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CAPABILITY, CAPACITY, AND RISK IN THE SUSTAINMENT OF AIR FORCE WEAPON SYSTEMS

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A 574th Aircraft Maintenance Squadron maintainer performs depot maintenance on an F-22 Raptor at Hill Air Force Base, Utah, in 2019. The 574th installed the first metallic 3D-printed part on an operational F-22 in 2018. USAF/R. Nial Bradshaw.

EXECUTIVE SUMMARY

As the world's security environment changes, weapon system readiness becomes even more important for the national security of the United States. Determining how to optimize the organic industrial base to generate the most readiness in a fiscally constrained environment will have a profound impact on deterrence credibility. This paper builds on the concepts from a 2010 research paper on the sustainment of Air Force weapon systems and updates the examination on the three pivotal components of capability, capacity, and risk.

Determining what *capabilities* are required for the sustainment of weapon systems requires an examination of equipment, facilities, human capital, and knowledge. As weapon systems change through technological advances, the sustainment capabilities necessary to support the maintenance, repair, and overhaul (MRO) of those weapon systems must also evolve while at the same time continue to retain the necessary support for legacy weapon systems. Scoping the *capacity* needed to sustainment Air Force weapon systems requires rigorous assessment of what the demand signal for support will be so that the organic industrial

base has adequate depth in the four capability components to meet readiness needs. A structured process for reviewing requirements and determining needed depot capacity has made significant improvements in recent years to maximize the readiness impact of every dollar expended. Ultimately, the *risk calculus* needed to optimize the needed capability and capacity requires a deep understanding of a complex ecosystem across an inextricably linked set of industrial and financial portfolios.

While progress has been made, changes are needed to adequately address the pacing threat of China and acute threats of Russia and others. *Holistic readiness assessments* must be made to determine resourcing needs to meet the security requirements of near peer competitors which are different than operations of the last two decades countering violent extremists. In order to optimize capability, capacity, and risk by mission area, *weapon system roadmaps* need to be codified with Congress and industry. These roadmaps should be accomplished in a classified environment to preserve effectiveness and then translated into the unclassified budget to limit anticipation by adversaries. *Stable and consistent* funding is needed so that American industry knows where to spend its capital and the organic sustainment enterprise is able to purchase the most readiness for each dollar.

Understanding the components of weapon system sustainment support and changes to national level processes are vital to maximize the nation's resources in fielding and supporting a force that can deter and if necessary win against a near peer competitor.

Sarah Holshouser, 553rd Commodities Maintenance Squadron composite fabricator, drills out rivets on a KC-135 aileron she is overhauling at the Oklahoma City Air Logistics Complex, July 25, 2016, Tinker Air Force Base, Oklahoma. The 553rd CMMXS manufactures and maintains components for KC-135, B-1B, B-52H, E-3 and E-6 aircraft. USAF/Greg L. Davis.

PREFACE

This paper is an examination of the critical components of the sustainment enterprise that support Air Force weapon systems. It updates the examination I completed in a sustainment primer when I had the opportunity to be a federal executive fellow at the Brookings Institution in 2009 – 2010.[1] Over the years, leaders and students in the logistics and sustainment community have contacted me about the 2010 paper. This has started great conversations that continue to this day; extending the journey of learning for us all and continually shaping our views. My personal view on the subject of logistics and sustainment has also been influenced by a number of career experiences and by the insights of some of the most senior thought leaders in the Department of Defense (DOD). It is because of these conversations and generous teachings — as well as finding the 2010 paper used as a reference — that I decided to update the primer.

In that initial paper, I explored the structure of sustainment and a number of considerations in the support of weapon systems. Of great importance was the determination of what

mix of weapon systems sustainment should be accomplished in government and what should be accomplished by the commercial sector. While determining the mix between organic and contract logistics support is still a critical discussion, in this addendum I explore a broader set of questions — as the global security environment facing the United States has shifted toward peer competition — using the same rubric of capability, capacity, and risk calculus as in the original work.

The pacing challenge of China and acute actions of Russia pose different weapon system requirements than the Department of Defense's extended focus on countering violent extremism. Effectively generating the readiness that is needed by field commanders and optimizing the use of taxpayers' dollars will require not only a deep understanding of the components that provide sustainment but also a change in the nation's approach to readiness assessment, sustainment, and resourcing. While change is hard, it is necessary.

Cardell Smith, a mechanic with the 76th Commodities Maintenance Group, puts a critical aircraft component through its paces on a test stand designed to mimic jet engine conditions by delivering up to 750 pounds per square inch of heated, compressed air. The shop responsible for creating that airflow made operational changes that saved the Air Force around $15,000 per month in energy costs. USAF/Chris Seaton.

THREE LENSES: CAPABILITY, CAPACITY, AND RISK

CAPABILITY

For the DOD and relevant industries, capability is determined by four components: equipment, facilities, human capital, and knowledge. Appropriate levels of each are needed to effectively run logistics and sustainment operations for aircraft weapon systems. This section of the paper highlights, in the government context, some of the key factors related to the four components.

Equipment. The equipment required to complete the MRO of aircraft weapon systems varies from the most basic machinery (relatively unchanged in the last half century) to additive manufacturing of metal parts and robotic depainting operations that remove mechanics from hazardous environments. Yet, regardless of how advanced a piece of equipment is, having it in place at the location of a required repair is vital. Whether it is a brand new technology, or much older piece of equipment that

is rarely used that must still be maintained because of the age of some fielded weapon systems, sustainment leaders must consider numerous factors when deciding to use stretched capital to purchase and maintain crucial tools of the trade.

Facilities. Current depot facilities, which periodically conduct depot-level maintenance activities and implement modernization programs, were born out of the pioneering age of aviation and largely date to the World War II era or Cold War era. While some important improvements have been made over the decades, many facilities have changed little since they were constructed more than a half of a century ago. But regardless of whether the facility requirement is resourced through what the DOD describes as current mission military construction (MILCON) supporting enduring missions, or new mission MILCON supporting the fielding of a new weapon systems, the projects are expensive and the department's ability to resource them is limited.

The capability of facilities in the defense industrial base varies widely, as do the needs for weapon systems sustainment. In specialized facilities — for example, those that handle engine tests, paint application and removal, and fuel cell operations — secure, classified workload environments, and software integration laboratories are needed to conduct the MRO of weapon systems and components that are often only accomplished in a depot. Specialized facilities are costly to build and maintain, so sustainment leaders must carefully determine the appropriate mix of facilities to meet requirements in an ever-present fiscally constrained environment. All the armed services rely on well-functioning facilities and address them in their congressionally-required Organic Industrial Base (OIB) optimization plans.

Human capital. While the number of personnel is a pivotal factor, having the correct capability in the work force depends on the diversity of talent and competencies needed for Air Force sustainment. The type of personnel skills required range from the sheet metal mechanic who puts life back into a B-52 bomber (made before his or her parents were born) to the more than 3,000 electrical and computer engineers in the Software Engineering Groups who code operational flight programs for the most advanced systems. This range reflects how challenging it is to find personnel with the specialized skill sets needed to support various weapon system requirements. Talent competition occurs across the spectrum of career fields. The Air Force is often unable to provide the employee pay and benefits found in the private sector, so successful recruitment and retention efforts require a compelling understanding of the meaningful work to be accomplished in serving one's country.

Knowledge. Possessing the technical and procedural knowledge needed to execute MRO activities in a secure environment is essential, but it requires resources and commitment. At a minimum, a technical baseline of knowledge is necessary to execute repairs. In many cases however, early in the life cycle, the government miscalculates the type of information it will need about a weapon system or component, or deems it too costly to acquire. Unfortunately, when a complicated repair eventually becomes necessary years later, the original equipment manufacturer might not be interested in providing the information or is no longer in business. For the knowledge that is accumulated, however, it must be both secure from adversaries but accessible to the sustainment enterprise so it can be leveraged.

Equally, if not more consequential, is the knowledge needed to effectively carry out processes for sustainment operations. In this area, significant improvement has been achieved in the Air Force's depots with the implementation of lean processes, which aim to reduce cost and waste, and the increased implementation of Theory of Constraints (TOC) processes, which aim to identify and reduce the central constraint preventing a goal from being achieved. The Air Force Sustainment Center uses a constraint-based management system called the "Art of the Possible" (AOP), which has become fundamental to how the Air Force effectively supports field units through the sustainment of airpower. The applicability of this system goes far beyond the shop floor so the publicly available AOP Handbook is a worthwhile read for any

organization.[2] Field-level maintenance organizations have found great success in implementing TOC processes for flight lines and intermediate maintenance units across the Air Force decreasing aircraft downtime and increasing aircraft availability. While TOC implementation varies by mission, the common principles are grounded in math and have resulted in quantitative improvements in weapon system readiness in both depot and field operations.

The 2018 National Defense Strategy[3] shifted the DOD's focus to strategic competition, and the 2020 National Defense Authorization Act[4] emphasized the Organic Industrial Base's key role in this environment. In response to the act's Section 359, titled "Strategy to Improve Infrastructure of Certain DOD Depots," the Office of the Under Secretary of Defense for Acquisition and Sustainment developed and published a strategy to improve OIB infrastructure in October 2021.[5] In the last few years, the Air Force Sustainment Center has made significant progress in planning for the OIB, which addresses the physical plant, the equipment, and the information environment. The OIB plan has three parts. The first part, the "Keep Up" strategy, leverages congressionally mandated investment from the Working Capital Fund to preserve the OIB by upgrading equipment and facilities. The second part, "Catch Up," prioritizes equipment and facility projects for depot missions that share platforms and scale up to handle evolving workloads. These projects typically require significant resources above current funding levels. The third part, "Leap Ahead," requires considerable Air Force Corporate Structure investment to fully optimize Air Force organic depot capabilities. How much funding these OIB initiatives receive in a fiscally-constrained environment should depend on the determined risk level and be informed by a high-confidence plan for when weapon systems will be fielded and how they will be sustained and divested.

CAPACITY

After thinking through the required capabilities, the focus then turns to capacity, or how much is needed. Numerous organizations contribute to the four components (equipment, facilities, human capital, and knowledge) that ensure sufficient capacity; this is a function of various demand signals and pressures from both inside and outside of the DOD.

Equipment. Leaders must carefully calculate the amount and type of equipment needed to ensure that workloads can be successfully executed. Several factors, including machine run times, calibration requirements, and expenses, must be considered when determining the number of each type of equipment items to have in place. Constraint-based considerations for equipment on the critical path of a repair process are important to address. The optimal use of equipment can be achieved in several ways, including by using constrained equipment only for the workload only it can do, performing targeted scheduled maintenance, and implementing multishift operation of the equipment. All analysis tools available should be used when making capacity determinations.

The needs of largely predictable rotational deployments to Central Command's Area of Responsibility in the wider Middle East are quite different than the needs of sustained efforts to counter fast-evolving challenges from a pacing challenge from China or an acute challenge such as Russia.

Facilities. This component is most commonly thought of when attempting to measure capacity of the OIB. Services report their depot capacity calculations to the Office of the Secretary of Defense (OSD) for Acquisition and Sustainment using the square footage of facilities for single-shift operations. While many industrial facilities operate more than a single shift, this rubric normalizes the reporting so that the OSD can easily consolidate and review the data before sharing it with Congress. Much of

America's MRO infrastructure for airpower was built in the middle of the last century. World War II and the Cold War drove an expansion in military readiness and rapid growth in new weapon systems, which, in turn, required a significant investment in sustainment capacity. But after the Cold War, the United States markedly reduced the size of the military. In particular, the Air Force reduced the number of depots from five to three. With such a cutback, continually determining the capacity of the remaining three depots and the commercial MRO industry is crucial for national security. What served us well through 20-plus years of operations countering violent extremism might not serve us well in our new global security environment. The needs of largely predictable rotational deployments to Central Command's Area of Responsibility in the wider Middle East are quite different than the needs of sustained efforts to counter fast-evolving challenges from a pacing challenge from China or an acute challenge such as Russia.

Human capital. Having sufficient human capital with the right mix of skills to meet workload requirements is also important for ensuring sufficient MRO capacity. Sustainment leaders must determine the correct number of personnel with the relevant skill sets needed for their organizations. There are several variables to consider, but to give a straightforward example, a depot might add a second shift without purchasing additional facilities or equipment and still realize an increase in throughput. In the previous section, we discussed the importance of having the right mix of skill sets to perform the critical work on the shop floor or in the laboratory. When deciding how many people to have in an organization, several factors come into play, including recruitment, training, retention, workforce development, and attrition planning.

While it is rare to perfectly align workload with the exact right number of mechanics who have the right skill sets, getting as close as possible to exactly right makes all the difference in ensuring readiness. If some skill sets are missing, production will likely be constrained and the field unit's needs will not be met. And if there are more personnel than actually needed for the workload that is executable, unnecessary costs will be incurred. These excess costs can be recovered in several ways, but the recovery normally results in an adjustment to the sales price of an aircraft, engine, or commodity produced and the funds to "buy" the items are transferred. If the sales price does not cover the cost of labor, the labor rate will likely go up in a future year, with no additional readiness in exchange for the increased cost. To borrow an adage from target shooting, "aim small and miss small" — if one makes every effort to be as precise as possible, the bullet might still be off center of the bullseye but by much less than if the shooter was just trying to hit the paper. The planning processes to bring on a skilled workforce and to procure adequate materiel are similar in nature.

Knowledge. The relationship between knowledge and capacity is not as straight forward or easy to outline as equipment, facilities, and human capital. A useful way to consider this component of capacity is to determine whether a sustainment activity has "islands of excellence" or the ability to leverage information and processes at scale. Most leaders have had experience with high-performing small organizations (islands of excellence); leveraging knowledge at scale in larger organizations can have many obstacles. The scaling and optimized utilization of knowledge gained to meet increasing demands from the field must be planned for and challenges to security and access must be addressed to be effective as an enterprise.

When determining how much MRO of weapon systems will be necessary, materiel is often the most elusive ingredient. Having the materiel on hand at the right time is a multifaceted challenge due to tiered suppliers, precious metal shortages, supply chain disruptions, and a host of other constraints. Often referred to as "supportability," the timely availability of parts is essential to logistics and sustainment and to meeting field units' needs. Critical to success is having the knowledge to accurately determine what parts will be required and in what quantity, as well as to effectively transmit that demand signal to either a manufacturer or source of repair so the parts are delivered in time. For new parts — ranging from a simple fastener to the

very high end of advanced low observable technology, a qualified vendor has to be incentivized, resourced through a contract, and capable of on-time delivery. For fielded parts, the source of repair will need its own stream of subcomponents to execute overhaul of the asset. In the Air Force, the three Air Logistics Complexes carry out the vast majority of these latter repairs; otherwise, either the original equipment manufacturer or another vendor executes the repair through a contract with the government.

CALIBRATING THE CAPABILITY AND CAPACITY NEEDED

The math involved in determining the capability and capacity needed to support the many demand signals requires collaboration across a number of organizations in the acquisition and logistics mission areas. Structured collaboration between a program office (typically the requirements owner) and an Air Logistics Complex (typically in charge of the sustainment activity) is absolutely critical. Fortunately, over the years, the collaboration process has become more formal and mature. The long-term strategic requirements are projected to the degree possible, and the operational and tactical requirements are considered with more granularity to support weapon system readiness in the shorter term. The Logistics Requirements Determination Process looks two to four years out and is fundamental to increasing the probability that the projected strategic requirements will be effectively supportable in execution. The tactical Requirements Review and Depot Determination process considers the workload on deck for execution in the one- to two-year time frame. To be an effective leader of any key part of the Air Force sustainment enterprise, this process is not only foundational but also critical to better understanding the broader impacts in both maintenance and supply support when decisions are made about capability and capacity.

A whole chapter could be written about collaboration between program offices and Air Logistics Complexes, but allow me to offer the following two examples to indicate just how integral it is to successful planning and enterprise sustainment.

In the first example, the Life Cycle Management Center signals the demand for aircraft needing MRO. Based on engineering analysis, the center determines what inspections and repairs are required to enable the aircraft to continue flying safely, and then it works with the lead Major Command (MAJCOM) on repairs and modifications that bring needed capabilities to their assigned platforms. The center and lead MAJCOM are responsible for Program Objective Memorandum requests to receive the funding necessary to accomplish the work. The Air Logistics Complexes review the requirements signaled and assess what human capital and materiel are needed for the depot to meet the sustainment health needs of Air Force weapon systems.

In the second example, the 448th Supply Chain Management Wing signals the demand for weapon systems components and how many parts needing repair based on modeling of the mean time between failures of systems and projected flying hours. And once again, the Air Logistics Complexes review the requirements signaled and determine what personnel, equipment, facilities, and materiel are necessary. Air Force Manual 63-143 not only describes the roles of the many participants in this collaboration process but also provides insight into how the Air Force requests the funds to execute these requirements.[6]

RISK CALCULUS

In the 2010 paper, risk was evaluated primarily by examining the relationship between contract logistics support and organic MRO. At that time, the United States was heavily focused on countering violent extremism and much less focused on near peer powers, specifically China and Russia. Today, the pacing challenge of China and the acute aggression of Russia are well-recognized threats but present a significantly different kind of risk to national security.

The question of what sustainment requirements should be accomplished within government versus the commercial sector has been a topic of consideration for decades. Congress has long acknowledged that retaining a ready capability owned and run by government is vital to national defense. A number of statutory requirements shape the activities of the services in this risk area. Most relevant to this discussion is 10 U.S. Code § 2464, focused on core logistics capabilities. The code states that:

> "It is essential for the national defense that the Department of Defense maintain a core logistics capability that is Government-owned and Government-operated (including Government personnel and Government-owned and Government-operated equipment and facilities) to ensure a ready and controlled source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situation and other emergency requirements."[7]

Deciding what to do organically in government, what to accomplish through contract logistics support, and what to do through partnerships must be considered carefully, as the decisions carry several types of risk.

The MRO of military weapon systems, whether executed by the private sector or government, faces many challenges. A commercial MRO company can experience unforeseen disruptions, could be purchased by another company with different interests or international alignment, or may elect to terminate support of legacy platforms. That said, it would be extremely difficult for government to take on all MRO activities from an affordability and capacity standpoint. Thus, a mix of private and public sustainment capacity is the most viable approach, but getting the mix right means making a critical set of decisions.

Having multiple sources of repair may seem like the obvious choice with a number of attributes to reduce risk but it is in some ways a double-edged sword. There are clear risk reduction advantages to having more than one source of repair — such as covering more geographic areas, driving down costs through competition, and generating innovative approaches to MRO operations in both government and industry. Having multiple sources of repair can increase surge capacity if supply chains, either for newly manufactured parts or for repairables, are not a constraint. It can also both help mitigate the impact of a natural disaster that hits a single facility and increase the ability to recruit and retain personnel through access to more than one locality.

With these advantages, one might question why the DOD does not have multiple sources of repair for the vast majority of its weapon systems. Cost is the primary reason, particularly the costs of physical plants and human capital. Another leading factor is supportability; when parts are not available on the critical path for the repair process, the impact can be significant. If the availability of parts is truly the constraint, having that constrained supply chain support more than one repair process does not normally result in production success. In sum, duplicate capabilities can reduce risk but can also increase costs and actually create risk to supply chains if not considered holistically.

The goal in utilizing American taxpayer dollars in organic sustainment is not to generate wealth for shareholders but to generate readiness.

Relevant to the cost discussion, it is important to note that the organic sustainment of weapon systems — specifically the MRO of systems and the associated supply chain activities — is sometimes referred to as a business. In my opinion, it is *not* a business and should instead be viewed as an operation that supports readiness. Of course, the fiscal environment and key financial decisions are inextricably linked to the health of the organic sustainment enterprise; cost effectiveness clearly and directly impacts the level of readiness that can been generated. But the goal in utilizing American taxpayer dollars in organic sustainment is not to generate

wealth for shareholders but to generate readiness. With readiness as the primary goal, important activities, capabilities, and risk reduction measures may be needed that do not seem prudent from a commercial business standpoint. That said, logistics and sustainment operations must leverage fiscal acumen and sophisticated business processes to preserve decision space for senior leadership.

Field-level maintenance and logistics experience normally does not prepare an aspiring Air Force leader for the fiscal intricacies inherent in the sustainment ecosystem. All too often, while gaining field experience, finance is a subject that receives little attention. A student or aspiring leader of sustainment should spend the time to fully research and understand the fiscal implications and risk drivers associated with weapon system readiness.

Whether new to the financial conversation or an expert, words matter and it is important to understand phraseology and lexicon. It is particularly crucial not to conflate Weapon System Sustainment (WSS) and the Air Force Working Capital Fund (WCF). Weapon System Sustainment represents the operations and sustainment requirements and funds in the weapons systems acquisition life cycle associated with depot maintenance, sustaining engineering services, technical order updates, and contract logistics support (CLS), which includes a broad range of maintenance and supply chain activities accomplished by a commercial business rather than the government.[8] The Working Capital Fund is a revolving fund, a business-like entity that provides products and services to customers. The goal of the revolving fund is to break even over the long term and establish fixed selling prices during execution to protect customers from unforeseen fluctuations that would otherwise impact on their ability to execute congressionally approved programs.[9]

Collaborating on requirements for WSS funding, learning how to articulate that need in budget considerations, and executing those dollars in sustainment operations are critical legs of any logistician's journey. Understanding the interrelationships between these three mission areas is both challenging and necessary and is recommended for deeper study later in this paper. While understanding the basics of the resources that are appropriate for sustainment operations through WSS is important, that is only part of the picture. It is key to have at least a basic understanding of the WCF critical for weapon system health decisions.

The WCF was provided by Congress to give the Air Force the ability to make repairs and also provide materiel in advance of the ultimate need. It is a revolving account to provide the sustainment enterprise the ability to pay for the resources needed to execute sustainment independent of the budget year. WSS is a resource to pay for depot repairs and safety of flight aircraft modifications. It is fairly straightforward to see that funding through WSS in the year of execution would be "late-to-need" for ordering long-lead materials and compensation for a workforce, even without the challenges of continuing resolutions. The WCF provides the sustainment enterprise a financial tool to make expenditures when needed and then get reimbursed as the funds are appropriated in the year of execution. There are many factors that contribute to the health of the WCF including flying hour reimbursement, the manner in which costs are recovered, and the mix of weapon systems that are organic versus CLS. The concept of a working capital fund is not unique to Air Force sustainment; there are several within the DOD. While learning all the intricacies of a WCF is daunting, a logistician should concentrate with special attention on how a fund's constrained cash position can impact readiness.

Lack of fiscal health and solvency can directly result in readiness degradation. For example, if the WCF's cash position is poor — which can happen for a number of reasons, but in this example let's presume it is due to an underexecution of the projected flying hours — there may not be the funding authority to drive in parts for repair. If so, a vicious circle of readiness degradation could be the outcome. The challenges on the CLS repair components in a parallel example have a different dynamic. Funds are paid on contracts for spare parts directly from WSS funding and is not reliant on flying hour reimbursement and the Working Capital Fund.

Escalating CLS costs under the umbrella of WSS are at times difficult to assess because of the nature of the contracts. Costs traditionally considered funded by the WSS are often not distinguishable from other costs under the same contract, making it challenging for leaders to assess the risk of funding at different levels. Important analysis and collaboration have been conducted to examine changing the construct of how repairables are addressed more specifically within CLS contracts. While valuable work has been pursued, more work is required in this area. The Air Force must consider these risk factors when allocating resources in support of Joint Force Commander requirements. Some key questions when analyzing risk include the following: What sustainment work should be accomplished inside of government to ensure readiness? What are the second and third order effects of a particular mix of organic and CLS sustainment on the solvency of the Working Capital Fund? Lastly, what changes are needed to meet readiness requirements for countering pacing challenges and aggression by other nations versus a more predictable rotational model focused largely on countering violent extremism?

As the threats to national security change, weapon systems must change to meet those threats. The Air Force must continue to engage leaders in Congress to deliberately divest outdated weapon systems and address this readiness imperative.

Most logisticians and operators understand the challenges of maintaining weapon systems beyond their planned service life; key problems include unanticipated structural repairs, corrosion, and diminishing sources of supply. And they also understand, from an operational effectiveness standpoint, that as the threats to national security change, weapon systems must change to meet those threats. The Air Force must continue to engage leaders in Congress to deliberately divest outdated weapon systems and address this readiness imperative. That incredibly consequential conversation is not the subject of this paper, but below are a few considerations particularly relevant for leaders assessing the health of the logistics and sustainment enterprise and the corresponding impact on readiness.

The importance of long-term forecasting and the deliberate planning of force structure changes cannot be overstated. The examination of capability, capacity, and risk demonstrates how complex and interrelated the various aspects of sustaining weapons systems are, necessitating a deliberated divestiture of a fleet with high confidence plans to ensure American taxpayers' dollars are optimally spent. A lack of decision, or decisions inside of the lead times for personnel and materiel divestitures, drives up the costs to buy the same readiness level. The result is an unnecessary expenditure of additional resources driving rate increases for organic workloads, and CLS providers have to charge higher fees to recover their costs based on unpredictable — or a lack of — decisions. To meet the needs of the national security environment and maximize effectiveness of American taxpayer dollars, a well-informed, transparent conversation with Congress is necessary. Progress is being made in this area, but the lack of a repeatable and high-confidence process for retiring weapon systems will negatively impacts our buying power, sends confusing or false signals to industry, and ultimately is an insidious detriment to our readiness.

Members of the Oklahoma City Air Logistics Complex Heavy Maintenance Center pose for a group photo with the Air Force's F-35A Lightning II Demonstration Team during their visit to Tinker Air Force Base, Oklahoma, in 2021. F135 engine maintenance is conducted as part of a public-private partnership between the U.S. Air Force and Pratt & Whitney. USAF/Paul Shirk.

THREE KEY AREAS FOR DEEPER STUDY AND BETTER UNDERSTANDING

For the aspiring student or lifelong learner in sustainment and logistics, there are three subject areas the merit digging deeper into to understand at a granular level:

1) Statutory requirements, organizational structure, formal command relationships, and informal influences by major players.

a. Congress plays a key role in the readiness of the Armed Forces and particularly the sustainment capacity and capability within government. There are numerous statutory requirements to consider when seeking to understand the OIB, but the core ones include 10 U.S. Code § 2460 (Definition of depot-level maintenance and repair),[10]

10 U.S. Code § 2466 (Limitations on the performance of depot-level maintenance of materiel),[11] 10 U.S. Code § 2464 (Core logistics capabilities),[12] and 10 U.S. Code § 2474 (Centers of Industrial and Technical Excellence: designation; public-private partnerships).[13]

b. Air Force Materiel Command underwent a major reorganization in 2012. While the reorganization was multifaceted, the most relevant aspects for this discussion are the establishment of the Air Force Sustainment Center and the Air Force Life Cycle Management Center. The Sustainment Center aligned under one center commander the three Air Force depots now called Air Logistics Complexes; the two Supply Chain Wings; and the Air Base Wings at Hill Air Force Base, Tinker Air Force Base, and Robins Air Force Base. The acquisition professionals in the program offices were aligned under a center commander for their organize, train, and equip requirements and were aligned to the Office of the Assistant Secretary of the Air Force for Acquisition for program executive officer responsibilities.

c. Collaboration between program executive officers/program managers, Lead Major Command directors of logistics, and Air Logistics Complex and Supply Chain leaders is critical to the readiness of fielded units. Their relationships should be a focus for leaders charged with the readiness of America's force. It is important to understand the dynamics so one can influence the system.

d. The Office of the Secretary of the Air Force and the Office of the Chief of Staff of the Air Force have specified roles and responsibilities in statute and policy. Understanding the roles of each office's supporting staff will provide valuable insight on which office is responsible for the mission area one needs assistance with or wants to learn more about.

2) Funding for the complex sustainment and logistics ecosystem. Specifically, start with the WSS, how risk is assessed, how requirements are specified and advocated in the Program Objective Memorandum, how dollars are applied to those requirements, and the difference in impact on CLS and organic platforms. Understanding the dynamics of the WSS will illuminate the complexities that different behaviors have on the WCF. As previously discussed, reimbursement of the WCF through flying hour program execution of organic weapon systems is not the same as that of CLS systems. While there has been some work done on boundaries of what is "in" and what is "out" of CLS funded by WSS, it remains to be seen what changes will come from that collaborative work.

3) The needs of countering aggressive near peer nations versus the fight against violent extremism we have been focused on for more than 20 years. When contemplating solutions for today's vexing problems, resist the temptation to universally apply approaches that are effective at the strategic level. Although alluring from an efficiency standpoint, centralization can sometimes be detrimental if applied in the field without a granular understanding of the impact. Execution of the mission occurs at the senior airman and captain levels. Units, not fleets, go to combat, and it is easy to slide down a slippery slope in the pursuit of efficiency at the cost of unit effectiveness. Views on this issue vary, so it is important to formulate one's own opinion based on an understanding of the specifics.

Thought leadership is continuously maturing within the Air Force on logistics and sustainment. Air Force headquarters is leveraging a collaborative platform called AVOLVE to share concepts, thought pieces, and reference material across a broad range of organizations.[14]

Anthony Farrow, 561st Aircraft Maintenance Squadron Production Support, changes intake fasteners on an F-15 during programmed depot maintenance at Robins Air Force Base, Georgia, in 2016. USAF/Ray Crayton.

THREE RECOMMENDATIONS

It is often said that the logistics and sustainment ecosystem in the Air Force operates like a federation, and while it may not be the most efficient construct, it is effective. The MRO of weapon systems and supply chain activities must be healthy enough to provide the readiness and support the field needs to defend the nation. The goal of this updated primer was to further outline for leaders and students some basic considerations when examining the sustainment enterprise through the lenses of capability, capacity, and risk. Once oriented in these areas, it then becomes important to determine what sustainment-related actions can help make sure America's weapon systems are prepared for the current and future national security environment. The following are three critical recommendations.

1) Conduct holistic readiness assessments. There is broad recognition that flying hours are a key component of readiness in aviation. Not as clear is the connection between readiness and other weapon system health factors, including inspection and structural repairs, modifications, support equipment, spare parts supportability, and more. Just like there is no single health measurement for a human, there

is no single health measurement for a weapon system. It takes a holistic assessment of health in both cases.

A deliberate approach for divestiture and the fielding of new systems sends a clear demand signal, both inside government and to industry, so that capacity can be adjusted to maximize throughput and minimize cost.

2) Codify roadmaps for weapon systems in order to appropriately manage capability and risk by mission area (such as fighter, bombers, and mobility aircraft). A deliberate approach for divestiture and the fielding of new systems sends a clear demand signal, both inside government and to industry, so that capacity can be adjusted to maximize throughput and minimize cost. The approach should ultimately allow the Air Force to achieve the highest level of readiness possible with taxpayer dollars. These roadmaps would need to be at a high classification level and congressional leaders will need to evaluate the context and risk associated with the roadmaps' implementation (classified) and the implications of decisions represented in the budget which is unclassified.

3) Stable and consistent funding of sustainment that supports the roadmaps is essential. The Air Force will always operate in a fiscally constrained environment. Stable and more predictable sustainment funding levels will result in healthier weapon systems and allow commanders to make informed risk decisions when planning and executing deliberate divestitures of old aircraft, fielding new aircraft, and managing the transition between those two efforts.

These three recommendations are not new. Smart and dedicated leaders have been working in these areas for a number of years. What is new, or more recent, is the burning platform to make these changes. The "Accelerate Change or Lose" directive[15] issued by Air Force Chief of Staff General Charles Q. Brown, Jr. and the shift in focus to the pacing challenge of China exhibited by Air Force Secretary Frank Kendall[16] both emphasize the urgent need for change to address the reality of today's national security environment. The need for change is real to provide weapon system readiness for the United States. While change will be uncomfortable for many, discomfort is better than the cost in blood and treasure of ignoring the future.

REFERENCES

1 Tom D. Miller, "The Defense Sustainment Industrial Base: A Primer," (Washington, DC: The Brookings Institution, June 30, 2010), https://www.brookings.edu/research/the-defense-sustainment-industrial-base-a-primer/.

2 "AFSCH60-101: Art of the Possible Handbook," (Tinker Air Force Base, OK: Air Force Sustainment Center, December 28, 2021), https://static.e-publishing.af.mil/production/1/af_sustainment_ctr/publication/afsch60-101/afsch60-101.pdf.

3 "Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge," (Washington, DC: U.S. Department of Defense, 2018), https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

4 National Defense Authorization Act for Fiscal Year 2020, Pub. L. No: 116-92, 133 Stat. 1198 (2019), https://www.congress.gov/bill/116th-congress/senate-bill/1790.

5 "Logistics & Materiel Readiness: Strategic Plans," (Washington, DC: Assistant Secretary of Defense for Sustainment, U.S. Department of Defense, October 2021), https://www.acq.osd.mil/log/LMR/.strategic_plan.html/OSD_L&MR_Strategic_Plan_20211004_Final.pdf.

6 "Air Force Instruction 63-101/20-101: Integrated Life Cycle Management," (Washington, DC: U.S. Department of the Air Force, June 30, 2020), https://static.e-publishing.af.mil/production/1/saf_aq/publication/afi63-101_20-101/afi63-101_20-101.pdf.

7 Core logistics capabilities, 10 U.S. Code § 2464 (2021), https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AUSC-prelim-title10-section2464.

8 "Air Force Manual 63-143: Centralized Asset Management Procedures," (Washington, DC: U.S. Department of the Air Force, December 18, 2020), 89, https://static.e-publishing.af.mil/production/1/saf_aq/publication/afman63-143/afman63-143.pdf.

9 "Defense Working Capital Funds: Activity Group Analysis, Volume 2B, Chapter 9," in "Financial Management Regulation," (Washington, DC: U.S. Department of Defense, December 2014), 9-1, https://comptroller.defense.gov/Portals/45/documents/fmr/archive/02barch/chapter09.pdf.

10 Definition of depot-level maintenance and repair, 10 U.S. Code § 2460 (2019), https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title10-section2460&num=0&edition=prelim.

11 Limitations on the performance of depot-level maintenance of materiel, 10 U.S. Code § 2466 (2009), https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title10-section2466&num=0&edition=prelim.

12 Core logistics capabilities, 10 U.S. Code § 2464.

13 Centers of Industrial and Technical Excellence: designation; public-private partnerships, 10 U.S.C § 2474 (2021), https://uscode.house.gov/view.xhtml?req=2474&f=treesort&fq=true&num=26&hl=true&edition=prelim&granuleId=USC-prelim-title10-section2474.

14 See "AVOLVE," Platform One, U.S. Department of Defense, https://avolve.apps.dso.mil. Note: Access to this Air Force web application requires a Department of Defense Common Access Card.

15 Charles Q. Brown, Jr., "Accelerate Change or Lose," (Washington, DC: U.S. Department of the Air Force, August 2020), https://www.af.mil/Portals/1/documents/csaf/CSAF_22/CSAF_22_Strategic_Approach_Accelerate_Change_or_Lose_31_Aug_2020.pdf.

16 Charles Pope, "Kendall presents unsparing blueprint for confronting China, other threats," United States Air Force, September 20, 2021, https://www.af.mil/News/Article-Display/Article/2781521/kendall-presents-unsparing-blueprint-for-confronting-china-other-threats/.

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