BY ORDER OF THE COMMANDER
EDWARDS AIR FORCE BASE

EDWARDS AIR FORCE BASE
INSTRUCTION 63-100

7 JULY 2017
Certified Current, 4 May 2021
Acquisition

LIFECYCLE SYSTEMS ENGINEERING OF TEST CAPABILITIES AND INFRASTRUCTURE

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RELEASABILITY: There are no releasability restrictions on this publication

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OPR: 412 TW/TENG

Certified by: 412 TW/CT
(David G. Wheaton)

Pages: 17

This Edwards Air Force Base Instruction (EDWARDSAFBI) implements Air Force Test Center Instruction (AFTCI) 63-100, *Lifecycle Systems Engineering of Test Capabilities and Infrastructure*. It provides informational guidance on Lifecycle Systems Engineering (LSE) Processes for all Test Capability and Infrastructure (TC&I). This Instruction is applicable to all 412th Test Wing (TW) organizations executing projects intended to develop, field, and sustain test and evaluation (T&E) capabilities necessary to support U.S. Air Force and other Department of Defense (DoD) T&E requirements. T&E capabilities include the tools, equipment, and facilities which are directly and primarily used to support test operations. They do not include general purpose facilities and infrastructure. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Form 847 from the field through the appropriate functional chain of command. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of in accordance with the Air Force Records Information Management Systems (AFRIMS) Records Disposition Schedule (RDS) located at **https://www.my.af.mil/gcss-af61a/afrims/afrims/**. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

Chapter 1

PROGRAM OVERVIEW

1.1. Objective. The purpose of this instruction is to establish disciplined Lifecycle Systems Engineering (LSE) processes for all Test Capability and Infrastructure (TC&I) projects across the 412th Test Wing. It establishes roles and responsibilities, management processes, and identifies the timing of events necessary to support Test Wing and Air Force Test Center (AFTC) resource planning processes. It also provides implementation guidelines for the eight LSE technical management processes specified in AFTCI 63-100. This instruction addresses the concept development processes for formal investment programs such as United States Air Force Test Investment Planning and Programming (TIPP) and Central Test and Evaluation Investment Program (CTEIP), and for development efforts seeking internal funding. It applies to developments using Reimbursable Budget Authority (RBA) customer funds as well as programs which seek to research new Test and Evaluation capabilities through advancement of technology such as Small Business Innovation Research (SBIR) and Air Force Office of Scientific Research (AFOSR). The goal of the 412 TW LSE process is to effectively plan and validate test capability needs, develop and gain approval of test capability proposals, perform advanced planning as required for material solutions, and ensure TC&I projects are properly managed and receive the appropriate level of oversight during the development and sustainment phases.

Chapter 2

ROLES AND RESPONSIBILITIES

2.1. Wing Commander shall:

2.1.1. Appoint a Wing-level Technical Authority.

2.1.2. Advocate for resources necessary to conduct and sustain effective and efficient Systems Engineering (SE) processes, tools, and procedures.

2.1.3. Approve and implement an organizational SE Operating Instruction (OI) consistent with Air Force Test Center (AFTC), Air Force Material Command (AFMC), and other Air Force (AF) Instructions (AFTCI 63-100, AFMCI 63-1201).

2.2. Test Wing Technical Authority shall:

2.2.1. Establish the Systems Engineering Council (SEC) to administer implementation of organizational LSE processes and approve LSE process tailoring criteria as necessary.

2.2.2. Ensure TW SE process documents (instructions and procedures) are reviewed annually and updated as required.

2.2.3. Keep the Wing workforce current with respect to evolving LSE policies and guidance.

2.2.4. Ensure that a self-assessment of the Organizational LSE processes is conducted at least annually in accordance with (IAW) AFTCI 63-100. A combined assessment of a subset of the organization's projects/programs is acceptable, IAW AFMCI 63-1201, Implementing Operational Safety Suitability and Effectiveness (OSSS&E) and Life Cycle Systems Engineering (LCSE).

2.2.5. Ensure that Critical Program Information (CPI) is identified and protected IAW AF and local CPI policy and procedures. Plans to protect CPI shall be documented in the Life-Cycle Management Plan (LCMP) or equivalent document.

2.2.6. Develop and implement a mechanism that encourages continuous organizational and engineering process improvement and seeks best practices consistent with (AF policy and procedures (AFTCI 63-100, AFMCI 63-1201, AFTCI 16-501).

2.3. 412 TW Systems Engineering Council (SEC). The 412 TW SEC, consisting of technical leadership within the Wing and chaired by the 412 Test Wing Technical Director (412 TW/CT), serves as the governing body by administering the implementation and providing oversight of the 412 TW LSE processes. The 412 TW/CT will appoint a secretariat who will be responsible for setting the agenda, publishing meeting minutes, tracking action item status and maintaining the SEC information database. Designated personnel from 412 Test Engineering Group (TENG), 412 Electronic Warfare Group (EWG), 412 Communications Squadron (CS), and 412 Operations Group (OG) will support the SEC, as required. The specific SEC membership is captured by the SEC Charter.

2.3.1. The SEC is responsible for oversight of 412 TW development programs across all test-related mission/mission support areas. The SEC will integrate the LSE activities and ensure that the TC&I are in place to meet the needs of current and future customers. The SEC approves proposal submissions for all formal investment program "Calls", including prioritization of proposals. The SEC does not have authority to allocate resources, it provides a recommended course of action to the TW Council. The final authority to allocate TW resources is the TW Council.

2.4. Systems Engineering Board (SEB). Systems Engineering Boards will be established to provide a lower level of oversight and integration of the TC&I development and sustainment activities within key test capability areas as shown in figure 3.1. Each SEB will be chaired by a Master Architect (MA) or Technical Advisor as designated by 412 TW/CT. Membership of the will be described by each respective SEB Charter.

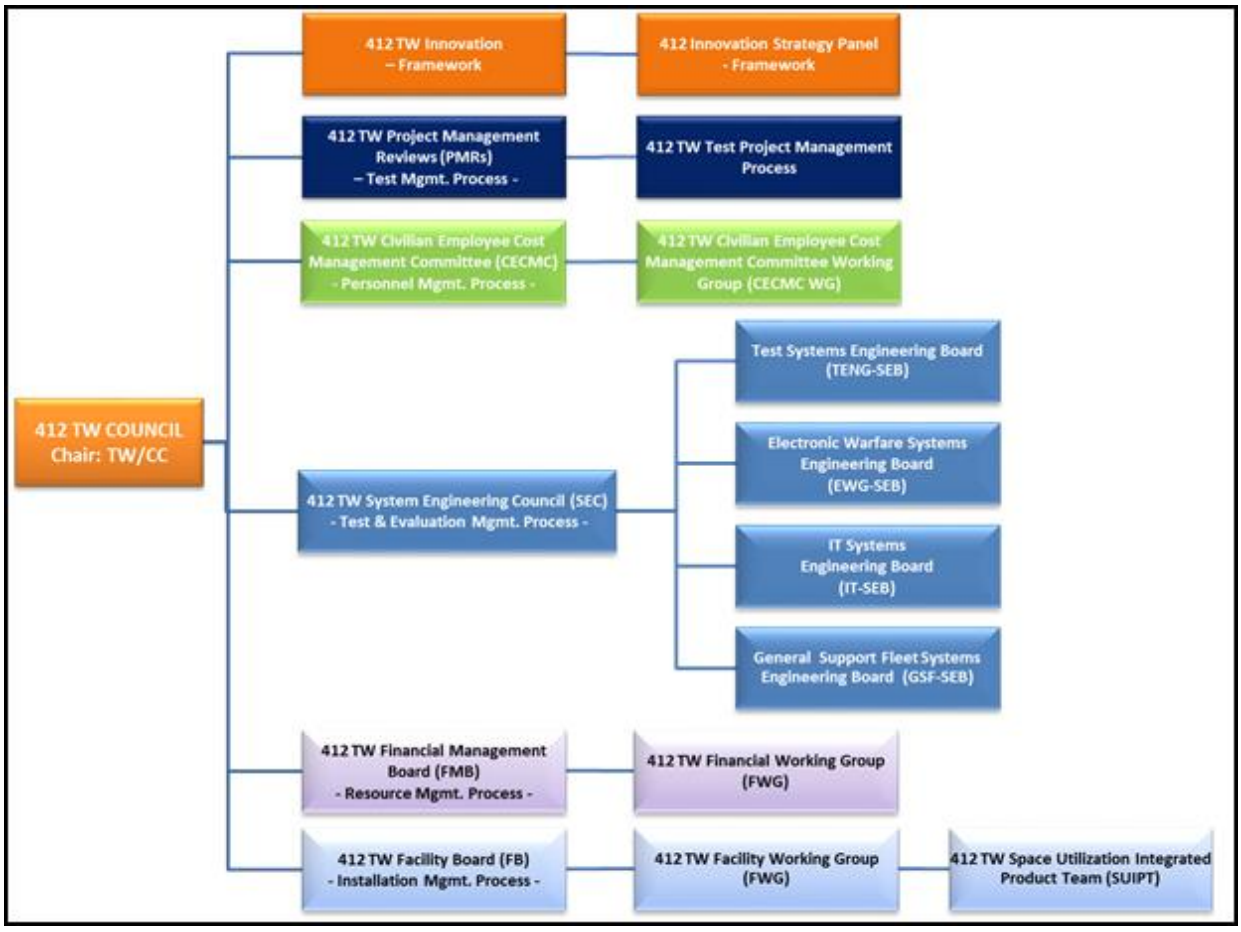
2.4.1. The SEB is responsible for assessing and validating capability requirements, validating shortfalls/needs, authorizing proposal development, and maintaining technical oversight of 412 TW test capabilities across their respective mission/mission support areas. The SEB is also responsible for approving capability development strategies within their respective mission/mission support areas and subsequently endorsing and prioritizing capability proposal packages within a mission area. The SEB is responsible for reviewing the existing investment portfolio for TC&I to re-validate requirements and adjust priorities as needed. The SEB's will elevate LSE issues that cross mission areas to the 412 TW SEC. The SEB subsequently presents a capability review summary briefing to the SEC. The SEBs will coordinate with the SEC secretariat to bring forward issues requiring SEC action.

Chapter 3

GUIDANCE AND PROCEDURES

3.1. Interface with 412 TW Corporate Governance . The 412 TW corporate governance structure is shown below in figure 3.1. The SEC is an advisory body to the 412 TW Council and will report to the Council for issues requiring 412 TW/CC approval. The SEBs are advisory bodies to the SEC and will report to the SEC for issues requiring Wing Commander's approval. As advisory bodies, the SEC/SEBs will recommend courses of action regarding the LSE of TC&I and may be delegated decision approval authority by the 412 TW/CC. Recommendations from the SEC will be approved by the Test Wing Commander prior to presentation at the AFTC level.

Figure 3.1. 412 TW Corporate Governance Structure.

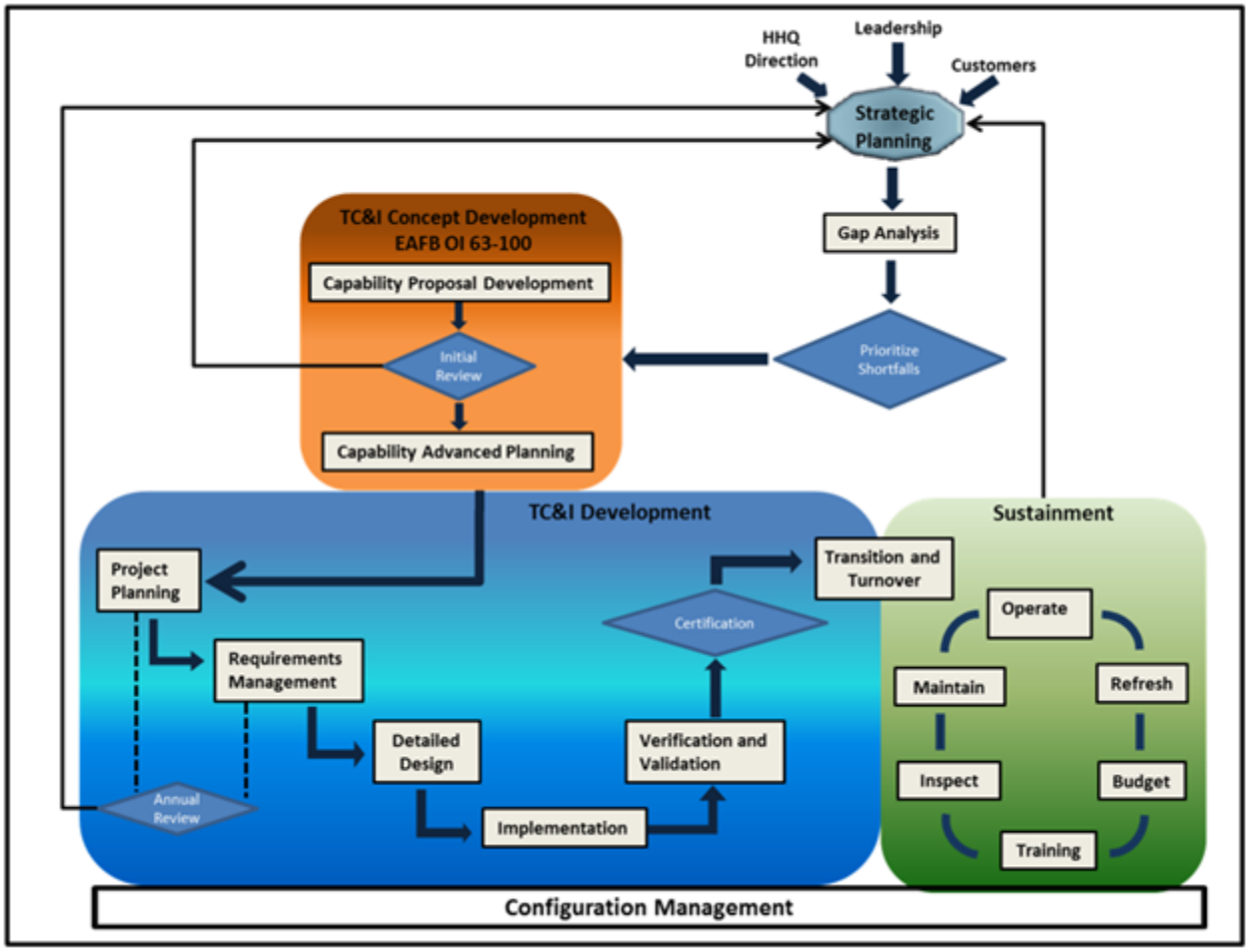


3.2. Lifecycle Systems Engineering (LSE) Processes. The planning, development and sustainment of TC&I follows a standardized set of LSE processes across the Test Wing. The overall LSE process is shown in Figure 3.2. It consists of three major phases: TC&I Concept Development, TC&I Development, and Sustainment. Resource shortfall inputs are identified via a strategic planning process which includes gap analysis and shortfall prioritization. Details

describing the process steps, entry and exit criteria for the major decision points, tools, and templates are included in the TW LSE handbook.

3.3. Strategic Planning Process. The 412 TW LSE processes for TC&I are driven by the AFTC and 412 TW strategic planning process. The TW strategic planning process takes inputs ("drivers") from a variety of sources, including Higher Headquarters (HHQ) direction, leadership, customers, and the internal Systems Engineering (SE) processes (squadrons, SEBs, SEC), to create a 412 TW Strategic Plan which provides direction for use in updating test capability development plans (roadmaps).

Figure 3.2. 412 TW Lifecycle Systems Engineering Process.



3.4. Integration with Resource Planning Processes. The 412 TW LSE processes interface with the 412 TW and AFTC Resource Planning processes. Information on test capability requirements, gaps, and planned development and modernization projects which have been coordinated through formal LSE processes are provided as inputs to the TW resource planning and programming processes where they are rolled up and prioritized with other organizational resource requirements. Once vetted through Test Wing corporate processes, they are provided as inputs to the AFTC T&E Resource Planning process as described in AFTCI 16-501, Test and Evaluation (T&E) Resourcing Process. The Resource Planning processes are facilitated by Plans

and Programs (XP) and Financial Management (FM) organizations at the Test Wing and AFTC levels and subsequently determine funding for proposed development efforts.

3.4.1. The AFTC T&E Resourcing OI (AFTCI 16-501) requires submission of 412 TW TC&I inputs to the AFTC Mission Area Panels (MAP) via Capability Roadmaps. The test capability roadmaps associated with each of the MAPs are requested in July of each year and must be endorsed by the 412 TW SEC prior to submission. Similarly, the AFTC Investment and Modernization (I&M) process commences with a consolidated capability "Needs" call in September. A subsequent cycle of "Solutions" development follows after individual "Needs" have been validated and prioritized by AFTC and Air Staff. These Needs and Solutions submissions also require SEC endorsement. Figure 3 shows the overall 412 TW strategic planning and resourcing event timeline.

Chapter 4

MANAGEMENT PROCESSES

4.1. Technical Management Processes. The 412 Test Wing employs eight LSE technical management processes. These processes can be tailored depending upon cost, risk, and complexity of the project as described in Attachment 2.

4.1.1. Decision Analysis. Decision analyses through the use of Analysis of Alternatives (AoA), trade studies, decision briefs or other tools as appropriate, will be accomplished to consider options and propose recommendations in support of key decisions throughout a TC&I project's development and acquisition lifecycle. These decision analyses will be documented and available for review by the SEB and/or SEC depending on the tailoring criteria as described in attachment 2. The level of documentation required will depend on the complexity, technological risk and cost of a proposed TC&I project, but at a minimum it must support the acquisition strategy, technical approach and operation and sustainment (O&S).

4.1.2. Requirements Management. Requirements will be developed and documented for each 412 TW TC&I development project. When appropriate, multiple requirements documents or formal requirements reviews may be required for a project involving multiple increments and/or subprojects. Once approved, the requirements will set the project functional baseline used for system design and verification.

4.1.3. Project Planning. Project Planning begins when a TC&I development project is approved and programmed by the funding authority. At the onset of the TC&I Development and Sustainment project phase, the LSE process and documentation requirements should be defined to ensure the proper level of oversight and management is being applied as determined using the tailoring criteria.

4.1.3.1. Life-Cycle Management Plan (LCMP). A LCMP may be required for a TC&I development project based on the approved tailoring criteria. The LCMP describes the overall acquisition and program management strategies, as well as life-cycle sustainment support strategy and disposal. For complex efforts, the LCMP will be initially written at a strategic level and updated with increasing level of detail as the project matures. Certain funding sources (e.g., CTEIP) require different documentation of the acquisition, program management and sustainment strategies, for those projects, the required documentation will be considered equivalent to the LCMP.

4.1.4. Design and Implementation. 412 TW TC&I project personnel will create an overall acquisition strategy, product support approach, and the technical management processes and incentives to ensure design and sustainment objectives are met. This includes ensuring technical representatives from the appropriate functional and O&S organizations have necessary insight and input into design and implementation activities. For design being performed by contractors, the project manager (PM) and technical lead (TL) will ensure the appropriate level of reviews and reporting are prescribed in the contract. The O&S organization will support all project reviews with the necessary technical expertise. In the event that government personnel are performing design and/or implementation activities, the

PM and TL will ensure design activities are properly documented and reviewed according to the approved tailoring criteria.

4.1.5. Risk Management. Each TC&I development project will have a risk management plan which describes the approach for identifying, analyzing, mitigating, tracking, and controlling performance, cost and schedule risks. The Risk Reporting Matrix in the TW LSE handbook will be used for the evaluation and reporting of program risk assessment findings. The status of critical risk areas, as defined in the risk management plan or LCMP, will be updated in project status reports and Program Management Reviews (PMRs).

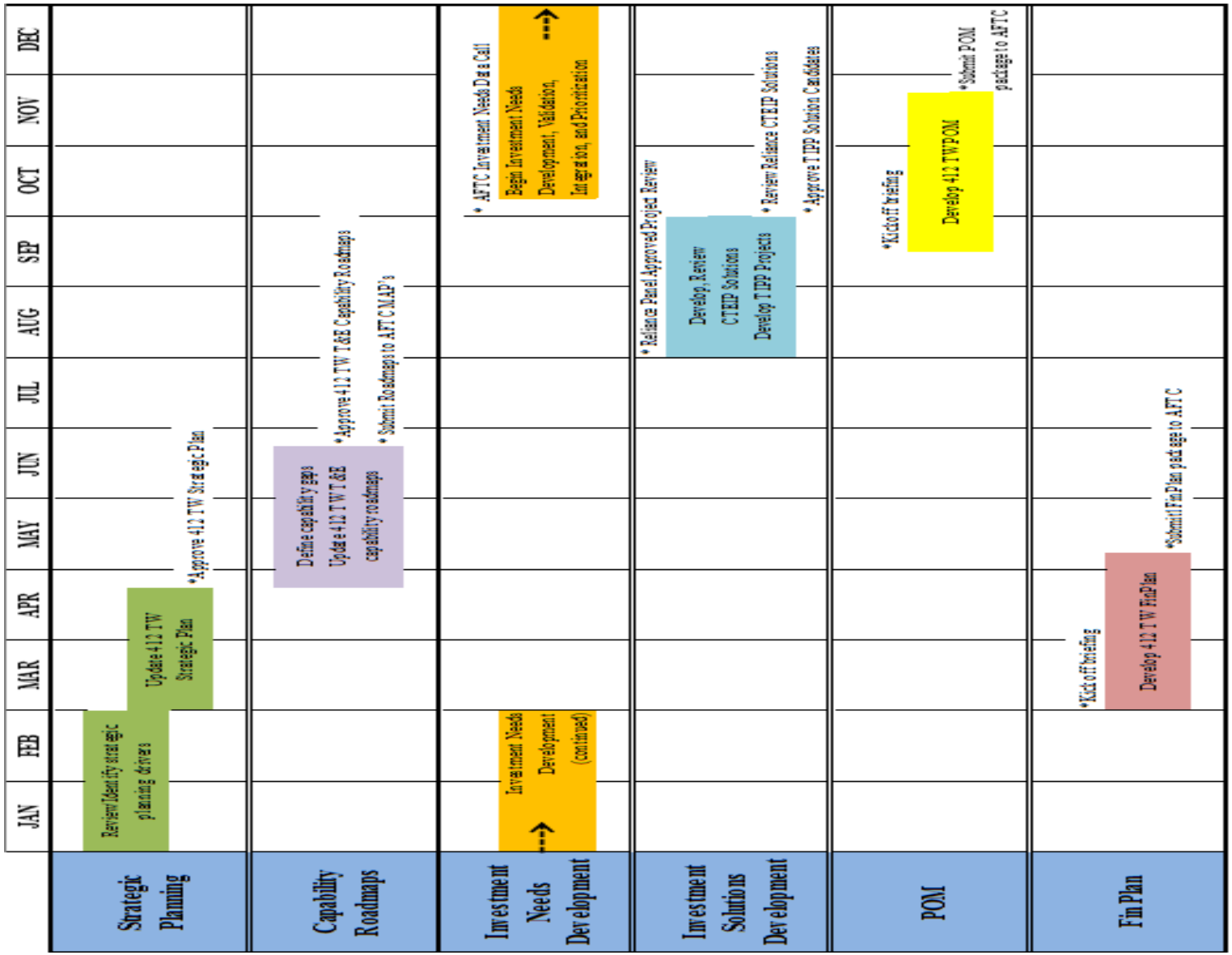
4.1.6. Technical Management and Control. The technical management and control process includes management and control of the project's cost, schedule, and performance. It begins when a proposed TC&I development project is approved by an authorized funding authority and continues until a TC&I is transitioned to a receiving O&S organization. The PM will provide project status reports to the mission area SEB and other project stakeholders as required. Program Management Reviews will be provided to the appropriate mission area SEB and SEC at least annually.

4.1.6.1. The PM is responsible for the accomplishment of project objectives within cost, schedule and performance constraints. If performance trade-offs are required that eliminate critical capabilities, then these trade-offs will be approved by the SEB and or SEC (depending on cost and complexity/risk).

4.1.6.2. The project technical lead (TL) is responsible for managing technical performance. This includes leading the project requirements development efforts, design activities, and verification and validation (V&V). The TL is also responsible for identifying and tracking performance deficiencies throughout the development process.

4.1.7. Data Management. Data products required for sustainment of the system throughout its lifecycle including all technical information and computer software, will be identified and documented in the LCMP or equivalent. Of particular importance is the identification and description of the technical data rights for each of the key system components and how the data will be provided to the O&S organization.

Figure 4.1. 412 TW Strategic Planning and Resourcing – Event Timeline



4.1.8. Configuration Management. Configuration management will be implemented by the applicable SEB. The configuration management plan will describe the process for establishing and maintaining the products' functional baseline, that change is controlled and documented, that interfaces are defined and understood, and that there is consistency between the product and its supporting documentation.

CARL E. SCHAEFER, Brigadier General, USAF
Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFMAN 33-363, *Management of Records,* 1 Mar 2008

AFMCI 63-1201, *Implementing Operational Safety Suitability and Effectiveness (OSSS&E) and Life Cycle Systems Engineering (LCSE),* 14 Oct 2009

AFTCI 63-100, *Life Cycle Systems Engineering of Test Capabilities and Infrastructure,* 19 Mar 2015

AFTCI 16-501, *Test and Evaluation (T&E) Resourcing Process*, 18 Nov 2015

Adopted Forms

AF IMT 847, *Recommendation for Changes of Publication*

Acronyms and Abbreviations

412 EWG—412th Electronic Warfare Group

412 TENG—412th Test Engineering Group

412 TW—412th Test Wing

412 TW/CT—412th Test Wing Technical Director

AF—Air Force

AFMAN—Air Force Manual

AFMC—Air Force Material Command

AFOSR—Air Force Office of Scientific Research

AFRIMS—Air Force Records Information Management System

AFTC—Air Force Test Center

AFTCI—Air Force Test Center Instruction

AoA—Analysis of Alternatives

CCB—Configuration Control Board

CD—Concept Development

CONOPS—Concept of Operations

CPI—Critical Program Information

CS—Communications Squadron

CTEIP—Central Test and Evaluation Investment Program

DoD—Department of Defense

EDWARDSAFBI—Edwards Air Force Base Instruction

FM—Financial Management

HHQ—Higher Headquarters

IAW—In Agreement With

I&M—Investment and Modernization

LCMP—Life-Cycle Management Plan

LSE—Lifecycle Systems Engineering

MA—Master Architect

MAP—Mission Area Panel

O&S—Operation and Sustainment

OG—Operations Group

OI—Operations Instruction

OPR—Office of Primary Responsibility

PM—Project Manager

PMR—Program Management Review

RBA—Reimbursable Budget Authority

RDS—Records Disposition Schedule

SBIR—Small Business Innovation Research

SE—Systems Engineering

SEB—Systems Engineering Board

SEC—Systems Engineering Council

T&E—Test and Evaluation

TC&I—Test Capabilities and Infrastructure

TIPP—Test Investment Planning and Programming

TL—Technical Lead

V&V—Verification and Validation

XP—Plans and Programs

Attachment 2

TAILORING

A2.1. Tailoring. Tailoring provides the ability to integrate, consolidate, incorporate, and streamline strategies, oversight, reviews, decision levels, documentation, and information. Depending on the cost/complexity and risk of the TC&I development or sustainment effort, projects will be tailored to enable compliance with the LSE processes while not overburdening the effort. The purpose is to streamline the acquisition program to the maximum extent possible, consistent with risk, in order to deliver a capability most efficiently and effectively. At the onset of project planning, each test capability development project will be tailored to 1) provide the needed capability to the stakeholder in the shortest practical time, 2) balance risk, 2) ensure affordability and supportability, and 4) provide adequate information for decision making.

A2.1.1. The intent of this section is to provide consistent tailoring guidance on all LSE processes for TC&I development or sustainment efforts and to ensure that the appropriate decision authority level is approving the tailored application of LSE. These tailoring decisions will be based on a consistent set of criteria and will be approved at the level determined by these criteria.

A2.2. Tailoring Criteria. Tailoring approval for 412 TW TC&I development or sustainment efforts is based on complexity/risk and cost criteria similar to that used for the Test Safety Review process. The tailoring criteria assessment will be performed and presented to the SEC, SEB, or Squadron/Group level Configuration Control Board, as indicated using the LSE Tailoring Matrix shown in Figure A2.1 below, along with documentation for the factor determination. If the cost is low, then less oversight is required, similarly if the risk is high, then more oversight is required. As depicted graphically in Figure A2.1, the approval of LSE tailoring is at the SEC level when the cost factor and complexity/risk factor are assessed to be in the red areas of the LSE tailoring matrix. The approval of LSE tailoring is at the SEB level when the criteria fall within the yellow and the approval of the LSE tailoring is at the Squadron/Group level CCB when the criteria fall within the green areas of the matrix. For some projects that have high visibility or cross multiple capability areas, the SEC can mandate that a higher level of oversight is required.

A2.3. Cost Factor. The cost factor is designed to account for development costs (development and acquisition, initial sparing, training, documentation, etc.) and the estimated possible increases in lifecycle O&S costs (replacement spares, repairs, operations, etc.). Figure A2.2 shows the cost factor determination.

Figure A2.1. LSE Tailoring Matrix.

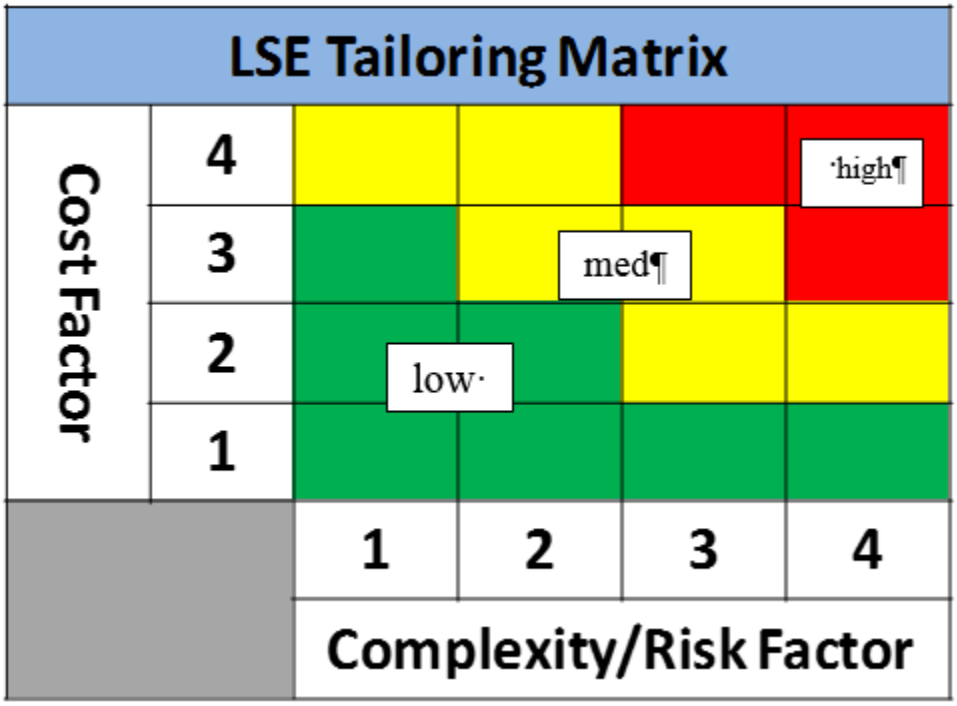


Figure A2.2. Cost Factor.

Cost Factor	
4	> $5M
3	$1 - $5M
2	$250K – $1M
1	Below $250K
Cost Factor = Cost + Estimated increase in O&S	

A2.4. Complexity/Risk Factor. The complexity/risk (C/R) factor is designed to account for the complexity of the development, the criticality of the development to the test mission, how well the capability shortfall is understood, and the technical maturity of the proposed solution. Table A2.3 shows the C/R Factor determination.

A2.5. Tailoring Spreadsheet. The LSE process is designed to be tailored so that all TC&I development and sustainment efforts can follow the spirit of the process. The tailoring spreadsheet will be completed for each proposed development or sustainment effort, unless the sustainment is a repair or minor modification (cost factor level 1) of an existing system. Repairs will be approved by the O&S organization and minor modifications will be approved by the Squadron/Group level CCB.

Figure A2.3. Complexity/Risk Factor Determination.

Complexity/Risk (C/R) Factor											
Integration	4	High complexity, impacts three or more interfacing systems and involves other projects and multiple technical disciplines	Mission Impact	4	High, significant impact to test capability or causes major/multiple test delays/cancellations	Capability Shortfall Maturity	4	Need poorly understood, requires extensive research with external customers	Technology Maturity	4	Significant technology development required
	2	Moderate complexity, impacts two or less interfacing systems, involves multiple technical disciplines		2	Medium impact to test capability or causes significant test delay with impact to customer		2	Need understood, CONOPS with scenarios requires significant investigation		2	Technology development required
	2	Low complexity, impacts no interfacing systems, single discipline		2	Low, no impact to baselined test capability and minor test delay, but no impact to customer		2	Need understood, CONOPS with scenarios requires minor investigation		2	No technology development required, utilizes proven technology
	1	Replace-in-kind		1	No mission impact		1	Well defined and validated need		1	No technology development required, and accomplished before at the 412 TW
C/R Factor = (Integration + Mission Impact + Shortfall Maturity + Technology Maturity)/4											

A2.5.1. The tailored spreadsheet will detail the documentation that will be provided and which documentation will be eliminated. Any eliminated documentation will be justified. As a result of determining what documentation will be required, the LSE process steps (e.g., required approvals, briefings, etc.) will be identified. This tailoring spreadsheet will be approved at the appropriate level based on the LSE Tailoring Matrix.

A2.5.2. Tailoring may need to be accomplished in several steps in order to allow for the maturation of the understanding of the development/sustainment effort. The proposed tailoring of the required Concept Development (CD) process steps will be presented prior to entering the TC&I Concept Development Phase (figure 3.2). The tailoring of the project execution documentation will be approved at the Initial Review phase during TC&I Concept Development. Additional tailoring of the Development and Sustainment process steps can also be proposed at this time or immediately after entering the TC&I Development and Sustainment phase.