. He was one of the early leaders in understanding and applying advanced Lean manufacturing methods to US operations, with a specific emphasis on large-scale transformation. He has direct, front-line experience in a wide range of environments, to include automotive assembly, heavy machining, aerospace production, aircraft maintenance repair and overhaul, petroleum, medical device, and pharmaceutical production. He left the firm as an Expert Principal, and had 7 years in a lead role of the North American Manufacturing Practice. He also served as Global Knowledge Committee Chair.

We're Old-Fashioned, but . . .

Air Force Journal of Logistics



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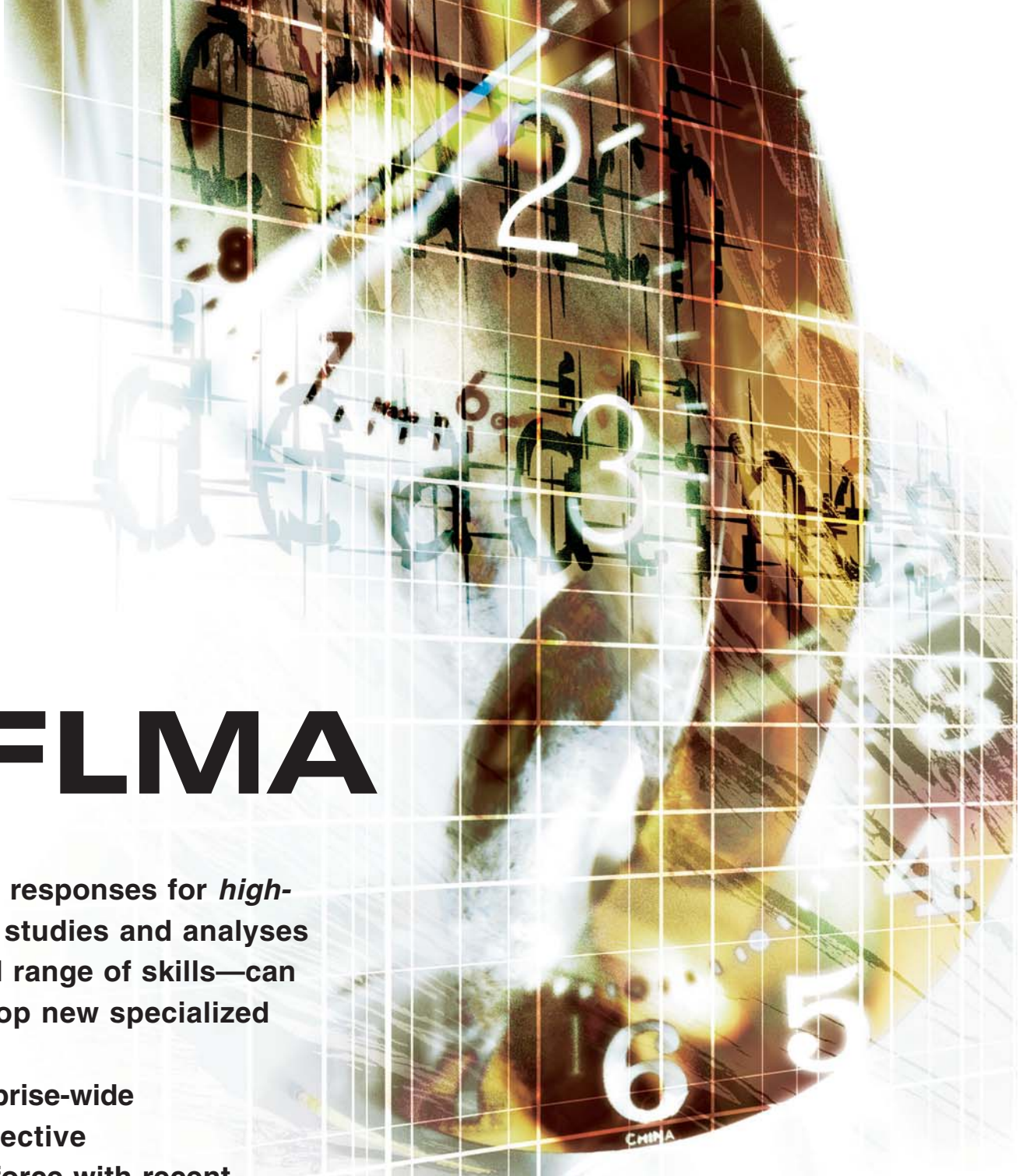

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Facts and Glossary

The Editors, Air Force Journal of Logistics

AFSO21 signifies a shift in Air Force thinking. It is centered on processes (groups of tasks) rather than tasks alone, which allows the Air Force to gain insights into the value, or lack of value, in each task performed. It is built on successful principles from the corporate world, and has already yielded results in the Air Force.

Introduction

Air Force Smart Operations for the 21st Century (AFSO21) encapsulates the Air Force intent to develop and institutionalize a comprehensive, Service-wide, strategic-level, continuous process improvement approach. As stated in the *Air Force Strategic Plan*:

> We will capitalize on using knowledge from other organizations and disciplines to improve every business process within the Air Force. With AFSO21, we are challenging all Airmen to examine processes and eliminate steps in business processes that add little to no value.

In other words, the aim is to take high performing organizations to the next level, by reviewing how value is maximized and waste eliminated in all Air Force environments—operational, support, and otherwise—and fully integrate continuous process improvement across the total Air Force.

AFSO21 is an improvement model customized to the unique environment of the United States Air Force that leverages improvement methods from various sources such as Lean, Six Sigma, Theory of Constraints, and Business Process Reengineering. AFSO21 is a transformational initiative empowering all Airmen to eliminate waste from every end-to-end process. It is about delivery of warfighting capabilities today and tomorrow. It is about our warfighters successfully engaging and defeating our adversaries in 2015 and beyond. AFSO21 aligns the Air Force with a world-class continuous process improvement culture to create a standardized, disciplined approach. AFSO21 is applicable across organizational, functional, and capability boundaries with the ultimate objective of improving combat capability.

AFSO21 Vision

The vision for AFSO21 is to establish a continuous process improvement environment whereby all Airmen are actively eliminating waste and continuously improving processes. These improvements must be centered on the core missions the Air Force is responsible for conducting—specifically, to maintain the asymmetric advantages and capabilities the Air Force delivers in air, space, and cyberspace. Also inherent is the need to drive efficiencies and improvements across the board. Therefore, the Air Force must use the right tools and techniques to see and attack problems, leverage opportunities for improvement, and employ its greatest resource—innovative, dedicated Airmen. The vision directly supports the Air Force's mission statement. The desired effect is an increase in Air Force combat capability directly linked to the core Air Force mission.

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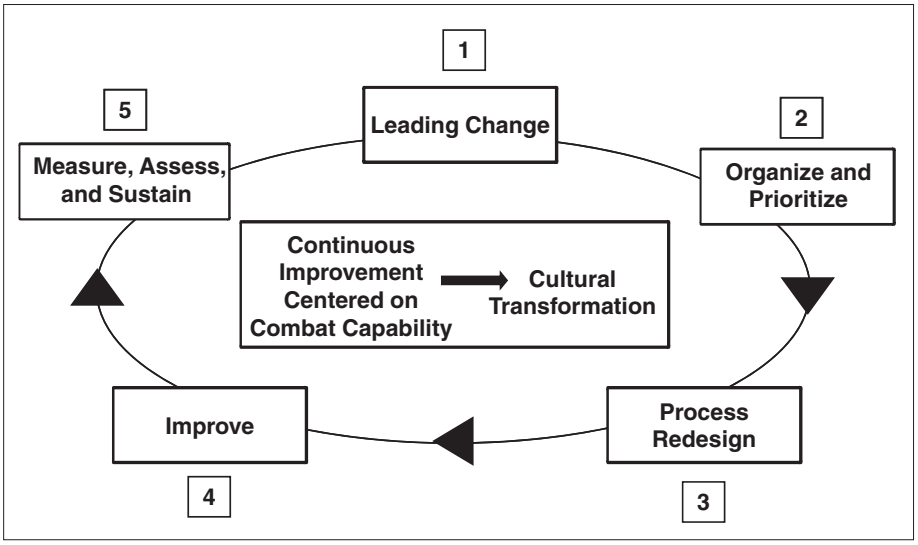
The sections that follow in this portion of the *Journal* provide the reader with some essential facts, a glossary of AFSO21 terms, and a listing of the acronyms used in the AFSO articles.

Key AFSO21 Principles

Continuous Improvement Cycle

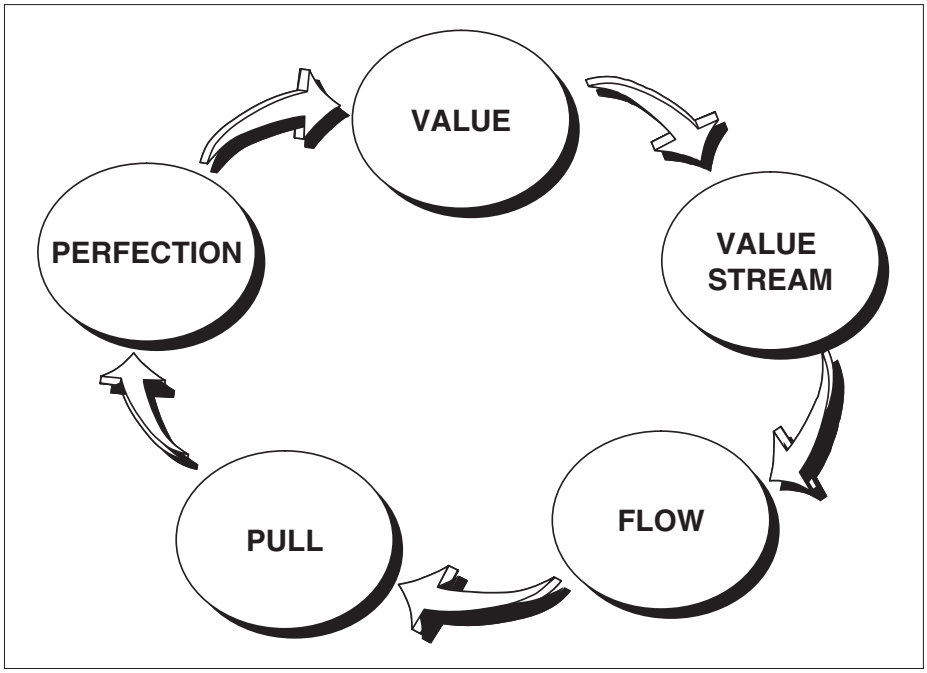
The AFSO21 continuous improvement cycle model consists of 5 steps. It can be applied to improvements in the shop area, within command processes, or to Air Force-wide processes. The steps can be applied to Lean projects focused on immediate improvements as well as to larger Business Process Reengineering efforts that involve much more time and many more



actions to implement and sustain improvements. The cycle can represent a quick improvement event accomplished over several weeks (typical of a Lean rapid improvement event), steps in projects that may take 2 to 4 months (typical of a Six Sigma project), or steps in a clean sheet reengineering effort that can take months to years to implement. The model reflects cycles of continuous improvement and revisiting how work is performed and how it can be further improved upon.

Five Principles of Lean

Lean is a systematic approach to identify waste, focus activities on eliminating it, and maximize (or make available) resources to satisfy other requirements. Lean is simply about removing waste. Achieving the Lean enterprise requires a departure from traditional thinking. The goal is to stop performing those activities and processes that do not add to a product or service's value. Five basic principles characterize a Lean enterprise. They are shown below.



Value: specify value from the customer's perspective.

Value Stream: characterize the value stream (set of activities) for each product and process while removing waste.

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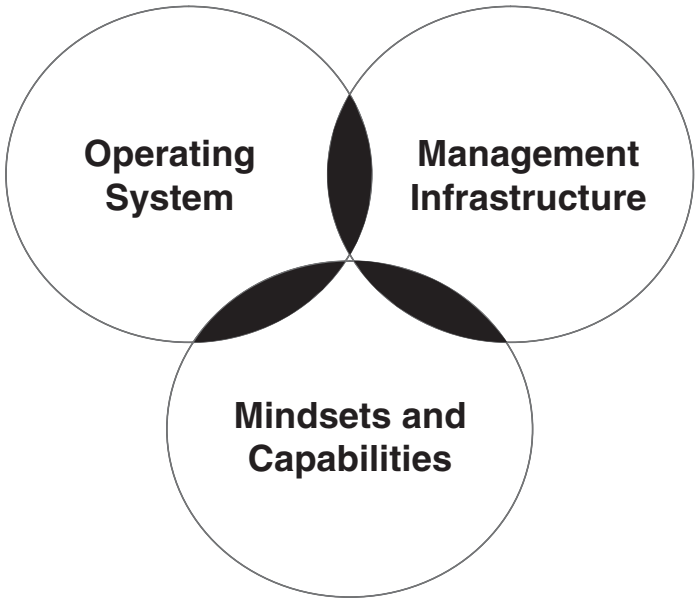
Flow: progressively achieving value creating steps with minimal queues and no stoppages or backflows of product, information, or services.

Pull: a system in which nothing is produced by a supplier until the customer signals a need.

Perfection: always compete against perfection, not just current competition.

Three Elements of Transformation

The three major components of any enterprise include its operating system, management infrastructure, and mindsets and capabilities. The greatest gain will come from improvements across the three components, vice limiting improvement activities to one. The three components are as follows:



Operating System: the physical tools and techniques to create value and minimize losses.

Management Infrastructure: the formal structures, processes, and systems through which the operating system is managed to deliver warfighting capability.

Mindsets and Capabilities: the way people think, feel, and conduct themselves in the workplace, both individually and collectively.

AFSO21 Tools

A variety of tools and methods are available to transform an organization or enterprise. They are listed below. A detailed discussion of each and how they can be used is found in the *AFSO21 Playbook*.

Situation Tools and Methods:

- Value Stream Mapping
- Constraint Analysis
- Metrics and Performance Measurement
- Go and See
- Risk Assessment and Capability Gap

Analysis Tools and Methods:

- Value and Waste Analysis
- Root Cause Problem Analysis
- Analysis of Alternatives
- Process Control
- Stakeholder Analysis
- Supplier, Inputs, Process, Outputs, Customer (SIPOC)
- Cost-Benefit Analysis
- Demand Analysis
- Enterprise Analysis and Action Planning
- Six Sigma and Statistical Analysis

Design Tools and Methods:

- Project Management
- Process Design
- Cell Design
- Visual Management
- Sort, Straighten, Shine, Standardize, Safety, and Sustain (6S)
- Line of Sight
- Material and Information Flow Design
- Systems Thinking and Management
- Quick Changeover
- Error Proofing
- Level Production
- Design of Experiments and Simulations
- Quality Function Deployment

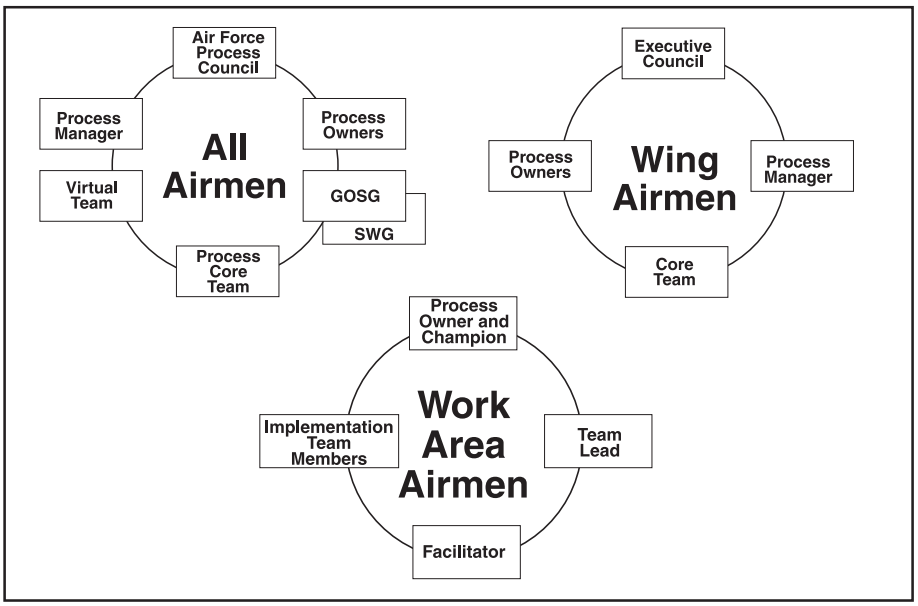
The *AFSO21 Playbook* is accessible at the *AFSO21 Knowledge Area* within *Air Force Knowledge Now* on the Air Force Portal at the following URL: https://rso.my.af.mil/afknprod/ASPs/CoP/FuncCoP.asp?Filter=OO-21. Select the CPI Resource Center icon to access the playbook and many other helpful AFSO21 materials.

Human Systems and Methods:

- Team Problem Solving
- Change Management
- Communications
- Rewards and Recognition
- Training and Education
- Understanding Roles
- Suggestion Systems
- Work Design and Ergonomics

AFSO21 Roles

Below is a macro-level view of the roles and responsibilities for key AFSO21 stakeholders and participants.



Essential AFSO21 Glossary

6S: Sort, Straighten, Shine, Standardize, Safety, and Sustain. A process improvement tool. An approach to cleaning up, organizing, and standardizing work:

- Sort (clear out rarely used items)
- Straighten (organize and label a place for everything)
- Shine (clean)
- Standardize (make standard the best known way to do something)
- Sustain (consciously continue to work the previous four items)
- Safety (ensure all hazards are removed)

Air Force Smart Operations for the 21st Century: The Air Force dedicated effort to develop and institutionalize a comprehensive, Service-wide, strategic-level, continuous process improvement approach. "We will capitalize on using knowledge from other organizations and disciplines to improve every business process within the Air Force. With AFSO21, we are challenging all Airmen to examine processes and eliminate steps in business processes that add little to no value" (*Air Force Strategic Plan*).

Air Force 8-Step Problem Solving Process: The 8-step problem solving process is an iterative approach which reflects continuous improvement and revisiting how work is performed and how it can be further improved. The 8-step problem solving process is based on the OODA Loop (Observe, Orient, Decide, Act) as originated in the 1950's by Colonel John R. Boyd, USAF. He defined how successful fighter pilots engaged in combat by repeating the decisionmaking process (OODA Loop) faster than their enemy, and he was able to help teach new pilots to do the same, improving their chances for success. Air Force leaders today increase the combat capability of their organizations by using the same infinitely repeating nature of decisionmaking emphasized by Colonel Boyd, using AFSO21 and continuous process improvement.

- **O**bserve: step 1 – clarify and validate the problem; step 2 – break down the problem and identify performance gaps
- **O**rient: step 3 – set improvement targets; step 4 – determine root causes
- **D**ecide: step 5 – develop countermeasures
- **A**ct: step 6 – see countermeasures through; step 7 – confirm results and process; step 8 – standardize successful processes

Balanced Scorecard: A strategic management system used to drive performance and accountability throughout the organization. The scorecard balances traditional performance measures with more forward-looking indicators in four key dimensions:

- Financial
- Integration and operational excellence
- Employees
- Customer

Constraint: Any resource whose capacity is less than the demand placed on it. Theory of Constraints attacks constraints and barriers (restrictions or other blocks to increases in output). If no demand is placed on the resource, but it is still the limiting step in a process it is called a *time trap*.

Continuous Process Improvement: A comprehensive philosophy of operations that is built around the concept that there are always ways in which a process can be improved to better meet the needs of the customer and that an organization should constantly strive to make those improvements.

Current State: Part of value stream analysis, this depicts the current state or as-is process—how it actually works in terms of operations, materiel, and information flow.

DMAIC: Define,Measure,Analyze,Improve, and Control. DMAIC is an ordered problem solving methodology applied widely in private and public sector organizations. The DMAIC phases direct a process improvement team logically from problem definition to implementing solutions that are linked to root causes, towards establishing best practices to help ensure the solutions stay in place. A Six Sigma tool.

ERP: Enterprise Resource Planning. A type of software package that attempts to consolidate all the information flowing through the enterprise from finance to human resources. ERP is used to standardize data, streamline the analysis process, and manage long-term planning with greater ease.

Facilitator: Consultant, advisor, or subject matter expert who leads or drives the pace and direction of a group participation event.

Five Whys: The problem solving technique of asking *why* five times to identify the root cause of a problem. Solutions to other than the root cause address symptoms and may provide temporary relief, but will not ensure that another symptom does not return in its place. The most effective countermeasures developed and implemented should address the root cause. This problem solving technique was made a standard practice by the US Air Force. This technique was made popular by Taiichi Ohno and Shigeo Shingo.

Future State: Part of value stream analysis. A vision of the optimum operating environment with new or improved processes in place.

Ideal State: Part of value stream analysis. A vision of the *future state* that depicts what the system should look like if there were no constraints. Based on the *King or Queen for a Day* mentality.

Just-in-Time: A strategy for inventory management in which raw materials and components are delivered from the vendor or supplier immediately before they are needed in the transformation.

Lean: A systematic approach to identify waste, focus activities on eliminating it, and maximize (or make available) resources to satisfy other requirements.

Non-Value Added: Any activity that takes time, materiel, or space, but does not add value to the product or service from the customer's perspective. For example, inspections or reviews normally are non-value added because they are checking to see whether the work was done right in the first place. A non-value added process step violates at least one of the following criteria:

- The customer is willing to pay for this activity.
- It must be done right the first time.
- The action must change the product or service in some manner.

Rapid Improvement Event: A short-term, high intensity effort to address a specific problem. The focus is typically a week, though the preparation normally begins several weeks before and followup continues after. Also called by other names, including Rapid Improvement Workshop, Kaizen Event, Kaizen Blitz, Accelerated Improvement Workshop.

SIPOC: Supplier, Inputs, Process, Outputs, and Customer. A SIPOC diagram is a tool used by a team to identify all relevant elements of a process improvement project before work begins. It helps define a complex project that may not be well scoped, and is typically employed at the Measure phase of the Six Sigma DMAIC methodology. It is similar and related to Process Mapping and *In/Out of Scope* tools, but provides additional detail. The tool name prompts the team to consider:

- The suppliers (the *S* in SIPOC) of your process
- The inputs (the *I*) to the process
- The process (the *P*) your team is improving
- The outputs (the *O*) of the process
- The customers (the *C*) that receive the process outputs

Six Sigma: A strategy that espouses increasing profits by eliminating variability, defects, and waste that undermine customer loyalty. Six Sigma can be understood or perceived at three levels:

- Metric—3.4 defects per million opportunities
- Methodology—a structured problem solving roadmap
- Philosophy—reduce variation in business and make customer-focused, data driven decisions

Subject Matter Expert: A recognized expert in a given area of knowledge (subject).

Supply Chain Management: Proactively directing the movement of goods from raw materials to the finished product delivered to customers. Supply chain management aims to reduce operating costs, lead times, and

inventory, and increase the speed of delivery, product availability, and customer satisfaction.

Theory of Constraints: A philosophy and a methodology for addressing logical thinking, scheduling and controlling resources, and measuring performance. The philosophy emphasizes that a systems constraint exists in any process and controls the output from the entire process.

Value Added: The parts of the process that add worth to the customer's product or service. To be considered value added, the action must meet all three of the following criteria:

- The customer is willing to pay for this activity.
- It must be done right the first time.
- The action must somehow change the product or service in some manner.

Value Stream Map: Identification of all the specific activities occurring along a value stream for a product or product family.

Waste: Anything that adds cost or time without adding value. Generally, waste includes injuries, defects, inventory, overproduction, waiting time, motion, transportation, and over processing waste. Waste is often placed into the following categories (D-O-W-N-T-I-M-E):

- Defects: having a direct impact to the bottom line, quality defects resulting in rework or scrap are a tremendous cost to organizations.
- Overproduction: to produce an item before it is actually required.
- Waiting: whenever goods are not moving or being processed, the waste of waiting occurs.
- Nonstandard Over Processing: often termed as *using a bazooka to swat flies*, many organizations use expensive high precision equipment where simpler tools would be sufficient.
- Transportation: moving product between processes is a cost that adds no value to the product.
- Intellect: human brainpower squandered in processes that do not require intelligent thought, such as expediting, chasing paper, and others. Any failure to fully utilize the time and talents of people.
- Motion: this waste is related to ergonomics and is seen in all instances of bending, stretching, walking, lifting, and reaching.
- Excess Inventory: stockpiles of both in-process and finished goods inventories are a direct result of overproduction and waiting.

Article Acronyms

6S – Sort, Straighten, Shine, Standardize, Safety, and Sustain
AFMx21 – Air Force Maintenance for the 21st Century
AFSO21 – Air Force Smart Operations for the 21st Century
ARM – Active Risk Management
BPR – Business Process Reengineering
CANS – Comprehensive Assessment of Nuclear Sustainment
CBT – Computer Based Training
CCPM – Critical Chain Project Management
CFETP – Career Field Education and Training Plan
CFT – Contract Field Team
COD – Council of Deputies
CPI – Continuous Process Improvement
CPI-MT – Continuous Process Improvement-Management Tool
D&SWS – Develop and Sustain Warfighting System
DMAIC – Define, Measure, Analyze, Improve, Control
DoD – Department of Defense
ERRC – Engine Regional Repair Center
GLMFI – Global Local Manufacturing Factory Initiative
GLSC – Global Logistics Support Center
GOSG – General Officer Steering Group
GWOT - Global War on Terror
IT – Information Technology
JACOT – Joint Air Cargo Operations Team
K-S – Kolmogorov-Smirnov
MAF – Mobility Air Forces
MTD – Maintenance Training Device
OODA – Observe, Orient, Decide, Act
ORR – Operational Risk Reduction
PDM – Programmed Depot Maintenance
PE – Periodic Inspection
QEC – Quick Engine Change
RIE – Rapid Improvement Event
RNT – Repair Network Transformation
SA&D – Strategic Alignment and Deployment
SIPOC – Supplier, Inputs, Process, Outputs, Customer
SME – Subject Matter Experts
SWOT – Strengths, Weaknesses, Opportunities, and Threats
TOC – Theory of Constraints
TQM – Total Quality Management
VSM – Value Stream Mapping
UE – Undesirable Effects

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Featured Efforts and Studies

The Editors, Air Force Journal of Logistics

While the vast majority of good ideas come from the front line, Airmen at all levels have a role to play. Mid-level officers and noncommissioned officers have the experience and operational responsibility to identify opportunity areas and guide Smart Operations work.

Air Force Smart Operations for the 21st Century (AFSO21) builds on initial successes and work to broaden process improvement efforts in Air Force operational, maintenance, logistics, and support environments. Fundamentally, AFSO21 is a method to see and resolve problems as well as a mindset of continuous improvement grounded in mission results. It emphasizes the use of the Air Force's greatest resource in doing so—dedicated Airmen, guided by world-class leadership and unique core values. It is a transformational initiative that eliminates waste from end-to-end processes. It also focuses on working smarter to deliver warfighting capabilities.

In this section of the *Journal* AFSO21 in action is highlighted. The selection of articles includes everything from AFSO21 basics to using the right AFSO21 tools and techniques to solve time sensitive, demanding problems. Brigadier General Posner and Dr Ritter introduce the section and this is followed with three articles that illustrate AFSO21 basics, tools, and techniques. The section concludes with a series of articles that illustrate AFSO efforts and initiatives—good news to say the least.

AFSO21 Purpose

AFSO exists for the sole purpose of helping Airmen continue to strengthen mission capability. AFSO is all about doing your job faster, better, more safely, and smarter. It is important to understand that AFSO doesn't make decisions to cut or constrain resources. Quite the contrary, AFSO helps Airmen deal effectively in an environment where those limitations already exist.

Air Force Smart Operations in action

Air Force Smart Operations for the 21st Century

Here to Stay!

While the specific nature of the challenges we will face remains uncertain and dynamic, one of the inherent strengths of Air Force Smart Operations (AFSO) is its flexibility to effectively address any unique set of circumstances. In this regard, it is easy to see that AFSO exists for the sole purpose of helping Airmen continue to strengthen mission capability. AFSO is all about doing your job faster, better, more safely, and smarter. It is important to understand that AFSO doesn't make decisions to cut or constrain resources. Quite the contrary, AFSO helps Airmen deal effectively in an environment where those limitations already exist.

Brigadier General John Posner, USAF
Ronald C. Ritter, PhD, USAF

The Air Force has a long and proven history of using innovation to solve problems, reduce risk, and create new opportunities—but, perhaps most importantly, for using innovation to exponentially increase combat airpower capability. As our former Chief of Staff, General T. Michael Moseley, frequently remarked, "... it is in every airman's DNA." Over the 60-plus-year history of the United States Air Force, and for many more years before that during the genesis of airpower in the Army Air Corps, the immutable and unique characteristics of airpower—precision, speed, lethality (just to name a few)—have all witnessed extraordinary improvement.

Throughout this evolution of airpower, one enduring principle remains true—it is the ideas and creativity of front-line Airmen that continue to fuel this continuous strengthening of mission capability. Engaging the imagination and initiative of our people is not only the right thing to do, it is, without question, necessary to the future success of the Air Force. Supervisors and leaders across the Service, therefore, have an obligation—and daily responsibility—to make the absolute best use of airmen's time and strive

to constantly improve the operational performance of the Air Force.

Of particular note, many of the innovation initiatives adopted by the Air Force have their roots in the business sector where their intrinsic value has been tested and proven over time. This tried-and-true formula for success has now brought us Smart Operations.

The earliest activities related to AFSO began in the air logistics centers. AFSO has now spread to virtually every aspect of the Air Force daily battle rhythm. After years of dedicated and focused efforts—from the most senior Air Force leaders to the most junior Airman—AFSO is now on a very steep vector and climbing. Secretary of Defense Robert M. Gates recently highlighted the Air Force for transforming: "… the institutional culture that empowers Airmen … to challenge the status quo and take responsibility for building a stronger Air Force."

Current and future challenges—perhaps best described generically as additional mission taskings, whether that be continuing Global War on Terror operations, aging fleets, increased security requirements, and others—are placing ever greater demands on airmen's time with little to no relief in sight. In addition, resource availability forecasts continue to show significant limitations for military budgets in the foreseeable future—leading the Air Force to find a way to ensure mission execution within existing or even reduced funding. Against that challenging backdrop, the need for finding efficiencies becomes even more critical.

There is, however, some very good news. AFSO provides a proven way to function effectively—even in a severely resource-constrained operating environment. This is not just some unsubstantiated claim. We have seen this time and time again in the business sector where organizations that successfully implement the discipline of Lean thinking have not just survived, they have completely dominated their competition. This should sound familiar to Airmen because the Air Force has never been interested in just competing. It has a long history of a single-minded focus on completely dominating any would-be adversary.

In that regard, all Airmen should have a deep and abiding interest in what Lean can do for them—and senior leaders are all in. In fact, the commander of Air Combat Command (ACC), General John D.W. Corley, recognized the great potential inherent in AFSO and initiated a *war on waste*. The focus of his campaign is to enhance mission performance throughout ACC by looking at how we are spending our time, studying our processes for mission value, and using the Lean tools available within AFSO21.

While the vast majority of good ideas come from the front line, Airmen at all levels have a role to play. Mid-level officers and noncommissioned officers have the experience and operational responsibility to identify opportunity areas and guide AFSO work. Senior leaders set the course and more than ever, personally lead large, high-value initiatives like aircraft fuel, additional duties, and information technology overhaul.

Finally, it is important to note that Congress has also recognized the power of Lean and has directed the Secretary of Defense, in the 2008 National Defense Authorization Act, to implement business transformation efficiency programs across all of the military Services. To date the result has been a Congressional requirement to appoint a chief management officer to direct the Department's efforts and a standing directive by the Deputy Secretary of Defense on continuous process improvement. For the Air Force, AFSO21 has emerged as a core component of its strategy to meet these Department of Defense mandates.

While the specific nature of the challenges we will face remains uncertain and dynamic, one of the inherent strengths of AFSO is its flexibility to effectively address any unique set of circumstances. In this regard, it is easy to see that AFSO exists for the sole purpose of helping Airmen continue to strengthen mission capability. AFSO is all about doing your job faster, better, more safely, and smarter. It is important to understand that AFSO doesn't make decisions to cut or constrain resources. Quite the contrary, AFSO helps Airmen deal effectively in an environment where those limitations already exist.

On behalf of the Secretary of the Air Force, we will continue to facilitate AFSO efforts across the Service. We look forward to working with as many Airmen as we can as we strive to make all Airmen more conscious of their *AFSO DNA* by making an AFSO mindset an integral part of every airman's daily routine.

Together we can give a great Air Force an even better future—a future in which the Air Force is a much more lethal force and a much more effective partner on the Joint warfighting team; a future in which the Air Force will be able to provide a wider array of sovereign options to our national leadership, where they can

choose to employ an even more capable Air Force to meet the increasingly complex national security challenges and threats our country will inevitably face.

While this overall effort is important, your individual participation is that much more critical. So, pitch in to the AFSO fight. We're absolutely confident it won't take long before you too see the true value, and appreciate the professionally rewarding aspects of how AFSO can help you do your part to make this great Air Force that much better.

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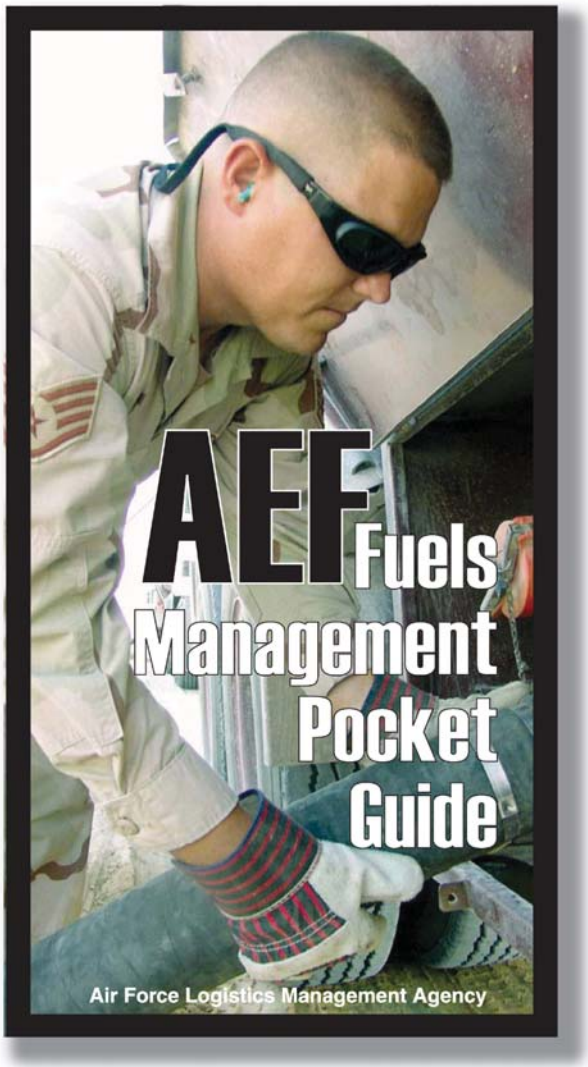

Critical ideas and information need to be presented in a crisp and clear format. If you look around at some of the things being produced today, that's not always the case. That's why AFLMA was asked to produce this guidebook. The *AEF Fuels Management Pocket Guide* is in high-impact format and meets a defined Air Force need.

This guide is designed to assist in understanding fuels issues as they relate to expeditionary operations. The information is intended to provide a broad overview of many issues and be useful to anyone who has an interest in the Air Force fuels business. Call or e-mail for your copy today.

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The Basics

Air Force Smart Operations for the 21st Century

Air Force Smart Operations for the 21st Century (AFSO21) was introduced as an initiative, in part, as a response to the Air Force's need to modernize and recapitalize our aging aircraft and equipment fleet. Antiquated and *stove-piped* processes contributed to wide spread inefficiency throughout all areas of the Air Force, ranging from administration to production processes. It includes the commercial practices of four proven process improvement methodologies, all of which share the traits of continuous process improvement (CPI). These methodologies are Lean, Six Sigma, Theory of Constraints, and Business Process Reengineering. Key principles contained in these methodologies include improving flow within a process, focusing on factors that degrade quality in products, identifying and overcoming constraints within a process, and complete redesign of a process.

Major Anthony F. Antoline, PhD, USAF
Steven Green, The Greentree Group

How can we be more effective at our jobs with efficiency built into the processes we have to execute every day? This is not a rhetorical question—leadership expects an answer. In order to meet the challenges we face daily, we must work smarter. AFSO21 is the instrument to get this accomplished. This article describes the basics of ASFO 21, provides some history, describes its principles, and discusses some of the AFSO tools available.

Air Force Smart Operations in action

What is the goal of implementing AFSO21 across the Air Force? The vision statement lays this out clearly.

> The vision for AFSO21 is to establish a continuous process improvement (CPI) environment whereby all Airmen are actively eliminating waste and continuously improving processes. These improvements must be centered around the core missions we, as Airmen, are responsible for conducting—specifically to maintain the asymmetric advantages and capabilities the Air Force delivers in air, space, and cyberspace. We need to ensure we are also driving efficiencies and improvements across the board. Therefore, we must use the right tools and techniques to see and attack problems and leverage opportunities for improvement; and employ our greatest resource—innovative, dedicated Airmen.[1]

AFSO21 is not centered around one process, base, or major command. The Air Force is implementing AFSO throughout its entire enterprise. AFSO focuses on the components of the enterprise, the operating systems or tools and techniques we use, and the management infrastructure—including the structure, processes, and systems—that are required to execute the Air Force mission. Further, AFSO is very much about changing the mindset and capabilities of the people executing the Air Force mission. Simply put, it provides the tools and techniques to improve areas that are overburdened or inflexible, improve standardization, and eliminate waste.

Why AFSO21

AFSO21 was introduced as an initiative, in part, as a response to the Air Force's need to modernize and recapitalize its aging aircraft and equipment fleet. Antiquated and stove-piped processes contributed to wide spread inefficiency throughout all areas of the Air Force, ranging from administration to production processes.

AFSO21 includes the commercial practices of four proven process improvement methodologies, all of which share the traits of continuous process improvement. These methodologies are Lean, Six Sigma, Theory of Constraints (TOC), and Business Process Reengineering (BPR). Key principles contained in these methodologies include improving flow within a process, focusing on factors that degrade quality in products, identifying and overcoming constraints within a process, and complete redesign of a process.

The five desired effects of AFSO21 are as follows:[2]

- Increase productivity of the Air Force's most valuable asset—Airmen
- Significantly increase critical asset availability
- Improve response time and decisionmaking agility
- Sustain safe and reliable operations
- Improve energy efficiency

Lean

AFSO21 is largely based on the principles of Lean. Lean focuses on the identification and elimination of waste within a process and sets the stage for other CPI approaches, making them more effective. Five basic principles characterize a Lean enterprise—specifying value, value stream identification, flow, pull, and perfection.

Value

Defining value is the critical first step in the Lean process. From a Lean perspective, value is defined by the ultimate customer and is only meaningful when expressed in terms of a specific product that meets the customer's needs at a specific price and at a specific time.[3]

Value Stream Identification

The next step in the process is identifying the value stream which includes all actions required to deliver a product to the customer, to include waste. The identification of the value stream is best accomplished using value stream mapping (VSM). VSM involves developing a visual depiction of the process, identifying each activity from beginning to end.

Flow

After the value stream is specified, the next step is to determine if the process flows throughout the value stream with little to no interruption. The greatest hindrances to flow are traditional batch processing and departmentalization which occurs when work is performed in groups and then passed on to the next step in the process or to another department for further processing. This contributes to longer lead times because of the amount of wait time between process steps.

Pull

Pull enables the customer to extract the product from the value stream based on demand (as needed). Simply put, nothing is produced by a supplier until the customer signals a need. The benefits of the pull are providing the right amount of product or service, at the right time, when needed by the customer. This significantly decreases, or sometimes eliminates, the requirement for large stockpiles of inventory that can be a source of waste within the value stream.

Perfection

The fifth Lean principle is the endless pursuit of perfection—all activities along the value stream become value added. Continually revisiting the process will identify additional waste that can be eliminated, thus moving the process ever closer to the state of perfection.

There are eight specific forms of waste defined by Lean. Day-to-day activities are full of wasteful steps, and identification and elimination of waste is critical in improving a process. The following is a list and brief description of each form of waste:[4]

- **Defects.** Defects cause rework and increase costs. Valuable resources are consumed reworking and correcting errors associated with defects. Examples are incorrect documentation, missing information, rework, and scrap.
- **Overproduction.** This occurs when more information or product is generated than needed, leading to excess inventory. Examples are batch processing and making too many copies of a document or presentation.
- **Wait-time.** This includes all idle time within a process. Examples range from waiting for a fax to waiting for delivery of a required part to complete a work order.
- **Nonstandard Over-Processing.** This form of waste has no value from a customer perspective. Nonstandard work practices and over inspection of items or parts are examples of this waste.
- **Transportation.** This is the unnecessary movement of information or materials. Examples include physical hand-off of information and moving materials or products in and out of storage.
- **Intellect.** This form of waste arises from not capitalizing on expertise and knowledge of individuals within an organization.
- **Motion.** Any activity requiring movement by a person or machine that does not add value to a process is wasted motion. Examples are searching for lost parts or tools and walking too far to use a copier.
- **Excess Inventory.** Excess inventory results from keeping too much information or material than is needed to fulfill a customer order. Forms of this waste include producing documentation ahead of customer orders and unnecessary parts or product inventory.

Adhering to the Lean principles—specifying value, value stream identification, making the process flow, pulling value from the customer, and the endless pursuit of perfection—provides a clear path to process improvement. Equally important is the identification and elimination of waste within the process to create overall value in the eyes of the customer. As Lean seeks to identify and eliminate waste, Six Sigma seeks to reduce variation within a process or product while improving quality and reducing cost.

Six Sigma

Six Sigma is another methodology under the AFSO21 umbrella. The use of Six Sigma as a process improvement method means using a disciplined, data-driven approach to measuring the defects produced by a business process and then systematically determining how to remove them.[5] The ultimate goal is to reduce variation in a product or process to no more than 3.4 defective parts per million opportunities. Define, Measure, Analyze, Improve, and Control (DMAIC) is the structured problem-solving methodology used for the five phases of Six Sigma improvement.[6]

DMAIC

- Define the purpose and scope of the project. It is also important in this step to capture the voice of the customer, which in short, is capturing the customer's requirements.
- Measure the current state of the process and collect reliable data on process speed, quality, and costs that will be used to expose underlying causes of problems.[7]
- Analyze the process to identify root causes of problems affecting the product or process and support these discoveries with data.
- Improve the process by implementing solutions to root causes and create measurement standards to evaluate results.
- Control the process by documenting and standardizing improvements to prevent workers from going back to the old way of doing business. It is also important to develop metrics to be used for regular process auditing.

The DMAIC framework should be utilized when an existing process or product is not meeting customer requirements. As Lean and Six Sigma address improvement to individual processes, there is another improvement methodology that takes more of a systems view and focuses on eliminating constraints within the system—Theory of Constraints.

Theory of Constraints

TOC is a management philosophy introduced by Eliyahu Goldratt in his 1984 book *The Goal*. It is based on the principle that complex systems exhibit inherent simplicity. Even a very complex system made up of thousands of people and pieces of equipment can have at any given time only a very small number of variables—perhaps only one (know as a constraint)—that actually limits the ability to generate more of the system's goal.[8] The purpose of TOC is to correctly identify and eliminate the constraint or constraints.

The objective of TOC is to maximize the throughput of a process while minimizing operating expenses in the form of labor resources and costs.[9] TOC focuses on five key steps in implementing continuous improvement. Although not formally a step in this process, it is vitally important to correctly articulate the goal to the organization before embarking on the process of change.

Five Steps of TOC Application[10]

- **Identify and Prioritize the System's Constraints.** Here a process is analyzed so that a task or activity that limits the productivity of an entire system can be identified. Be mindful that a constraint can be a physical or policy constraint. A physical constraint will require a strengthening of the weak link in the process chain. Policy constraints require replacement of the policy.[11]
- **Exploit the Constraint.** In this step, decisions must be made on how to modify or redesign the task or activity so that work can be performed more effectively and efficiently.
- **Subordinate the Constraint to All Other Processes.** All efforts are directed at improving the performance of the constraining task or activity and any other task or activity that directly affects the constraining task or activity.
- **Elevate the Constraint.** This may require a permanent increase in capacity that will increase (elevate) the overall output of the constraining task or activity. It can include purchasing more equipment or machinery, implementing a new information technology program, or hiring additional personnel.
- **Return.** If the constraint is removed, return to step 1 and begin the process again.

The assumption is that once a constraint is broken, another will surface within the process. Following the five steps of TOC will enable continuous improvement of both the overall system and its processes. The three previously described methodologies focus on incremental improvement within a process. Business Process Reengineering, on the other hand, is a comprehensive process requiring a change in the fundamental way business processes are performed.[12]

Business Process Reengineering

To maintain competitiveness in today's global marketplace many companies are using BPR. In a world of unprecedented customer power, past performance is no longer acceptable, and conventional remedies do not address non-value added activities within business processes.[13] Removing waste and minimizing non-value added work from a process is the major focus of BPR.

BPR is not about incremental improvement. It focuses on inventing a totally new business process from a *clean slate* perspective. It doesn't mean tinkering with what already exists or making incremental changes that leave basic structures intact.[14] It is a complete rethinking of how the process should be performed with a major focus on creating value from a customer's perspective. BPR also focuses on reducing costs and accelerating the flow of information throughout a process. Technology acts as an enabler for BPR by enhancing the flow of information from both within an organization and across organizations.

The BPR methodology addresses envisioning a new process, change management, process diagnosis, process redesign, implementation, and monitoring of the new process.

BPR Methodology[15]

- **Envision New Process:** secure management support, identify reengineering opportunities, identify enabling technologies, and align with corporate strategy
- **Initiating Change:** set up reengineering team and outline performance goals
- **Process Diagnosis:** describe existing process (who, what, why, and how) and uncover pathologies in existing process
- **Process Redesign:** develop alternative process scenarios, develop new process design (future state process), design human resource architecture, select information technology (IT) platform, develop overall blueprint, and gather feedback
- **Implementation:** develop and install IT solution, implement process changes

- **Process Monitoring:** performance measurement (including time, quality, cost, and IT performance) and link to continuous improvement

Lean, Six-Sigma, TOC, and BPR are all important and proven CPI tools. A onetime effort will produce improvement, but utilizing CPI concepts will prevent process stagnation, continuously improve processes, and instill a culture of continuous improvement within an organization. Ingraining the CPI mindset into the Air Force culture is a necessary and positive step forward and using the tools available will help create this mindset. CPI tools and methodologies are discussed in the *AFSO21 Playbook,* which is available via the AFSO21 Community of Practice.

Facilitator Tools—The Rapid Improvement Event

The AFSO office has detailed the tools and methodologies available to a facilitator in the *ASFO 21 Playbook*. If you have been involved in an event, you have witnessed several of these tools put to use. If you have not, this section will familiarize you with a typical rapid improve event (RIE) utilizing the Value Stream Mapping (VSM) methodology and other tools commonly utilized throughout an event.

If the problem being evaluated is manageable with a small number of people, an RIE may be tailored and a small project (just-do-its) may be sufficient to make the improvements needed. Often the problem is larger and several organizations or offices are involved in an RIE. Incorporating various problem-solving tools may be the best route to getting everyone on the same page.

Keep in mind that an RIE does not just happen. There is coordination that must be done beforehand. The guiding document for an RIE, the charter, needs to be developed (4 weeks out) and approved (3 weeks out).[16] The charter sets the goals and scope of the event for participants and the sponsor. It also will help ensure that the event fulfills the sponsor's expected outcome (solutions developed and manpower and resources not wasted).

The first day of an event is a busy one. The foundational work for a successful meeting is set during this critical time. Once the introductions are made, ground rules have been set, and jobs given to the participants (timekeeper, scribe, and others), the facilitator will outline the expectations for the group. An open environment that keeps participants engaged and feeling they are contributing to the event is essential. The charter needs to be briefed to ensure everyone understands what the RIE is about and what the team is expected to accomplish. Often the sponsor will address the group and express support for the event and give his or her views and guidance. Once this occurs, the event is ready to roll and will be turned over to the event team lead and the facilitator.

The event team lead does much of the preparation for the meeting and should be in contact with leadership to ensure support. This also allows the lead to brief leadership on issues that might affect the success of the event.[17] The facilitator will run the event and ensure the activities are properly scoped, planned, and carried out.[18] Many good ideas and questions will be generated during the course of the event that may not fit in the scope of the RIE or that may need to be answered later. The facilitator will establish a running list of these items in what is termed the *parking lot*. These items will need to be revisited before the group adjourns and may be used as part of the outbrief or implementation plan.

Part of the facilitator's responsibility during the event is to conduct an AFSO awareness brief that puts the group on an even playing field. When an event is hosted, the participants' AFSO experience will vary—in some cases, it may be their first exposure. The awareness briefing will provide all the participants a glimpse of

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what AFSO21 is, what is going to occur, and what they will be responsible for throughout the event.

The facilitator will then take note of the participants' experience and start to validate the data sources for the event. If possible, real data from observing the process in question should be used rather than historical data or best guesses.[19] Once the review has been accomplished, the facilitator will review the steps to create a VSM, which will define the current state of the process used to produce the end item or service under consideration.

Before getting too far into what is currently happening with the process, defining the impact of the process and those involved is useful. The facilitator will typically use a tool that gives the group a good reference point from which to start, defines the process at a high level, and helps scope the project. A SIPOC (Supplier, Inputs, Process, Outputs, Customer) is the tool used to do this. It pinpoints the *supplier* to the process, the *inputs* the supplier has to the *process*, names the process that is under scrutiny, defines the o*utputs* of that process and, identifies the *customer* who receives the outputs of the process.[20] Narrowing the scope and discussing how each element delivers value to the customer is complemented by actually taking the group to see the process in question. At the very least, the team lead should do this to ensure he or she is able to lead the group and keep the event on track. It may help to draw the process—a spaghetti diagram can be utilized— to define the flow of the product through the process.

Next, each step of the process is mapped out. This portion of the VSM takes a significant amount of effort. The VSM is core to the analysis the group will accomplish, so getting it right is imperative. During this effort the group is not only labeling each step, it is assigning touch time, cycle time, number of people in the step, and cost of the step.[21] Touch time is the time spent in which the item is actively being worked. Cycle time is the time from receipt to release. If touch time and cycle time appear to be the same, the facilitator would want to verify that is, in fact, the case. (Often items sit and wait before they are actually processed; sometimes technology can expedite this and bring those times closer together.)

Once the current state is fully developed, the group will start to identify the problem by labeling each step as value added, no value added, or no value added but required. Consider the value added to the product or service from the customer's point of view.[22] Frequently a member or members of the group are responsible for part of the process and that portion will be very important to them. Two questions need to be asked. Would the customer care about that step? Does it add form, fit, or function to the product or service? Participants may have a difficult time divorcing themselves from the process and focusing on the value to the customer.

Once the as-is VSM is complete, the gloves come off and the group's next exercise is to define the perfect state for the process. The team should define the process as it should be with no budget, technology, or regulatory constraints—the goal being to completely eliminate waste. This will help to illustrate the amount of waste that is in the as-is process. The group will assign *value* or *no value* to these steps as was done before.

Once the group has an idea of what the future state can be, it will evaluate the current-state map for undesirable effects (UE). UEs are symptoms of the problems in the process. These problems need to be analyzed for root causes. A facilitator can utilize several techniques to discern the *real* cause of a problem. The Five Whys is one method. You may have done this as a young child to irritate your parents, but it can lead to a solution, as long as the questions are focused on the last response. Simply ask, "Why did (insert the problem here) happen?" Repeat this five times, more or less, and the root cause is likely to reveal itself.[23]

Solutions directed at issues other than the root cause may lead to a small improvement and may only address the symptoms, not the actual core issues. Some facilitators may use a fishbone diagram to ensure the root cause is identified. This method seeks to organize like issues, much as an affinity diagram does. The diagram will resemble a fish skeleton, with six ribs branching off a central spine. A problem statement serves as the head, with the six ribs representing the six broad categories of causal factors: manpower, machine, method, material, measurement, and environment.[24] These factors can be traced back to the problem. You might find that you can eliminate some causes if they cannot be traced back to the head. Other tools, such as brainstorming or the Observe, Orient, Decide, and Act Loop method, may be used to seek solutions to the problems. Once the solutions are formed, the group will design the future state of the process.

The future state should be designed for a 3 to 6 month period into the future. This will allow time to implement some of the solutions the group has developed. The changes that must occur to amend the current state to the future state are noted, and each step is labeled in regard to value as before. What will become apparent

is that there are many opportunities to eliminate waste, idle time, and inventory, as well as improve information flow and the overall process.[25] You may also find that many requirements are levied on your processes that are driven by Occupational Safety and Health Administration guidelines, Air Force instructions, or some other mandate. If the solutions developed can be done safely and legally, challenge the standard.

Once the group has the solutions to the problems listed, it needs to prioritize them and determine how much work will be required for implementation. Some solutions will be classified as *just-do-its* which are easily accomplished. However, just-do-its may require another RIE to get to the root of the real problem. Solutions that will require significant time will be termed projects. A project may take several months and require research to accomplish. To prioritize solutions, the facilitator will normally use a tool called a pick chart. This is simply four quadrants with *difficulty* running along the x-axis and *level of impact* running down the y-axis. The solutions are then placed on the quadrant where the group thinks they should be listed. This is a simple way to determine which solution should be tackled first and where to get the greatest results for the least level of effort. With this accomplished, the group can develop an implementation plan and assign points of contact, as well as start and stop dates to ensure the tasks get accomplished. The implementation plan is the heart of the RIE. It is the plan that enables the solutions to come to fruition.

The sponsor also needs to be briefed on the group's findings and the implementation plan. When stepping through the outbrief, group members get to play a part and explain some of the events that have taken place during the week. One comparison that needs to be highlighted during the outbrief is the difference between the current as-is process and the future to-be process—savings of time, resources, and money by the elimination of waste. All is not done at this point, however. The group spent its time coming up with a plan, now comes the real work to execute it. Ensuring the ideas are implemented and periodically reviewed is the only way to see returns from the team's hard work.

Conclusion

The Air Force is proving itself as a first-class example of how to use peoples' initiative and ideas to make the enterprise better. Keeping the basic AFSO principles in mind while doing our day-to-day job is the key to making the needed improvements to our processes. If you get an opportunity, become involved with an RIE to see how it works. Getting the Air Force community to think CPI and having it become second nature is a major goal of AFSO21.

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Captain Dan Henderson, USAF

AFSO21 Continuous Process Improvement

Management Tool

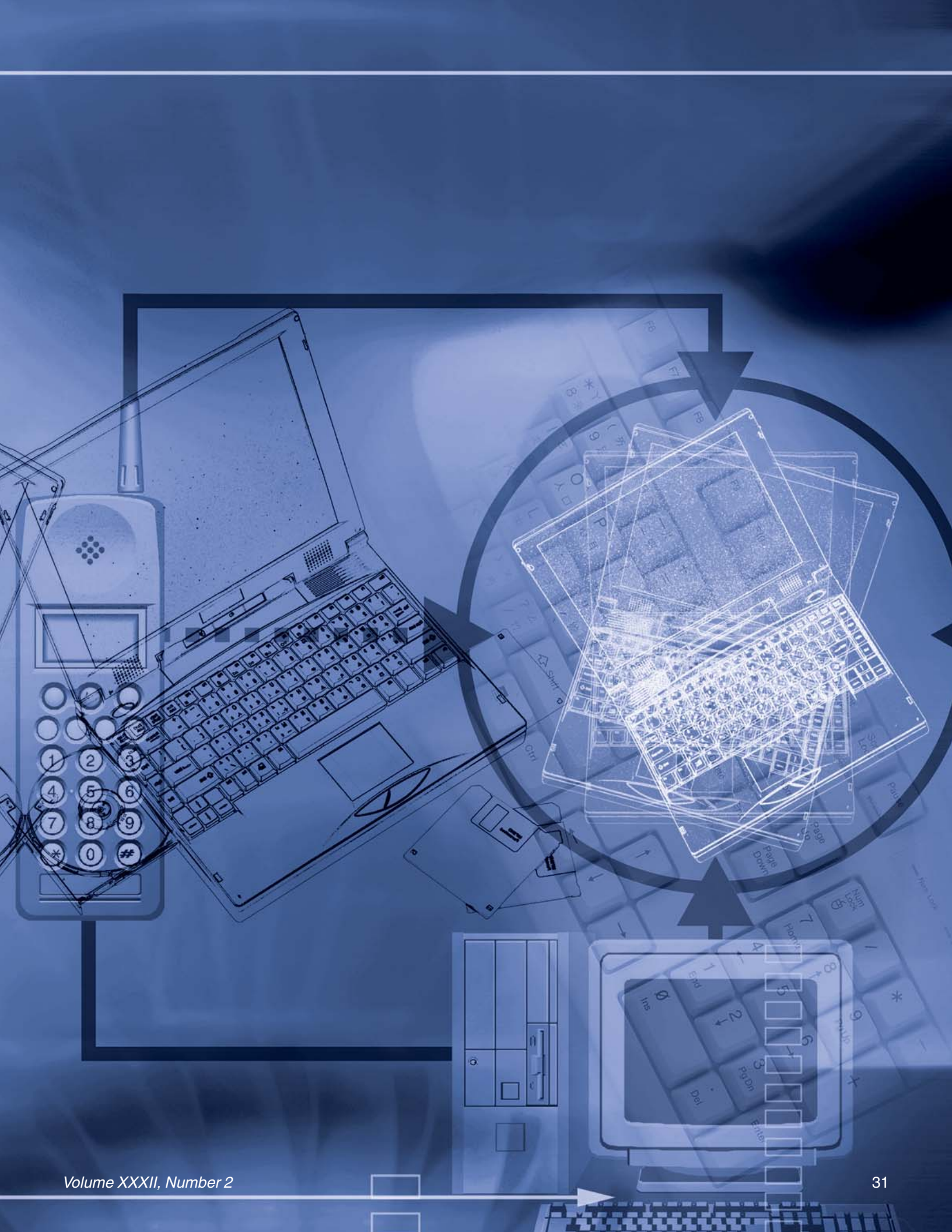
The Continuous Process Improvement-Management Tool system is a common access card-only enabled Web-based system, utilizing the Air Force Portal for its security boundary. Currently access to the system is granted by major command-, base-, or wing-level AFSO21 offices. There are over 3,500 users in the system, with nearly 1,300 having permissions to enter new or edit existing projects in the system.

Introduction

As the Air Force started the enterprise rollout of Air Force Smart Operations for the 21st Century (AFSO21), a requirement existed for a secure, Web-based, searchable and collaborative information technology tool that could not only provide a central repository of AFSO21 events for use in the field, but also could quickly roll up information for higher-level reporting. The AFSO21 office chose a commercial-off-the-shelf software solution, PowerSteering, from PowerSteering Software, Incorporated.

As the Air Force originally configured and implemented the software, it was designed to provide Air Force key process owners, major commands (MAJCOM), Air Force key process owner core teams, wing AFSO21 offices, problem solving team leaders, and problem solving team members with the following:

Air Force Smart Operations in action



- **Project Management.** Create, manage, analyze, process, control, and report process improvement project information
- **Strategic Alignment.** Align process improvement projects to Air Force key processes
- **Executive Visibility.** Provide management dashboards for enterprise awareness
- **Reporting.** Provide an automated report delivery system
- **Idea Portal.** Provide the capability to submit suggestions for review of AFSO21 events, which could be turned into chartered projects

A heavy emphasis was placed on the project management component, and a formalized *gated* (approval) process was used to enter and track AFSO21 projects. However, recent v*oice-of-the-customer* feedback has resulted in changes to this configuration, and a *non-gated* basic work template is now available in the system, allowing users to quickly enter information without having to utilize a formal approval process for AFSO21 events.

The AFSO21 office, in consultation with PowerSteering Software, developed a set of seven user-level computer based training (CBT) modules, each of which is less than 10 minutes in length. The CBTs allow a new user to quickly and sequentially go through training, which includes everything from a basic system overview, to entering a new AFSO21 project, to detailed reporting and collaboration capabilities. This modular approach also allows a user to go through *on-the-fly* refresher training for any particular component of the system.

System Overview

The Continuous Process Improvement-Management Tool (CPI-MT) system is a common access card-only enabled Web-based system, utilizing the Air Force Portal for its security boundary. Currently access to the system is granted by MAJCOM-, base-, or wing-level AFSO21 offices. There are over 3,500 users in the system, with nearly 1,300 having permissions to enter new or edit existing projects in the system.

The CPI-MT system allows AFSO21 projects or events to be tracked in a work tree structure that is similar to using the common Microsoft Windows File Explorer. However the AFSO21 work tree structure is aligned both organizationally and by the 10 Air Force key processes. This allows individual units, aligned under their organizational structure, to enter AFSO21 projects or events under their MAJCOM. Each MAJCOM AFSO21 office has administrative control over its users and the projects under its MAJCOM. For AFSO21 events that have Air Force-wide impact, impact multiple MAJCOMs, or are better tracked by the process owners, those events are stored in the 10 Air Force key processes portion of the CPI-MT work tree. As with the MAJCOMs, the Air Force key process owner core teams have full administrative control of their users and their portion of the AFSO21 work tree.

Each MAJCOM was provided great flexibility in the structure of the work tree. Some MAJCOMs chose to keep an organization (base or wing) type structure for entering and storing information, while others chose to use a process-based approach, based upon MAJCOM strategic alignment and deployment priorities.

Numerous and powerful reporting capabilities are available *out-of-the-box*, both visually and in electronic formats. Numerous reports are available in PDF, Word, Excel, and Hypertext Markup Language formats. Hard copy reports can also be set up to automatically run at specific intervals and the results e-mailed in the desired format to multiple users. A visual dashboard is available to graphically see the results and progress of AFSO21 events and can be configured to the individual user. Dashboards can be developed to brief senior leadership direct from the CPI-MT system, without having to create separate PowerPoint-based briefings. However, for those who desire to use PowerPoint, a PowerPoint slide builder is also included in the CPI-MT system.

The built-in e-mail, document repository, and collaboration capabilities of CPI-MT allow the system to be a central location for everything connected with an AFSO21 event. From a document perspective, many common document types (such as PDF, Word, Excel, PowerPoint, Visio, Microsoft Project) can all be stored and added to an AFSO21 project. Documents may even be *checked out* and updated, ensuring multiple versions of the document are not being edited at the same time. The collaboration capabilities of the software are a powerful feature, allowing discussion threads to be started on items. These discussion threads can be elevated to issues, or even individual action items can be created and assigned to specific individuals. This collaborative environment ensures that all the relevant information and discussions associated with an AFSO21 project or event are stored in an easily

searchable central repository for permanent storage and long-term retrieval.

In addition, the CPI-MT system has a powerful search capability that allows users to do a basic search based on people or project and event titles, or conduct an advanced search that will look through stored documents and detailed project information.

Air Force Maintenance for the 21st Century (AFMx21) Usage

The original *Air Force Maintenance for the 21st Century (AFMx21) Implementation Plan* utilized an extensive Microsoft Excel spreadsheet that was the blueprint for implementation and the mechanism for tracking progress in completing tasks and subtasks related to achieving the goals and objectives of the *AFMx21 Strategic Plan*. As the implementation plan progressed and evolved, maintaining that spreadsheet became an onerous and man-hour intensive process. Additionally, efforts to Web-enable the *AFMx21 Implementation Plan* met near insurmountable information technology, security, and access restrictions in attempting to develop a stand-alone AFMx21 implementation application.

In lieu of developing an independent Web-enabled implementation application, Headquarters US Air Force Directorate of Logistics, Installations, and Mission Support, Maintenance Division (AF/A4M), approached the AFSO21 office about using the CPI-MT system for tracking and reporting of the AFMx21 implementation, project completion and transformation progress. This resulted in a new section in the AFSO21 CPI-MT work tree dedicated to AFMx21. This couples AFMx21 implementation progress with the AFSO21 business processes for managing transformation. In addition, the powerful document management capability, report generation, progress tracking, and automatic message generation were all key features that led to the decision to utilize the CPI-MT system.

The implementation plan data was loaded into CPI-MT by the AFMx21 office. A detailed users' guide was developed for Air Force Maintenance Advisory Group members, offices of primary responsibility, offices of collateral responsibility, and individual task owners. The guide provides instructions for accessing, updating, amending, and creating AFMx21 implementation tasks and subtasks. By using the AFSO21 CPI-MT application, AFMx21 implementation plan tracking uses the CPI-MT application terminology, business processes, and templates. While some unique AFMx21 modifications were necessary, generally the standard CPI-MT terminology is used throughout.

Upcoming System Enhancements

The most significant change expected to the CPI-MT application is making the vast information stored in CPI-MT available to any Air Force Portal user. Work is currently underway with PowerSteering Software to allow any Air Force Portal user to *self-register* in the CPI-MT system, as a *read-only* user, without requiring any intervention from the MAJCOM, base, or wing AFSO21 office. This update, expected in the fall of 2008, will greatly increase the knowledge sharing capabilities of the system, allowing more Air Force users to search the central repository of AFSO21 projects and events.

Work is also ongoing to allow the MAJCOMs, 10 Air Force key processes and AFMx21 to each develop a standardized portfolio, which would enhance the ability to allow all similar users to see data in exactly the same way, every time they access the system.

Finally, the AFSO21 office is exploring the possibility of making the CPI-MT database searchable from external sources, perhaps directly from the Air Force Portal or Air Force Knowledge Now. This would greatly increase the capability to ensure AFSO21 information is readily available to any individual who desired it.

Captain Dan Henderson is assigned to the Global Operations Center, Integration Branch, United States Strategic Command, Offutt Air Force Base, NE. At the time of the writing of this article, he was the Branch Chief, Information Technology, Secretary of the Air Force, Office of Smart Operations for the 21st Century.

No form of transportation ever really dies out. Every new form is an addition to, and not a substitution for, an old form of transportation.

—Air Marshal Viscount Hugh M. Trenchard, RAF

Air Force Smart Operations in action

AFSO 21 Problem Solving

The Process and Related Tools

Paul A. Dunbar, USAF
Lieutenant Colonel Joseph Heilhecker, USAF

We have learned and grown in our continuous improvement understanding as we have implemented Air Force Smart Operations over the past few years. Early efforts were largely oriented around conducting rapid improvement events (RIEs), which are an effective tool but an incomplete approach to problem solving. Early AFSO21 facilitator training was also largely focused on planning and facilitating a group through an RIE.

Our current AFSO21 training for facilitators (Level 1 and 2), leaders, and Airmen orientation, as well as the *AFSO21 Playbook*, have changed to put greater focus on structured problem solving with RIEs being one of several useful tools. Problem solving events range from j*ust do it* actions to large process reengineering initiatives. The AFSO21 problem solving structure is scalable to the type problem being addressed by a team or individual.

What follows is the Air Force Observe, Orient, Decide, Act (OODA) 8-Step Problem Solving model (see Figure 1, page 36). Within it is a structured, and recognizable, 8-step sequence Airmen are being trained to use. The OODA cycle is one that would be repeated in the course of continuous process improvement (CPI). It is a cycle analogous to Deming's *Plan, Do, Check, Act*, but fit to our Airmen's culture and language.

The first steps of the OODA model are critical, ensuring the right problems are being addressed and align with local leadership priorities. These steps will help teams or individuals think critically about why a particular issue should be addressed. They will help one answer a question that should be asked by their leaders or external stakeholders, Of all the problems you could have attacked, why this one?

The next set of steps requires improvement targets be set and the true root causes be identified. Next, countermeasures need to be set and followed through as part of the Act stage of OODA. The last two steps are accomplished to confirm the achievement of desired results and to

standardize the successful process improvements. The last step is most often skipped but is critical to the never-ending cycle of continuous improvement using OODA. Unlike an extra helping of dessert, don't skip it!

Following the sequenced actions in the 8-step methodology will help teams ensure they do not jump to improvements and countermeasures to problems prior to understanding the problem and root causes. Following the eight steps will ensure the results are aligned with the needs of the organization. All of this leads to a coherent nesting of organizational purpose and activities, as well as a virtuous cycle of continuously improving organizational and Air Force capability.

Readers will find additional information on the 8-step methodology in the *AFSO21 Playbook*. The playbook is accessible at the *AFSO21 Knowledge Area* within *Air Force Knowledge Now* on the Air Force Portal at the following URL: https://rso.my.af.mil/afknprod/ASPs/CoP/FuncCoP.asp?Filter=OO-21. Select the CPI Resource Center icon to access the playbook and many other helpful AFSO21 materials.

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Lieutenant Colonel Joseph Heilhecker *is currently the Deputy Chief, Integration Division, Air Force Smart Operations. He was instrumental in the successful introduction of Smart Operations into the KC-135 depot line at the Tinker Air Logistics Center.*

Observe, Orient, Decide, and Act
8-Step Problem Solving Model

1. Clarify and Validate the Problem. (O) O D A

Identifying and clearly defining a problem is critical. Only after a problem is completely understood is the team in the best possible position to solve the problem.

a. Does this problem, when solved, help meet needs identified by the organization?
   - Is it linked to the SA&D of organization?
   - Does it help satisfy customer needs?
b. Does this problem, when solved, address key issues identified during SWOT analysis?
c. Has this problem been identified and directed by a value stream map at the appropriate level?
   - What does the future state need?
   - What resources have been identified to address this issue?
d. What opportunities were identified or observed by the process or problem area walk?
   - Will addressing or improving these issues deliver results that relate to item a or item b?
   - Will addressing or improving this problem deliver the desired future state from item c?

2. Break Down the Problem and Identify Performance Gaps: (O) O D A

The first step in assessing a problem area is gathering and reviewing key process indicators (KPI) and metrics. Understanding what objective data is needed and what the data, once it has been gathered, means is critical to root cause problem solving and process improvement.

a. Does the problem require more analysis or does leadership have enough information to execute a solution?
   - Is this simply a leadership directive?
b. If more data is needed, how do we measure performance now?
   - What are the KPIs? What is the performance gap?
c. Does other data need to be gathered?
d. What does the data indicate are the potential root causes?
e. Does the data review indicate a bottleneck or constraint?

3. Set Improvement Target: O (O) D A

Improvement targets must be set on two levels simultaneously; the strategic and the tactical. At a high level, the Air Force leader must create a vision of what the organization will strive to become. Tactical targets define the performance levels required to make the vision a reality.

a. Is the improvement target measurable? Is it concrete? Is it challenging?
b. Is the target output oriented?
   - What is the desired output?
   - Should be things to achieve; should avoid things to do
     - Will be addressed by action plans (Step 5)
c. The desired target should:
   - Do what? By how much? By when?
d. If it is a process problem, what is the future state?
   - How will it be realized?

4. Determine Root Cause: O (O) D A

Root cause analysis is a trade-off between digging as deeply as possible, and finding the deepest point that is still within the team's sphere of influence.

a. What root cause analysis tools are necessary?
   - Why are these tools necessary?
   - What benefit will be gained by using them?
   - Who will need to be involved in the root cause analysis?
     - Ten heads are better than one
     - Remember cultural issues related to problem
b. What are the root causes according to the tools?
c. How will the root cause be addressed?
d. Will addressing these address the performance gap?
e. Can the problem be turned on or off by addressing the root cause?
f. Does the root cause make sense if the Five Whys are worked in reverse?
   - Working in reverse, say therefore between each of the whys

5. Develop Countermeasures: O O (D) A

The key principle to remember is that the impact of a solution is a combination of the quality of the solution and the acceptance of the solution by the people who must implement it.

a. Develop potential countermeasures
   - Tools and philosophies from Lean, Theory of Constraints, 6 Sigma, and Business Process Reengineering as appropriate.
b. Select the most practical and effective countermeasures
c. Build consensus with others by involving all stakeholders appropriately
   - Communicate, communicate, communicate
d. Create clear and detailed action plan
   - B-SMART actions
   - Reference facilitation techniques as appropriate

6. See Countermeasures Through: O O D (A)

Action comes at the end of the OODA Loop for a reason. Air Force leaders acting before they are ready for this step are likely to be as successful as the marksman with the motto ready, fire, aim.

a. Which philosophy best prescribes tools that address root causes?
b. Which tools best address root causes?
c. Which method for implementation fits the tool and improvement need?
   - Rapid improvement event (RIE)?
   - Improvement project?
   - Point improvement or Just Do It?
d. If RIE or project, create charter and communicate
e. What training or education is needed? By whom?

7. Confirm Results and Process: O O D (A)

This step closely mirrors the data collection portion of Step 2. Ideally the KPIs and metrics identified in Step 2 will be all that is needed here.

a. How are we performing relative to the Observe phase (Steps 1 and 2)?
b. How are we performing relative to Step 3?
c. How are we performing relative to financial reporting template projections?
d. If we are not meeting targets, do we need to return to Step 4?
   - Most problem solving breakdowns occur relative to improper root cause identification

8. Standardize Successful Processes: O O D (A)

This is the most commonly skipped and under-completed of the entire problem solving process. It is very tempting to take newfound knowledge and skills and immediately move on to the next improvement initiative, skipping the effort of ensuring the results stick.

a. What is needed to standardize improvements?
   - Tech order changes?
   - Air Force instruction changes?
   - Official instruction changes?
b. How should improvements and lessons learned be communicated?
   - CPI-Management Tool (PowerSteering)
   - Key meetings?
c. Were other opportunities or problems identified by the problem solving process?

Figure 1. Observe, Orient, Decide, Act 8-Step Problem Solving Model

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Air Force Smart Operations in action

T56 Engine Line—Little Rock AFB

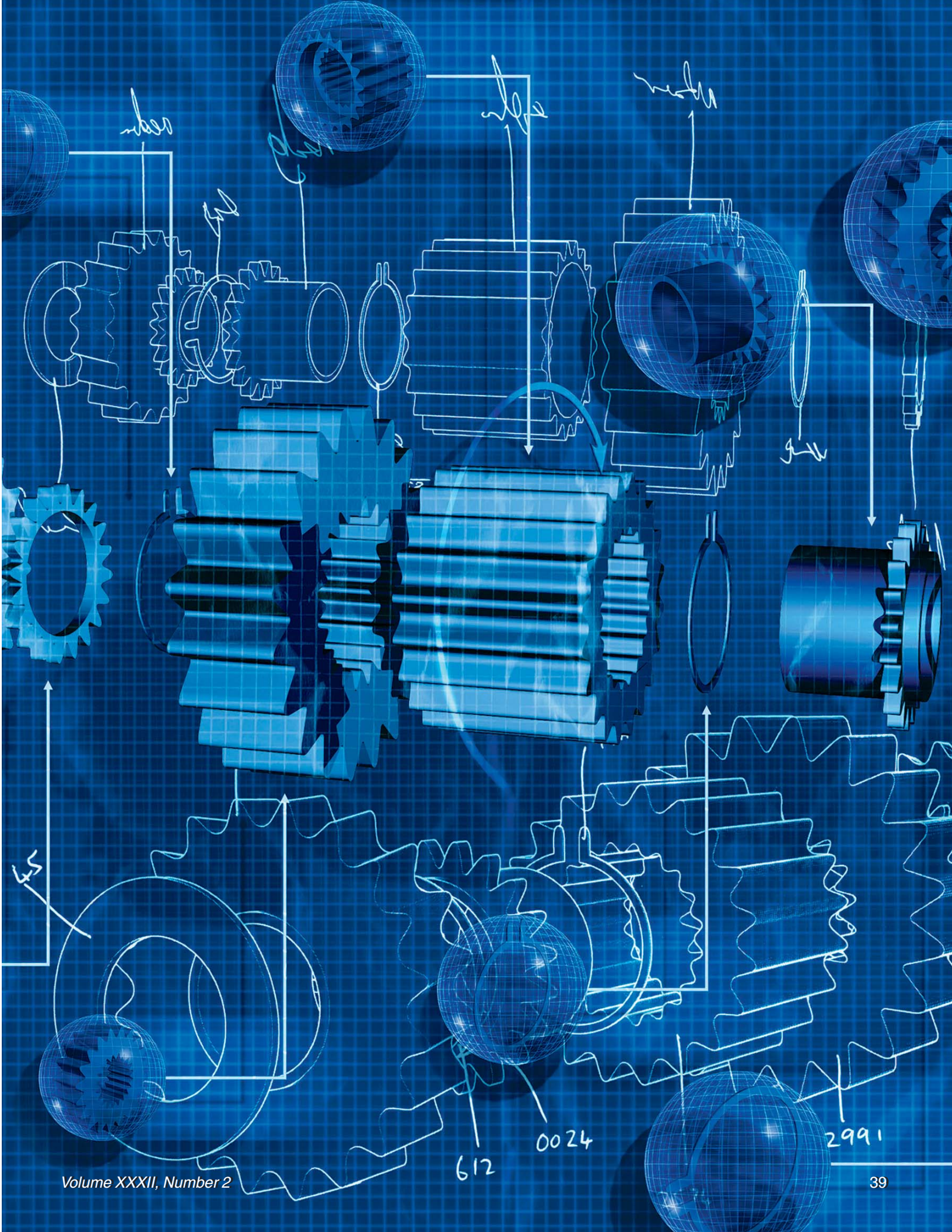
Successes and Challenges

In 2006 the Engine Regional Repair Center (ERRC) set out to deliver T56 engines faster, with more precision, and using fewer resources by applying the key principles of Lean manufacturing as a part of Air Force Smart Operations for the 21st Century (AFSO21). Our initial goal was to increase efficiency 30 to 40 percent—meeting engine demand 100 percent of the time.

Colonel Jeffrey Hoffer, USAF
Lieutenant Colonel David Haar, USAF
First Lieutenant Nicole Hagerman, USAF

Introduction

The 463d Airlift Group's ERRC provides regional T56-A-7B/-15 Jet Engine intermediate maintenance for Air Mobility Command's (AMC) C-130 units at Little Rock, Dyess, and Pope Air Force Bases (AFB). The ERRC was first established in 1996 with a 54-man contract field team (CFT). In 1998 the CFT handed supervisory control over to the Air Force. Since then, the ERRC's concept of operation has incorporated training and developing assigned Air Force personnel with increased propulsion system troubleshooting and maintenance skills. Although senior Air Force enlisted members help develop new Airmen through their usual supervisory roles, much of the training is actually completed by tapping into the CFT's extensive expertise. These CFT members have over 20 years of experience with the C-130 weapon system and pass along this experience to the new Airmen. Furthermore, the CFT supplies a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solid foundation for engine repair while their military counterparts support AMC deployment commitments. Today we have 58 authorized Air Force personnel and 38 CFT members.

The ERRC is unique in a number of ways. For example, there is a special authorization for system engineers that allows the center to perform specific depot level maintenance repairs, saving thousands of dollars annually. Another example is the center's use of reliability-centered maintenance practices and estimated time-on-wing calculations as a baseline to produce more reliable engines. The only other repair facility comparable to the ERRC is the Lockheed Martin/Kelly Aerospace facility located in San Antonio, Texas.

Our Journey on the Air Force AFSO21 Path

In 2006 Air Force and contractor personnel at the ERRC embarked upon a journey of continuous process improvement. The ERRC set out to deliver T56 engines faster, with more precision, and using fewer resources by applying the key principles of Lean manufacturing as a part of AFSO21. Our initial goal was to increase efficiency 30 to 40 percent—meeting engine demand 100 percent of the time. The overarching goal within the ERRC remained—continuously improve, and make a *good* process a *great* process.

Pre-AFSO21

Members of the ERRC embarked on their AFSO21 journey by identifying the most apparent areas of waste:

- Engine production was based on the crew buildup structure
- Erratic output, nonstandard work, and sharing of special tools and equipment
- No visual cues built—either visual management or controls in place
- *Push system* production—high inventory buildup and over production
- Section isolation—disconnected from the overall engine production flow
- Section takt times nonexistent or synchronized
- Extensive unnecessary travel to and from a composite tool kit section
- Maintained significant excess work-in-progress
- Shop floor layout reflected disarray and excessive work travel distances

Instilling the AFSO21 Culture

To eliminate or reduce the above mentioned waste, change and innovation had to be encouraged through the use of AFSO21. The tools and techniques of the AFSO21 methodology were viewed as a continuous effort versus a one time, short-run effort. Each person came to accept the concept of continuous improvement. It was evident the desire to control one's own destiny by recommending and making changes was spreading from person to person and work area to work area until the entire shop was on board and hungry for more.

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AFSO21 to Present

From 2006 to 2008 great progress was made toward a more efficient process. Production efficiency increased 30 percent by applying basic AFSO21 methodologies. The following are examples of past findings and initiatives.

- Designed and implemented a new, single item flow process, which eliminated batches of products waiting

in the queue. Reinforcement and self-discipline in this standard work provided for sustainable and predictable production output.

- Relocated toolboxes closer to the workstations. Technicians travel for specialty tools only. These tools require stricter controls due to calibration requirements or other restrictions.
- Established a *supermarket* of inventory items controlled and used in production at an upstream process. This is a designated area on the shop floor, close to the technician, where items are stored until installation. This concept promotes the *just-in-time* concept—having what is needed, only when it's needed. Because of its high visibility, an empty area triggers the need to replenish an additional part (subsystem).
- Created a hazardous material locker within the work area—reduced walking and waiting in line for chemicals in the composite tool kit section.
- Created a bench stock list for lockers with necessary hardware—reduced time spent walking, waiting, and searching for hardware at bench stock carousels.
- Segregated lockers into A, B, and C shelves to coordinate with the assembly line cells, enabling the technician to immediately view all components and hardware for tasks to be performed.
- Arranged work packages for inspection, repair, and buildup flow, creating an organized and orderly process which allows the technician to know what needs to be done next.
- Developed a quick engine change (QEC) kit locker, allowing the technician to have all necessary components and hardware needed for a QEC kit buildup at his or her station—eliminated walking, waiting and searching for hardware in bench stock carousels.
- Realigned sheet metal technician duties—organized technicians into teams for lower QEC kits and reduced large batches of end-item products and long waits.
- Repositioned work cells to synchronize production flow.
- Visual production management and control boards were implemented, allowing management to view all engine and module production status.
- Implemented error-proofing picture books.
- Established *6S* efforts.

In late 2007, Dr Ron Ritter, Special Assistant for Air Force Smart Operations to the Secretary of the Air Force, highlighted the ERRC as *The model T56 propulsion enterprise for the Air Force.* Members of the ERRC were tasked to establish a 6-month plan to develop the optimum shop design and processes for T56 engine and propeller repair. This model would be detailed enough for potential deployment enterprise-wide. To date, numerous activities have occurred, including two significant rapid improvement events (RIE). These events consisted of a high-level value stream map (VSM) to identify the interactions of all propulsion functions. This floor plan is intended to guide our followup events for the next few months. Each followup event will develop a particular repair line and the physical layout of each cell within the repair line. Personnel assignments and standard work are to be based upon takt and cycle time. As predicted, the second event (Assembly line [or A-line] and Test Cell RIE) did just that for the A-line and contributed to the VSM for the engine test cell process. Although our journey has proven successful, we have encountered many

ERRC Prior to AFSO21

ERRC in the Final States of AFSO21

challenges and foresee more to overcome. (See Figures 1 and 2 for the future and ideal states)

Our Challenges

Communication

It is one thing to simply state that communication is key, and quite another to elevate it to the level of daily reinforcement it requires. With this in mind, communication continues to be the most critical challenge. There are a myriad of stories to communicate to the various entities involved in the ERRC's development; however, there are few sustainable opportunities by which to communicate these stories. The deployment of any effort with the magnitude of the propulsion enterprise and the potential impact upon the Air Force, demands the use of every conceivable communication tool. There are multiple levels of communication (coordination, information sharing, and approvals) required to keep all individuals within the ERRC up to date. This may seem like an easy task; however, it was harder than expected. Many discussions and decisions were made within the inner workings of an event that did not always get communicated to the floor. We found the easiest way to communicate to those individuals was through the event members themselves and not so much through the leadership team. Mid-level communication was keeping our group up to date on initiatives and barriers via the monthly AFSO21 Executive Council Meetings. Now that our internal engine AFSO21 project has become an Air Force-level enterprise effort, communication in all directions has become more rigorous. Currently we have biweekly gate reviews with our team lead and have proposed monthly gate reviews with Secretary of the Air Force, Smart Operations (SAF/SO); Headquarters Air Force, Deputy Chief of Staff, Logistics, Installations, and Mission Support, Maintenance Directorate (AF/A4M); and Headquarters Air Mobility Command, Logistics Directorate (AMC/A4). Sustaining these meetings requires constant coordination and becomes

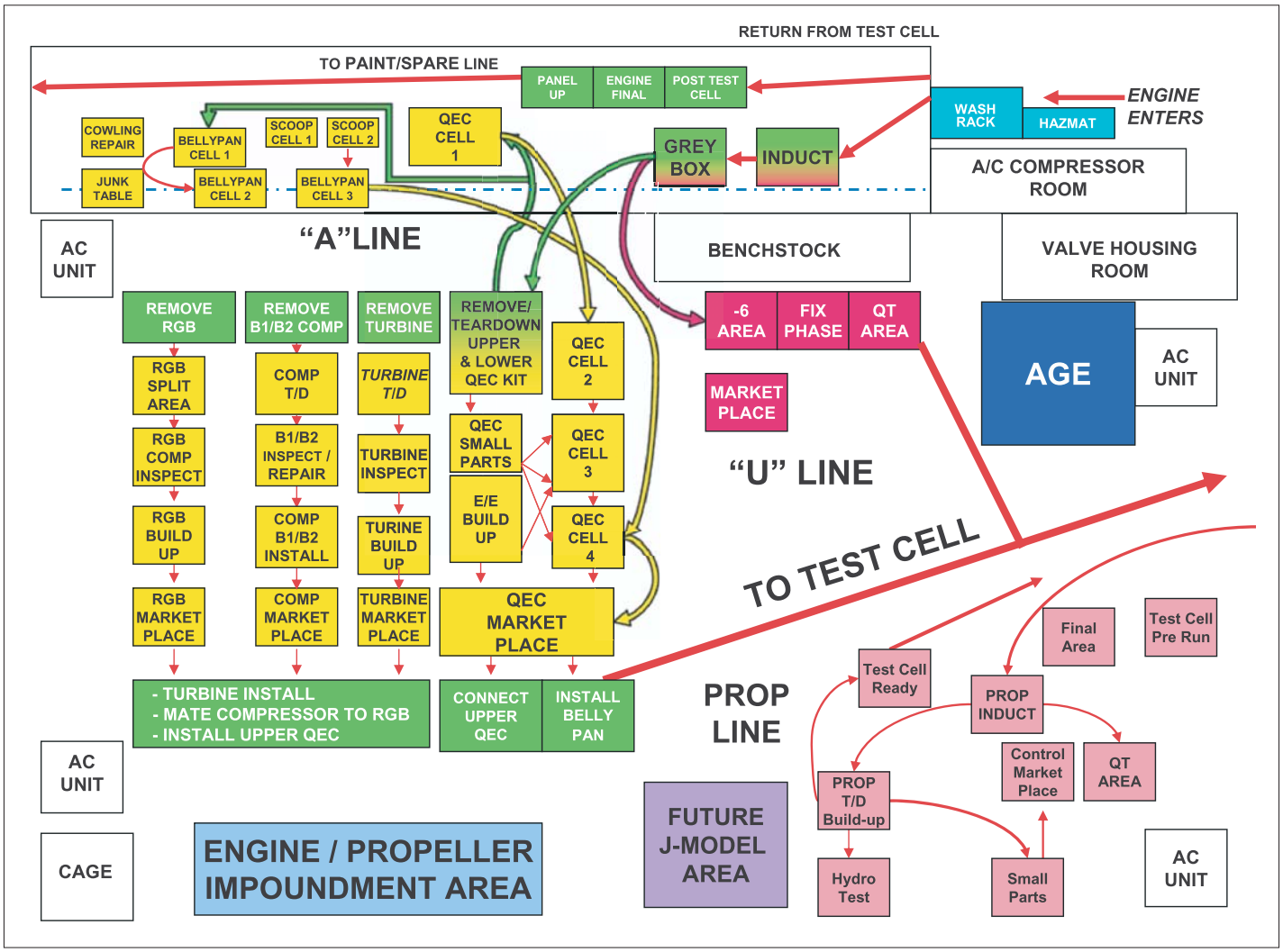

Figure 1. Future State

complicated, competing for time with day-to-day operations.

Knowledge Management, Personnel, and Turnover

The CFT provides a wealth of knowledge; however, as the contractors leave the workforce they take with them vast amounts of experience and knowledge. The military workforce is continually changing with younger, inexperienced Airmen replacing CFT members. If great care is not taken to capture the vast contractor knowledge base, we will dramatically limit our ability to improve and not benefit from historical lessons learned. In an ideal world, the Air Force manpower system would take these manning challenges into account and provide replacements who have similar experiences and training. Unfortunately, this is not always the case and the practical experience gained by working within the ERRC is often lost. Military members are subject to the same long-term challenges as our CFT members—retirement, relocation, as well as activities the CFT does not contend with such as deployment, career development and training absences, and others. To compensate for the manning changes and disruptions, the team has begun developing new training tools and new software programs that allow us to collect huge amounts of information and research in a very short time.

Time

Time constraints will continue to be one of the greatest challenges. Several RIEs and 6S efforts were completed, and many more are scheduled in the future in order to complete establishing the model T56 engine line. Five improvement events have been completed to date, each of which has taken the standard week to accomplish. However, the administrative burden has required personnel to be taken *out of hide* in order to consolidate, focus, and maintain data. The T56 engine project has significantly benefited from part-time expert

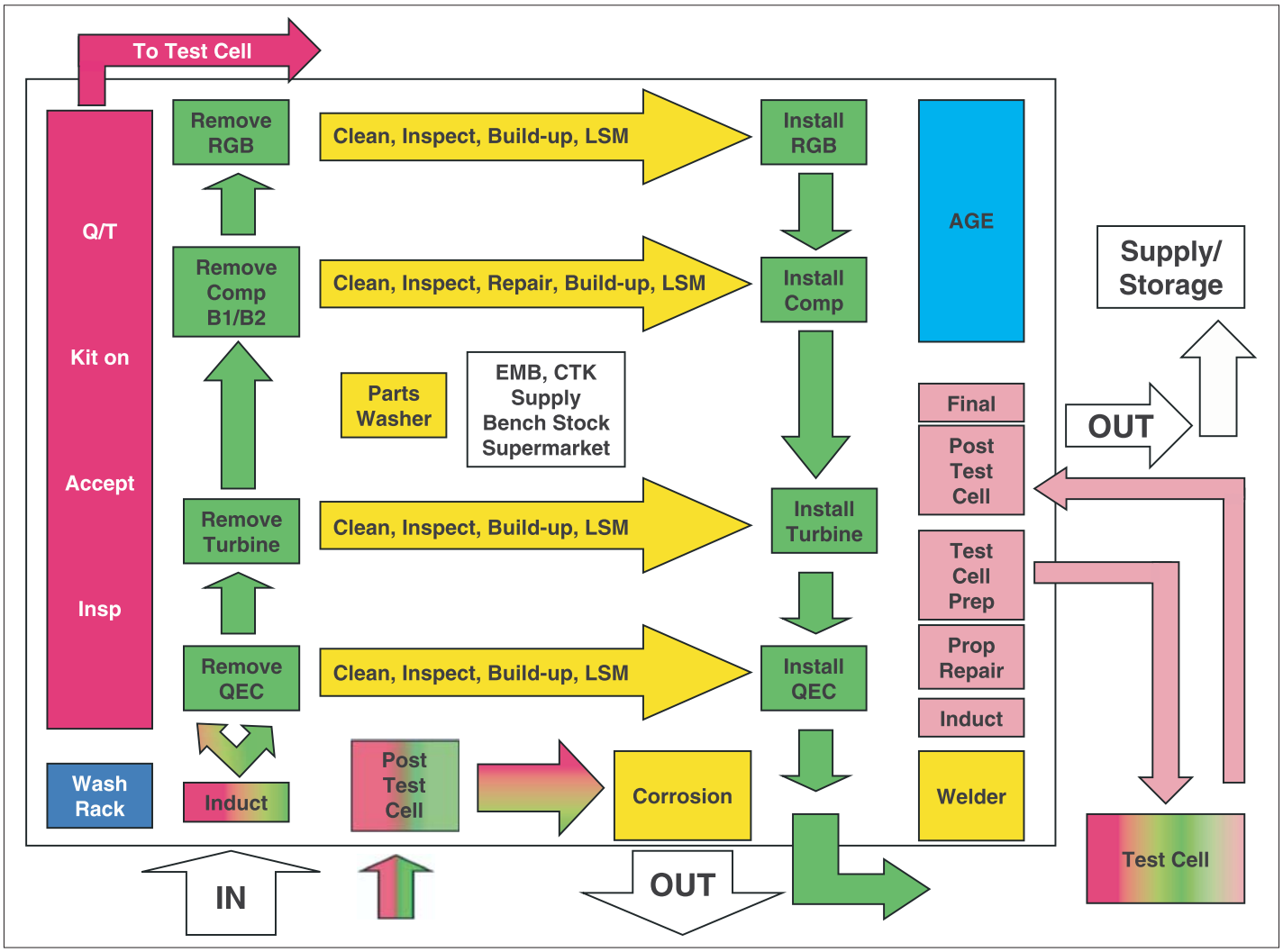

Figure 2. Ideal State

consultant support to help guide us with overall efforts. This support provides an outside-the-Air-Force, industry perspective, and helps our team maintain both its focus and intensity.

To overcome time and personnel limitations, success has been achieved through the scheduling and goal setting process. Once the 6 month project surge began, it became absolutely critical to establish the project's pace and priorities, and to build a comprehensive schedule agreed upon by all team members.

The schedule was revised at several points because of unforeseen limitations and time to coordinate throughout the enterprise. Multi-agency coordination can be a daunting task; however, once achieved the momentum gain was impressive. It took several months to coordinate the first working-level meeting intended to encompass the entire enterprise. This was a communication opportunity and a truly demanding challenge; however, persistence prevailed and the result was a successful meeting and exchange of information. The entire enterprise was brought together in a single forum—invaluable discussions culminated in a greater understanding of the opportunities and constraints ahead. The time taken to bring the team together has improved our latest events. Air Force Special Operations Command members have become essential, supporting each of our events with experts and providing valuable input into the construction of the model engine line.

Manpower Reductions

AFSO21 (and more to the point Lean) is not an acrostic for *fewer employees are needed*—although ideally, it does cut the waste that sometimes leads to workforce realignment. Instead, Lean looks at manpower inefficiency and capital resources producing nonstandard work. Nonstandard work found was unnecessarily bound by illegitimate constraints. Some examples of nonstandard work include:

- Repeat quality problems causing additional quality and 7-level inspections.
- The development of local procedures to apply more stringent controls, resulting in additional manpower to monitor the program and to maintain the written procedures.

With the implementation of recent DoD-wide manpower reductions, Lean tools were instrumental in highlighting this kind of waste, as well as other waste driving the research, study, and implementation of viable alternatives.

Building Synergy

Synergy within the project will remain a challenge as it moves forward, and as greater demands are placed upon the people to identify the next set of innovations or improvements. Synergy is built by demonstrating a desire to hear and discuss all possible solutions or opportunities, and by including as many people as possible in team events. The project will not wait until every person can participate in a team; however, every opportunity is taken for open discussion.

Competing Wing Resources

Manpower reductions are not the only events that impact a unit's resource picture. Air Force requirements such as the Global War on Terror (GWOT) and the subsequent deployment of qualified technicians to support GWOT operations have also created obstacles to production. In addition, other traditional Air Force duties such as the physical fitness program, training requirements for all skill levels, and various *details* take their toll. Fortunately, we have a workforce that also consists of contractors who work side-by-side with the Air Force members and is able to step in as needed. In order to manage these constraints, visual controls were established using a production manning board. The information on this board provides a quick reference to the availability and training level of an employee. Management is then able to adjust personnel assignments based upon the known availability of the employee.

Air Force Priorities and Support

To establish the Air Force's model T56 engine line, the project must compete at the Air Force level for priority and dedicated resources. It must demonstrate its value competing against such activities as GWOT, recapitalization of the Air Force's weapon systems, and other national or global considerations. AFSO21 and the use of business case analysis tools help the project compete. In addition, the project was selected for review at the Air Force 4-Star Process Council. Leadership and executive oversight has been critical to keeping this project on track, and essential when working at the enterprise level.

Too Far Out Front?

Once the model engine line is built and ready for deployment, management of this engine repair node will require repair network transformation (RNT) management support. The propulsion enterprise repair model can be deployed and implemented as the first Air Force enterprise tool— essentially a *plug and play*

concept for other engine types and repair facilities to follow. This RNT-managed deployment will be able to achieve far-reaching versus localized efficiencies. We foresee customer demand being the driver versus a traditional adding or subtracting *X percent* for out-year production goals. The propulsion enterprise concept potential is enormous, perhaps extending to all DoD repair facilities.

Conclusion

Our success, to date, has been fraught with conflict and frustration, with equal amounts of excitement and satisfaction mixed in. However, one thing is clear, from 2006 to 2008 production efficiency increased 30 percent by applying basic AFSO21 methodologies.

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Colonel Jeffrey Hoffer *is the Group Commander, 463d Airlift Group, Little Rock AFB, AR. Colonel Hoffer is a previous contributor to the Air Force Journal of Logistics.*

Knowledge - Technology - Innovation

Lots of organizations have catchy mottoes. Likewise, many have catchy vision statements. We do, too. But there's a big difference—we deliver on what we promise. *Generating Transformation Solutions Today; Focusing the Logistics Enterprise of the Future* aren't just words to us; they're our organizational culture. We use a broad range of functional, analytical, and scientific expertise to produce innovative solutions to problems and design new or improved concepts, methods, systems, or policies that improve peacetime readiness and build war-winning logistics capabilities. Our key strength is our people. They're all professionals from logistics functions, operational analysis sections, and computer programming shops. Virtually all of them have advanced degrees. But more important, virtually all of them have recent field experience. They've been there and done that. They have the kind of experience that lets us blend innovation and new technology with real-world common sense and moxie. It's also the kind of training and experience you won't find with our competitors. Our special blend of problem-solving capabilities is available to every logistician in the Air Force.

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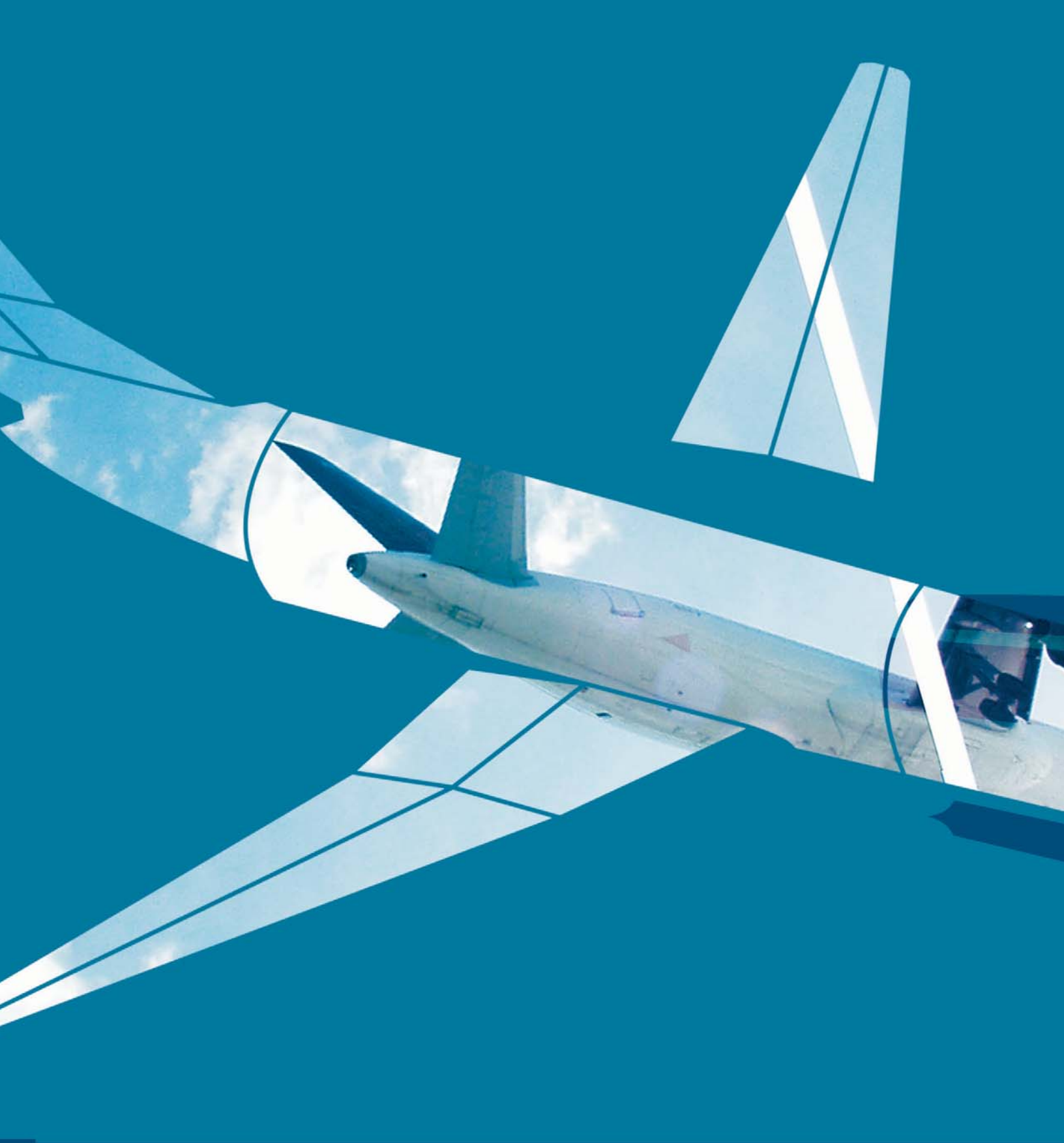


Air Force Smart Operations in action

AFSO21 and the 6th Maintenance Group

Reconceptualizing Maintenance Practices

The group remains focused on AFSO21 for several reasons. First, it is a way for Airmen at all levels to rethink and engage the day-to-day waste inherent in all our processes and make continuous improvements. It is critically important to obtain buy in at all levels to ensure this will not become a passing fad. Next, Airmen recognize that leadership is serious about implementing the changes they suggest. Third and most important, leadership is given a tool to reduce workload on their troops. We've cut 2.5 work days off the #2 Periodic Inspection and reduced the duty day from 12-hour shifts to 10 hours. Our goal is to slash another 2 days and an additional 2 more duty hours per day per troop to get our folks *back* to a normal duty day and still roll out a quality product.

Colonel James C. Howe, USAF
Captain John E. Creighton, USAF

Introduction

In today's environment, MacDill Air Force Base, like many other bases, continues to experience budget pressures, personnel reductions, and time constraints. Downsizing and base realignment and closure commission initiatives have significantly strained our capabilities to sustain home station missions as we continue to support a high operations tempo in the Global War on Terror.

In 2005, the Secretary of the Air Force and Chief of Staff issued clear direction to implement Air Force Smart Operations for the 21st Century (AFSO21). Leaders in the logistics arena stressed more efficient use of logistics resources through two major initiatives: implementing aircraft

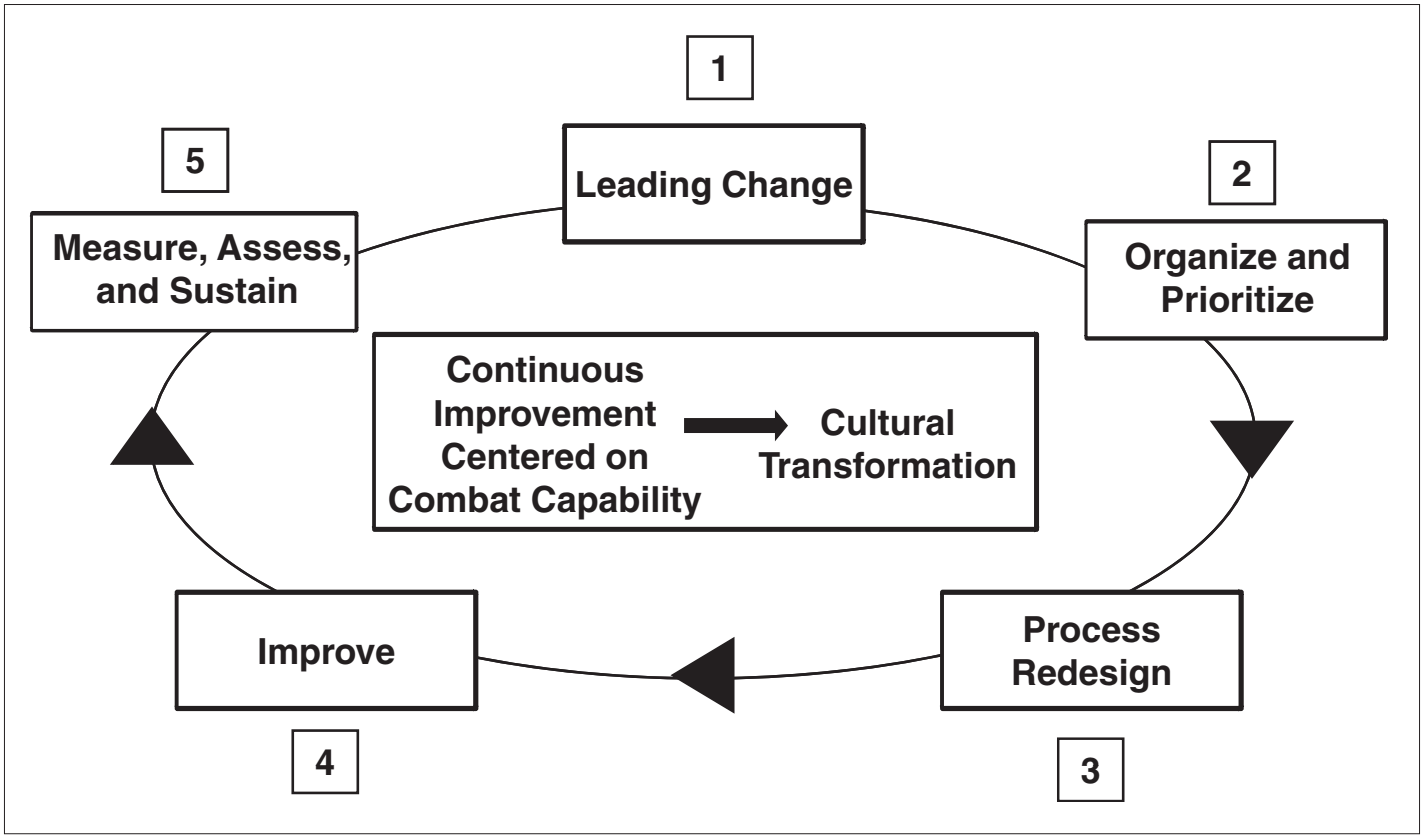


Figure 1. Model for AFSO21 CPI

availability improvement programs and institutionalizing Lean concepts throughout logistics organizations (see Figure 1).

The call for AFS021 continuous process improvement (CPI) and the need for transformation challenge us to look for more efficient ways to do business. We must become more combat effective while on the journey and remain focused on our Air Force priorities: *Win Today's Fight, Take Care of Our People, and Prepare for Tomorrow's Challenges*.

In addition, multiple deployments, rapidly developing technology, and supply chain management enterprise globalization have created hyper-work (24 hours per day) environments which are ripe for CPIs and transformation. These environments present unique challenges to Air Force Airmen regardless of echelon of command. Air Force leaders at all locations must lead the charge to change how we think about and perform our business—organizational- and intermediate-level maintenance.

The 6th Maintenance Group (6 MXG) has embraced the culture of AFSO21. Airmen throughout the group have experienced significant benefits from various AFSO21 projects first hand. The group standardized work practices and improved major maintenance processes throughout the maintenance complex. These improvements have positively impacted the wing and mobility air forces (MAF) KC-135 aircraft availability. Rapid improvement events (RIE's), standard work evaluations, 6S (sort, straighten, shine, standardize, sustain, and safety), Gantt charts, and visual work space projects are all words which are now part of the daily language of the group.

Initiatives

Headquarters Air Mobility Command, Directorate of Maintenance, encouraged its KC-135 maintenance group deputy commanders to form a *Council of Deputies* (COD) and empowered them to implement AFSO21 initiatives across the command. The 6 MXG volunteered to tackle the aircraft transfer process which was identified as a proposed improvement area from the initial COD conference held at McConnell Air Force Base (AFB) in January 2007. Airmen from 6 MXG have also refined the aircraft quick turn process and turned the fuel cell trainer initiative into a reality. Both efforts could potentially become standard work practices across the KC-135 community.

In addition, this past January, the 6 MXG partnered with the 319 MXG (located at Grand Forks AFB, ND) to host the #2 Periodic Inspection (PE) project for the KC-135. This ground breaking event went from an RIE

to a project with 49 *just-do-its* and 30 follow-on projects, all catalogued in the community of practice Website—more on those results later.

The 6th Maintenance Squadron (6 MXS) proposed two manufacturing initiatives: the OMAX water jet cutting machine and the Global Local Manufacturing Factory Initiative (GLMFI)—both of which offer potential Air Force-wide benefits. Our most recent project is tackling the corrosion control aircraft wash process, which is exacerbated by the highly corrosive Florida environment.

These initiatives are just a few examples of processes, concepts, and maintenance practices that the highly motivated Airmen of the 6 MXG have evaluated and are continually working on improving. Our AFSO21 successes are challenging, but well worth the effort. The 6 MXG's first event, the aircraft transfer process, demonstrates the benefits of AFSO21.

From 30 April through 4 May 2007, the 6 MXG led a MAF-wide KC-135 Aircraft Transfer RIE. The goals were to standardize work, reduce man-hours and ultimately increase KC-135 aircraft availability to the warfighter. MacDill AFB is located in a severe corrosion environment, which drives an abridged aircraft rotation program between bases every 24 months. This nonstandard process required 72 hours to accomplish, but more importantly took the aircraft *out of the fight* for 3 days.

This initiative was a huge success. It resulted in a standardized 18-step checklist, which now only takes 24 hours to accomplish and saves 60.8 maintenance man-hours per aircraft transfer. Currently, the KC-135 Weapon System Manger at Headquarters Air Mobility Command (HQ AMC) is working with counterparts at Tinker AFB, OK (KC-135 depot) to incorporate these steps into the official aircraft transfer technical order. All MAJCOMs flying KC-135s concurred with this reconceptualized maintenance practice and have incorporated the standardized checklist into their aircraft transfer process. A true MAF-wide AFSO21 success!

Standardizing The KC-135 Aircraft Transfer Process

Aircraft Quick Turn Process: Increasing Velocity in the Mobility Environment

With today's unprecedented aircraft flying tempo, the 6 MXG needed a way to increase our aircraft availability to match the 6 Air Mobility Wing's (AMW) increased flying mission. We charged ourselves to review our aircraft quick turn process in an effort to afford the 6 MXG a greater opportunity to utilize the aircraft quick turn, in lieu of preflighting another aircraft or turning down a mission. This process needed to have at least a 90 percent predictability factor for success.

The wing formed a cross-functional team made up of experts in operations, maintenance, and support across the 6 AMW to review the established quick turn process. The wing was using 4 hours and 15 minutes as the scheduling standard for the current state. The group addressed every facet of the process including the aircrew's 30-minute call out procedures, tire roll over checks, aircraft taxi times, and aircraft parking locations. The team analyzed the operation and standardized the way we schedule our quick turn missions by adding notes concerning each quick turn in each affected line of the flying schedule. We also added reminders to the aircrew of the quick turn process during the aircrew 30-minute call out report. In addition, the group agreed to assign specific aircraft quick turn parking locations (to facilitate refueling if necessary) and postponed the aircraft *bird bath* until the last flight of the day. The bird bath is a unique aircraft clear water rinse used in highly corrosive environments to limit salt water corrosion. Finally the group agreed to eliminate the tire roll over check. The proposal to eliminate the tire roll over check required HQ AMC approval, and not only was it granted for MacDill, but it was implemented throughout the entire Air Force.

After a week of review and refinement, the team eliminated wasted actions that shaved 30 minutes off every quick turn at MacDill. Some may say, "It's only 30 minutes," but when you add those 30 minutes saved from every quick turn over the course of the year, the minutes add up to days. Though saving 30 minutes is nice, the true measure of how successful we were in our

charge comes when one looks at the flying schedule. A year ago, we may have had one quick turn scheduled in a week. Now the norm is for the wing to see three to four quick turns in a week. By allowing the 6 MXG to increase its quick turn opportunities, we have freed up three to four more aircraft a week to fly additional missions. We've also added predictability into our flying schedule by measuring ourselves against a 90 percent predictability factor. This has proven to be the benchmark in that 100 percent of our quick turns now take 3 hours and 45 minutes to execute—10 percent above our self-imposed scorecard.

Fuel Cell Wing/Confined Space Trainer: Improving Fuel Cell and Confined Space Training

The Fuel Cell Wing/Confined Space Trainer was recognized as a blue ribbon AFSO21 base-level initiative, and adopted by Air Education and Training Command as a *best practice*. In previous years, confined space training was accomplished on KC-135 aircraft that were not mission capable for maintenance. Once repaired, the aircraft was kept down to perform proficiency and skill-level upgrade training.

The development of the Fuel Cell Wing/Confined Space Trainer enables the 6 MXG to directly impact the AMC Commander's Annual Enterprise Improvement Priority vision to "reduce the cost to operate all functions of AMC by 10 percent ... and improve productivity of Airmen by 20 percent."

Additionally, the trainer facilitates confined space training for emergency rescue and fuel cell familiarization training, without requiring aircraft downtime. It is also used for familiarization training for machinists, sheet metal and metal technology personnel, and other specialists. We've recently included Airmen requiring nondestructive inspection certification to our user list, as we continue to maximize the number of Air Force specialty codes that are capable of utilizing this device.

This event was a joint effort between Grand Forks and MacDill AFBs. The team engineered this stand-alone device that simulates the exact dimensions of an actual KC-135 aircraft. The team coordinated with the Aerospace Maintenance and Regeneration Group, Davis-Monthan Air Force Base, AZ to obtain the left and right wing sections from a decommissioned donor aircraft, and transported the wing sections to MacDill and Grand Forks.

The 6 MXS fuel systems supervision coordinated with the fabrication flight to convert the wings into a brand new maintenance training device (MTD). The fire department began construction by cutting the wing sections into specified dimensions, and used the remaining structure for practice response to aircraft incidents and accident simulations.

Personnel assigned to the 6 MXS fastened the 13.6 foot by 2.6 foot wing section onto a 10 foot high steel stand which cost only $3,000 to construct. This eliminated the requirement for a dedicated aircraft for training purposes, and realized a $16,439 savings annually based on the KC-135's hourly operating cost. This initiative projected a savings of 5 days annually in aircraft downtime, which was significant to our operating tempo. The fuel cell work center now utilizes the MTD for 28 percent of career field education and training plan (CFETP) task certification training. Other work centers can also utilize the MTD in their area because the trainer is a mobile towable platform.

The second phase of this concept is currently in work. MacDill acquired an aft body cell cavity, which, when modification is completed, will allow bladder cell removal and replacement training. This capability adds an additional 30 percent of the CFETP tasks for bladder cell replacement training, which raises the overall CFETP task certifications performed on the MTD to a whopping 59 percent without the use of an aircraft. Other benefits include training certification for five support sections, zero training delays and overdues at home station, and increased proficiency during air and space expeditionary force cycles and deployments.

Improving the KC-135 Periodic Inspection Process

From 7 January through 25 January 2008, the 6 MXG hosted a 319 MXG led, MAF-wide AFSO21 event to standardize the #2 KC-135 Periodic Inspection (PE) across the Air Force. PEs are extensive 2-week inspections which evaluate the integrity of all structural components. It is the only time between major depot overhauls when maintainers perform in-depth inspections of an entire KC-135 aircraft. The look phase alone typically takes an average of 589 man-hours from start to finish. This does not include maintenance *fixes* that are required during the latter part of the PE.

The 6 MXG and 319 MXG partnered with 31 active duty, Air National Guard (ANG), and Air Force Reserve Command (AFRC) representatives from 14

Periodic Inspection #2 for the KC-135 Stratotanker

bases worldwide. The focus of this project was to combat the *consistently inconsistent* practices of the KC-135 #2 PE by establishing a standardized work flow based on the work card requirements. The team of experts observed a #2 PE on a MacDill jet for 1 week and spent 2 additional weeks creating a logical *future state*.

The team discovered immediately that the PE process varied across the represented bases. The process varied from 7 to 33 personnel and the numbers of flow days varied from 8 to 21 days to accomplish the same deck of work cards. This caused wide fluctuations with scheduling aircraft maintenance and achieving maximum aircraft availability. Variances by participating base are outlined in Table 1.

The PE team highlighted that manning was nonstandard across the KC-135 community. This was one of the contributing factors that made the #2 PE flow a nonstandard process.

The team also discovered that the support equipment required to accomplish this inspection varied among the bases as well. The team was able to produce a standardized *equipment required* chart and melded it into the equipment shortfall listing in Table 2.

The team studied equipment throughout the event and developed a critical equipment listing. This list of equipment is required to complete the flow of the #2 PE in the most efficient manner. The red blocks indicate equipment not available at a particular base.

The milestones achieved so far in this improvement process are:

- A standard work flow Gantt chart for all KC-135 bases
- An Air Force Knowledge Now Community of Practice Website specifically for PEs
- Forty-nine recommended technical order changes categorized as *just-do-its* and if approved will eliminate roughly 147 man-hours from the process

Other initiatives in this project could eliminate up to 48 more man-hours per #2 PE, which equates to 6,912 man-hours per year MAF wide. In addition to the MAF-wide PE event, the MacDill PE dock has taken advantage of open dock opportunities. The PE dock

Base	FLOW DAYS	WORK SHIFTS	SHIFT HOURS	CC PE MAN	CC FL MAN	TOTAL MAN CC	SP ASSIGNED	8 HOUR MAN DAYS	ACFT ASSIGN
Altus	8	2	8	12	6	18	15	144.0	24
Grand Forks	8	1	9	13	2	15	8	135.0	38
McConnell	8	3	9	10	2	12	8	108.0	39
Grissom	9	2	8	11	2	13	0	117.0	16
MacDill	9	1	10	11	1	12	5	135.0	16
Mildenhall	9	1	9	8	2	10	0	101.3	15
Fairchild	10	2	8	12	1	13	0	130.0	34
Robins	12	2	8	11	2	13	5	156.0	9
Scott	12	1	8	9	0	9	0	108.0	8
Kadena	14	2	9	9	2	11	0	173.3	16
Andrews	18	1	8	8	1	9	0	162.0	8
March	18	1	10	8	0	8	0	180.0	12
Tinker	18	1	9	7	0	7	4	141.8	12
Seymour	21	1	8	6	1	7	0	147.0	8

Table 1. Manpower Listing

	CRITICAL ITEMS TOTAL	WING STAND	CARGO DOOR STAND	AFT HATCH STAND	BOOM CABLE ACCESS ST.	OVER-WING STAND	RADOME STAND	MX TAIL PLATFORM	BOOM STAND	AREA PANEL RACKS	RUDDRVATOR RACK	FALL PROTECTION	PAPERLESS ISO	MAN LIFT (JLG/GENIE)	AIR HOSES	FORKLIFT	OVERHEAD HOIST	UKE/TOW BAR
Kadena	10	R	R	R	2	2	R	2	R		2	R	R	R	R		R	2
Andrews	6	R				2	R	2	R			R	R		r			2
Altus	5			R				2	R			R	R				R	2
Robins	5			R	2	2		2	R			R	R				R	2
Scott	4			R	2	2	R	2				R					R	
Grissom	3	R		R	2	2		2	R									2
MacDill	3		R	R	2	2				R						2		2
March	3			R				2				R	R					
McConnell	3				2	2		2	R			R					R	2
Mildenhall	3			R	2	2		2	R				R			2		2
Seymour J	3					2		2	R				R				R	2
Fairchild	2			R		2		2				R						
Tinker	2				2	2		2	R				R					
Grand Forks	0				2	2		2										
Eq Needed	52	3	2	9	9	12	3	13	9	1	1	8	8	1	2	2	6	9

Table 2. Equipment Listing

has taken on preflight and hourly postflight inspections, 900 hour inspections, and even volunteered to perform several #2 PE's for sister units to ensure personnel stay proficient and expedite experience gained in furthering the #2 PE continuous process journey.

The 126th Air Refueling Wing at Scott AFB hosted a PE work card validation just this past June. The event again included a total force make up of active duty, ANG, and AFRC personnel to validate the #1 and #2 PE work cards. They also validated technical order changes to include 23 approved changes from the January 2008 MacDill event.

The routine maintenance of a 50-year-old airframe becomes increasingly demanding as the aircraft fleet continues to age. The complexity is exacerbated by a myriad of issues including technical order changes, parts availability, and aircraft component wear that cannot be predicted from jet-to-jet or inspection-to-inspection. As an eventual outcome, the work cards will be reorganized into the new work flow and a standardized electronic work package will be implemented for all units Air Force wide.

AFSO21 Savings Initiative

In November 2007, the 6 MXS Metals Technology Section reevaluated its manufacturing processes with the intent to optimize base-level fabrication capabilities. The section proposed a new cutting-edge machine that could potentially enhance section productivity and reduce material waste. This machine is the OMAX Water Cutting Jet. This $220,000 piece of equipment removes material through erosion by introducing a concentrated high-pressure water stream along with fine sand particles. There are no blades or drill bits, just water which can cut virtually any two-dimensional shape from a sheet of steel up to 8 inches thick.

The major benefits realized from this technology include scrap material savings of $26,000 and programming setup times of 160 hours per year. The OMAX has the unique capability to cut closely nested shapes from one piece of metal which reduces scrap material by approximately 40 percent. Additionally, programming and setup time is reduced by as much as 80 percent. This is also an environmentally friendly process since it operates on a closed loop system, which doesn't introduce any new contaminates into the environment.

According to an extensive cost analysis, the 6 MXG will save up to $36,000 annually once this machine is put into place. With the monetary savings alone, the machine will pay for itself in less than 6 years. This initiative was proposed to HQ AMC in January 2008, and was identified as 1 of 14 initiatives from the

OMAX Water Jet Cutting Machine

command to have Air Force-wide applicability. The section secured funding from HQ AMC in August 2008 and hopes to have initial operating capability by 30 Septemer 2008.

Global Local Manufacturing *Factory*

Sharing Base-Level Factory Capabilities to Meet Department of Defense Demands

Because of our expeditionary nature and aging military airframes, local manufacture (base level) of aircraft parts is becoming a growing concern. The 6 MXS Fabrication Flight proposed this initiative to increase the agility of our manufacturing capability by rapidly responding to machinery and manpower availability worldwide while providing seamless support to expeditionary units. The proposed Global Local Manufacturing Factory Initiative (GLMFI) allows the *sharing* of base-level local manufacturing capabilities to meet demands across the Air Force and ultimately the Department of Defense.

The current local manufacture process focuses on satisfying a base-level demand with that particular base-level manufacturing capability. If parts cannot be made at the base-level because of broken machinery, limited manning, or lack of materiel, the demand is outsourced to the supply system, vendor, or depot. Once outsourced, vendors can charge an extensive programming and machine setup cost because of the urgency of the need and minimal quantity ordered. As a result, Air Force dollars are spent unnecessarily on minor components. Also, since deployed environments have limited machinery, most of the local manufactured items are outsourced.

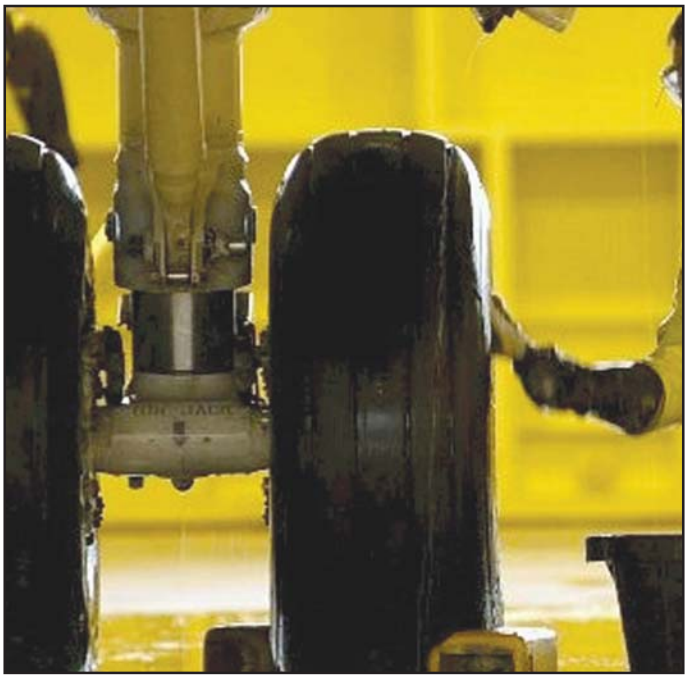
Current technology allows technicians to translate a computer program into a precision cut part. Most of the time and effort, however, is involved in writing the actual program. A recently developed Metals Technology Community of Practice Website is now serving as a database to allow users to store validated programming code. Once the code is written, anyone connected to the database can access that code from anywhere in the world and quickly translate that program into the part needed assuming the proper machinery is available.

The bottom line is the resources are available, but there simply isn't a network in place to allow bases to reach out to other military installations and share manufacturing capability. As an Air Force-wide initiative, creating a process to centrally order local manufactured items from any and all fabrication activities will prove effective on an enterprise level.

The implementation of this concept is just getting underway in the late summer of 2008. The 6 MXG, in conjunction with HQ AMC/A4M, is gathering data on local manufacturing workloads across the command to scope the problem. Once scoped and defined, an action plan will be developed to chart the future direction of the initiative. An eventual outcome could be the development of a command and control network, set up to provide a common operating picture with total asset manufacturing capability. It could drive the assignment of requirements to a specific shop. This idea, if turned into a capability, would allow locally manufactured parts to be managed through the Global Logistics Support Center (GLSC) much as the GLSC manages aircraft parts today.

Evaluating the Scope of Human Factors

Every 20 to 30 days each KC-135 must be hand washed by Airmen from the group. This process takes anywhere from 12 to 20 hours, and takes valuable technicians away from sortie production. The aircraft wash improvement process was a complete evaluation of an entire aircraft wash, which entails three phases: preparation, wash, and lubrication (lube) tasks. Key items were evaluated to include equipment, tasks, work environment, and training. The initial evaluation resulted in several just-do-it items. Hoses and reels needed replacement because of rust, wear, and tear. Also, scrubbing pads proved to be flimsy and



Aircraft Wash Process

ineffective. New, more effective pads were found and purchased.

On 20 April 2008, the evaluation team completed a *spaghetti chart* measuring the work of six wash team members. It was evident from this exercise that standard work was not accomplished throughout the three phases of the wash. This drove the evaluation team to create a wash tracking sheet to document and track scheduled versus actual completion times for each wash phase.

During the preparation phase evaluation, the team noticed that documentation and warning tags consumed on average 2.5 hours to complete. This means it took 1 person 2.5 hours alone just to complete the forms documentation and preparation of 25 warning tags. As a result, the team implemented laminated warning tags to streamline the documentation process. This saves 132 man-hours per year.

Finally the maintenance training flight also looked at the current state and suggested developing a training plan for future aircraft wash team members. The training will help cut out wasted effort.

Finally, the team is designing a wash workspace to create a *visual workplace*. Each piece of equipment will have a place in the hangar thus creating a more efficient work flow for wash team members.

Conclusion

MacDill, like many other bases, has identified better ways of utilizing manpower, equipment, and facilities by embracing the spirit of continuous reconceptualization of standard maintenance practices. We've effectively increased velocity and precision to accomplish our home station missions and ensured uninterrupted Global War on Terror support.

The group remains focused on AFSO21 for several reasons. First, it is a way for Airmen at all levels to rethink and engage the day-to-day waste inherent in all our processes and make continuous improvements. It is critically important to obtain buy in at all levels to ensure this will not become a passing fad. Next, Airmen recognize that leadership is serious about implementing the changes they suggest. Third and most important, leadership is given a tool to reduce workload on their troops. We've cut 2.5 work days off the #2 PE and reduced the duty day from 12-hour shifts to 10 hours. Our goal is to slash another 2 days and an additional 2 more duty hours per day per troop to get our folks *back* to a normal duty day and still roll out a quality product.

Colonel James C. Howe *is the Group Commander, 6th Maintenance Group, MacDill AFB, FL, and* ***Captain John E. Creighton*** *is the Operations Officer, 6th Maintenance Operations Squadron, 6th Maintenance Group, MacDill AFB, FL.*

Also contributing to this article were: ***First Lieutenant Karen Legal****, Executive Officer, 6th Air Mobility Wing. Lieutenant Legal was the Maintenance Flight Commander for the 6th Maintenance Squadron during the time of this writing;* ***First Lieutenant Robert Tudi****, the Fabrication Flight Commander for the 6th Maintenance Squadron;* ***Senior Master Sergeant Ronald Caudill****, the Maintenance Superintendent for the 6th Aircraft Maintenance Squadron;* ***Senior Master Sergeant Greg Kuhn****, the Aircraft Maintenance Unit Superintendent for the 6th Aircraft Maintenance Squadron;* ***Master Sergeant Angela Neal****, the Operations Flight Superintendent for the 6th Maintenance Operations Squadron;* ***Master Sergeant Warren Stocker****, the Fabrication Flight Chief for the 6th Maintenance Squadron;* ***Master Sergeant Kevin Killimett****, the Fuels System Flight Chief for the 6th Maintenance Squadron; and* ***Master Sergeant Gail Philebaum****, the Fuels Systems Assistant NCOIC for the 6th Maintenance Squadron. All are assigned to MacDill AFB, FL.*

Master Sergeant Laron Dass*, the Aircraft Fuels Systems Maintenance Shop NCOIC for the 319th Maintenance Squadron and* ***Technical Sergeant Dale Bangert****, an aero repair craftsman for the 319th Maintenance Squadron, Grand Forks AFB, ND also contributed greatly to this article.*

He who will not apply new remedies must expect new evils; for time is the greatest innovator.

—Viscount Francis Bacon

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Air Force Smart Operations in action

The Problem Is Big, Time Is Short,and Visibility Is Enormous

Using AFSO21

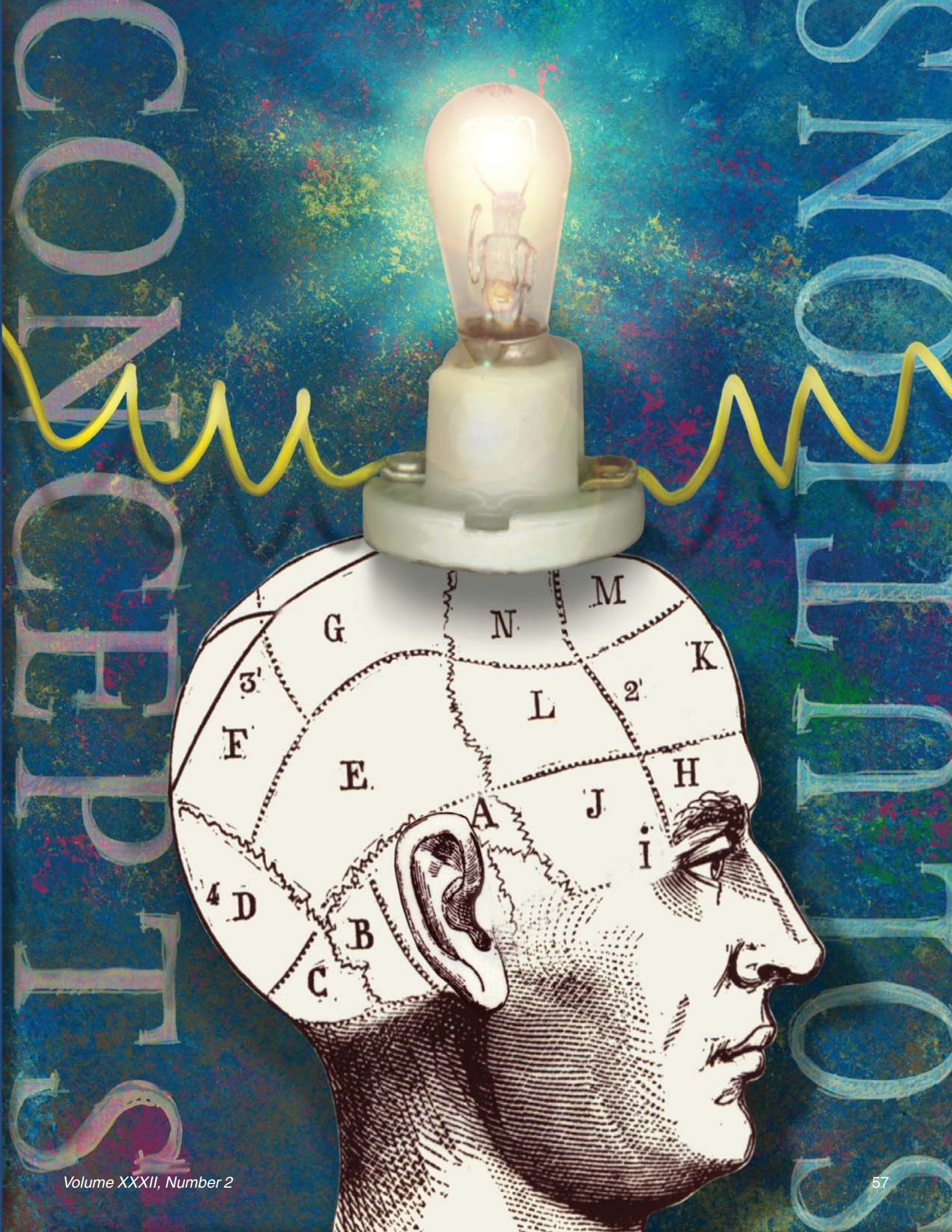
The foundation of the Comprehensive Assessment of Nuclear Sustainment (CANS) analysis was the aggressive use of Air Force Smart Operations for the 21st Century (AFSO21) tools to attack root causes. Though the effort was time constrained and many of the processes were modified to streamline the application, this did not detract from the effort, and actually enhanced the team's ability to use those portions of AFSO21 that made sense. Overall, the CANS effort highlights the power, flexibility, applicability, and simplicity of the AFSO21 toolkit and is a resounding success story.

Major Jennifer G. Walston, PhD, USAF

Introduction

When initially assigned to the Air Force CANS project, I wondered what role analysis would play in the effort. Typically, analysts are brought into projects after all the data has been collected and it is time to *analyze*. Most often, this is much too late for the analytic effort to have the optimum impact on the problem and its solutions. However, in this case, the CANS chairman brought me on board at the very beginning. This was a chance to shape the effort and to ensure that a methodical and repeatable analytic process was both followed and documented.

Given this phenomenal opportunity and the fact that I am an operations research analyst by trade, not an AFSO21 expert, why did I choose to use the tools of AFSO21? The simple answer is that it just made sense. When researching applicable industry methods for root cause analysis and risk analysis, the methods that I found most used by industry were available in the *AFSO21 Playbook*. Additionally, because the AFSO21 process is tailorable, we were able to use an industry accepted process and tools while still meeting a very short schedule. The remainder of this article reviews the methodology used in the CANS project.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CANS Methodology

The focus of the CANS methodology was to not only investigate nuclear sustainment and develop solutions, but also to ensure a clear linkage would exist amongst the prioritized findings, root causes, and actionable solutions for implementation.

A team of subject matter experts (SME) was selected, divided into seven subteams, and subsequently consolidated into five working teams as follows:

- Organizational structure and lines of authority and responsibility
- Logistics and supply chain management
- Maintenance and storage
- Training and standardization
- Previous report review and research

In order to ensure that the CANS study produced solutions that addressed the root causes of the problem instead of only treating the symptoms, the team followed a methodical, industry and Air Force accepted, appropriately modified, 5-step problem solving approach called Define, Measure, Analyze, Improve, and Control (DMAIC)[11] which worked as a framework, encapsulating the overall solution methodology (see Figure 1). (Please note that at the time of this study, the Air Force had not yet fully adopted the Toyota 8-step problem solving model as the preferred model for AFSO21. For more information, see the AFSO21 Website.)

Define

The first step of the DMAIC model is to define the problem and develop an improvement project plan.

In this stage, the CANS team built subteam-level charters, defined the scope, and established milestones and roles. Additionally, based on the defined scope, the team developed a comprehensive questionnaire for the team to use during all site visits.

The overall problem was defined and scoped. From the definition, using affinity diagramming, cause and effect diagramming, and brainstorming,[3, 4, 5, 10, 11, 12] the team determined and stratified key mission elements, or focus areas, contributing to the overall problem. These key mission elements are noted as follows:

- **Training.** Activities addressing the level of competence to execute the required job. They include formal training, education, on-the-job training, certifications, and experience.
- **Policy.** Activities that define how the Air Force does business. They should be clear, concise, standard, and relevant.
- **Culture.** Intangibles such as trust, support, accountability, internal and external environment, spirit, politics, pride, personal commitment, perceptions, and tribe mentality.
- **Resources.** People, equipment, systems, facilities, funding, and time.
- **Oversight and Control.** Activities that provide feedback on Air Force processes. They include performance measurements and metrics, inspections, closed loop feedback processes, and corrective actions.

Also during this step, the research subteam collected and reviewed over 2,000 documents related to the Air Force nuclear enterprise. From this group of documents, the research team identified 67 key documents and scrutinized previous findings as they related to the key mission areas. It is important to note that the other subteam members were not given access to the previous documents so that the data collection in the site visits would not be biased.

Measure

The second step of the DMAIC model is to measure the existing process and identify the process capability requirement.

The teams collected data through a variety of methods during the measurement step. These methods include the following:

- Site visits consisting of 23 members of the team visiting 31 sites with nuclear capability or related functions

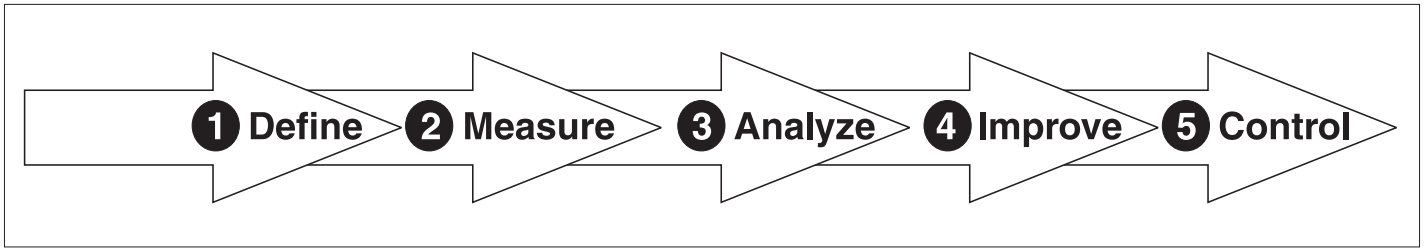

Figure 1. The DMAIC 5-Step Problem Solving Approach[5]

- Personal interviews during site visits, and followup interviews as needed with SMEs
- Research included staff studies, reports, policy, audits, and other sources
- A rapid improvement event addressing the engineering technical support process

Analyze

The process is analyzed to determine its capability. Data is analyzed to identify opportunities for improvement and to develop plans for improving the process. The steps in this phase include root cause analysis, solution development, risk analysis and mitigation, and determining the path forward.

Root Cause Analysis

Root cause analysis was conducted using proven methods, accepted by both industry and the Air Force. Specific methods used included flow diagramming (value stream or process), affinity diagramming, brainstorming, cause and effect diagramming, and the Five Whys. [3, 4, 5, 10,11,12] Brief descriptions of these methods follow.

- Flow Diagramming (Value Stream or Process Mapping). Value stream mapping (VSM) is a tool to visualize an entire process, such as the flow of material and information as a product or service makes its way through the value stream. It is a good method for displaying relationships between material and information, making waste and its sources visible, setting a common language and basis for discussion, and getting the *big picture*. Value stream mapping differs from process mapping in that it is broader in scope, tends to be at a higher level, and is typically used to identify where future focus should occur. The process map shows a process in more detail than a VSM. Such information is useful in analyzing all aspects of a specific process. VSM was used by the engineering team to map out the technical order 00-25-107 maintenance assistance engineering process. Process mapping was used by the engineering team to map out the information flow of the time change technical order process. The CANS team did not perform a full VSM on the entire Air Force nuclear sustainment enterprise due to time constraints. However, the team did use the tool to visualize the highest-level processes of the entire enterprise in order to scope the problem and to view the entire enterprise as one overall process. This was helpful as it highlighted the *seams* to organizations outside of the Air Force and was especially useful in integrating process solutions to non-Air Force processes.
- **Affinity Diagramming.** Affinity diagramming, sometimes called the JK Method for its creator Jiro Kawakito, is useful for organizing and presenting large amounts of data (ideas, issues, solutions, problems) into logical categories based on user perceived relationships and conceptual frameworks. When paired with brainstorming, affinity diagrams can help organize data and ideas, group like items, sort a large number of brainstorming ideas quickly, build consensus, avoid long discussions, stop people from dominating discussions, stimulate independent thoughts, and enable a greater variety of ideas. The CANS team used affinity diagramming when determining the five key mission areas.
- **Brainstorming.** Brainstorming is a problem solving technique in which team members attempt a deductive methodology for identifying possible causes of any problem via free-form, fast-paced idea generation. Brainstorming was popularized by Alex Osborn (advertising executive) in the 1930s, and can be an effective means to develop many ideas in a short amount of time. Brainstorming was used throughout the CANS study.
- **Cause-Effect Diagramming (Fishbone Diagramming).** Cause-effect diagramming, also called fishbone or Ishikawa diagramming, was created by Kaoru Ishikawa in the 1960s as part of the quality movement at Kawasaki Shipyards. It is a visual tool used to logically organize possible causes for a specific problem or effect by graphically displaying them in increasing detail. Additionally, it helps to identify root causes and ensures common understanding of the causes. In this method, a problem statement is written in a box on the right side of the diagram and then possible causes are determined (usually via brainstorming) as categories branching off the problem statement. Benefits include conciseness, adding structure to brainstorming, easily trained and understood, works well in team environment, and the ability to determine and analyze countermeasures. This method was used in determining the five key mission areas and during root cause analysis.
- **The Five Whys.** For root cause analysis, the team used the Five Whys, a well accepted method, first developed by Sakichi Toyoda of Toyota, described by Taiichi Ohno as "… the basis of Toyota's scientific approach," and is now widely used across industry and within AFSO21. The Five Whys

typically refers to the practice of asking, five times, why the failure has occurred in order to get to the root cause or causes of the problem. There can be more than one cause to a problem as well. In an organizational context, generally root cause analysis is carried out by a team of persons related to the problem. No special technique is required.

Using these tools, the hundreds of tactical findings discovered during data collection were analyzed to determine common trends or higher-level issues, which the team chose to call strategic level findings. These findings were then analyzed to determine the root causes. Finally, solutions were developed and then further scrutinized via a *murder board* process to ensure they truly solved the root causes instead of merely symptoms of the real problem.

Risk Analysis

Risk analysis[2,14] and mitigation was performed on each solution using a modified version of the Develop and Sustain Warfighting Systems (D&SWS) Core Process Working Group[13] Active Risk Management (ARM) Process model. Because of the high visibility and importance associated with the correction of the enterprise, the risks of not implementing the solutions were assumed to be known and sufficiently high such that all solutions would be implemented. Thus, the risk analysis in this study focused on the risks associated with implementing the solutions.

These risks were identified and analyzed as follows. The teams identified potential risks to solutions via brainstorming with SMEs by indentifying and explicitly defining potential unintended consequences which might occur when the solutions are implemented. These consequences were then scored by the SMEs, via a Delphi voting method, using life cycle risk management likelihood and severity ratings as defined in the D&SWS ARM Process model and shown in Tables 1 and 2. (Note that the CANS team focused on performance impact as the most critical characteristic. Each proposed solution was reviewed on the basis of consequence, vice cost or time to implement.)

Notional risk analysis output is shown in Figure 2, where the green squares identify a safe area where there is little likelihood of a risk occurring and low impact to the system if it does. Similarly, the yellow and red squares identify medium and high risk areas, respectively. The line is calculated by measuring the full range of the yellow area (medium impact) and determining the 98 percentile point. The team determined that the +98 percentile data points (within the medium area), could have very easily been scored within the red area (high impact) relative to the error margins within the scoring process and should be treated as high risk. Thus, solutions with risks above and to the right of this line required additional review by the teams to determine risk mitigation strategies.

1	Not Likely	1% - 20%
2	Low Likelihood	21% - 40%
3	Likely	41% - 60%
4	Highly Likely	61% - 80%
5	Near Certainty	81% - 99%

Table 1. Consequence Likelihood Ratings[13]

Prioritization via Multi-Objective Optimization

To determine a prioritized order, the strategic level findings were scored on their impact, if solved, on the five key mission areas. The result was then modeled as a multi-objective optimization problem in which five key mission areas represent the competing objectives and the prioritized order of the strategic findings represents the decision variable. In this type of problem, there often exists no single criterion for choosing the best solution. In fact, even the notion of *best* can be unclear when multiple objectives are present; and in many cases, it can be shown that improvement to one objective actually degrades the performance of another.[1]

The multi-objective optimization problem,

$$\min F(x)$$

subject to

$$x \in \Omega = \{0,1)^n : g_i(x) \leq 0, \ \ i = 1,2,..., M\}$$

where $F:\{0,1\}^n \longrightarrow R^J$, *is that of finding a solution* $x^n \in \Omega$ that optimizes the set of objectives $F = (F_1, F_2, ..., F_J)$ *in the sense that no other point* $y \in \Omega$ yields a better function value in all the objectives.[15] (Note the precise mathematical definition of x^n *can be found in Ehrgott*[8]) The point x is said to be *non-dominated*, *efficient*, or *optimal in the Pareto sense*.[9] The (typically infinite) set of all such points is referred to as the *Pareto optimal set* or simply the *Pareto set*. The image of the Pareto set is referred to as the *Pareto Frontier* or *Pareto Front*. If the Pareto set (or corresponding Pareto front) results from a solution algorithm and is not exact, it is referred to as the *approximate* (or *experimental*) *Pareto set* or *approximate* (or *experimental*) *Pareto front*, respectively.

Once defined, a multi-objective optimization problem can be solved via many methods. The particular method selected can depend on many factors including, but not limited to, the complexity of the problem, the time allowed for problem solution, the availability and quality of information, and the preferences of the decisionmaker. In this case, an *a priori* scalar method called weighted-sum-of-the-objective-functions (WSOTOF) was selected. As the name implies, this method combines the various objectives via a convex combination (a weighted sum). Though it is among the simplest of the multi-objective methods, it is guaranteed to produce an efficient solution (see Lemma 3.3.11 in Walston[19]). It should be noted that this method is not guaranteed to find all possible solutions, particularly if the corresponding Pareto front is non-convex;[6,7,16,17] however, in this particular case, the benefits of simplicity and speed far outweigh potential risks associated with examining only a portion of the Pareto front.

	DoD Guide	Proposed Air Force Definition
1	Minimal or no consequence to technical performance	Minimal consequence to technical performance but no overall impact to the program success. A successful outcome is not dependent on this issue; the technical performance goals will still be met.
2	Minor reduction in technical performance or supportability, can be tolerated with little or no impact on program	Minor reduction in technical performance or supportability, can be tolerated with little impact on program success. Technical performance will be below the goal, but within acceptable limits.
3	Moderate reduction in technical performance or supportability with limited impact on program objectives.	Moderate shortfall in technical performance or supportability with limited impact on program success. Technical performance will be below the goal, but approaching unacceptable limits.
4	Significant degradation in technical performance or major shortfall in supportability; may jeopardize program success.	Significant degradation in technical performance or major shortfall in supportability with a moderate impact on program success. Technical performance is unacceptably below the goal.
5	Severe degradation in technical performance; cannot meet KPP or key technical/supportability threshold; will jeopardize program success	Severe degradation in technical/supportability threshold performance; will jeopardize program success.

Table 2. Risks

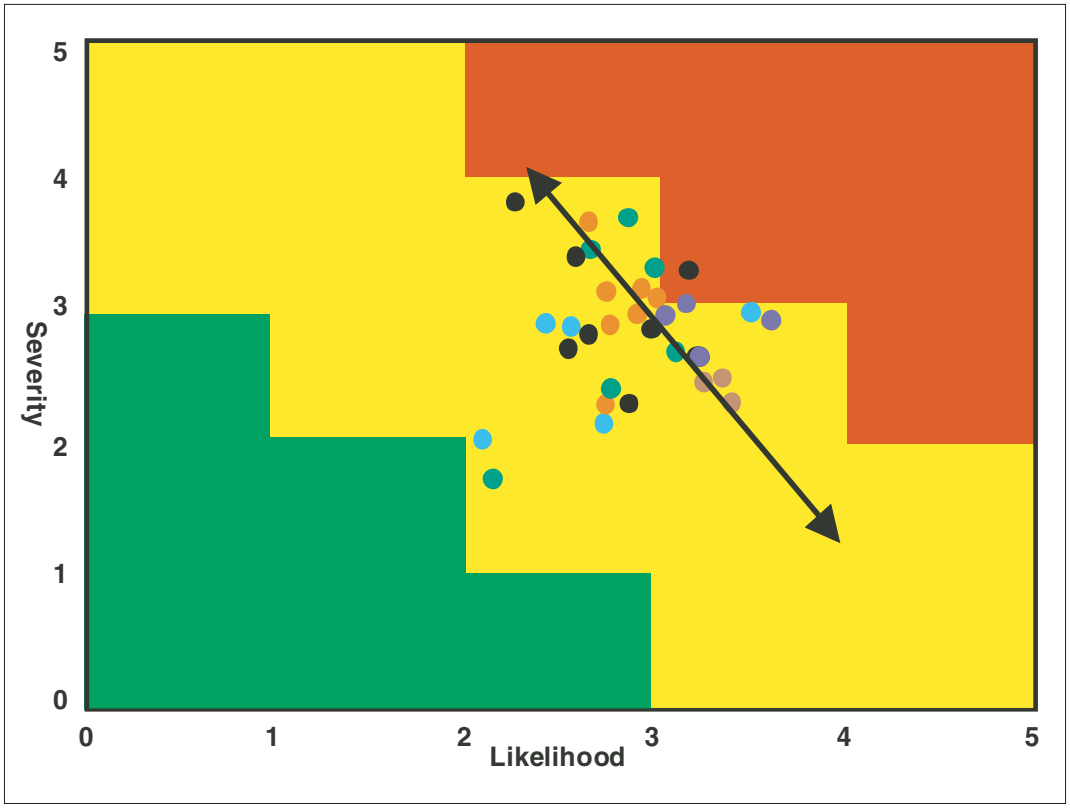

Figure 2. Notional Risk Analysis Output

To combine the objectives, the WSOTOF method requires a predetermined set of weights. In many cases, this can be problematic[18] as it is dependent on subjective judgment of the decisionmaker which may not be available or fixed across the duration of the study. Thus, this step is of particular importance. Additionally, in this particular problem, the determination of weights is even more complex as there are multiple decisionmakers to be considered.

To ensure that multiple decisionmaker preferences are included and considered in the solution, the following method was used. First, a group of senior Air Force leaders was identified as stakeholders for the nuclear sustainment enterprise and defined as the decisionmakers for the multi-objective problem. After each stakeholder provided a set of weights, the problem was solved as follows:

- A simple average of the weights provided by the stakeholders was used as the weights for the problem. However, there was considerable variance in the weighting schemes provided by the stakeholders (see Figure 3 and Table 3) indicating that further investigation was necessary. The distribution of the weights was tested for normality using normal p-p plots and the Kolmogorov-Smirnov (K-S) goodness test for normality. The plots and the K-S test indicate failing to reject the null hypothesis that the weights are normally distributed. Though in this case, parametric statistics would then be applicable, the use of a simple mean may not be adequate because of the high degree of variance.
- The weights were further analyzed as follows. A sensitivity analysis was conducted to determine the impact of the weighting scheme on the overall prioritized solution. It was found that the top priority issues in the prioritization solution were relatively impervious to the weighting scheme. A prioritized list of findings was determined for each decisionmaker's preference of weights and was then examined against the others. In this case, it was also found that the top priority issues did not vary much over the various weighting schemes. The average of the ranks assigned from each weighting scheme was determined for each finding, and was used to assign its final rank.

Once the objectives have been combined, any applicable optimization method can be used to determine the prioritized list of findings. In this case, because no constraining information was identified, and impact to the overall problem statement was the sole criteria for selection, a simple greedy heuristic method was used. Simply stated, once the weights are determined, the *value* of solving each particular finding becomes clear, and the prioritized list follows directly.

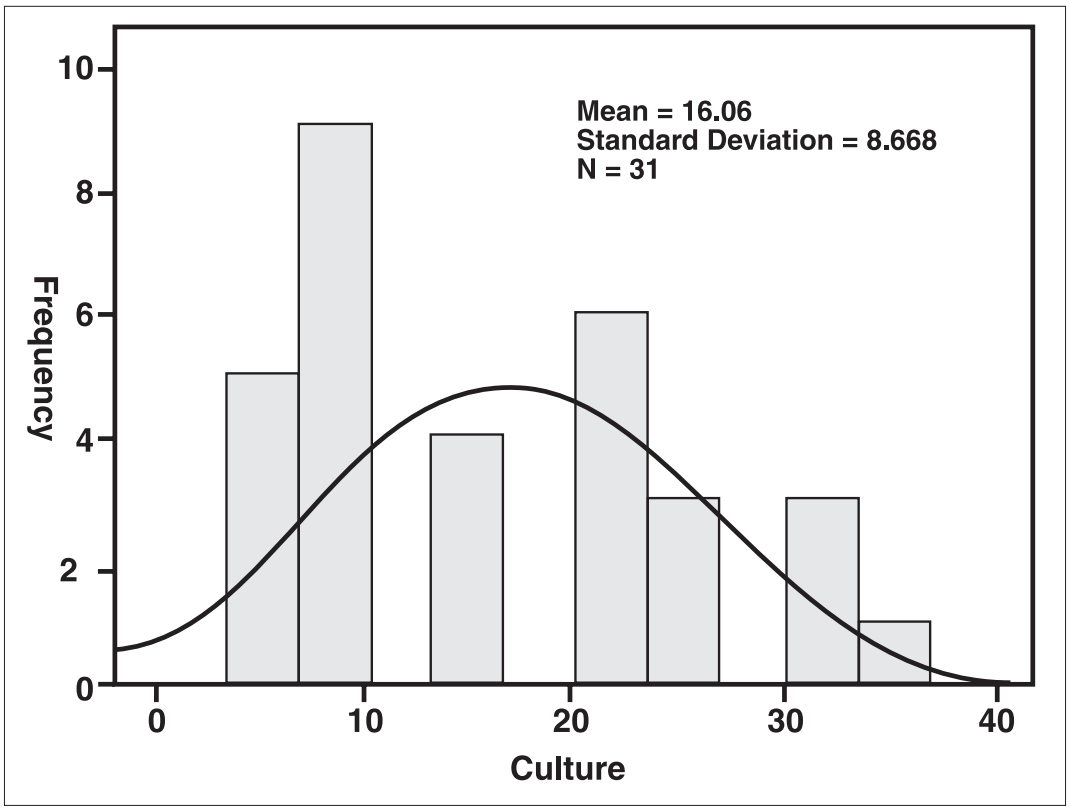

Figure 3. Histogram of Weights Assigned to Culture

	N	Minimum	Maximum	Mean	Standard Deviation	Variance
Training	31	5	40	22.16	7.267	52.806
Policy	31	10	50	21.77	8.995	80.914
Culture	31	5	35	16.06	8.668	75.129
Resources	31	5	40	22.52	8.282	68.591
Oversight/Control	31	5	30	17.48	5.591	31.258
Valid N (listwise)	31					

Table 3. Descriptive Statistics

Cost Analysis

The CANS cost team estimated costs for solutions that required funding. Cost analyst support upfront was critical to providing leadership with vital financial information. As solutions were identified, the cost team worked to define tasks, timelines, and associated costs. Identifying and linking costs with solutions allows leadership to make timely, informed decisions with known costs. In this case, costs of the CANS solutions totalled $25.6M for fiscal year 2008—the process worked and our leadership provided the funding to fix the problems because the methodology was solid.

Improve. During the Improve step, the plan that was developed in the Analyze phase is implemented. The results of the change are evaluated and conclusions are drawn as to its effectiveness. This can lead to documenting changes and updating new instructions and procedures.

The CANS chairman was given authority to immediately implement some solutions. There were six *just-do-it* solutions. The remaining results of this team's efforts were presented to senior leaders in a number of briefings at the major commands and Air Staff.

Control. Control plans were developed to ensure the process is institutionalized and continues to be measured and evaluated. This can include implementing process audit plans, data collection plans, and plans of action for out-of-control conditions, if they occur.

This study team worked concurrently with SAF/IG (Secretary of the Air Force, Inspector General's office) and AF/A9 (Studies and Analyses, Assessments, and Lessons Learned Directorate) to develop inspection and assessment criteria and plans to assess the status of the Air Force nuclear sustainment enterprise and measure the progress of addressing the CANS findings.

Conclusion

The foundation of the CANS analysis was the aggressive use of AFSO21 tools to attack root causes. Though the effort was time constrained and many of the processes were modified to streamline the application, this did not detract from the effort, and actually enhanced the team's ability to use those portions of AFSO21 that made sense. Overall, the CANS effort highlights the power, flexibility, applicability, and simplicity of the AFSO21 toolkit and is a resounding success story.

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Award-Winning Continuous Process Improvement

WR-ALC and AFSO21

In addition to having an official Air Force Smart Operations for the 21st Century (AFSO21) advisor, the Warner Robins Air Logistics Center also utilizes an AFSO21 Panel and Transformation Management Board. The AFSO21 Panel allows change managers from the wings and staff offices to meet to discuss issues relevant to AFSO21. Panel members share success stories, benchmarking ideas which might work across wing lines, and the latest information and guidance received from Headquarters Air Force Materiel Command and Air Force-level AFSO21 officials. The Transformation Management Board is comprised of wing and staff office leadership who meet to discuss issues relevant at the center level.

Lisa Mathews, USAF

Introduction

When the Secretary and Chief of Staff of the Air Force issued a joint memorandum to "Lean across the Air Force" on 7 November 2005, Warner Robins Air Logistics Center (WR-ALC) was prepared for the challenge. The center proceeded to do business much as it had before. In 1999 the center adapted a version of the Toyota Production System, which is also known as *Lean*, in the F-15 Avionics and F-15 Wing Shop. By 2005 Lean practices had progressed beyond maintenance activities and into the administrative arena.

On 11 July 2006, another joint memorandum was issued to introduce AFSO21. AFSO21 is the umbrella under which all continuous process improvement (CPI) initiatives fall, including Lean, Six Sigma, Theory of Constraints, and others.

One major factor in the successful pursuit of continuous process improvement initiatives at WR-ALC has been the commitment of senior leaders at the center. Beginning with Major General Richard Goddard, commander of the center when Lean was first introduced in 1999, to the current commander, Major General Polly A. Peyer, WR-ALC personnel have had the support of leaders to *think out of the box* to find ways to complete the work, while at the same time improving quality, on-time delivery, and to do so at the lowest cost.

Kudos and Awards

Even before November 2005, WR-ALC was being recognized for successes gained by using CPI initiatives. Earlier that year the center was the first Department of Defense (DoD) entity to receive gold level Shingo recognition for the C-5 programmed depot

78th Medical Group AFSO21 Efforts

Ensuring patients receive the best possible care in the most timely manner is a priority for the 78th Medical Group at Robins. The group's commander, Colonel Jim McClain, said the concept of process improvement is an important part of the reason the group can efficiently and effectively accomplish their mission.

"In the medical business we, like any organization, face challenges with manpower, challenges with money, and we support a very diverse population," he said. "The medical business itself is a very complex process. Most patients don't see that process; they just see the point-of-contact with the physician, and they don't see all the other dynamics behind it."

McClain credits Air Force Smart Operations for the 21st Century (AFSO21) and Lean initiatives for the group's successes to date in eliminating waste in processes and he said the group strategically plans events each year to continue improving.

Major (Dr) Chrystal Henderson, chief of the medical staff, and Katty Adkins, manager for quality, patient safety, and performance improvement, are two champions of the implementation of AFSO21 initiatives, according to the colonel. He said the two have played important roles over the last couple of years with multiple AFSO21 events for improvements in areas such as access to care, optimizing annual health care assessments, medical evaluation board processes, appointment scheduling and standard work in healthcare operations.

"We've just recently completed our third AFSO21 look at our preventive health assessment, and our annual health assessment process," McClain said. "That's key to the AFSO21 concept—it's not just a one-time thing; you're always looking for ways to improve and make it better and better."

maintenance process. Shingo has been described as the *Nobel Prize* in manufacturing.

The C-5 programmed depot maintenance (PDM) line repeated the gold-level success in 2006 and the center also received two other Shingo awards. Both the F-15 PDM and F-15 Avionics programs were named bronze-level recipients. The following year (2007), the F-15 Wing Shop was a bronze-level recipient.

In 2007, the center's personnel directorate was awarded the Human Capital Management for Defense Award in the Most Innovative Recruitment and Retention Program category when the organization, through AFSO21 initiatives, was able to cut the fill rate from an historic average of 100-plus days down to the 78 to 80 day range. The award was presented by Worldwide Business Research, a non-DoD organization.

The center won the Franz Edelman Award for Achievement in Operations Research in 2006. Referred to as the *Super Bowl* of operations research, the award brings together the best examples of innovation from large and small, for-profit and nonprofit, corporate and governmental organizations around the world. The winning entry discussed how the center used a technique called Critical Chain Project Management (CCPM) to reduce the number of C-5 aircraft being repaired and overhauled in the depot from 13 to seven in just 8 months. Through CCPM, the time required to repair and overhaul the C-5 was reduced by 33 percent.

When accepting the award for the center, Ken Percell, the WR-ALC AFSO21 advisor and director of the engineering directorate, said,

> Warner Robins is extremely pleased to receive the Franz Edelman Award for our work

C-5 Programmed Depot Maintenance work is carried out at the Warner Robins Air Logistics Center. When this aircraft, the largest cargo jet in the US Air Force fleet, first arrived at the center it took longer than 300 days to complete the PDM. Through Air Force Smart Operations for the 21st Century initiatives, the PDM process is now averaging less than 170 days. Because of the continuous process improvement initiatives put in place by the C-5 PDM program, the center has received two gold Shingo awards—first in 2005 and again in 2006—as well as the Franz Edelman Award for Achievement in Operations Research in 2006.

Warner Robins Air Logistics Center performs the F-15 programmed depot maintenance. By using Lean methodologies and the tools in the Air Force Smart Operations for the 21st Century toolbox, the center has streamlined the process to return the F-15 Eagles back to the warfighter on time, on cost, and at improved quality. One of the AFSO21 events culminated in the development of the tail stands shown in this picture. These stands allow workers on either side of the tail to raise or lower their platform to better accommodate their body height. Mechanics also have their tools on hand and avoid constantly going up and down the steps to retrieve tools needed to perform each task. The F-15 PDM line, the F-15 avionics shop and the F-15 wing shop have all been bronze recipients of the Shingo Award.

on reducing flow days for the C-5 aircraft line. The results underscore the gains that a proper application of these tools can offer to the Air Force. This accomplishment should reinvigorate the use of operations research in the Air Force and across all branches of the military in general.

A Look at WR-ALC

WR-ALC is located at Robins Air Force Base, Georgia. The base is large—8,400 acres—with more than 20,500 personnel to include military, civilian, and contract employees. The base is home to the center as well as associate units which include Headquarters Air Force Reserve Command, 116th Air Control Wing, 5th Combat Communications Group, Defense Logistics Agency, and Global Logistics Support Center.

The Lean journey at the center began in the 402d Maintenance Wing. It has since been deployed into the 330th Aircraft Sustainment Wing, the 542d Combat Sustainment Wing, the 78th Air Base Wing, and supporting center staff offices.

Now the center is assisting its associate units as they begin their AFSO21 journey. Assisting others in learning how to use the tools and methodology of AFSO21 is not new to the transformation branch of the WR-ALC Directorate of Plans and Programs.

In addition to having an official AFSO21 advisor, WR-ALC also utilizes an AFSO21 Panel and Transformation Management Board. The AFSO21 Panel allows

An event on health care operations accomplished just that.

"The healthcare optimization event decreased the overall number of steps taken by clinic personnel during each patient's visit," said Henderson. "By decreasing the number of steps overall, the transit time for patients within the clinic during their visit was decreased 50 percent."

An Air Force Materiel Command-led effort is ongoing to apply AFSO21 to medical operations throughout the command, McClain said.

"AFMC is the Air Force medical service AFSO21 champion and Robins Air Force Base, specifically the 78th Med Group, has been identified as the champion for expeditionary health processes," the colonel said. "So anything health related to getting people out the door to support our military operations, we are the champion for AFMC for that process."

From a recent predeployment rapid improvement event (RIE), they estimate a 50 percent reduction of time a patient will need to spend in the medical group to ensure all of their healthcare needs are met prior to deployment.

The colonel said that, eventually, the gains realized by AFMC could be used throughout the entire Air Force.

The group not only works to improve processes for deploying military, they also look for ways to improve healthcare services to all patients which include military, retired military, and dependents.

The group has developed the one-stop shop method. For example, the PHA process previously included multiple visits to the clinic. Now, for most cases, patients are in and out in one visit, and the time for that visit has been reduced from several hours to, on average, less than 1. Patients now are seen in one room, and the healthcare providers come to the patient rather than the patient having to move throughout the clinic to different locations.

"The medical management event integrated the different areas involved

in the care for complicated patients under one umbrella, which has enhanced continuity of care for those patients and decreased the likelihood of parts of their care falling through the cracks," said Henderson.

She added that additional events, such as 6S (which stands for sort, straighten, shine, standardize, sustain, and safety) also take place during the year.

The group recently was the winner in the 78th Air Base Wing's 6S competition. Through the group's 6S event in their logistics area they accomplished a 698-percent increase in available floor space and realized a savings of $17,000 when they were able to cancel an order for additional shelves.

The group has a dedicated core team that annually plans 10 to 12 events. Adkins and Henderson are both members of this core team.

"Annually, we strategically plan events so that we have a game plan pertaining to what we want to focus on," McClain explained. "We generally try to focus on the things that will bring us the greatest value and the things that have the most importance to our patients."

78th Communication Group AFSO21 Efforts

When Warner Robins Air Logistics Center conducted an operation risk reduction (ORR) inspection, findings showed areas of concern which needed to be addressed. Through AFSO21 and Lean initiatives, courses of action were defined to correct these areas of concern.

Information technology might not be the first thing to come to mind when thinking ORR, but Carl Unholz, 78th Communications Group director, said his organization discovered a lot of things to think about.

"When you think ORR, you think of safety and such," he said. "You don't necessarily think of business software; but, in fact, we were one of the original buckets."

change managers from the wings and staff offices to meet to discuss issues relevant to AFSO21. Panel members share success stories, benchmarking ideas which might work across wing lines, and the latest information and guidance received from Headquarters Air Force Materiel Command and Air Force-level AFSO21 officials. The Transformation Management Board is comprised of wing and staff office leadership who meet to discuss issues relevant at the center level.

Both the board and the panel have charters and have been determined to be useful tools in sharing AFSO21 successes in order that other organizations may learn from individual groups' experiences and synergize capabilities.

Sharing Knowledge with Others, Spreading the Skills

Calvin Butts is now the civilian deputy director of the WR-ALC Directorate of Plans and Programs. In 2005 Butts was an active duty lieutenant colonel deployed for 4 months to support the war on terrorism in Iraq. Under his leadership military members from all branches of the military worked to set up a Joint Air Cargo Operations Team (JACOT). The JACOT was used to mitigate cargo losses by using airlift for transport versus convoys. He commanded a team of 29 Airmen as well as a company of Marines, soldiers, and sailors.

"You don't have a better incentive to Lean out and streamline your processes than when people are shooting mortars at you while you're working," Butts said. "If they would've hit an aircraft on the ground, it would've been a big victory for the terrorists.

"So we had to expeditiously work those aircraft and protect the crews—get them in and out as quickly and safely as we could," he said.

Butts put the same methodology in Lean that WR-ALC had been implementing to work in his deployed location. "We actually redesigned the cargo and passenger flow on ground time to one-sixth of the normal previous times," he said. "While the average C-130 takes in excess of 30 minutes to upload and download, the JACOT was able to get it done in less than 20 minutes. C-17s, which once took more than an hour, were fully uploaded and downloaded in less than 20 minutes."

"The aircrews loved us for that because they didn't want to hang around," Butts said. "We used a lot of the same steps we do in Lean events at the center. The more time the aircraft were on the ground, the more vulnerable they were to a stray rocket or mortar. So we worked hard to cut those times."

By the end of the deployment, Butts' group had worked 1,200 missions and moved more than 26,000 tons of cargo and 32,000 military passengers.

"Sixty-plus convoys were not necessary because of airlift. That's a good feeling to know the GIs don't have to risk it on those roads," he said. "It was good for the Marines as well as the Air Force and Army, because fewer convoys were getting shot up on the roads. It was especially good for my Air Force troops because it showed them one of many areas where we can have significant relevance to the war on terrorism."

WR-ALC, along with the other two air logistics centers, has led the

way in sharing AFSO21 knowledge to the other Air Force bases and organizations. Soon after the announcement that AFSO21 was going to become an Air Force-wide initiative, people from other Air Force bases began contacting the transformation branch at WR-ALC for information and assistance on how to implement AFSO21 at their locations.

AFSO21 professionals from the center took temporary duty assignments to some of these bases to help facilitate AFSO21 events and to train others on how to put AFSO21 to use in areas outside the air logistics center arena. Many Air Force military and civilians have come to WR-ALC for AFSO21 training and to tour areas where processes have improved significantly because of improvements gleaned through AFSO21 implementation.

But the sharing of skills and knowledge has not been limited to a US Air Force audience. Many people from other DoD branches as well as military personnel from other countries, such as the Royal Air Force from the United Kingdom and the Royal Australian Air Force, have found their way to WR-ALC to learn more about the steps taken to improve processes which have netted great results for the center.

A Sampling of Successes

WR-ALC has used a variety of tools to improve processes and eliminate waste, such as value stream mapping, standard work, 6S events (which stands for sort, straighten, shine, standardize, safety, and sustain) rapid-improvement events, root-cause analysis, strategic alignment and deployment, and many others. Some of the successes the center has experienced have had major

Then Lieutenant Colonel Calvin Butts, far left, stands with a group of military personnel from his consolidated Joint services team. Under his leadership, military members from all branches of the military worked to set up a Joint Air Cargo Operations Team. During his deployment in 2005, Butts commanded a team of 29 Airmen as well as a company of Marines, soldiers and sailors. Butts is currently the civilian Deputy Director, Plans and Programs Directorate, Warner Robins Air Logistics Center.

The group, which was the information technology (IT) directorate at the time of the inspection, had 35 findings of noncompliance issues across the center in regards to IT, IT systems, and infrastructure following the ORR.

"We discovered that a lot of the findings attributed to the *production-first* mentality," Unholz said. "It was OK to break the rules, as long as we were getting something done quicker; or so we thought."

The directorate, which had only recently stood up when a focused area risk reduction team was at Robins, used the findings and the ORR, to develop a roadmap for their business processes.

"We as a center were being very inefficient and ineffective about how we were doing IT. We had no centralized planning, which resulted in a high level of expenditures without much analysis about what we were spending it for," Unholz said. "We had a lot of projects, either command-wide, Air Force-wide, or even Department of Defense-wide; and yet we didn't send the right subject matter experts. So we ended up, in the end, getting a product that didn't meet our needs. That put us into an immediate condition where we needed changes made, and there was no good requirements process to handle those things," he added.

After a comprehensive analysis of the organization's processes, the directorate developed 61 courses of action. That was the highest number of any organization on base, including the wings, Unholz explained.

"I hope this demonstrates how seriously we took this," he said. "We wanted to dive into these issues and details and arrive at an effective way ahead."

The director, who describes himself as a Lean advocate, said that using the Lean principles helped the organization arrive at the smarter solutions in a shorter period of time.

"The result was a wonderful roadmap for us in how to move ahead

and change the way we were doing business," he said.

Starting with 61 tasks, IT currently has only one task still outstanding.

Results from the organization's work have been very good, Mr Unholz said. When the ORR was first begun, the organization was spending $112M on IT. Now, 2 years later, this amount has dropped to around $41M. The directorate has also saved base organizations man-hours by turning back 145 positions which, in the past, had to work IT issues as well as other duties.

"So we've overcome all service gaps and are providing efficient support with fewer dollars and less people," Unholz said. "We're getting much greater value for our investment because of the changes," he explained.

The customer has been involved in all aspects of the organization's change. IT zones and help desks have been established to deal with issues when someone has a computer problem they need fixed.

Liaisons and requirements managers are in place for the wings and staff offices. The liaisons work to fully understand customer needs and bring their concerns to the 78th Communications Group's attention.

"When we meet, even if the customer isn't there, we still have someone who knows their concerns and issues and can bring those to the table for them," Unholz said. "We have a customer perspective in everything through the liaisons and the way we're organized."

The director said the actions that came out of the ORR have helped the organization better deal with current budget and personnel cuts the Air Force is facing.

"We find, as long as we explain to the customer why we are doing something, they can accept and support what we have to do, whether it is because of security or cost reasons," Unholz said.

impacts (some have been more minor), but all improvements help the center stay the course of striving for perfection. While understanding true perfection is not really possible, AFSO21 helps the workforce to relentlessly eliminate waste to help support war-winning capabilities.

The tools of AFSO21 and Lean allowed the center to complete PDM on 23 C-5 aircraft in fiscal year 2003, something that had never been done before. Other accomplishments in the C-5 PDM area include cutting PDM flow days from more than 300 to less than 170, freeing up an entire dock in the hangar for other work, and taking on the torque deck work on the aircraft—work that had previously been done by contractors.

The F-15 Wing Shop Leaned out its processes and have managed to complete work on all F-15 wings on time, every time, since June 2003. The wings are worked through the cells in the shop in a neat, logical order.

Developing kitting processes, shadow boxes for tools and instruments, and implementing visual management for items frequently used in various shops has reaped benefits for all manufacturing and production areas of the 402d Maintenance Wing. Personnel are dedicated to restocking supplies, thus eliminating the need of technicians and mechanics to leave their work areas to travel (sometimes to another building), for parts and tools. This ensures that work continues uninterrupted.

Through streamlining portions of the end-to-end process of filling civilian positions, the personnel directorate (DP) at Robins has been able to reduce the time to complete the process from 160 to 120 days. While doing this, DP developed a new employee orientation through which all new employees receive initial training in various aspects of their jobs as well as the center, its mission, and AFSO21 basic awareness.

The list could go on and on; the above are just a few examples of how AFSO21 has had a positive impact at WR-ALC, and in turn, the greater Air Force enterprise. The center has maintained a high operations tempo, increased throughput and capacity, and worked on developing and sustaining a culture of continuous process improvement throughout the organization. With leadership support and innovative thinking we are motivating teams to new and better ways to effectively support the warfighter. Team Robins will continue the drive to be America's dominant air and space power sustainer. Included with this article are two short articles with more in-depth detail on specific areas at the center which have benefitted from continuous use of AFSO21 principles. The 78th Communications Group and the 78th Medical Group, through numerous Lean and AFSO21 events, have experienced unprecedented success in eliminating wasteful steps in their work to provide better support to the Air Force.

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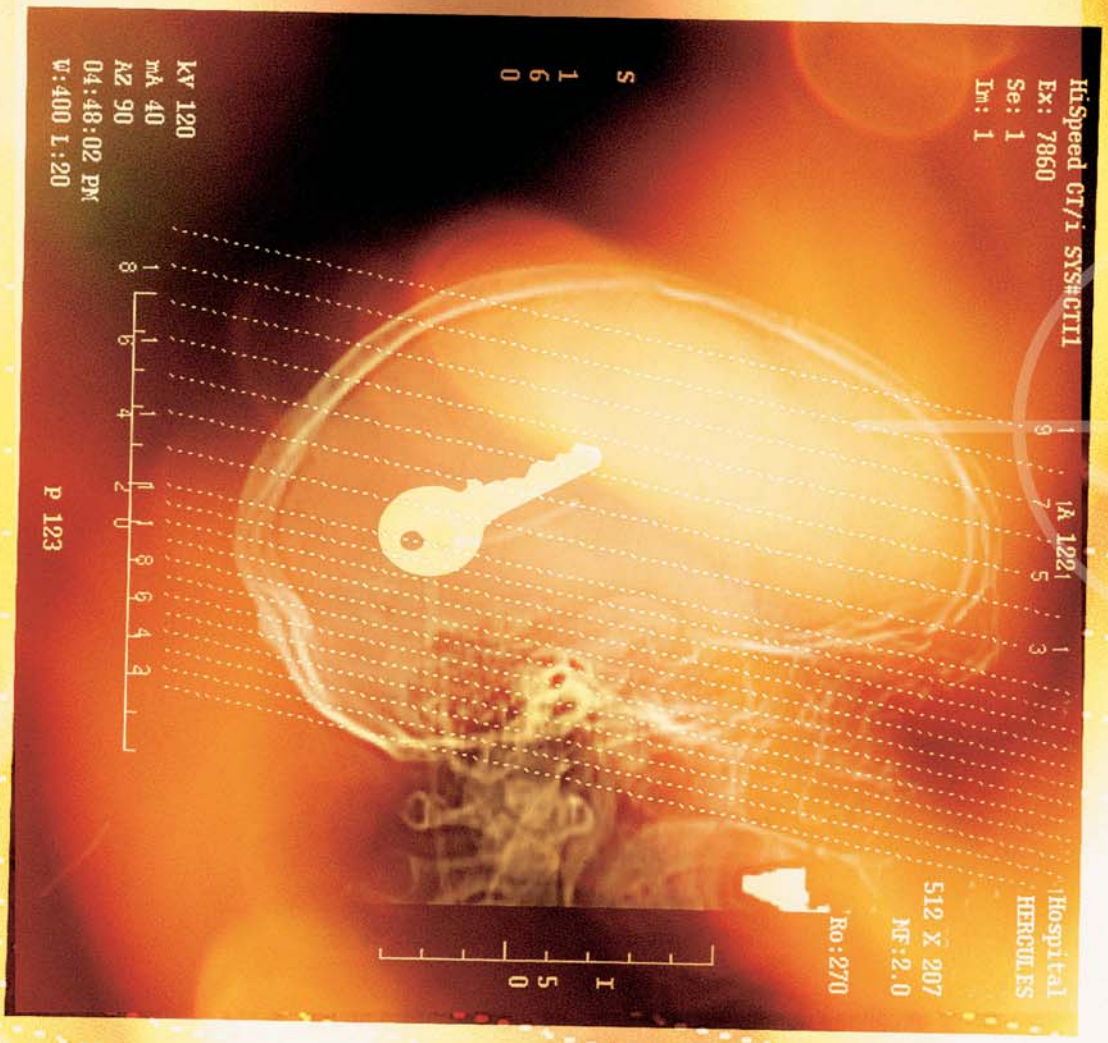

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