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USAF AIRCRAFT MAINTENANCE MANAGEMENT

IS THERE A BETTER WAY?

by

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In Partial Fulfillment of the Graduation Requirements

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Abstract

Aircraft maintenance performance has steadily declined since the Objective Wing organizational structure was implemented for the Tactical Air Forces (TAF). Is the Objective Wing the right organizational structure for aircraft maintenance? USAF maintenance management philosophies have changed numerous times. Over the past 50 years, the Air Force searched for an organization that maximized efficiency and performance. Reorganization has been the preferred method of gaining efficiency or performance. The focus of this research is to analyze past organizational structures to define key elements that affect maintenance performance and develop an organization that will improve maintenance performance. The research method is a historical analysis of tactical aircraft maintenance organizations in the USAF. The researcher found that there are three key elements that affect the organizational structure and its subsequent performance. Those elements are context, culture, and strategy. A maintenance organizational structure must be based on these enduring elements to succeed. A matrix organizational structure based on our current and expected context, culture, and strategy is proposed.

Part 1

Introduction

When visiting K.I. Sawyer AFB, shortly after the implementation of Strategic Air Command's (SAC) latest aircraft maintenance reorganization, Gen John Chain asked my Noncommissioned Officer in Charge (NCOIC) what he thought of SAC's new maintenance organization called the Readiness Oriented Logistics System (ROLS). My NCOIC calmly responded that it was a bad idea and he didn't think it would work. I thought we were in big trouble, but General Chain simply looked SMSgt Fentress in the eye and said, "The Sgt Fentresses of the Air Force will make it work."[1]

Maintenance Organizations-The Search for Performance

General Chain was correct, of course. Regardless of the organizational structure maintainers are given to work with; they find a way to make it work. However, organizational structures can limit or enhance performance. The Air Force has tried a number of organizational structures for aircraft maintenance in an effort to achieve performance and effectiveness.

Maintenance organizations have changed a number of times over the last 50 years. Centralized and decentralized organizational strategies have been tried and discarded many times. Tactical aircraft maintenance has reorganized eight times since the Air Force was established as a separate service a little over 50 years ago.[2] Organizational structures changed because of the context, culture, and strategy at the time. Reorganizing the tactical aircraft

maintenance organization has been the preferred method of dealing with shortages of personnel, low experience levels, or lack of performance. The tendency was to decentralize maintenance when there were experienced technicians available, thus making it more responsive to its main customer, the operations squadron. However, when there was a dramatic increase in the size of the maintenance work force or when skill levels dropped, the maintenance complex was centralized in a functional structure.

The latest evolution of the maintenance organization, the Objective Wing, was implemented in 1992. Unfortunately it is the wrong organization for today's context, culture, and strategy. Only three years after implementation of the objective wing, Air Combat Command (ACC) began to note problems with a decline in maintenance standards and downward trends in safety and maintenance production.[3] The United States Air Forces in Europe Director of Logistics noted several maintenance problems during Operation ALLIED FORCE.[4] The essence of any Air Force is its ability to produce combat sorties. Aircraft out of commission and poor maintenance practices directly impact the aircraft available for tasking and the airpower available to the theater commander.

Before the Air Force simply reorganizes again, it needs to identify the elements that affect the performance of a maintenance organization. The focus of this research is to study past maintenance organizations and determine the elements that must be considered before selecting an organizational structure. A new structure can be defined, based on the elements of strategy, culture, and context that will improve tactical aircraft maintenance performance.

Notes

[1] Conversation witnessed by author during CINCSAC visit to 410 BMW(H), 410 Organizational Maintenance Squadron, Tanker Branch, K. I. Sawyer AFB, MI, September 1986.

Notes

[2]Capt Barbara L. Harris, *Challenges to United States Tactical Air Force Aircraft Maintenance Personnel: Past, Present and Future* (Air University; Air Force Institute of Technology Thesis, September 1991), 183-192.

[3]Headquarters Air Combat Command, *Air Combat Command History 1995, Volume 1, Narrative,* (Air Combat Command, July 1996), 282-292.

[4]Brig. Gen Terry L. Gabreski, "Briefing, Posturing Aircraft Maintenance for Combat Readiness", Unpublished.

Part 2

Maintenance Organizations Since 1947

The Air Force has continuously changed the organizational structure for aircraft maintenance since the birth of the Air Force in September 1947. For the first 30 years the structure was either a functional organization (organized by specialty) with centralized control or a divisional structure (organized by product) with decentralized control. In the late '70s a matrix organization (combination of functional and divisional organizations) was implemented. It was refined in the '80s and used until the objective wing was adopted in the '90s.

Birth of the Air Force to Korea

At the end of WWII the Air Force rapidly demobilized. Each command had its own regulations and procedures and most reflected some variation of the crew chief system.[1] Under this system, a senior NCO was responsible for all aspects of maintenance performed on his aircraft.[2] Crew chiefs were assigned to the operational (flying) squadrons.[3] This system used a divisional organizational structure with decentralized decision making. It gave crew chiefs autonomy and operational commanders control of sortie production.

The '50s and '60s

This period saw the establishment of a functional organization with centralized control under a senior maintainer on the wing staff. The focus was on efficient use of resources, especially manpower.[4] Each MAJCOM experimented with its own system, but by 1953 the

USAF Inspector General began to question the wisdom of having numerous organizational concepts.[5] The Air Force published AFR 66-1 in December 1953 and began the move to a functional organizational structure based on SAC's model of centralized maintenance. In 1959, it was redesignated AFM 66-1 and became mandatory for throughout the Air Force.[6]

Vietnam

By the mid-sixties Tactical Air Command (TAC) leaders had lost faith in the centralized system because of the deployment strategy used in TAC wings. Squadrons, not whole wings, were the deployable units and maintenance technicians were temporarily attached to flying squadrons for each deployment.[7] TAC was allowed to experiment with alternate organizations and published its own guidance for a new organization in 1966.[8] Its goal was, "To provide the tactical squadron commander self-contained maintenance capability during periods of squadron deployments."[9] On-aircraft maintenance was put back under the operations squadron commander as it had been in the late '40s. This system was used throughout the Vietnam War.[10]

Post-Vietnam, 1972-1977

TAC had a battle-tested system that worked, but it was not without costs. It was manpower intensive and the post-Vietnam era was marked by dramatic reductions in personnel.[11] The Air Force felt that it could no longer afford TAC's organization during the dramatic drawdowns after Vietnam. It directed that all commands go back to the functional organization in AFM 66-1.[12]

Production Oriented Maintenance Organization (POMO)

Maintenance production continued to decline through out the '70s, even with the efficient functional organization.[13] The Air Staff and TAC were searching for ways to perform maintenance with fewer personnel without compromising standards.[14] They discovered that the

Israelis demonstrated high sortie generation rates during the 1973 Yom Kippur War. Their on-aircraft maintenance personnel were assigned to the flightline and not dispatched from shops, everyone worked together to launch and recover aircraft.[15] After studying the Israeli organization, TAC developed a matrix organizational structure with centralized control called POMO. A flightline organization, the Aircraft Maintenance Unit (AMU), was established. It contained all technicians who performed on-aircraft maintenance and was associated with operations squadrons, but remained under the Deputy Commander for Maintenance (DCM).[16] The DCM staff retained overall control of the maintenance effort.

Combat Oriented Maintenance Operation (COMO)

General Wilbur Creech took command of TAC in the late '70s. He firmly believed in decentralized decision making.[17] He used the same matrix organizational structure as POMO but took centralized control away from the DCM staff. The authority to make decisions on scheduling aircraft and moving assets was decentralized and given to the AMU production supervisor. AMUs were also tied directly to a flying squadron. Each squadron/AMU team was responsible for their schedule and meeting sortie goals.[18] AMUs were still part of the Aircraft Generation Squadrons (AGS) within the DCM complex, but worked hand-in-hand with its associated operational flying squadron.[19]

The Objective Wing

The objective wing was implemented in the early '90s. Under the objective wing the oversight of the DCM was eliminated and AMUs were placed under the operations squadron commanders. The shift was from a decentralized matrix organization back to a divisional decentralized organization used in 1947 when the Air Force became a separate service. The Operations Group Commander (OG) was given all on-equipment maintenance responsibilities.[20]

Notes

[1]Lt Col Thomas E. Reiter, *USAF Aircraft Maintenance Organizational Structure: Where We've Been, Where We Are, What's The Future* (Air War College, Air University, Research Report, April 1988), 6.

[2]CMSgt Robert Holritz, "Aircraft Maintenance Yesterday and Today", *Flying Safety,* Vol 48 no. 11, (November 1992): 23-25.

[3] Reiter, 6

[4] Ibid., 8.

[5] Ibid., 9.

[6] Capt. Barbara L. Harris, *Challenges to United States Tactical Air Force Aircraft Maintenance Personnel: Past, Present, and Future* (Air University; Air Force Institute of Technology Thesis, September 1991), 126.

[7] Reiter, 13.

[8] Ibid.

[9] Harris, 128.

[10] Reiter, 14.

[11] Ibid., 16.

[12] Capt William B. James, "New Look in Aircraft Maintenance Management," *TAC Attack,* March 1972, 29.

[13] James M. Hurley et al., *USAF Executive Leadership and Management Initiatives* (Air War College, Air University, Research Report 1985), 12.

[14] Beu, Norman J. and Nichols, Richard C., *More Maintenance in OMS,* (Air University, Air Command and Staff College, Research Report, May 1977), 76-78.

[15] Ibid.

[16] Ibid.

[17] Peter U. Sutton, *Visionary Leadership-General W. L. Creech 1978-1984,* (Industrial College of the Armed Forces, National Defense University, Research Report, 1991), 12.

[18] Ibid.

[19] Ibid., 13.

[20] Maj Joseph B. Michels, Ph.D., "Tactical Fighter Wing Reorganization: The Implications for the Maintenance Officer", *Air Force Journal of Logistics*, (Spring 1992): 21-22.

Part 3

Organizational Theory

Successful strategy implementation depends in large part on the firm's primary organizational structure

— John A Pierce

Types of Organizations

There is no perfect organizational structure for all organizations and situations. Most references list three "pure" organizational structures that have evolved over time: functional, divisional, and matrix.[1] Each one has strengths and weakness that should be matched to the strategy and products of the organization.

Functional Organizational Structure

The most basic organizational structure is the functional structure. In the functional structure tasks are divided into functional specialties or skills. All key functions of the operation report to a single executive who is responsible for coordinating them.[2] He does this with the aid of a centralized staff and decisions are made at the executive level.

Dividing tasks into functional specialties enables the personnel of these organizations to concentrate on only one aspect of the necessary work which allows the use of the latest technical skills and develops a high level of technical competence and efficiency in a given specialty.[3] The main challenge of this type of organization is effective coordination between the functional

units. It also promotes narrow specialization and functional rivalry and conflict. Priorities at lower levels may focus on functional areas and not on the best interests of the entire organization.[4] According to Flamholtz and Randle, whenever an organization has more than one set of customers or multiple product lines, a functional structure will be limited in its ability to meet customer needs.[5]

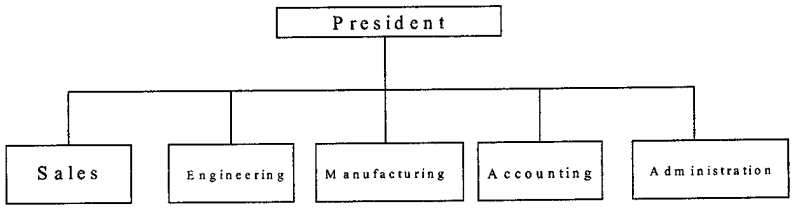

Figure 1, Typical Functional Organization

Divisional Organizational Structure

The divisional structural was created to mimic the benefits of relatively small entrepreneurial businesses. Divisional organizational structures are based on the product, not the function. The idea is to subdivide a larger entity into a set of smaller units called divisions, each handling their own products, resources, operational systems, and culture but with all units sharing certain core resources.[6] This expedites decision-making in response to varied competitive environments.[7] A divisional structure allows corporate management to delegate authority for the strategic management of distinct business entities to each division. In addition to expediting decision making in the competitive environment, this structure also enables corporate management to concentrate on strategic decisions.[8]

The divisional structure also has its limitations. Divisional structures lack the cost efficiency of functional structures because they typically require that the same organizational functions be duplicated in each division.[9] Another potential problem is that this form of organization can lead to intense competition between divisions for resources. If competition is not controlled through a sophisticated planning system, divisions can waste valuable time fighting among themselves. The final draw back is that managers require significant expertise to make it work. To operate as a divisional structure, an organization needs general managers in each division who have a broad set of skills and expertise.[10]

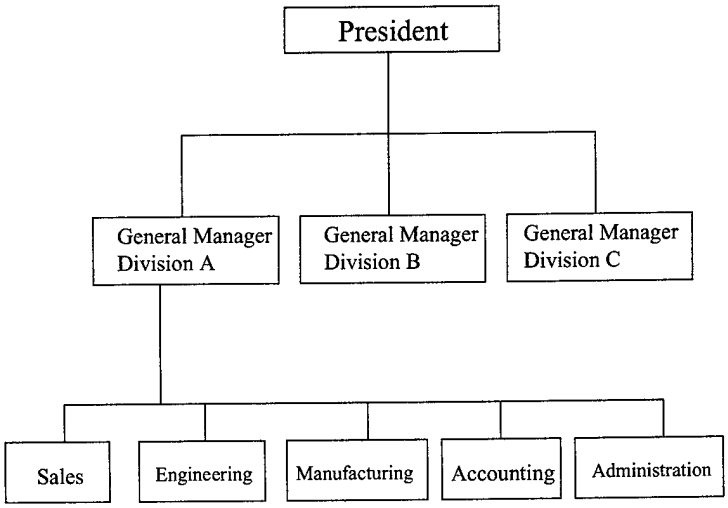

Figure 2, Typical Divisional Organization

Matrix Organizational Structure

The matrix structure tries to achieve the best of both worlds through a mixture of functional and divisional approaches. Subordinates are assigned both to a functional area and to a project

or product manager. Like the divisional structure there are managers responsible for a project, program, or client set. However, this manager forms a team of functional specialists to meet the needs of the client or to complete the project. The functional specialists thus have two reporting relationships, one to their functional specialty and the other to the project or program manager.[11]

The primary strength of a matrix structure is that it increases the flexibility of the organization. It provides for functional specialization, while at the same time permitting the organization to focus on meeting customer needs through the development of new products and services. It fosters creativity and multiple sources of diversity. It also gives middle management broader exposure to strategic issues.[12]

The matrix structure is very difficult to execute in practice. Its main problem is its complexity and the need for a very high level of coordination and communication between units and people. Both functional managers and project managers must work together to ensure that resources (including human resources) are effectively allocated to maximize the firm's overall results. There also needs to be a performance management system that provides an opportunity for both functional and project managers to have input about an individual team member's performance.[13]

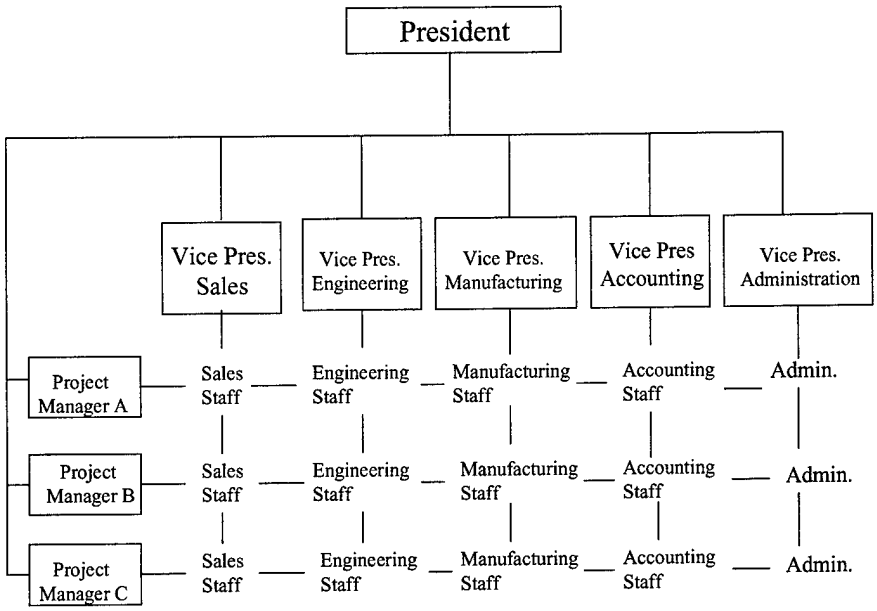

Figure 3, Typical Matrix Organization

Choosing an Organizational Structure

No one organizational structure is best for every situation. Most texts identify factors that must be considered in choosing an organizational structure. The literature on organizational theory shows that the factors that apply to maintenance can be grouped into three elements.

Strategy—The first element

Strategy is a key factor in choosing an organizational structure. Alfred Chandler believed that there was a cycle to organizational changes and strategy. He conducted a study of structural choice as a function of strategy and found a common strategy structure sequence: 1. The choice of a new strategy, 2. Administrative problems and a decline in performance, 3. A shift to an organizational structure more in line with strategy's needs, and 4. Improved profitability and strategy execution. He believes firms change their strategy in response to environmental

changes, but the existing organizational structure is ineffective in organizing and coordinating the activities required by this new strategy and performance suffers until a new organization structure is designed.[14] If we want to maximize performance we must choose an organizational structure that is compatible with our maintenance strategy.

Culture—The second element

Karl Weick believes culture is a vital element in an organizational structure that operates in an environment that requires high reliability. He says organizations like NASA, the FAA, and airlines require high reliability because the stakes are so high. In this environment, execution must be decentralized but procedures and processes must be centralized and taught as culture to make the organization highly reliable in execution.[15] The importance of high reliability in combat is obvious. Therefore, culture is a key element in choosing an organizational structure for maintenance.

Context—The third element

Thomas Peters lists several factors that determine how to organize they are: culture, people, management style, systems, and procedures.[16] These factors can be defined as the context in which the system operates. In aircraft maintenance context has revolved around manning. Maintenance is manpower intensive and the key to maximizing performance is selecting an organizational structure that makes the best use of available manpower based on manning level and experience level. In the next chapter, historical analysis will show that strategy, culture, and context determine how well a maintenance organization functions.

Notes

[1] Eric G. Flamholtz and Yvonne Randle, Yvonne, *Changing the Game—Organizational Transformations of the First, Second, and Third Kinds,* (New York: Oxford University Press, 1988), 183.

[2] Ibid.

[3] John A. Pearce II, Richard B. Robinson Jr., *Strategic Management—Formulation, Implementation, and Control,* Fourth Edition, Homewood IL: Irwin Press, 1991), 328.

[4] Ibid., 329.

[5] Flamholtz and Randle, 184.

[6] Ibid.

[7] Ibid.

[8] Pearce and Robinson, 332.

[9] Flamholtz and Randle, 185-186.,

[10] Ibid.

[11] Ibid. 186-188

[12] Ibid.

[13] Ibid.

[14] Pearce and Robinson, 335.

[15] Karl E. Weick, *Organizational Culture as a Source of High Reliability, Organizations Close-Up, A Book of Readings,* editor James L. Gibson, Sixth Edition (Plano Texas, Business Publications Inc.), 29-32.

[16] Thomas J. Peters and Robert H. Waterman, Jr., *In Search of Excellence: Lessons for America's Best Run Companies* (New York: Harper and Row, 1982), 9.

Part 4

Analysis of Past Maintenance Organizations

From the very beginning, more than a century ago, the study of organization has rested on one assumption: that there is or must be a single "right" form of organization. That one-size-fits-all idea persists today.

—Peter F. Drucker

Over the years the Air Force continuously changed its maintenance organizational structure in an effort to maximize performance and efficiency. An analysis of the history of maintenance organizations indicates that we are not considering the elements (strategy, context, and culture) that affect the success or failure of our organizational structures.

Birth of the Air Force to Korea

From the birth of the Air Force to Korea, the maintenance strategy was decentralized control and the divisional organizational structure used at the time was compatible with this strategy. Post-WWII mechanics were experienced and talented. The crew chief knew every system from engine to guns. He was very independent, set his own work schedules, and worried only about his aircraft.[1] Most crew chiefs were very senior and experienced NCOs who stayed in the service after the war.[2] In July 1947, the Air Force took the first step toward establishing a formal maintenance structure when it adopted the Hobson Plan.[3] It made the wing the main fighting unit. There were four groups under the wing commander: Operations Group, Maintenance and Supply Group, Base Support Group, and Hospital Group. Crew chiefs were assigned to

operations (flying) squadrons; specialized and intermediate-level maintenance was accomplished by the Maintenance and Supply Group.[4]

There were several changes in context and culture that affected the decentralized organization's performance. The biggest change in context was the loss of experienced personnel. The crew chief system and the AFR 65-1 organizational structure depended on experienced NCOs and relatively simple aircraft. The Korean War caused a dramatic increase in the size of the Air Force and thus the need for technicians increased dramatically. A combination of personnel rotation and frequent moves stripped units of skilled crew chiefs that were the key to making the system work.[5] The other contextual change was aircraft complexity. Jet aircraft replaced WWII era aircraft during this period. WWII era aircraft were relatively simple compared to early jet aircraft which required specialized skills.[6] This further complicated the lack of experienced personnel. One of the key requirements of a divisional structure is trained personnel to fill all the slots in each division.[7]

Complex aircraft required more standardization and sophisticated maintenance procedures than in the freewheeling days of the individual crew chiefs. The divisional structure did not foster the high reliability culture that these sophisticated aircraft demanded. When manpower shortages and changes in aircraft systems reduced the overall experience level the system began to falter. The response was a move to centralization.

The '50s and '60s

During the '50s and '60s, maintenance strategy focused on efficiency and standardization through centralized control. According to theory, a divisional structure is not compatible with a strategy based on efficiency because personnel positions are duplicated in each division.[8] A functional organization is more compatible with a strategy of efficiency.[9]

Two events in the late '40s set the stage for the move to centralized maintenance in the Tactical Air Forces (TAF); the Berlin Airlift and the publication of Strategic Air Command Regulation (SACR) 66-12. When the Berlin Airlift began on 26 June 1948, the commander of United States Air Forces in Europe was Lt Gen Curtis LeMay.[10] During the massive airlift operation, he had to maximize cargo movement with a limited number of aircraft. He determined that the only way to meet the requirement was to fly around-the-clock. Of course this would require around-the-clock maintenance. Crew chiefs could not keep up with the fluctuating schedules and the 24-hour demands that this type of operation required. USAFE decided that the only way to fill the requirements was to organize based on maintenance specialties.[11] In this system, crew chiefs worked on any aircraft and specialists were dispatched to jobs by a central control that prioritized workload based on all aircraft in the wing. Shortly after the Berlin Airlift, Gen LeMay took command of SAC. Within a year it adopted the specialized maintenance system. SACR 66-12 implemented the change to "establish a functional aircraft maintenance organization within the wing-base organization which would insure full utilization of personnel and facilitates to produce maximum availability of aircraft."[12]

In 1953 the USAF Inspector General reported that:

> As a result of over one hundred inspections it was determined that no universally effective specialized and standardized system of aircraft maintenance existed in the United States Air Force. The one notable exception was the Strategic Air Command, which has made a concerted effort to achieve a modern concept of maintenance and was experiencing excellent results.[13]

This report combined with the tremendous influence that SAC wielded in the Air Force led to the next step. The Air Force published AFM 66-1, which was based on a functional organizational structure with centralized control.[14]

The functional organizational structure allowed the Air Force to cope with contextual elements of limited manning and complex aircraft in the '50s and '60s. Functional organizations

allow people to develop technical expertise and maximize utilization.[15] A functional organization was chosen because leaders recognized the need for compliance and standardization of maintenance procedures with sophisticated jet aircraft. A culture of compliance was developed and promoted in this functional organization.

By the end of the '50s, the Air Force had a centralized maintenance organization for all major commands and aircraft types. Priorities were set at wing level and it maximized the use of experienced personnel. However, the one size fits all approach would not last long.

Vietnam

The AFM 66-1 organization worked well at home station, but there was a basic flaw. Just prior to Vietnam TAC implemented a new strategy, deploying squadrons instead of whole wings.[16] The basic fighting unit was no longer the wing as envisioned in the Hobson Plan. However, maintenance was still organized around the wing.[17] As the number of squadron deployments increased, TAC leadership became more and more concerned about the "spin-up time" required to build a maintenance organization to attach to the deploying squadron. Gen Hunter Harris, PACAF Commander, said in 1965, "The present organization is completely adequate for a fixed-base operation. However, when the assigned mission requires squadron deployment which is normal for TAC, it becomes necessary to assemble the deploying unit from cells of various maintenance squadrons."[18] An Air War College paper from the Vietnam era argued that deployment requirements trumped the efficiencies of centralized maintenance.[19] Manning in the early '60s did not allow maintenance manpower to be divided between the three squadrons in the wing because the resultant number could not support the requirements of each squadron. The effect was that the deployed maintenance contingent was overworked and was not generating adequate sorties even when working 14-16 hour days.[20] The new strategy of

deploying squadrons was not compatible with the functional organization because it was not flexible and it couldn't deal well with the needs of multiple customers.[21]

TAC addressed this problem through the TAC Enhancement Program. The goal was, "To provide the tactical squadron commander self-contained maintenance capability during periods of squadron deployments."[22] It accomplished this goal by reorganizing in 1966; on-aircraft maintenance was put back under the operations squadron commander.[23] This approach could have been a problem because, until the build up for Vietnam, the contextual elements did not change; manning was low and aircraft were still complex. However, Air Force personnel strength increased 8.8 percent during the spin up for the Vietnam War.[24] This influx of inexperienced technicians would have created a problem similar to the one the Air Force had in Korea, but this time it chose to dramatically increase training. In 1966, TAC's OJT rate jumped from 16,711 to 32,355 as trainees flowed through training courses to fill TAC's requirements as well as for Southeast Asia.[25]

The Air Force successfully changed the contextual elements that would allow the decentralized, divisional organization to work. Leaders chose to pay the price in manpower and training to provide the skilled technicians required for a divisional organization. However, after Vietnam, contextual elements changed again.

Post-Vietnam, 1972-1977

TAC had a battle-tested system that worked, but this system had its costs. It was dependent on supporting proper contextual elements. Unfortunately, after the war there was a massive draw down. By 1972, Air Force personnel strength had dropped to its lowest number since 1950; an 18 percent reduction just since 1966.[26] Air Force leaders again focused on efficiency and this became the overriding strategy for aircraft maintenance. A divisional organization was not

compatible with this strategy so the Air Force directed that all commands go back to the centralized system under AFM 66-1. HQ USAF stated, "Under these circumstances standardization can become cost effective. Therefore, the decision has been made to reorganize the USAF to a standardized and centralized system of maintenance management."[27] In this era, contextual changes drove a shift back to the functional organization. However, manning continued to drop and performance declined. Ultimately, maintenance couldn't produce enough sorties even with the most efficient functional organization they had ever known.

Production Oriented Maintenance Organization (POMO)

As the '70s wore on the search for efficiency and reduced costs continued, but the centralized system that had produced efficiencies in the past was failing. The Air Force had to find a solution, they discovered it in an unlikely location, Israel. A study of Israeli's performance in the 1973 War suggested a shift back to decentralization would be the answer.

After standardization across the Air Force under AFM 66-1, the Air Force continued to reduce manning. By 1976 there had been another 20 percent drop in manning.[28] The Air Force had already done what worked in the past when manpower was short; implement a functional organization with centralized control. However, TAC's sortie needs were increasing while it had less and less manpower to do the job.[29] This created a situation know as "the slippery slope" where the need for sorties gets larger and larger as maintenance falls farther and farther behind. During the '60s sortie productivity, combat capability, and morale steadily declined.[30] MGen William Nelson, the Air Force director of Maintenance, Engineering, and Supply said:

> To say that base level maintenance today is a management challenge is an obvious understatement of the issue. However, given the constraints in people and dollars we are faced with, there is a limit to how much running faster, jumping higher, and sweating more we can do without some major changes in the way we go about our business.[31]

Clearly the TAF needed to find a way to meet its sortie needs.

The question was how to get more performance out of the organization. The strategy was still focused on efficiency and the context was still limited manning and complex aircraft. Air Force leaders decided to try a matrix organization similar to the one used by the Israeli Air Force in an attempt to change culture. The cultural change they wanted was to shift maintenance technician's orientation from their functional specialization to their product, sorties. In the past technicians identified mainly with their specialty, even when decentralized, at the expense of the goal of the organization; to produce combat sorties.[32] The new organization was called POMO.

There were two key cultural problems that POMO tried to fix. One, a significant amount of time was wasted dispatching and transporting specialists to and from their shops to aircraft.[33] Two, when there was no work to do for their specialty, they simply waited in the shop while crew chiefs struggled to keep up with the work on the flightline. The theory was that if specialists doing on-equipment work were moved to the flightline and cross-trained in basic launch and recovery tasks, transportation and waiting time would be eliminated and aircraft could be recovered, repaired, and launched faster, thus generating more sorties.[34] A flightline organization called the Aircraft Maintenance Unit (AMU) was established that contained all technicians who performed on-aircraft maintenance and the goal was for them to work together to produce sorties. Specialists were cross-trained to perform launch and recovery tasks to avoid the pitfalls of a divisional system, which required more people while taking advantage of their functional expertise. The DCM was still in charge of all aspects of maintenance. His staff retained control of the maintenance effort.[35]

Initial tests looked favorable, the aircraft operational ready rate was 4.4% higher at the POMO test base, specialist response time dropped, and on-time take-offs increased. After

completion of the test, TAC began to convert to POMO.[36] However, the results of POMO were mixed. Two years after implementation a study conducted by AFIT students revealed that when two bases were compared there was actually a decrease in operational ready aircraft at the POMO base. In fact of the eight performance related factors tested by the researchers, none showed improvement after the implementation of POMO.[37]

POMO ran into one of the pitfalls of matrix organizations; implementing it.[38] The DCM retained centralized control of scheduling; this strategy didn't give the matrix organization enough balance between the divisional and functional organizations because too much power remained in the functional area. The result was little improvement in performance. It would take a visionary leader to refine what many believed was a sound maintenance concept for fighter aircraft.

Combat Oriented Maintenance Operation (COMO)

When General Wilbur Creech took command of TAC in 1978 only 20% of all broken aircraft were getting fixed in eight hours or less; pilots were averaging 10 hours per month when they needed 15 and maintenance was supporting a utilization rate of 11 when its goal was 18.[39] General Creech believed that the problem was the way maintenance was organized.

He built a new organization, called COMO, around several strong convictions: (1) authority and responsibility should be pushed as low as possible in the organization; (2) squadrons constituted the basic fighting units; and (3) performance had to be measured by output, not input. He saw the sortie as the output and the utilization rate as the measure of merit.[40]

General Creech firmly believed in decentralized decision making and pushed decision-making authority to the lowest level possible.[41] The key move he made was taking centralized control away from the DCM staff. The authority to make decisions on scheduling aircraft and

moving assets went to the squadron production supervisor. He also emphasized teamwork, pride of ownership, clear-cut goals, and rewards for organizations that exceeded goals. He did this by tying the AMUs to a flying squadron.[42] AMUs were still part of the Aircraft Generation Squadrons (AGS) and the AMU maintainers worked for the AGS commander, who in turn worked for the DCM. This allowed experienced senior maintainers to supervise the activities of the AMUs without interfering with the teamwork and bonding necessary for the operations and maintenance team to operate in combat.[43]

The change was dramatic. TAC had an 11% average yearly gain in sortie production—by the time General Creech left TAC, sortie production had increased a whopping 73% and the mission capable rate went from 56% to 86%.[44] There were other benefits as well. Major accidents declined and pilots were flying significantly more hours per month. The eight-hour fix rate went from 20% to 75% in this same time frame.[45] TAC was finally meeting its flying hour and sortie goals and seemed to have hit upon the system that was right for them. COMO took control out of the wing staff and put it at the lowest level where decisions could be made more quickly. It forced the AMU and the operational squadron to work as a team and this culture of working together paid off in increased sorties and mission capable rates. Because AMUs reported to and worked for a senior maintenance officer, procedures were standardized and quality was verified. However, execution was decentralized. There was one other test, the one that truly matters to any military organization, the test of combat.

COMO got its real combat test in Operation DESERT STORM. COMO had been in place for approximately 12 years when Sadam Hussein invaded Kuwait. The squadron/AMU teams were able to achieve or exceed the availability rates laid down for operations in Europe where more complete facilities were used. In the 43-day offensive, F-15Es from Seymour Johnson

AFB flew over 4,000 hours of sorties or half their normal yearly flying programs and F-15Cs from Bitburg AB flew the equivalent of 20 months of peacetime flying![46]

General Creech changed the strategy and successfully changed the context without affecting the high reliability culture required in maintenance when he created COMO. He changed the context by closely tying the AMU to its customer, the flying squadron, and giving them common goals. He changed the strategy to decentralized control and focused on performance by decentralizing scheduling. However, he did not change the maintenance culture because he did not take away the influence of the DCM. Standardization, quality assurance, and personnel issues remained his responsibility. COMO was a classic matrix organization that took advantage of the strengths offered by both functional and divisional organizations. While authority was pushed down, the high reliability culture remained because the DCM controlled compliance and standardization as well as maintenance training. This organizational structure lasted longer than any other system and proved itself in Operation DESERT STORM. COMO overcame the biggest pitfall of matrix organizations (implementation) by balancing a functional and divisional organization. One officer at the time said that the main lesson from DESERT STORM was that the maintenance systems establish over many years were effective and great care should be taken before altering them in the future.[47] When the objective wing was implemented, the Air Force took a step backward.

The Objective Wing

Fighter maintenance had been operating successfully under COMO for 14 years. This was the longest period of stability for a Tactical Air Force (TAF) maintenance organization. However, dramatic changes would shake up the maintenance community in the 1990's. A new leader, who would have as much impact on maintenance as General Creech, became Chief of

Staff in 1990, General Merrill A. McPeak. The fall of the Berlin Wall in 1989 signaled the end of the Cold War, Congress was talking about spending the "peace dividend", and the Air Force was going to have to down size.

When General McPeak took over, the Air Force budget was dropping dramatically. Manpower was expected to drop nearly 30 percent.[48] Gen McPeak had to find a way to reduce the size of the Air Force without losing combat capability. His approach was based on several themes: strengthen the chain of command, consolidate where practical, decentralize, streamline and flatten, clarify functional responsibilities, and cut overhead.[49] General McPeak felt the wing structure was top heavy and unbalanced. He felt that there were too many colonels in the wing and each colonel had a staff that he considered too large.[50] He said the real problem was to create an Ops/maintenance team that worked together and did not rely on two colonels to work together. Finally, he believed that Air Force's efforts to improve reliability and maintainability in aircraft was paying off and "we could now put emphasis where it rightly belongs. The Air Force exists to operate and employ equipment, not fix it...we can organize around the centrality of operations."[51] The objective wing was supposed to solve these problems and handle the looming cuts in manpower.

The objective wing was tested at the 347th Wing at Moody AFB. Its goal was to demonstrate that integrating maintenance in the operations squadron would improve maintenance effectiveness and achieve economies of scale.[52] Scheduling would be totally controlled by the operations squadron and the senior maintenance officer on base would only be an advisor to the maintenance officers in the flying squadron. In fact, it was envisioned that the LG could be any logistics AFSC, so there may not be a senior maintenance officer on the wing commander's staff.

Once again the Air Force had reacted to down sizing by reorganizing. This time, instead of cutting technicians, Air Force leadership took aim on middle management. General McPeak also saw a chance to focus the wing on operations. He ended the long established concept of a senior maintainer responsible to the wing commander for the health of the fleet. A cultural change occurred due to the loss of the DCM. The lack of a functional leader to standardize procedures and oversee quality allowed maintenance practices and performance to become erratic.[53]

The objective wing was a change back to a divisional theory of organization. The strategy was decentralization in an effort to increase efficiency. However, efficiency is not an attribute of a divisional organizational structure. History shows that divisional organizations require trained technicians for all positions and without sufficient manning, this organization will falter. When the objective wing was implemented the Air Force had excess manpower.[54] However, during the draw downs in the 1990s the Air Force lost a lot of skilled technicians. They quickly went from excess manpower during the draw down to manpower shortages and a dramatic loss of experience.[55] The poor performance of the objective wing indicates that a high reliability system was no longer in place.

An analysis of history shows that strategy, context, and culture are key elements that determine if a given maintenance organizational structure will succeed. The divisional organizational structure of the objective wing is not compatible with our current strategy, context, and culture. In this organization, a lack of performance can be expected. To help summarize the historical analysis of the Air Force maintenance organizations, the key elements of each era are identified in the table below.

Table 1, Aircraft Maintenance Performance Elements

Historical Period	Context	Culture	Strategy
Birth of USAF to Korea	Experienced Tech.s Relatively Simple Aircraft	Independent Crew Chief Lack Standardization	Decentralization Wing main fighting unit
1950s-1960s	Complex Aircraft Increased Training	Specialization Compliance/Standard Procedures	Centralization Efficiency
Vietnam Era	Increase in Personnel Increased Training Load		Squadrons become the deployable unit Deployments are common Decentralization
1970s	Draw down	Reduce Costs	Efficiency Centralization
POMO	Poor Funding Cross Training	On/Off equipment focus	Performance and Efficiency Centralization
COMO	AMUs tied to Ops Squadrons	Authority pushed down	Performance and Decentralization
Objective Wing	Draw down Reduce Overhead Loss of Mid-Level NCOs	End of Senior Maintenance Leader	Decentralization Expeditionary Strategy

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[20] Reiter, 14.

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Part 5

Final Analysis: Performance of Aircraft Maintenance Under the Objective Wing

From an organizational perspective, the critical factor in human performance is the structure in which we operate. The most basic management decision we make is how to organize ourselves.

—Gen. Merrill A. McPeak

Air Force maintainers had succeeded beyond anyone's expectations during DESERT STORM. They were well trained, experienced, and well led. However, the Air Force had to get smaller and the objective wing was seen as the answer. It wasn't long before things started going wrong, and by Corona 1995 maintenance was again the subject of focus for senior Air Force leaders. ACC took the lead in trying to get things back on track. Unfortunately, the downward trends have continued right up to today.

The objective wing was implemented in 1992 and by 1995 maintenance performance had declined to the point that aircraft maintenance was once again a concern. The objective wing idea was extremely unpopular with aircraft maintainers. Many predicted that the Air Force would lose an important component of officer leadership and the objective wing would reduce combat capability and increase safety problems.[1] These individuals were advised to "make it work". In fact one writer at the time said, "Those individuals who are unable to adapt to change will find that career opportunities in the civilian sector may become more attractive."[2] Despite their misgivings, maintainers tried to make it work. Unfortunately, things went down hill faster

than anyone expected. The mission capable rate steadily declined from October 1994 to December 1995; it went from a high of 84.6 percent to 83.9 percent.[3] ACC under flew its utilization rate in 13 of 17 Mission Design Series (MDS)s.[4] The same trends that led General Creech to establish COMO were occurring again after only three years. At the 1995 Corona commander's conference, Air Force leaders directed a functional review of maintenance.[5]

The report from the functional management review was frank and comprehensive. It began by saying that leadership was sending conflicting signals when it came to taking time to do maintenance or meet sortie goals. Maintenance mishaps were up from 2 percent to 5.4 percent in one year. Most were blamed on complacency, judgement, and lack of discipline. The report said that most OGs lacked the background to address maintenance issues. It also said some LGs took responsibility for maintenance and the health of the fleet, but that it was personality dependent. It also noted that it was much more difficult for the LG to act as a mentor for maintenance officers in the operations squadrons. Finally, it said the objectives of the organizational structure should be reevaluated.[6] It was a stinging criticism of the new organizational structure.

In July 1995 General Joseph Ralston, ACC Commander, sent a memo to ACC units addressing the "gradual decline in critical standards of aircraft maintenance."[7] He was concerned about maintenance leadership and went on to say "the Objective Wing deleted the central staff functions that provided day-to-day oversight and guidance to maintenance organizations. We no longer have experienced colonels and maintenance staffs focused on the fundamentals and health of the fleet," but he was not ready to drop the objective wing.[8] He said the intent was not to reverse "sound decisions that streamlined doing business," but that ACC had to get back to sound basic maintenance. He asked the wing commanders to provide the ACC staff with suggestions on how they could improve maintenance and reverse the trends.[9]

The ACC LG collected the recommendations of the wing commanders and presented them to General Ralston. He believed that the cross-functional accountably of the LG created blurred and overlapping responsibility and accountability between two commanders.[10] Many of the proposals from the wing commanders suggested putting more maintenance experience and senior leadership in the Operations Group. ACC decided to create a deputy commander in the Operations Group who would be responsible for maintenance and sortie production for the wing.[11] In 1995 General Ralston established a Deputy Operations Group Commander for Maintenance (DOGM). Senior Lt Cols would fill this position. Their job was to consolidate maintenance oversight and increase expertise for maintenance discipline, integration, and accountability.[12] ACC had taken a step back to making a senior maintainer responsible for maintenance.

The DOGM concept took effect in late 1995 and early 1996. A look at the mission capable rate for fighters shows a steady decline since 1991 and by the end of 1998 was down from 86 % to 75 %.[13] Figure 1 shows the steady downward trend since 1991. The total Nonmission Capable Rate for maintenance climbed steadily from a low of 7 percent in 1992 to a high of 17.3 by 1999. Even after the DOGM was established, the trend continued.

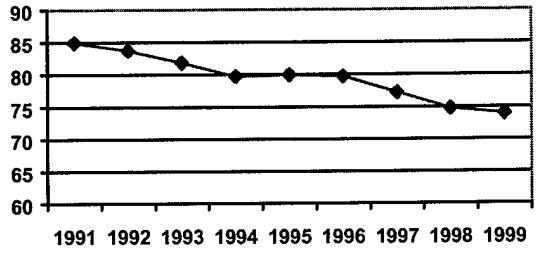

Figure 4 Fighter Mission Capable Rate

During Operation ALLIED FORCE, the first combat test of the objective wing with the DOGM, there were several problems. Aircraft arrived unprepared for combat. They deployed with high-time engines, overdue time changes, overdue grounding inspections, and aircraft that would require phase inspections soon after they arrived in theater.[14] Several units deployed without critical tools. The USAFE LG felt that a cohesive long-term plan for fleet management was absent or a low priority. Many units failed to address requirements until phase flow became critical. During the conflict, operations squadron commanders were focused on their wartime function of leading pilots in combat. This limited their ability to focus on a major part of their squadron, maintenance.[15]

After the initiation of the objective wing, declining capability lead to immediate problems that were identical to the ones addressed by General Creech. ACC recognized the problems as a lack of senior leadership and tried to keep the divisional structure of the Objective Wing and created a DOGM to oversee maintenance issues. The DOGM couldn't influence culture enough due to the organizational structure because maintenance in operations squadrons still work for the operations squadron commanders (divisional heads in this divisional structure). There is still no functional leader to influence maintenance practices and culture. The trends are still on the decline and the performance of this organization in Operation ALLIED FORCE was not satisfactory.

Notes

[1] Maj Joseph R. Rine Jr., "The Maintenance Officer Role in the Objective Wing Organization", *Air Force Journal of Logistics*, (Spring 1992): 24.

[2] Maj Joseph B. Michels, Ph.D., "Tactical Fighter Wing Reorganization: The Implications for the Maintenance Officer", *Air Force Journal of Logistics*, (Spring 1992): 23.

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Part 6

Recommendation and Conclusion

In each era context, culture, and strategy determined how the organization was shaped and how well the organizational structure performed. We need to look at all three of these elements to develop an optimal organization for aircraft maintenance. The objective wing organizational structure is no longer compatible with our context and culture. However, before we simply change back to an old system that worked in the past, we need to analyze each of our key elements.

Strategy

The Air Force's strategy is expeditionary. The largest deployable unit of a single type of aircraft for the TAF is the squadron. Units will be organized in wings of like aircraft at home, but deploy as squadrons as part of an Air and Space Expeditionary Task Force. They will go through a training and work-up cycle then deploy as part of a larger expeditionary wing.[1] If wings ever became the deployable unit, the choice would favor a functional organization. However, given the expeditionary Air Force concept, it is doubtful that this strategy will change. Decentralized control is best when the strategy is to deploy squadrons as the main combat unit.

Context

The context for maintenance is going to revolve around manning. The Air Force is experiencing retention problems among maintenance personnel. The DoD projects that 50% of

the force will not reenlist for second and third terms.[2] VADM P.A. Tracey, Deputy Assistant Secretary of Defense (Military Personnel Policy) indicates that we will face a 50% turnover for the foreseeable future due to competition with the civilian job market for qualified candidates.[3] Demographically, today's generation is less likely to look at the Air Force as a career and will be even more prone to take the skills they have learned to the civilian market.[4] The loss of these experienced NCOs will keep our general experience level low. The skill and knowledge required to maintain aircraft will not change significantly. Most of our current fighter aircraft will remain in the inventory for the next 10-15 years.[5] Thus, we can expect that the manning, experience, and complexity of aircraft in the future will stay pretty much the same as it is today. Past practices focusing on functional organizations achieved efficiency, but at the expense of flexibility and performance. Air Force history shows that a divisional type organization can not be sustained unless manpower is plentiful. Therefore, a matrix organization that is compatible with both strategy and context is needed, but how should it be structured?

Culture

The organization must reinforce a high reliability culture. A culture of compliance with standards and a method of verification are critical to safe flying. Karl Weik says culture can provide the centralization of procedures needed in high reliability systems.[6] He says we have to have some centralization so people are socialized to use similar decision premises and assumptions. Then when they operate on their own, in decentralized units operations are equivalent and reliable.[7] This fits in with our proposed strategy; the organizational structure must provide the centralized socialization of premises and assumptions while at home station, but subunits must be able to operate on their own as deployable units. The influence of a senior

maintainer is required at a high enough level to establish a culture through standardization and quality assurance. There needs to be a functional influence in the matrix.

Proposed Organization

Based on context, culture, and strategy, the matrix organization in Fig. 5 is proposed. The basic unit is the on-equipment maintenance unit. It should be tied to the flying squadron it supports. It must have strong bonds with the squadron and be able to operate independently when deployed. The maintainers assigned to the operations squadron are answerable to the squadron commander (the division chief in the matrix) for meeting the production goals he sets. Personnel should be assigned long enough to identify with this team. In the expeditionary Air Force organization this can be accomplished by assigning the on-equipment maintenance unit to the squadron it will support at the beginning of the deployment training cycle. This would give them at least 18 months to work together and become a team.

The proposed organization also has a maintenance functional manager. He should be responsible for quality assurance, standardization, and training. This functional manager needs to be at the wing level so he/she can influence aircraft maintenance scheduling decisions without directly controlling them. He should control maintenance personnel career paths and performance reports. Input for the performance reports should formally go from the operations squadron commander to the maintenance functional manager who accomplishes the performance report. This will give both parties input into the rating process. He should directly control off-equipment maintenance functions and provide functional oversight to on-equipment maintenance to provide the oversight needed for a high reliability system.

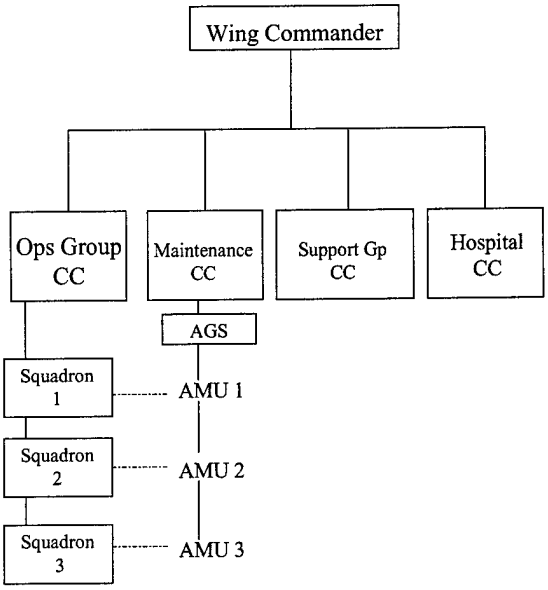

Figure 5, Proposed Organizational Structure

Conclusion

Some may argue that the proposed organization is simply COMO again. It does look a lot like COMO but I'm not recommending it simply because COMO is a system that worked in the past, I'm recommending it because the current context, culture, and strategy demand it. There is much more to choosing an organizational structure than simply basing it on what worked before or what is perceived as "the best way". The early history of maintenance shows that choosing an organization just because it worked in the past is a mistake. I looked deeper to determine what makes a maintenance organization successful or unsuccessful. Once again the Air Force finds itself confronted with an organization that is not performing well. It would be tempting to simply say let's go back to COMO, many have. However, that would ignore the lessons that our own history has to teach us.

By researching the history of aircraft maintenance I was able to define three elements, strategy, context, and culture, that had an impact on the success or failure of a maintenance organization. I then defined those elements for the near future and developed an organization structure that is compatible with them.

The proposed organization is a balanced matrix that emphasizes decentralized decision making and flexibility as well as standardization and following established procedures. If it looks like COMO it is because the context, culture, and strategy are not that much different today than when General Creech first implemented it. However, there are now established criteria to make accurate decisions on organizational structures for aircraft maintenance.

Notes

[1] AFDD 1 *Basic Aerospace Doctrine.*

[2] VADM P. A. Tracey, "The Case for Agility—Adapting Military Human Resources to a Changing World", Briefing to Air Command and Staff College, 12 Jan 00.

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Glossary

ACC	Air Combat Command
AEW	Air Expeditionary Wing
AFIT	Air Force Institute of Technology
AFM	Air Force Manual
AFR	Air Force Regulation
AGS	Aircraft Generation Squadron
AMU	Aircraft Maintenance Unit
COMO	Combat Oriented Maintenance Organization
DCM	Deputy Commander for Maintenance
DOD	Department of Defense
DOGM	Deputy Operations Group Commander for Maintenance
LG	Logistics Group Commander
NCO	NonCommissioned Officer
NCOIC	NonCommissioned Officer in Charge
OG	Operations Group Commander
OJT	On-the-Job Training
PACAF	Pacific Air Forces
POMO	Production Oriented Maintenance Organization
QA	Quality Assurance
ROLS	Readiness Oriented Logistics System
SAC	Strategic Air Command
SACR	Strategic Air Command Regulation
SMSgt	Senior Master Sergeant
TAC	Tactical Air Command
TAF	Tactical Air Forces
USAFE	United States Air Forces Europe

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