*US AIR FORCE*

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# Air Force Sustainment Center


15 April 2016

# *Foreword*

The Air Force Sustainment Center (AFSC) continues to make great gains toward achieving the Art of the Possible. While these gains have been significant, we've only started to realize the full potential of the Air Force's logistics and sustainment enterprise. In order to continue the trend of substantial improvements in the way we do business, we need a long-term vision to vector revolutionary changes to our business practices, process re-engineering, and technology development across the enterprise. A few years ago, based on the counsel and expertise of the Scientific Advisory Board and the National Research Council, we released the first version of *Complex of the Future* in October 2014. We quickly realized the opportunities for AFSC extended well beyond the boundaries of the Complexes. The title has unfortunately constrained the vision when communicating with our mission stakeholders. As the Complex of the Future vision and AFSC matured, I believed it necessary to revisit the foundations upon which it was created. In my role as the Logistics & Sustainment Enterprise Lead for Agile Combat Support, I must ensure that the vision set forth in this document encompasses all aspects of the AFSC mission with an additional focus on mission assurance. I have established a new title for this document: *Logistics & Sustainment Enterprise 2040.*

*LSE 2040* aligns with Secretary James's July 2014 call to action: *America's Air Force: A Call to the Future*. "The Air Force's ability to continue to adapt and respond faster than our potential adversaries is the greatest challenge we face over the next 30 years." The mission of the LSE is to provide enterprise logistics agility to support the joint force by delivering globally integrated, intelligent, and agile logistics and sustainment. The Command and Control of the LSE ensures that logistics decision-making is agile and informed, based on capacity, capability, risk, and cost awareness to deliver combat power. The vision of *LSE 2040* cannot be achieved without the support of the host installation to address mission assurance while expanding the field of view to include installation security, cybersecurity, installation/infrastructure resiliency (facilities, airfields, communications, and energy), and logistics Command and Control. The next revision of *LSE 2040* will incorporate attributes that refine the strategic vision for these four additional mission components. *LSE 2040* seeks to improve the agility of the AFSC enterprise to provide war-winning support to the warfighter.

I view this endeavor as a three-pronged approach and provide the following Commander's Intent:

First, the *LSE 2040* must achieve unity of effort by establishing common goals. Just as weapon systems have modernization programs, the *LSE 2040* is the infrastructure modernization vision and strategy that will enable the logistics and sustainment enterprise to be agile and remain relevant and capable of delivering combat power for America well into the future.

Second, the *LSE 2040* strategy takes an integrated approach iteratively releasing capabilities to achieve the 30-year vision while coordinating robust continuous process improvement and technology development. All participants must exude strategic patience and a long view in developing the right long-term mission assured posture for AFSC. Agile war winning logistics and sustainment capability can only be achieved through disciplined commitment to the *LSE 2040* vision by the process owners from across the supply chain, maintenance, research and development, and installation and support enterprises.

Third, the *LSE 2040* strategy must foundationally treat the LSE as a collection of strongly interwoven installations providing combat power across multiple domains: Air, Space, and Cyber. The strategy must strengthen and facilitate the reality of a singular AFSC mission architecture and not perpetuate a perspective of three depots and multiple supply chain providers.

The *LSE 2040* is intended to help answer the questions: Are we improving processes and investing in technology with the *LSE 2040* vision in mind? Are the analysis of needs and problems we are seeking to resolve appropriately framed into DOTMLPF (Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities) capabilities ensuring a common vernacular exists to provide a laser focused definition of capabilities and requirements?

My intent regarding the *LSE 2040* is ambitious. It will push us to reach across organizational lines to form new partnerships. It will drive us to make hard investment decisions. It will force us to think about process improvements from a multi-decade, Art of the Possible perspective. Based on our successes thus far in AFSC, I'm confident we will not only achieve this vision of the *LSE 2040*, but we will exceed it in many ways. Our country and our Air Force deserve our very best as we look toward the future; our national security demands it.

LEE K. LEVY II
Lieutenant General, USAF
Commander

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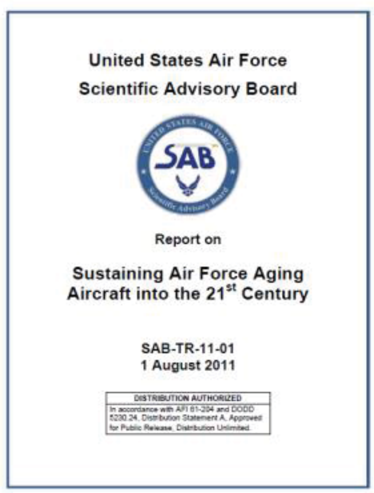
## Executive Summary

*Logistics and Sustainment Enterprise 2040 (LSE 2040)* represents both a multi-decennial vision and a management and execution strategy in the pursuit of vastly improved logistics and sustainment enterprise (LSE) operations. *LSE 2040* provides a LSE infrastructure modernization plan that addresses needs and gaps at an enterprise level. The *LSE 2040* vision serves as the north star for guiding leadership prioritization of game-changing LSE improvements in 5-year increments through 2045. To date, a list of nine *LSE 2040* attributes have been developed that serve as guideposts to break the LSE environment down into manageable pieces to fully transform the Air Force Sustainment Center's (AFSC) people, processes, resources, and capabilities. *LSE 2040* addresses many of the recommendations in the United States Scientific Advisory Board report, dated 1 August 2011, on Sustaining Air Force Aging Aircraft into the 21st Century and in the National Research Council's 2011 report, *Examination of the U.S. Air Force's Aircraft Sustainment Needs in the Future and Its Strategy to Meet Those Needs*. (Figure 1) The *LSE 2040* management and execution strategy relies upon the incremental identification of technology gaps, needs, and constraints. In response, the attribute owners will deploy improved re-engineered processes, continuous process improvement (CPI), training, and new technologies.


United States Air Force
Scientific Advisory Board

Report on

Sustaining Air Force Aging Aircraft into the 21st Century

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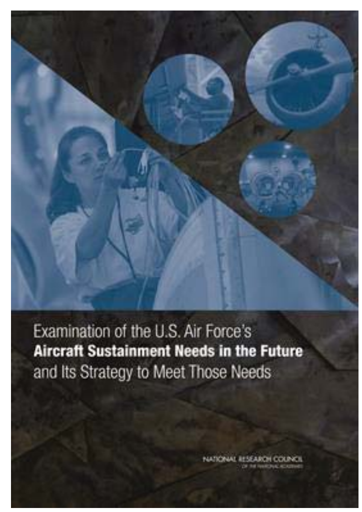


**Figure 1 – SAB and NRC reports**

A roadmap for each *LSE 2040* attribute will be developed separately and utilize the 30-year *LSE 2040* vision as a foundation. The roadmaps break down the 30-year time horizon into incremental 5-year phases with specific tactical programs that will provide tangible benefits, improvements, and return on investments (ROIs) to the LSE. *LSE 2040* stems from AFSC's Art of the Possible (AOP) vision ensuring that appropriate investments are made today, paying it forward, so that the needed technologies, training, and processes are mature and incorporated into programmed depot maintenance (PDM) and LSE processes to achieve AOP efficiencies and cost-effectiveness.

**The *Logistics and Sustainment Enterprise 2040* vision enables LSE infrastructure modernization through a focus on new or re-engineered processes and technology infusion to reduce costs and execute the sustainment mission safer, greener, and faster while improving quality and process discipline.**

## Introduction

*LSE 2040* is founded on the AFSC Way and Leadership Model (Figure 2) and complements the scientific method of the production machine. The strategy promotes a future enterprise with AOP performance achieving the right results the right way providing services that meet or exceed speed, safety, and quality parameters at a cost-effective bottom line. *LSE 2040* centers on the nine attributes shown in Table 1 along with their major success characteristics and AFSC and AFRL owners and co-leads, respectively. Each attribute is described in more detail in Appendix B.

The nine attributes are mapped to the leadership model to correlate how *LSE 2040* supports the leadership model (Figure 3). The attributes contain technology needs, gaps, and constraints that when incrementally resolved will improve the effectiveness, efficiency, and agility of the LSE's people, processes and resources. The improvements cannot be achieved without an environment that promotes teamwork, accountability, respect, transparency, credibility, and engagement across the spectrum of stakeholders and close collaboration with AFLCMC and AFNWC.

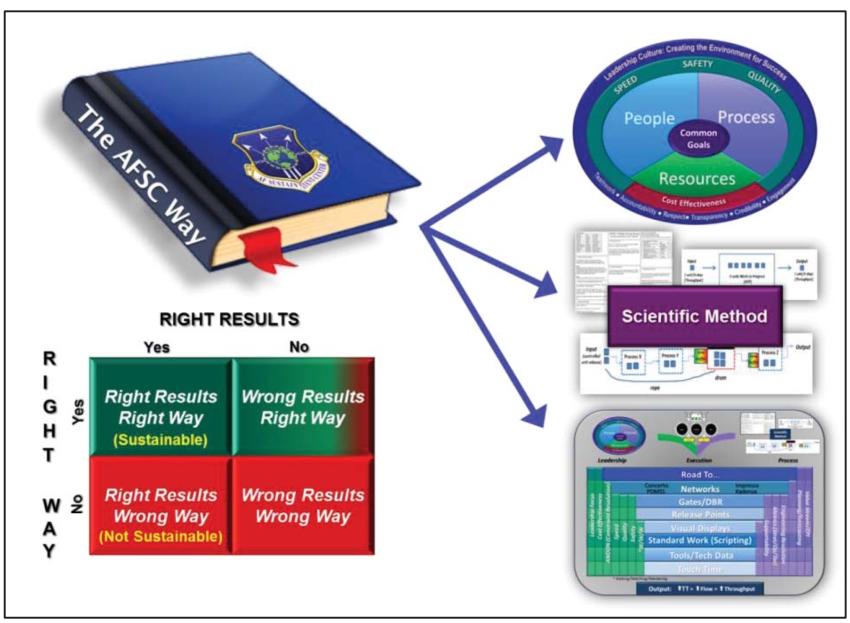


**Figure 2 - AFSC Way and Leadership Model**

| Attribute | | Major Success Characteristics | Attribute Owner/Co-Owner | Execution Group |
|---|---|---|---|---|
|  | **1. 100% Data Integration & Availability** | All Data Sources are Digital (Digital Thread)<br>Common Software Tools to Manipulate the Data<br>Tail Number Weapon System/Commodity Digital Twins<br>Data Fusion and Linkage to SME on Production Floor | AFSC/EN<br>AFRL/RX | IEG |
|  | **2. 100% Parts Availability** | 100% On-Time, Cost-Effective Parts Availability<br>Rapid Certification of New Parts & Sources<br>Accurate Parts Forecasting<br>Agile Local Manufacturing<br>3-D Reprocurement Packages | 448<br>SCMW/DLA<br>AFRL/RX/RQ | SCMEG |
|  | **3. Safe & Environmentally Compliant** | Processes and Facilities That Are Inherently Safe<br>Eliminate All Hazardous Materials from Processes<br>Eliminate All Dangerous Tools & Working Conditions | AFSC/EN<br>AFRL/RXS | DMEG |
|  | **4. Efficient Depot** | One-Pass, Whole Weapon System NDI Assessment<br>Perfectly Scheduled PDM Tailored to Individual Tail<br>Extensive Robotics (Where Appropriate)<br>Technology Enabled Reconfigurable Facilities<br>Data Fusion of Digital WCDs | AFSC/EN<br>AFRL/RXM | DMEG |
|  | **5. Effective Workforce** | Clear Daily (8 hour) Work Expectations<br>Training Aligned with Complex Mission/Goals/Objectives<br>Less Intrusive & Capability Enhancing Personnel Protection Equipment | AFSC/DP<br>AFRL/RH | DMEG |
|  | **6. 100% Process Control** | All Processes Configuration Controlled & Managed<br>Each Process Ideally Tuned: Statistical Process Control<br>Processes as Good/Better Than Commercial Practices<br>Balance of Quality Assurance & Quality Control | AFSC/EN<br>AFRL/RX | DMEG |
|  | **7. Strategic Sustainment Management** | Single AFSC Entry Point for Workload<br>Common MRO Toolsets Across The ALCs<br>Enterprise Loading of Common Production Capabilities<br>Planning Tools That Optimize Workloads Among ALCs | AFSC/LGX<br>AFRL/RX | SCMEG |
|  | **8. Resilient Mission-Ready Software Sustainment** | Resilient software development, tools, and processes<br>High fidelity WS simulations for val/ver/test/training<br>Technology driven cross complex collaboration/innovation | AFSC/EN<br>AFRL/RI | DMEG |
|  | **9. Energy Efficacy** | Enabler in Meeting Air Force Energy Reduction Goals<br>Energy Savings an Important Criteria for New Equipment Selection | Energy Consortium<br>AFRL/RX | IISEG |

## Table 1 – *Logistics and Sustainment Enterprise 2040* Attributes

**Note: Execution Groups are defined in AFSCMAN 90-105, *AFSC Integrated Decision Making Framework*.**

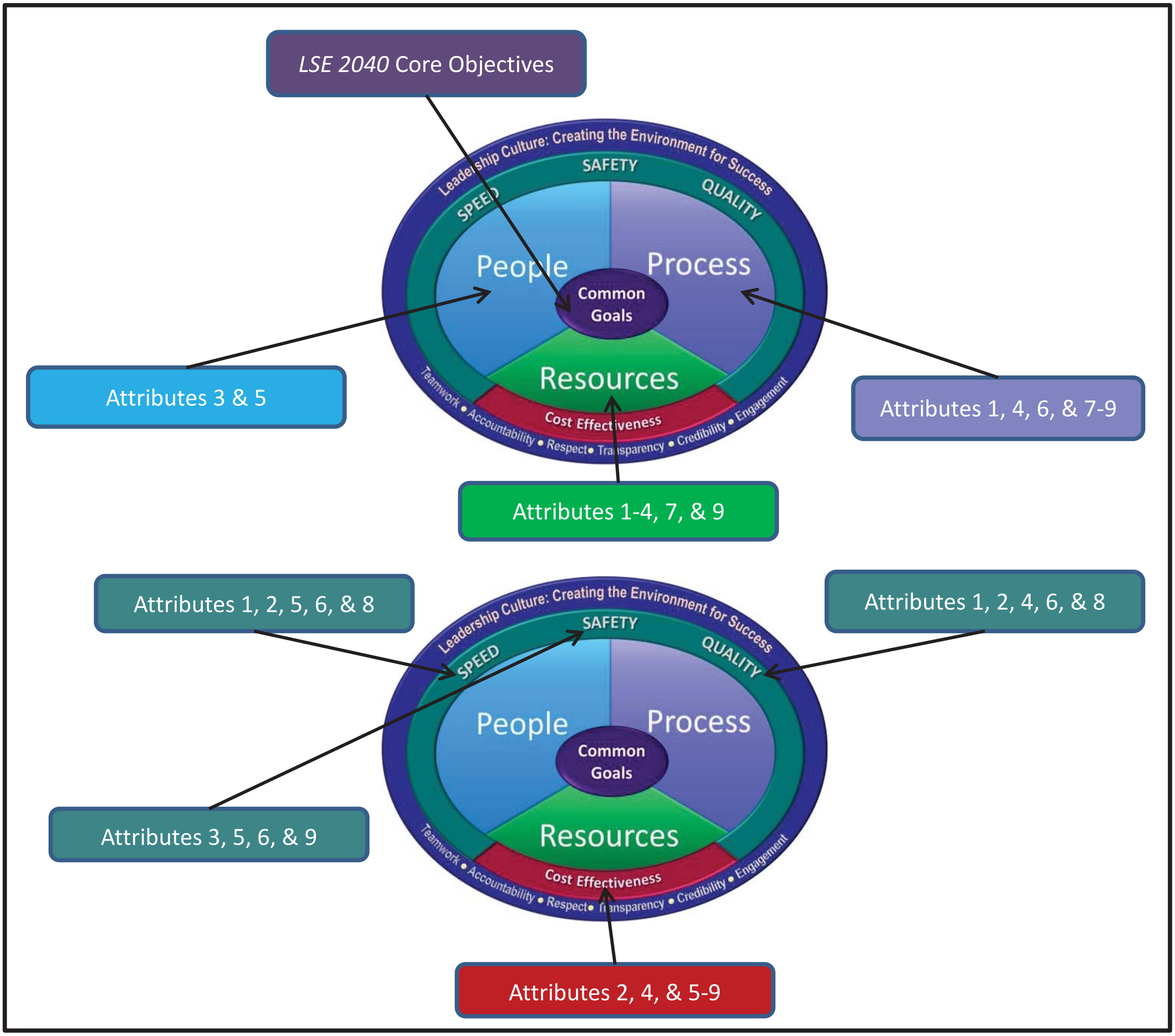


**Figure 3 – *LSE 2040* and Leadership Model Correlation**

## Current State

Historically, the Complexes have had a culture that emphasized short-term tactical thinking. The focus was appropriately on getting the current weapon systems, commodities, and software on the shop floor completed and out the door. Consequently, most technology insertion and/or upgrade projects were tactical in scope to address a specific Maintenance Squadron's or Group's needs to optimize without addressing the larger LSE. This resulted in pockets of excellence and disconnects between AFSC's strategic needs and the ALC's individual tactical projects.

The Supply Chain and the Complexes lack a long-term strategy to help guide common technology development and insertion across the LSE. Previous endeavors to develop a strategic vision were started, but were unsustainable because the three ALCs and the Supply Chain operated independently of one another within AFMC. However, with the AFSC stand-up, sustainment senior leadership can better integrate and leverage common technologies across multiple weapon systems, ALCs, and the Supply Chain. AFSC is successfully achieving needed cost savings through its Road to a Billion and Beyond campaign with a focus on cost-effective engineering through extensive engineering reviews of Bill of Materials on multiple systems. Out-year campaigns will not realize substantial savings unless we re-engineer how we do business today. We must invest today in better future-state processes and repair and manufacturing technologies to make them available over the next 20-30 years. The incremental approach to *LSE 2040* will enable AFSC to facilitate improvements year to year as we rapidly push maturing processes and technology into the production machines.

## Logistics and Sustainment Enterprise 2040 Assumptions

1. The *LSE 2040* Strategic vision encompasses a 20 to 30-year horizon with incremental implementation of improved processes and capabilities.
2. Encompasses maintenance, workforce safety and environmentally compliant Complexes, and the LSE.
3. The sustainment mission will not fundamentally change (e.g., the fleet mix will remain steady).
4. In the 1960s, approximately 5% of the functionality of our weapon systems was controlled by software. That number has grown to more than 80%. Our military is very software reliant, with the newest F-35 Joint Strike Fighter requiring more than 9M lines of code and the KC-46 Pegasus more than 15M lines of code. Software support is expected to triple in the next 10 years with upgrades to current models and new aircraft entering our inventory.
5. Demand for advanced aerospace materials, advanced sensors and a host of integrated systems will drive the requirement for engineers and scientists significantly higher.
6. Environmental regulations will only get tougher (i.e., DoD Emerging Contaminants of Regulatory Interest Program).
7. The "true north" metrics are cost, schedule, safety and quality, and aircraft availability.
8. MILCON dollars are very limited.
9. *LSE 2040* is cross-functionally supported and funded utilizing a diverse portfolio of funding sources such as depot activation, Small Business Innovation Research (SBIR), Rapid Innovation Funding (RIF), Capital Investment Program (CIP) and many others.
10. AFSC, AFLCMC, AFNWC, AFRL, DLA, OEMs, suppliers and other partners will work in a cooperative collaborative manner in support of the *LSE 2040* Attributes, Phases, and actionable Steps to implement them across the enterprise.

11. The cycle time from technology gap identification to resolution and implementation on the shop floor can vary from 1-2 years to as much as 10 years. AFSC is committed to investing in needed technologies over the long haul.
12. *LSE 2040* is not static, rather it is a dynamic plan that will require annual reviews, adjustments and updates to ensure that it remains relevant and executable.
13. *LSE 2040* will be integrated with all technology insertion efforts/sources within AFSC.
14. Public-Private partnerships will continue to be enablers in achieving Art of the Possible performance.
15. The transformative improvements in operational efficiency and effectiveness of our depot operations will be achieved through focused technology insertion and improved re-engineered processes.

## Relationship to Other Strategic Planning Efforts

*LSE 2040* is complementary with the strategy documents listed below because *LSE 2040* is focused on the processes and technologies necessary to execute the future sustainment mission in a more cost-effective and efficient manner focused on speed, quality, cost, and safety. The *LSE 2040* initiative provides a transformative approach grounded on innovative inter-disciplinary partnerships across key sectors of DoD, business, industry, and academia. *LSE 2040* is a future-forward framework to explore complex sustainment-related problems and technical challenges from every possible angle to create practical, relevant, sustainable cost-effective solutions.

1. <u>AF Depot Maintenance Strategy (DMS)</u>. (OPR: SAF/IEL) The AF DMS ensures AF weapon systems and equipment are operational and available to support mission requirements. *LSE 2040* has several attributes that plan investigation of technologies and processes that directly pursue the five major tenets of the AF DMS. These tenets are:
    a. Posturing current/future capabilities and technologies across the organic enterprise
    b. Maintaining world-class infrastructure/processes through investment and transformation initiatives
    c. Viable complementary private sector capability and leveraging public-private partnerships
    d. Depot performance to meet warfighter requirements
    e. Retaining professionally skilled workforce
2. <u>AFSC Industrial Energy Plan</u>. (OPR: AFSC/LGMI) AFSC is the largest process energy (PE) consumer in the Air Force. Saving energy is vital to energy independence and controlling out-year production costs. Attribute 9 (Energy Efficacy) fully supports this plan and seeks to identify the technology insertion efforts the ALCs must incorporate to support and execute the Industrial Energy reduction objectives. Technology insertion activities must find a balance in the trade-off among investment, conservation, and industrial production capabilities.
3. <u>AFSC Technology Development Insertion Process (TDIP)</u>. (OPR: AFSC/ENSI) The TDIP is AFSC's approach for identifying technology insertion needs and is executed IAW AFSCI 61-101, *Technology Development and Insertion Process*. The technology

requirements/gaps are prioritized based upon alignment with *LSE 2040*. Requirements that align with *LSE 2040* will fare well in the prioritization review and presentation to the AFSC Technology Governance Board (TGB). The TDIP will provide all stakeholders a consistent, strategically focused set of technology needs in which to invest intellectual and financial resources.

4. AFMC Sustainment Technology Process (STP). (OPR: AFMC/A4D) *LSE 2040* intrinsically supports the STP through the AFSC TDIP process and the AFSC Technology Governance Board. Needs/requirements with a 20 to 30-year out technology horizon will work through the STP for prioritization into the Agile Combat Support (ACS) Core Function Master Plan (CFMP)/Program Objective Memorandum (POM) process.
5. AFSC Strategic Plan. (OPR: AFSC/LG) This plan identifies the AFSC mission, strategic vision and goals. The AFSC Logistics Directorate's Strategic Planning Division (LGX) develops short definitions, OPRs, and strategic objectives for each of the annual goals. AFSC strategic objectives are woven throughout the *LSE 2040* and are mutually supporting. *LSE 2040* is readdressed annually to ensure that it remains aligned, relevant, and reflects the strategic goals and objectives of AFSC.
6. Flightline of the Future. (FoF) (OPR: LM Aero) FoF is an annual effort started in 2011 to improve flightline planning and operations for legacy and future aircraft to include F-35 sustainment integration with legacy infrastructure. As part of FoF, a Cooperative Research and Development Agreement (CRADA) with the Air Force Academy and Lockheed Martin Aero evaluates technologies for insertion into flightline operations in collaboration with ACC/A4 per the 2020 vision to increase effectiveness and efficiency for warfighters. The resulting competition among the Air Force Academy and US Military Academies includes projects focused on the application of enabling technologies. The FoF is intended to be applicable across all USAF flightlines and all platforms. In 2013, AFSC/EN began collaborating with Lockheed Martin Aero to propose new topics and shape proposed topics in the competition to expand the scope of the effort to include *LSE 2040*. Topic calls are provided in the May – July timeframe each year for incorporation into the project portfolios that can be selected at each Academy for the following school year's activities.
7. AFRL Sustainment Science and Technology Strategy. This strategy describes the Air Force Research Laboratory (AFRL) views on maintaining cutting edge technology from a broad range of technology areas (e.g., structural and functional materials and their fabrication processes, sensors and diagnostics, airframes, propulsion, space, manufacturing, etc.). Key tenets to achieve available, safe and affordable aerospace systems are defined to guide the AFRL Science and Technology (S&T) Investment Strategy. A key tenet of the strategy is to partner with AFSC to develop science and technology solutions that will advance the LSE 2040 vision.

## LSE 2040 Attribute Development and Execution Process

**Brainstorming:** LSE 2040 development began in December 2012. Subject matter experts from across the LSE brainstormed the major technology gaps and needs presenting significant present-day constraints to Art of the Possible performance. Brainstorming meetings were held with AFRL, AFSC, each of the three ALCs, and the 448th Supply Chain

Management Wing (SCMW) to clarify the LSE 2040 development. *LSE 2040* coalesced over the period between December 2012 to July 2013 and resulted in the identification of the initial Attributes 1 through 7. Further refinements occurred over the next year and an additional attribute addressing software sustainment was identified and authored as Attribute 8. As *LSE 2040* evolves and current attributes are executed, the planning process will identify new attributes that will contribute to achieving the vision of continually improving capability within the LSE. Attribute 9, Energy Efficacy, was added in December 2014 as an outcome of the annual review.

**Planning:** LSE 2040 planning includes the development of a roadmap for each attribute. Given the complexity of *LSE 2040*, each attribute will have a co-lead from AFSC and AFRL. AFSC/EN will lead the overall development and execution of *LSE 2040*.

**Execution:** Each attribute and roadmap identifies the AFSC 2-letter long-term Owner/Lead and AFRL Co-Lead. This owner will take over the responsibility of executing/management of that attribute's roadmap. AFSC/EN will lead the overall *LSE 2040* initiative and multiple attributes, and will lead the annual updates and vector checks on this living document. An annual LSE 2040 Visioneering Summit will be held to assess progress on current attributes and to brainstorm and accept nominations for new attributes and the tailoring of existing attributes. New LSE 2040 attributes may be added annually as a part of the review process but attributes should not be de-scoped significantly for 3- year periods. Holding the attribute scope relatively stable for 3 years will enable AFRL, academia, and industry a chance to respond appropriately to the need, gap, or constraint.

**Governance:** The AFSC LSE 2040 Governance Structure will utilize the existing AFSC-integrated decision making framework (IDMF) in accordance with AFSCMAN 90-105, *AFSC Integrated Decision Making Framework.* Individual attributes will be led by the attribute owner and performance metrics managed by the respective integrated execution group. Roadmaps documenting the activities that seek to facilitate achieving the attribute objectives will be developed by the attribute owners. These will document cost, schedule, and performance metrics measuring progress toward those objectives. Status of the individual attributes will be briefed to the responsible execution group as identified in Table 1 bi-annually. The status of *LSE 2040* will be briefed annually to the AFSC Integration Board in accordance with the AFSC IDMF providing an overall performance picture of the Center toward meeting the objectives of *LSE 2040*. As technology insertion/process improvement activities mature and are implemented at a specific location across the enterprise, AFSC/EN will manage the development of Technology Proliferation Plans (TPPs) that seek to proliferate these technology successes across AFSC. These plans will address cost, schedule, funding, facilities, return on investment, and implementation timelines. TPPs will be presented to the AFSC Technology Governance Board (TGB) for approval and implementation management. Once approved by the TGB, the TPP will be vetted and prioritized through the IDMF. Execution of the technology insertion activities will be predominately funded and executed through Science & Technology avenues, the Complexes, and/or the 448 SCMW.

**Schedule:** The strategic and tactical schedules for each attribute can be found in the separate roadmaps. The roadmaps should identify the interaction with other roadmaps and seek to deconflict the associated schedules. These schedules are developed and updated by the long-term attribute owners to reflect the progress and changes in the program.

## Future State

*LSE 2040* provides a framework for defining a holistic picture of the future-state of the LSE within AFSC. It enables one to assess the linkages of what may be seemingly unrelated technology needs and gaps and tying them back to the roles and missions of AFSC. These linkages will provide academia, AFRL, and industry a sight picture of why these identified requirements are important and where they fit. Within the Air Force, *LSE 2040* provides the big picture of why particular technology investments are important to the future success of AFSC. Many new technologies will have taken 10-20 years to mature and deploy; therefore, investment activities in S&T must begin today. Appendix A contains an overview of the development of whole aircraft robotic laser de-paint. This program's evolution is representative of the LSE 2040 management and execution strategy. The future state LSE provides world-class cost-effective sustainment support to the warfighter with superior speed, quality, safety, and process discipline.

The LSE aspires to have the following characteristics:

1. World-class provider of LSE support for manned and unmanned aircraft, missiles, engines, vehicles, support equipment, software, and automated test equipment.
2. Widespread implementation of automation (e.g., robotics) to either remove or minimize the exposure of the worker to hazardous operations and/or improve LSE efficiency.
3. AFSC is a leader in VPP where STAR sites are the norm across the enterprise.
4. AFSC technology investment has resulted in an industry-leading reduction in workforce injuries.
5. Digital data and data fusion technologies are employed at the point-of-use from planners to maintainers on the shop floor.
6. Prognostic and autonomic systems aid the LSE in better maintenance and supply chain decision making.
7. Hazardous materials, processes, and/or conditions are minimized in LSE operations.
8. Emerging Environmental, Safety, and Occupational Health (ESOH) issues are addressed proactively rather than reactively.
9. The hierarchy of controls is so effectively implemented that the requirement for Personal Protection Equipment (PPE) is the exception rather than the norm.
10. Water contaminants, air quality emissions, and hazardous waste streams are minimized.
11. Industrial Process Energy (IPE) is measured and managed and conservation is a key capability driver in new technology workloads, process improvements, and equipment investments.
12. The LSE is the leader in achieving the energy reduction goals of the AFSC.

13. The LSE is energy independent and has balanced the investment in alternate energy sources and the use of alternate processes and technologies that consume less IPE. Air Force energy goals are achieved through technology insertion initiatives.
14. Work packages are tailored precisely to the specific part number/tail number of a commodity/weapon system to remove waste from the process flow.
15. All critical technical processes in the Complex are under 100% process control with configuration management and statistical process control driving process improvement activities. Processes are as good or are better than best commercial practices.
16. Subject matter experts are identified and accessible either on-site or via remote augmented reality to enhance engineering support to production processes.
17. Game-changing technologies are consistently deployed across the entire LSE versus pockets of excellence (i.e., Material replacements, robotics for common processes across the three Complexes etc.).
18. The science of the machine is efficiently implemented such that waiting, walking, and wandering of the mechanic is minimized, output per man-day approaches 8.0, the workforce is highly enthusiastic and engaged, and workcards establish a clear expectation of the work to be completed on a specific shift.
19. One hundred percent of production is on-time, under-cost, and on-quality.
20. Local manufacturing acquisition lead time is less than 6 months from contract award to completion of first article acceptance inspection.
21. Cutting-edge game-changing rapid manufacturing technology and processes are deployed across the LSE all the way down to the unit level under configuration control and with exceptional repeatable quality.
22. Complexes are cost-effective because of the balanced investment in new technologies, processes, and workforce training and equipment.
23. Process modernization is a key enabler in improving the production efficiency and reducing costs of sustaining our legacy weapon systems.
24. One hundred percent error-free software is the result of improved verification, test and training capabilities at the Complexes.
25. Seamless collaboration among the Complexes creates innovation in software development that leads the DoD software industry.
26. Software development environments are capable of resisting to or adapting to or repelling adversaries that are threatening DoD weapon system software capabilities.

## Summary

It is apparent with the AFMC reorganization and continued AF budget challenges that now is the time to leverage our USAF, AFMC, and AFSC-wide talents to chart a course to revolutionary changes in our LSE operations. As part of this effort, we need to develop and implement advanced Science and Technology (S&T) and process re-engineering activities that enable our Air Force to sustain its aircraft fleet and systems to achieve the required readiness at an affordable cost. The maintenance, repair, and overhaul arena has abundant opportunities for near and long-term technology insertion, process improvements, as well as investment in future visioning research and studies to address our most difficult strategic S&T challenges. Our responsibility in developing and executing the Logistics & Sustainment Enterprise 2040 is to think outside the box and conceptualize future capabilities of/in the organic depots, and how S&T can be used to achieve that Art of the Possible. Further, it is clear that the best way to do this is to bring together experts from the LSE and S&T areas and have them discuss current and future sustainment needs and gaps. It will take all of us, all functions and business areas, working collaboratively to not only refine the Roadmaps, but to determine the priorities to address those areas together as a team effort among AFSC, AFLCMC, AFNWC, AFRL, DLA, OEMs, and other partners as we move towards the Logistics & Sustainment Enterprise 2040.

# Appendix A:  Example LSE 2040 Program

## Example Program: Whole Aircraft Robotic Laser De-paint

Note: This example pre-dates the development of *Logistics and Sustainment Enterprise 2040* but it is representative of the management and execution strategy envisioned. This effort began with the identification of a technology gap, iteratively funded research and development with AFRL, incremental deployment of capability concurrent with continued research and development, and finally, deployment of final capability utilizing capital investment program funding.

Back in 2004, an engineer in the OO-ALC production group identified a technology gap in the aircraft and commodity de-paint technology area. He identified the need to remove the maintainer from the hazardous working environment of mechanical or chemical de-painting aircraft or commodities. Plastic Media Blasting (PMB) stripping and new generation chemical strippers were considered the Art of the Possible at that time. Additional development investment was needed to create and qualify PMB media that was usable on composite structures. The engineer had witnessed paint stripping utilizing commercial handheld lasers leading him to envision a handheld laser being transformed into a robotically controlled whole aircraft de-paint stripping process removing the operator from the hazardous process. Thus began a 14-year, $40 million incremental process working closely with AFRL and industry to develop and deploy a capability. Table 2 presents the list of diverse funding streams that funded this winning technological breakthrough. *LSE 2040* will utilize this strategy of inter-related investment programs for funding the spectrum of technological needs over the next 30 years. An incremental solution was deployed in less than 5 years that provided for robotic laser de-paint of commodities, becoming what is now known as the Laser Automated De-Coating System (LADS). This system reduces F-16 radome stripping from 18 hours to 45 minutes capturing 99.99% of the top-coat/primer waste-stream without generating additional stripping by-products such as chemical strippers or contaminated PMB media. The system removes the operator from the hazardous environment and saves the Air Force more than $330,000 annually over the traditional chemical/mechanical de-paint processes. The whole aircraft development effort continued as LADS proved the tremendous cost savings and workforce protection capabilities of robotic laser de-paint. The spring of 2014 saw the initial lab qualifications of a whole aircraft robotic laser de-paint system for the F-16. Full-up systems for whole aircraft laser de-paint capability are currently being installed and qualified at OO-ALC for the F-16 and C-130. (Figure 4) Upon completion of these qualification activities and Low Rate Initial Production validation, AFSC/EN will work to develop and present a Technology Proliferation Plan (TPP) to the LSE 2040 Governance Board. The TPP will seek to proliferate this technology usage across other weapons systems, aircraft and commodities at WR-ALC and OC-ALC. This success story is indicative of the LSE 2040 funding, development and implementation process.

**Figure 4 – C-130 Robotic Laser De-Paint Stripping From 2004 Technology Gap to Art of the Possible 2014**

| **Robotic Laser Depaint Investments** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Office/Program | Funding and FY | | | | | | | | | | | | | | | |
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| **Handheld Laser Development** | | | | | | | | | | | | | | | | |
| AFRL | $560K | | | | | | | | | | | | | | | |
| AFMC Polution Prevention (P2) | | $2.52M | | | | | | | | | | | | | | |
| Environmental Security Technology Cerification Program (ESTCP) | $2.335M | | | | | | | | | | | | | | | |
| NASA | | | | | | | $50K | | | | | | | | | |
| AFMC/A4 Handheld Laser Evaluation | | | | | | | | | | | $400K | | | | | |
| AFMC/ A4 Commercialization Pilot Program (CPP) - SBIR Transition Funding (Handheld Laser procurement & Transition) | | | | | | | | | | | | $3.0M | | | | |
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| **Robotic Laser Development** | | | | | | | | | | | | | | | | |
| AFMC P2 | | | | | | $1.736M | | | | | | | | | | |
| ESTCP | | | | | | $1.285M | | | | | | | | | | |
| AFMC A4 Hill AFB - LADS Replacement | | | | | | | | | $2.250M | | | | | | | |
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| **Full Aircraft Laser Development** | | | | | | | | | | | | | | | | |
| AFMC P2 | | | | | | | | | $8.029M | | | | | | | |
| AFMC A4 | | | | | | | | | | | | $600K | | | | |
| AFMC CIP | | | | | | | | | | | | | $18M | **F -16 2 Robots** | **C-130 4 Robots** | |

**Table 2 – Robotic Laser De-Paint Investment Portfolio**

# Appendix B: Logistics and Sustainment Enterprise 2040 Attributes

## Attribute 1 - 100% Data Availability

**1.0 Attribute Name**. 100% Data Integration and Availability

**1.1 Description**. This attribute focuses on providing all required data at the point of use via a single entry point. Technology deployment will provide real-time decision making, planning agility, efficient data mining, and improved communications and data analysis. Data from various sources will be dynamically linked and integrated providing the necessary tools, models, and predictive analysis to convert raw data into useful information. (Digital Thread and Digital Twin)

**1.2 Current Attribute Problem/Shortfall/Limitation**. Technical data is not all in digital form, is rarely interconnected, and requires extensive human manipulation to get useful information. Other issues include (1) the lack of complete data, (2) the lack of digital data, (3) the lack of verifiable data pedigree, quality, and configuration control, (4) the lack of point-of-maintenance/use information technology (IT) infrastructure and associated data delivery technology, (5) the lack of a single entry point for accessing currently available digital data, (6) the lack of a robust data search/retrieval capability, (7) the lack of data integration across the AFLCMC, ALC, AFSC, AFNWC, AFMC, USAF, & DoD enterprises, (8) the inability to convert data into usable information via models and tools, (9) the lack of data in real-time or near-real-time, (10) the data format variances, and (11) the lack of 3-D models to support engineering and reprocurement/local manufacturing activities.

**1.3 Desired Outcome**. Provide mechanics, maintenance engineering, production planning, production management, supply chain, and support staff access to all relevant data in a structured data format needed to perform their daily tasks. Provide a conduit for data to be relayed throughout the LSE from the mechanic to the various support organizations so that planning, scheduling, supply chain, 202/107 requests, etc. can be expedited and impacted in real time. For example, a mechanic opens a sidewall panel on an aircraft to incorporate an upgrade and discovers a wire harness not routed in accordance with the published data package. The mechanic/engineer will be able to easily access the materiel review board (MRB) or a 202 disposition that previously directed the alternate routing because the original harness had been previously repaired. Data fusion will be the norm and utilized in conjunction with augmented reality heads-up display-glass safety glasses to include live audio and video feed and communication with subject matter experts enhancing data presentation and format. Video work control documents and real-time engineering support are envisioned usages for these enhanced formats. Multiple user-friendly virtual environments tailored to each type of user will exist to view/display, enter/upload, access/retrieve/alter, and search/analyze data to execute the AFSC mission. MROi systems will provide real-time display of the maintenance status of commodities and aircraft within the maintenance Complexes. A Product Life Cycle Management (PLM) toolset will be deployed enabling digital capture, manipulation, and management of all data from the mechanic on the shop floor to the engineer in the program office. LSE agility is enabled by the implementation of a model based environment across all business, financial, maintenance, and technical processes in AFMC, DLA, and industry.

## Attribute 2 – 100% Parts Availability

**2.0 Attribute Name.** 100% Parts Availability

**2.1 Description.** This attribute focuses on the technology and processes to source and approve/certify the correct parts, where and when needed, delivered timely and at a "fair" cost, regardless of the source of procurement. Sources are the Defense Logistics Agency (DLA), ALC or contract repair, local manufacturing, "the boneyard" or 309th Aerospace Maintenance and Regeneration Group (AMARG), surplus sources, and Defense or commercial suppliers. The key aspects under AFSC influence include: defining requirements accurately, forecasting accuracy, 100% visibility of all inventories, discrepant materials handling, rapid manufacture or innovative supply of parts to include high volume and one-off/obsolete parts, agility in the rapid certification of industry/Complex local manufacturing sources, upholding/improving quality, maintaining parts integrity, and configuration management. Parts integrity is the ability to know and track each aircraft, part, or end item's status, expected lifetime, and component information in the LSE. Ensuring a forward looking, protected, viable, and healthy supply chain in a global economy fraught with inherent and evolving risks and threats.

**2.2 Current Attribute Problem/Shortfall/Limitation.** Agile Cost Effective Parts Availability is a challenge due to (1) insufficient/uncorrelated forecasting, (2) current methods do not interface or easily incorporate aircraft or commodity-specific data gathered by such methods as pre-induction inspections, nondestructive inspections (NDI), and operational use information, (3) inadequate visibility into inventories at the commodity or subcomponent level, (4) lack of agility, (5) counterfeit parts including for profit criminal intent and state actor malicious logic, fraud, (6) low first article test pass rates and associated poor supplier performance and unacceptably lengthy timeline first article acceptance process, (7) difficulty sourcing the raw stock materials to manufacture the end item, (8) lack of piece part visibility after delivery from suppliers, (9) Bill of Materials (BOM) for maintenance operations are incomplete and maintenance operations are not fully planned, (10) consolidations and reorganizations do not always maintain the source of repair (SOR) as a viable organic repair source, and finally, (11) other risks to the supply chain in a global economy.

**2.3 Supply Chain Resiliency and Risk Mitigations.** Supply chain risk mitigations are continually enhanced and upgraded to minimize the risk that DoD's warfighting mission capability will be impaired due to threats and vulnerabilities in system design or sabotage or subversion of a system's mission critical functions or critical components, by foreign intelligence, terrorists, or other hostile elements, or through natural or economic disasters. This includes improved source inspections, evaluations, source selection processes, product verification testing, discrepant material reporting and handling, counterfeit and malicious logic parts, and fraud. Reduced vulnerability to disruptions in associated supply chain infrastructure, data systems, protection of Mission Critical Functions to Achieve Trusted systems and networks, delivery and ensure supply chain resiliency including flexibility, adaptability, and responsiveness for threats not currently identified.

**2.4 Desired Outcome.** Agile Cost Effective Parts Availability is having the right quality parts where and when needed at a cost-effective price. A key element is the improved selection and sustainment of qualified, capable, and competent suppliers and associated long-term healthy relationships and partnering. The LSE will rapidly source and qualify new suppliers (including organic) and incorporate new or innovative repair processes and technologies where reasonable and effective. Rapid manufacturing technologies and processes have been incorporated into the LSE incorporating alternate manufacturing solutions such as material substitution of modern extrusions, additive manufacturing, etc.  Processes and technologies are in place to rapidly identify alternate methods or raw materials to manufacture the end items.  Near-real-time (NRT) certification processes of special needs applications will improve the cycle time and effectiveness of the organic first article qualification process.   3-D models will be developed where reasonable and effective and provided to suppliers for the manufacturer of spares to support the LSE and continue to improve the probability of first pass quality during first article acceptance and follow on production part/lot acquisitions through oversight and control of qualified and competent sources.  SCM and DLA-integrated activities reduce hand-off and cycle time.  BOMs are reviewed annually to assess actual usage versus forecasted usage and then updated to account for emerging issues ultimately replaced by real-time BOMs.  Recurring "stumble-on" and/or over-and-above repairs are engineered, planned, and incorporated into the work package and accounted for in the BOM (with appropriate usage or mortality factors) so that the supply chain can incorporate them into their demand forecasting and management activities.  Finally, the Logistics Requirements Determination Process (LRDP) is implemented across all commodity and weapons system repair lines.

## Attribute 3 - Safe & Environmentally Compliant

**3.0 Attribute Name**. Safe and Environmentally Compliant

**3.1 Description**. This attribute focuses on:

a) Identifying and eliminating unsafe and unhealthy working conditions.
b) Reducing/eliminating the abatement costs resulting from the continued use of hazardous materials during depot maintenance operations.
c) Reducing and/or eliminating the hazardous waste streams from the manufacturing processes.
d) Enhancing the effectiveness of the processes by instituting the proper hierarchy of controls, thereby minimizing the production efficiency losses due to the widespread usage of Personal Protective Equipment (PPE) in the workplace.
e) Reducing the amount and/or cost of industrial process energy consumed during and/or supporting depot maintenance operations.
f) Minimizing water contaminants, air pollutants/emissions, noise pollution, and hazardous waste streams to improve the environmental impact and cost-effectiveness of the LSE.
g) Implementing effective recycling programs and an efficient excess material utilization program.

**3.2 Current Attribute Problem/Shortfall/Limitation**. Key challenges include:
Depot maintenance operations require a vigilant engineering focus on the application of the proper hierarchy of controls to protect the workforce as prescribed by the Occupational Safety and Health Administration (OSHA). These are in order of precedence of the most effective to the least effective approach to manage the workplace safety hazard: (1) Elimination, (2) Substitution, (3) Engineering Controls, (4) Administrative Controls, (5) PPE. The historical approach by the Complexes has been to institute PPE as the preferred means of addressing the hazard rather than applying the appropriate systems engineering regimen and hierarchy of controls toward hazard resolution. Depot maintenance operations such as painting/de-painting, plating, and cleaning require hazardous materials including hexavalent chromium, cadmium, methylene chloride and other solvents that present environmental, safety, and occupational health (ESOH) risks. Handling, use, and disposal of these materials are covered under federal regulations such as 40 CFR, *Protection of the Environment*, and 29CFR*, Occupational Safety and Health Administration (OSHA)*, as well as numerous state and local regulations. Complying with applicable regulatory requirements for use of these materials is costly and requires time-consuming “behind-the scenes” processes including: environmental permitting, monitoring, record-keeping and reporting, hazardous materials handling and storage, hazardous waste storage and disposal, workforce medical physicals, personal protective equipment, industrial hygiene activities, and documenting compliance-related process requirements in Technical Orders. ESOH compliance failures have resulted in Notices of Violation from environmental regulators, OSHA citations, workforce exposure, injuries and elevated Workman’s Compensation expenses, increased maintenance costs, and adverse working conditions. ESOH compliance is a “must pay” bill that contributes to increased depot rates.

**3.3 Desired Outcome**. AFSC will efficiently and effectively comply with federal, state, DoD, and AF ESOH directives and goals. With approval from the Cognizant Engineering Authority (CEA), as appropriate, AFSC will (1) institute strong maintenance engineering process discipline founded upon the OSHA hierarchy of controls and (2) promote compliance by eliminating ESOH costs and risks by identifying, qualifying and implementing non-hazardous or less hazardous materials and processes.

AFSC is an industry leading Voluntary Protection Program (VPP) environment. VPP Star sites are the standard of excellence across the LSE. The AFSC safety management system is a key enabler of the lowest Total Case Incidence Rate for Injuries and Illnesses (TCIR)/ Days Away from Work, Restricted Work Activity, and/or Job Transfer (DART) rates in the industry.

AFSC shall be a leader in material recycling and the efficient usage of excess materials resulting from previously completed manufacturing activities.

# Attribute 4 - Efficient Depot

**4.0 Attribute Name**. Efficient Depot

**4.1 Description**. This attribute focuses on improving the operations within the Maintenance Repair Overhaul (MRO) environment to safely return a consistently high-quality asset (weapon system, engine, and commodity) to the warfighter at the best possible throughput and cost. Key aspects of the efficient depot include:

a) Factory/Depot Command, Control & Communications (C3) - ability to report, view and control all factory operations and resources across ALCs.
b) Flexible, Reconfigurable, and Responsive Depot Infrastructure and Support Equipment.
c) Comprehensive single-pass condition assessment of the weapon system at induction (or prior) to enable a tailored tail-number/serial number-specific work package.
d) Operations precisely tailored to the tail number-specific maintenance requirement and scripted to optimize the repair and return to the customer.
e) Instantaneous real-time collaboration directly or via augmented reality with SME community.
f) Advanced Automation - flexible and reconfigurable automation systems working in close proximity with, and augmenting, the human workforce.
g) Effective Exploitation of Emerging Processes/Technologies - rapid adoption, certification, and transition of game-changing processes/technologies.
h) "Delivery on time, every time."

**4.2 Current Attribute Problem/Shortfall/Limitation**. Key challenges include:

a) Scheduling of work tasks is not optimized, adaptable, or dynamic to produce assets on-cost and on-time in the most effective manner.
b) Standardized Gated Production Machines in the Aircraft Maintenance Groups across AFSC are in varying stages of maturity. These machines are critical path/drum buffer rope (DBR) oriented with varying degrees of process discipline focused on appropriately managing the critical path/DBR of the aircraft/commodity in the machine. Critical chain as a prioritization tool is in varying degrees of maturity across AFSC.
c) Current C3 is, to a great extent, manual. Efficiently orchestrating resources (parts, equipment, and manpower) is difficult, labor intensive, and time consuming on complex work packages.
d) Many depot processes rely on monuments – dedicated and expensive buildings and equipment.
e) Inspections are critical in determining necessary maintenance actions to restore aircraft or components to a safe condition. Current nondestructive inspection (NDI) methods are limited by coatings and contamination, are labor intensive, disruptive (x-rays, interactive with mechanics), and subject to human interpretation.
f) Many critical life limited component inspections require extensive disassembly to access NDI locations. Disassembly processes are not always non-destructive (i.e., the wing attach point disassembly to facilitate an inspection results in the need for replacement of critical fittings that otherwise have remaining service life).
g) Missed or late discovery of required maintenance impacts schedule and increases cost due to rework, awaiting engineering disposition, parts, and/or non-concurrent maintenance.
h) Depot processes are largely manual - little automation, consume large amounts of manpower, and result in variability in both execution and quality.
i) Development and certification of new maintenance and repair processes are time and resource intensive, hindering transition to the production floor.

**4.3 Desired Outcome**. Improved Throughput – return safe, high-quality major assets to the warfighter on-time, under-cost, first-pass quality, and with improved safety while adhering to stringent process discipline. This includes:

a) Complex Optimized Allocation of Resources – optimize resources across the Complexes in support of the Center by elimination of unnecessary (duplicate) work centers while maintaining the agility to shift work among Complexes in time of disaster or war.

b) Right Resources and Materials at the Right Time – The goal is to provide to the technicians what they need (correct resources, parts, tools, infrastructure, and information) exactly when they need it (just in-time delivery).

c) 100% Individualized PDM and Modification Scripts – (1) only perform the necessary work on the individual asset, (2) have an optimized schedule for the work tasks, (3) eliminating blanket repairs due to assumed defects and (4) optimizing the technician's time for repairs.

d) No Rework – 100% of the tasks completed correctly the first time. No rework due to preventable issues, late discovery of defects, or requirements added after induction into the repair process.

e) Rapid Condition Assessment – 100% accurate, up-front assessment of the condition of the asset with minimal disassembly to eliminate the discovery of additional required maintenance late in the MRO process.

f) Whole asset (aircraft, engine, commodity) inspection capability in a fully configured condition at induction that is able to view the asset in "slices," eliminating the need to disassemble to assess a critical structural condition. This inspection would take less than 24 hours or three contiguous 8-hour shifts to accomplish enabling: (1) The NDI operator is able to view internal built-up sandwiched/nested structures without any disassembly or degradation due to sealants and coatings and (2) Corrosion damage is easily discernable, internal, external, and intra-granular.

g) Automated C3 in scheduling resources, and orchestrating tasks.

h) Broad application of automation to reduce ESOH exposure of the workforce.

i) Easily reconfigured infrastructure to accommodate multiple weapon systems.

j) Effective management of industrial process equipment by implementing condition-based maintenance technologies.

k) Effective Development and Exploitation of Emerging Processes/Technologies – Processes enabling the development, rapid adoption, certification and transition of game changing processes/technologies are in place across the LSE.

# Attribute 5 - Effective Workforce

**5.0 Attribute Name**. Effective Workforce

**5.1 Description**. This attribute focuses on the effectiveness of the workforce. The workforce must be proficient and competent in all maintenance tasks with an added focus on supportability awareness, schedule and process discipline, and task completion documentation. The workforce must evolve in becoming universally proficient in consolidated skills. An example is the Federal Aviation Administration (FAA) Air Frame and Powerplant (A&P) licensed mechanic who has multiple skills and can complete a variety of different jobs to meet the mission. The industrial engineering technician workforce will have codified roles and responsibilities. Processes and standard work must be clearly defined and work control documents will be defined to be completed in less than a shift (8 or 10 hours). Work packages and training will be aligned so that the workforce can accomplish 8 hours of work assignments for 8 hours of time (or as adjusted for the length of the shift). There will be efficient task planning and non-value added work will be eliminated. Data/information needed to accomplish a work task will be available via hands-free data manipulation. Skills training will also be given just in time and tailored to the individual's needs through competency and proficiency-based assessments. Maintenance engineering will drive continuous process improvement that is supported by statistical process control data. The goal is to identify and streamline standard work and make the production machines more supportable, predictable, and efficient. Maintenance engineering will enhance the effectiveness of the workforce by instituting the proper hierarchy of controls, thereby minimizing the production efficiency losses due to the widespread usage of personal protection equipment (PPE) in the workplace.

**5.2 Current Attribute Problem/Shortfall/Limitation**. Current limitations include (1) Work Control Documents (WCDs) are greater than one shift decreasing efficiencies because of hand-offs to other shifts, (2) lack of standard work/schedule convolutes daily shift turnover meetings, (3) lack of a common planning and scheduling tool set across AFSC and production Groups, (4) software toolsets do not support efficient re-sequencing of daily operations to address constraints to critical path, (5) variability in the competency and proficiency among individual workers in the work place, (6) rapid movement to the next task is constrained due to lack of the following: standard work, rapid resequencing, prepositioned equipment/tools, and prepositioned parts, (7) multiple skill sets called out on WCD demand more scheduling orchestration than would be needed with a single skill consolidated workforce, (8) labor/management working relationships need improvement, (9) too much walking, wandering and waiting, (10) too much rework, (11) Working Capital Fund budget pressures drives poor outcomes on the most efficient balance of manning between direct and indirect labor, (12) technical data is presented to the technician in paper-printed format widely throughout LSE maintenance operations, (13) management of paper format technical information is inefficient and costly in the production environment.

**5.3 Desired Outcome**. Efficient, dynamic re-planning of WCDs on demand, decreased variance in WCD completion, effective training, and effective tools and information available directly to the mechanic. Tasks are so well scripted and supportable and processes are so efficient we eliminate the need for morning stand-up and shift turnover meetings. The right people are in the right jobs. Supervisors use Standard Core Personnel Documents (SCPDs), with performance plans where needed, to the maximum extent. Management will maintain positive working relations with union representatives and meet with them on labor business. Output per man day is maximized approaching 7.0. Increased efficiency equates to increased capacity that supports the warfighter at reduced cost. Digital hands-free presentation of technical data and information should be the preferred method of delivery and enhanced by data fusion and augmented reality technology.

These two technologies will enhance technical data and engineering support/assistance to production.

## Attribute 6 - 100% Process Control

**6.0 Attribute Name**. 100% Process Control

**6.1 Description**. This attribute focuses on control of all the technical processes that are planned, conducted, and executed throughout the depots.

**6.2 Current Attribute Problem/Shortfall/Limitation**. In the existing depot environment, there is a lack of clear or inherent controls for critical processes. This lack of process controls exposes the depot to a litany of potential challenges from environmental compliance to cost/quality/delivery/safety efficacy. In addition, there is not a clear consensus on what are the full set of each depot's technical processes. As important as cost, quality, and schedule are, each technical process in the depot does not track the schedule variance, cost variance, and quality variance. While the overall flow is meticulously tracked and reported, at the end of the day, it is the sum of all the individual processes that comprise the maintenance flowdays and cost. Without a clear POC for each and every process, it is difficult to assess if each process is adequately managed for robustness or benchmarked against commercial practices (where applicable). Statistical process control is non-existent in the Complexes and does not drive continuous process improvement. The science of the production machine is in the infant stages of deployment across AFSC.

**6.3 Desired Outcome**. The desired outcome is that the depots will have clear, measurable, and visible industrial process control with statistical process control driving continuous process improvement for all critical processes. In addition, having a structured tangible change management process will improve output quality and allow for structured, continuous process improvement; thus, it will ensure we can positively affect the four "true north metrics" of speed, cost, quality, and safety. Maintenance engineering will provide continuous process improvement oversight to enhance standard work and make the production machines more supportable by making them more predictable and efficient. Maintenance engineering will enhance the effectiveness of the processes by instituting the proper hierarchy of controls, thereby minimizing the production efficiency losses due to the widespread usage of PPE in the workplace.

## Attribute 7 - Strategic Sustainment Management

7.0 **Attribute Name**: Strategic Sustainment Management

7.1 **Description**. This attribute focuses on optimizing maintenance workload management across the enterprise and at the Air Force Sustainment Center (AFSC) level. AFSC will optimize workload across all the Complexes by serving as a single entry point to outside customers (AFMC/A4 is a significant participant). AFSC will have the capability to identify workload capabilities and shortfalls across the enterprise and use this information to intelligently pursue new workload and repatriated workload. An improved, single-interface solution will enable AFSC to share back shop and local manufacturing workload solutions among the Complexes, reduce costs, accelerate feedback loops, and develop greater local manufacturing agility. AFSC will have a robust and agile single-interface solution that provides optimum visibility and improvement opportunities for the Maintenance Repair Overhaul (MRO) enterprise based on capabilities and capacities utilizing the guidance reflected in the AF Technology Repair Center (TRC) construct. In executing this attribute, AFSC will not seek changes to public law.

7.2 **Current Attribute problem/shortfall/limitation**. The three Air Logistics Complexes (ALCs) operate with some different business processes creating an environment where AFSC cannot provide standardized guidance. AFSC does not have optimum visibility of capability, capacity, or cost across the MRO enterprise. There are many programs, processes and offices working multiple issues related to capacity, manpower, workload and so forth, but no aggregated data to allow analysis at the AFSC level. Analysis is performed in a variety of efforts throughout the enterprise but they do not use the same methodology. Even if AFSC had good data on capability and capacity, the lack of common equipment and tools makes temporary shifts to balance back shop and local manufacturing workload very difficult. A centralized enterprise-level Strategic Sustainment Management is necessary to provide an overall AFSC sight picture of current and future workload in areas such as backlog of workloads, surplus capacity, manpower requirements by skills, facilities capabilities, machine capabilities and space requirements. AFSC is at risk of discarding essential equipment and skill sets without Strategic Sustainment Management in place to review organic repair shop capabilities and verify interdependent capabilities are retained before restructures or consolidations. There is no enterprise level strategy in place to review any potential short or long-term workload reassignments. Repatriation efforts are not prioritized based on enterprise wide needs.

7.3 **Desired Outcome**. There will be a tool with the capability to properly integrate data from automated systems within a common infrastructure linking disparate data streams from the three ALCs into an accurate, actionable Strategic Sustainment Management. AFSC will take an enterprise level approach for capital investment management (disposal, reallocation and purchasing), back shop repairs, and local manufacturing workload across the MRO enterprise. There will be common MRO toolsets across the enterprise, an enterprise loading of common production capabilities and planning tools that optimize workload across the enterprise. Once collected, data must be fused and analyzed and the resulting analysis disseminated to targeted ALC audience and decision makers at the right time. This will require layered, mutually supportive analytic capabilities with improved data generation and dissemination methods that span the ALCs while maintaining appropriate security controls. Skilled program and logistics analysts will have the ability to convert mass data into actionable intelligence and then rapidly convey it to the appropriate recipients from enterprise leadership to production personnel. This comprehensive, centralized sight picture will allow analysts to search for similar processes, tools and equipment across the enterprise in order to find solutions to workload needs. This data will be evaluated in light of the AFSC 20 year depot workload projections to aid in future planning. It will also increase visibility and understanding of AFSC current and future workload capabilities, capacities, costs, gaps, shortfalls and other key metrics used to optimize the MRO enterprise's limited resources. AFSC/LG will use this analysis to provide recommendations that will include repatriation prioritizations from contracted workload and pursuit of new workloads such as more inter-service work, Foreign Military Sales (FMS) work, and other federal and state government agency work based on projected organic depot capacity, availability and capability. AFSC/LG will use this data to provide input into the AFSC Strategic Plan. When situations arise that justify a deviation from TRC construct, AFSC/LG and the Complexes will work with AFMC/A4 to optimize the MRO Enterprise's ability to accomplish AF core requirements. The future state of this attribute will provide Senior Leadership, Air Force Life Cycle Management and AFMC/A4 with trustworthy data resulting in data-driven decisions to make every dollar and minute count while delivering agile innovative war-winning capabilities.

## Attribute 8 – Resilient Mission-Ready Software Sustainment

**8.0 Attribute Name.** Resilient Mission-Ready Software Sustainment

**8.1 Description.** This attribute focuses on improving the Air Force's ability to sustain software products over the long term by using advanced science and technology. As weapon systems become more software intensive and complex, and adversaries look for ways to use cyber warfare against our software facilities, it is imperative that the Air Force Sustainment Center (AFSC) look for ways to advance and incorporate technology to improve the effectiveness of verification, test and training capabilities; employ collaborative techniques to address the increasing complexity of software sustainment across the enterprise; and assure resiliency of AFSC software development and engineering environments. The AFSC must be able to do this as seamlessly and cost-effectively as possible.

**8.2 Current Attribute Problem/Shortfall/Limitation.** AFSC software development and engineering environments are a potential target for adversaries who want to cyber-attack software intensive weapon systems. These environments use hardware and software design, engineering and test tools whose origins are unknown and are not tracked or considered, allowing for entry points for malicious code from adversaries into weapon system software. Loose and uncontrolled processes also provide entry points for threats to weapon system software. This can result in fielding software that could result in adverse conditions for our warfighters. In addition, modern weapon system software needs to operate in an interoperable battle-space with a diverse family of interrelated systems but is not tested early in the sustainment process with a high enough fidelity in a relevant and effective environment to discover issues until in operational testing or fielded. This can result in higher costs and lesser quality software after it has been fielded. Other areas that suffer from lack of fidelity in environments during software sustainment are warfighter requirements verification and training techniques. And finally, organic software sustainment is accomplished at three geographically-separate locations where communication and standardization among the three organic software groups is difficult. Each group is discovering innovative processes and techniques to design and sustain software. However, while much progress has been made via the AFSC Enterprise's various technological IPTs, additional work can be done to increase collaboration and efficiency. Organic software sustainment is accomplished at three geographically-separated locations, which presents unique challenges to standardization of processes, sharing of best practices, and collaboration of innovation.

**8.3 Desired Outcome.** The desired outcome is achieved when the AFSC Software Enterprise has resilient software development and engineering tools and processes within all cyber-secure software development environments; has high fidelity major weapon system simulations and test systems that are interconnected throughout the software enterprise where verification, test and training activities can be accomplished efficiently and in an interoperable environment reducing the amount of user evaluation; and use of constant and technology-driven collaboration and innovation such as gamification, virtual teaming, and code/design reuse among multiple AFSC software centers resulting in a highly effective and consistent environment to sustain weapon system software. The attribute pursuit of these advanced technology characteristics over the next 20 – 30 years will contribute to higher software product resiliency and quality, more process consistency and standardization, and increased agility and timeliness of software products delivered to the warfighter.

# Attribute 9 – Energy Efficacy

**9.0 Energy Management System (EnMS); Energy Efficiency (0% waste) and 100% Energy Availability**

**9.1 Description.** This attribute establishes the AFSC approach to improve industrial energy (IE) performance, including energy efficiency, consumption and availability as a critical mission resource. The intent is to reduce demand, improve production process efficiencies, reduce greenhouse gas (GHG) emissions and related environmental impacts, reduce costs, and improve energy security through the **systematic management of IE**. IE is an AFSC IE Plan (IEP) term encompassing a portfolio of Facility Energy (e.g., HVAC, ventilation, and lighting), Process Energy (e.g., painting, machining, plating, etc.), and Aviation/Ground Fuel Energy (vehicles, ground support equipment, aerospace ground equipment [AGE], engine and aircraft test) as defined in SAF/IE's Energy Classification Framework. IE includes electricity, fossil fuels (fuel oil, natural gas, propane, liquefied petroleum gas, coal, and diesel), energized waters (hot, chilled, steam), gases (e.g., compressed air, argon, nitrogen, etc.) and industrial waters (potable and non-potable).

**9.2 Current Problem/Shortfall/Limitation.** AFSC is the largest AF IE consumer due to our weapons system sustainment facilities, plant machinery, warehouses, and utilities infrastructure. Energy is a growing cost in our production budget as supply costs and consumption increase. Apart from cost, energy is a security concern as the majority of our energies come from commercial power sources, placing our mission at risk from supply disruptions. The DoD defines energy resiliency as having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet national security mission needs as well as the ability to recover from interruptions and price volatility of commercial energy sources. Renewable energy is a recognized method of providing security benefits and energy independence, but at a high cost compared to efficiency upgrades. ALCs require a constant and secure supply of energies to perform their missions; therefore, we must manage and improve the energy profile of our industrial mission while meeting customer expectations. Saving energy is a factor in controlling product costs and is vital to delivering mission capability. Our key challenges are balancing the efficiency-production trade-off and ensuring energy initiatives compete favorably in our funding processes.

**9.3 Desired Outcome.** AFSC/CC signed the AFSC IEP in 2012 stating the intent of his energy VISION is to, "Develop AFSC into a model organization for energy use and independence through world-class energy management;" therefore, GOALS of this Attribute are to (1) mature AFSC's IE management into a world-class management system, (2) reduce IE and water consumptions and costs through conservation and technology insertion of more energy-efficient equipment and processes that meet or exceed AFSC's 5% Year-Over-Year energy and water reduction strategic goal and ultimately contribute to Federal, DOD, AF, and AFMC energy reduction mandates, and (3) achieve energy independence through technology insertion of high efficiency alternate energy sources. Where fiscally and technically feasible and in coordination with the appropriate Cognizant Engineering Authorities (CEA) and supporting business case analyses (BCAs), our OBJECTIVES are to:

**a)** Establish an independently certified International Organization for Standardization **(ISO) 50001 EnMS** at each ALC by 2020 that:

1. Provides continual process improvement incorporating the principles of the AFSC Way, Art of the Possible and The Road to…, etc.
2. Utilizes advanced energy monitoring systems,

3. Integrates disparate data streams for management decision-making and control, enabling optimization of energy use and Condition Based Maintenance (CBM) methods to extend the life, utility and efficiency of production equipment.
4. Deploys energy-efficient and/or "green" designed technologies.
5. Merges efficient energy practices into organizational operations.

**b)** Certify 20% of our **facilities under** the **Superior Energy Performance**® (SEP™) ANSI/MSE 50021 **standard** by 2021 with all of those certified achieving energy performance improvement recognition of:

1. Silver (5%) Status by 2024.
2. Gold (10%) Status by 2027.
3. Platinum (15%) Status by 2030.

**c)** Attain near **NETZERO energy status** by 2035, producing almost as much energy from on-site generated renewable energy as consumed (*National Renewable Energy Laboratory Net Zero Energy Military Installations: A Guide to Assessment and Planning,* Technical Report NREL/TP-7A2-48876, August 2010).

1. Achieve NET75 (return 25% of consumed) by 2020
2. Achieve NET50 (produce 50% of consumed) by 2025
3. Achieve NET25 by 2030

**d)** Attain near **NETZERO water status** by 2035, limiting water consumption and returning almost all of the water drawn to the same watershed so as not to deplete the region's resources.

1. Achieve NET75 (return 25% of water drawn) by 2020
2. Achieve NET50 (return 50% of water drawn) by 2025
3. Achieve NET25 by 2030