

**AIR TRAFFIC ORGANIZATION
NEXTGEN AND OPERATIONS
PLANNING SERVICES**

**VERIFICATION AND VALIDATION
OPERATIONS GUIDE**



VERSION 1.0

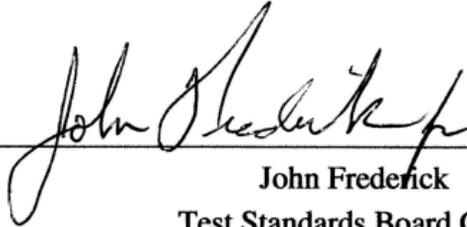
AUGUST 21, 2008

**FAA WILLIAM J. HUGHES TECHNICAL CENTER
ATLANTIC CITY INTERNATIONAL AIRPORT, NEW JERSEY 08405**

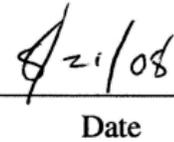
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APPROVAL SIGNATURES

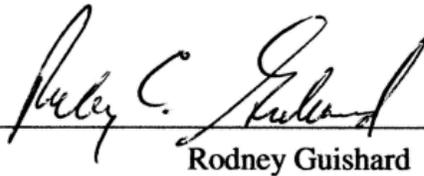
Document Title: ATO-P VERIFICATION & VALIDATION OPERATIONS GUIDE



John Frederick
Test Standards Board Chair



Date

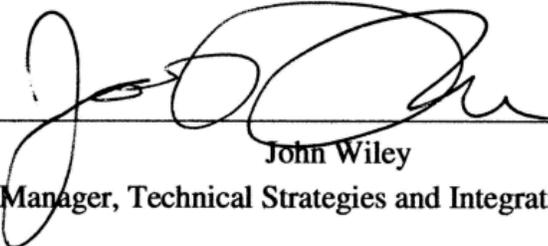


Rodney Guishard



Date

Manager, Test Standards and Program Assessment Team



John Wiley

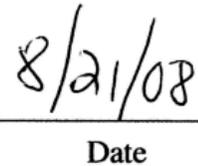


Date

Manager, Technical Strategies and Integration Group



Michael Greco



Date

Manager, Test and Evaluation (T&E) Services Group

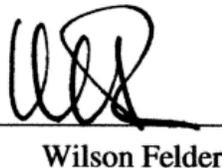


Stan Pszczolkowski

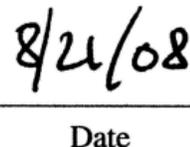


Date

Manager, Air Transportation System Evaluation (ATSE) Group



Wilson Felder



Date

Director, William J. Hughes Technical Center

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DOCUMENT VERSION CONTROL

VERSION	DESCRIPTION OF CHANGE	DATE
Draft 1.0	Initial Delivery to Management	12/20/2006
Draft 2.0	Pilot Version Release for Distribution	09/12/2007
Draft 3.0	Draft Version Release for T&E and Management Review	05/29/2008
Draft 3.1	Draft Version Release for Final Approval	08/08/2008
Final 1.0	Initial Delivery for V&V Process Implementation	08/21/2008

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1 INTRODUCTION

Air Traffic Organization NextGen and Operations Planning Services (ATO-P) initiated a Verification and Validation (V&V) Protocol of Operations effort to improve the Test and Evaluation (T&E) products and services, and to provide world-class system integration and test capability to the ATO. These T&E improvements are focused on supporting data driven, best value decision-making and process improvement strategies throughout the product lifecycle and are documented in this Verification and Validation Operations Guide and the Test and Evaluation Handbook. These documents should be used in conjunction with the FAA Acquisition Management System (AMS) Policy.

1.1 VERIFICATION AND VALIDATION

The standards and processes in this document address principles and practices identified in the V&V process areas that relate to the Capability Maturity Model[®] Integration (CMMI[®]) Model, Version 1.2, published by the Software Engineering Institute of Carnegie Mellon University. The CMMI[®] provides a guiding V&V model for the performance of T&E and to support continual improvement of T&E processes and standards. In accordance with CMMI[®], the purpose of verification is to ensure that a system is built right, while validation ensures that the right system (product or service) is built. Verification and validation represent complementary process areas that are distinguished below.

- **Verification** - The purpose of Verification is to ensure that the product or service meets its specified requirements. Verification is inherently an incremental process because it occurs throughout the development of the product/service and its relevant work products (e.g. plans, tools, reports, etc.) beginning with initial requirements, progressing through subsequent changes, and culminating in the verification of the completed system/service.
- **Validation** - The purpose of Validation is to demonstrate that a product or product component will fulfill its intended purpose when placed in its intended environment. Validation activities may be applied to all aspects of a product in any of its intended environments, such as operation, training, manufacturing, maintenance, or support services. The methods employed to accomplish validation can be applied to work products as well as to the product and product components.

V&V is a disciplined approach to assessing a product throughout the product lifecycle. V&V strives to ensure that quality is built into the product and that the product satisfies operational requirements. As an industry best practice, the strong focus on validation in addition to verification also helps to ensure customer satisfaction. The T&E standards defined in this Handbook support a significant portion of a comprehensive V&V approach. Some CMMI[®] V&V practices are executed outside of the T&E function and are therefore not addressed in this document. The relationship of how the T&E function applies to V&V is depicted in Figure 1-1, T&E Application to the V-Model. The V-Model demonstrates the relationships between each phase of the acquisition lifecycle and its associated T&E phase (i.e. T&E Planning and Support, Development Test (DT), and Operational Test (OT)).

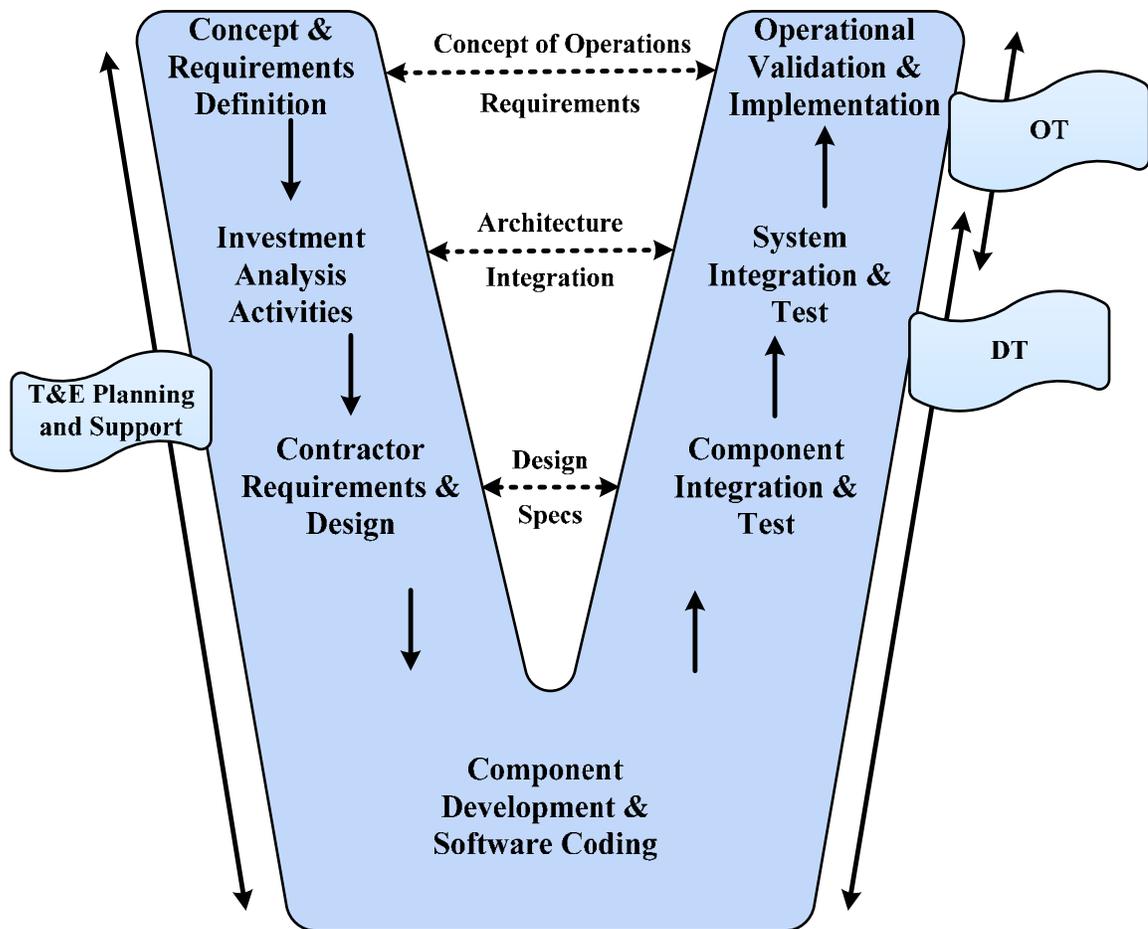


FIGURE 1-1. T&E APPLICATION TO THE V-MODEL

The large shaded “V” represents the concept that both Verification and Validation are performed throughout a system or service acquisition, from concepts and requirements definition through implementation/operational system validation. V&V is performed in varying degrees on a continuous basis by many entities involved in the acquisition. For instance, System Engineering has a large role in the V&V of requirements and concepts, while the service organization has a large role in the V&V of the design and SW code.

As depicted in the diagram, T&E also plays a role in all acquisition phases. The arrows on the outside of the diagram depict the three main phases of T&E described in this Handbook. The arrow on the left side of the “V” represents the T&E Planning and Support phase. The primary V&V role of T&E during this phase is to support the development of concepts, requirements, and design. The arrows on the right side of the “V” represent the DT and OT phases. The primary V&V role during these two phases is the conduct of T&E itself.

The arrows in the middle “V” are intended to show that each side of the “V” feeds the other. For instance, concepts and requirements definition drives the test cases for OT, while OT development and conduct can feed back for future concepts and requirements definition.

1.2 PURPOSE

The purpose of this document is to provide the necessary direction for the administration, management, and operations of quality V&V practices. Standard T&E processes necessary to conduct consistent quality T&E are described in the ATO-P T&E Handbook. The T&E Handbook should be used in conjunction with this V&V Operations Guide to implement standard T&E processes and methods. The processes and standards in the ATO-P V&V Operations Guide and T&E Handbook are based on and support the Acquisition Management System (AMS) T&E Process Guidelines and the processes documented in the FAA AMS Policy.

Preparation of these documents was guided by lessons learned from past test programs, industry best practices, future ATO-P T&E needs, and International Standards Organization (ISO)/CMMI standards. A mapping of the CMMI[®] Specific and Generic Practices to the standard processes and work products is contained in the CMMI[®] V&V Compliance Matrix. This matrix can be found in the V&V Repository (see paragraph 4.7).

1.3 SCOPE

This document describes V&V operations associated with T&E organizational roles, responsibilities, Test Standards Board (TSB) processes, and test program management processes. These operations apply to the TSB, all test practitioners, and accountable test managers and executives. The TSB is responsible for updating and managing this document.

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2 RELATED DOCUMENTS AND REFERENCES

- a) *Acquisition Management System, Exhibit 300, Attachment 3: Implementation Strategy and Planning*, U.S. Office of Management and Budget (OMB), Washington, DC, October 2007. http://fast.faa.gov/Exhibit_300/index.htm
- b) *Capability Maturity Model Integration (CMMI[®]) for Development, Version 1.2*, Carnegie Mellon Software Engineering Institute, Pittsburgh, PA, August 2006. <http://www.sei.cmu.edu/publications/documents/06.reports/06tr008.html>
- c) *CMMI[®] for Acquisitions, Version 1.2*, Carnegie Mellon Software Engineering Institute, Pittsburgh, PA, November 2007. <http://www.sei.cmu.edu/publications/documents/07.reports/07tr017.html>
- d) *FAA Acquisition System Toolset, Test and Evaluation Process Guidelines*, FAA Acquisition Management System, Washington, DC, August 2006. http://fast.faa.gov/test_evaluation/index.htm
- e) *FAA Test and Evaluation Gold Standard and Implementation Guide, Version 2.0*, Washington, DC, October 1, 2004. http://intranet.aos.faa.gov/aos22/pi/t&e/Documents/IG_v2.0_.doc
- f) *National Airspace System, System Engineering Manual*, Air Traffic Organization Operations Planning Service, Washington, DC, October 11, 2006. <http://fast.faa.gov/syseng/index.htm>
- g) *Test and Evaluation Handbook, Version Final 1.0*, Air Traffic Organization NextGen and Operations Planning Services, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ, August 21, 2008. https://ksn.faa.gov/km/ajpterep/VV%20Standards/TSPAT_TnE%20Handbook%2001-00.pdf
- h) *Test Standards Board Charter v1.6*, Air Traffic Organization Operations Planning Service, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ, April 17, 2008. https://ksn.faa.gov/km/ajpterep/VV%20Standards/TSPAT_TSB%20Charter_01-06.pdf
- i) *Project Management Process Description Document*, Air Traffic Organization NextGen and Operations Planning Services, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

- j) *Configuration Management and Document Control Process Description Document*, Air Traffic Organization NextGen and Operations Planning Services, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

- k) *Quality Assurance Process Description Document*, Air Traffic Organization NextGen and Operations Planning Services, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

- l) *Training Process Description Document*, Air Traffic Organization NextGen and Operations Planning Services, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

- m) *T&E Corrective and Preventative Action Process Description Document*, Air Traffic NextGen and Operations Planning Services, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ

3 ROLES AND RESPONSIBILITIES

This section addresses, at a high level, the various roles and responsibilities for a T&E program. Some of these roles may be performed by the same individual, depending on the scope and size of the individual test program. However, the modification or omission of any role or responsibility requires a waiver co-approved at the Group Manager level.

3.1 T&E FUNCTIONAL STRUCTURE

The T&E functional structure ensures the quality and integrity of test program baselines through clear and accountable T&E authorities and oversight. Figure 3-1, T&E Functional Structure, depicts the hierarchical structure for communications, decision making, and resolving issues within the T&E process.

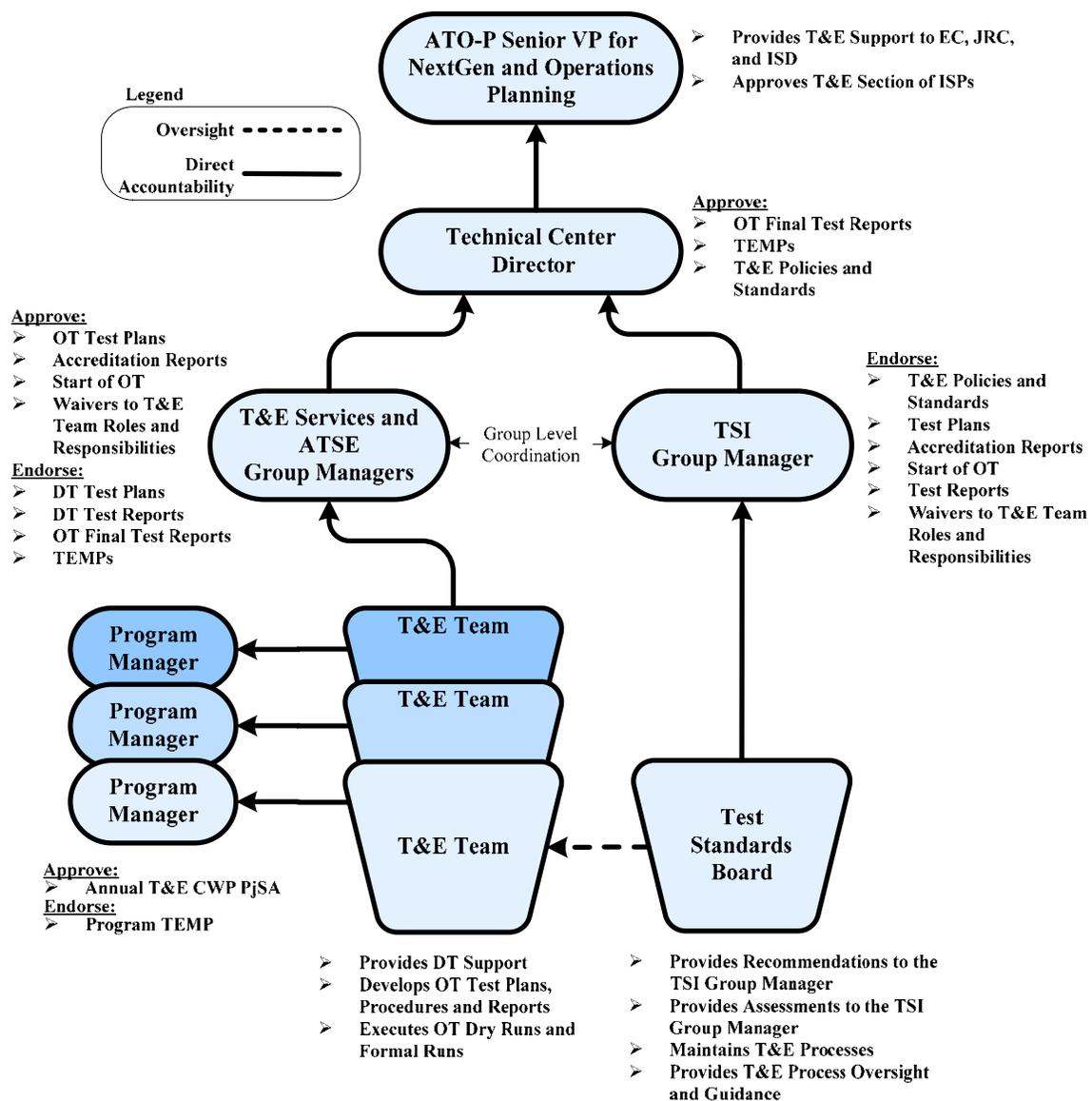


FIGURE 3-1. ATO-P T&E FUNCTIONAL STRUCTURE

3.2 MANAGEMENT AND OVERSIGHT ROLES

The following paragraphs define high-level ATO-P test roles and responsibilities. Detailed descriptions will be provided in program test plans.

3.2.1 ATO-P SENIOR VP FOR NEXTGEN AND OPERATIONS PLANNING

The ATO-P Senior Vice President for NextGen and Operations Planning is responsible for providing quality Test and Evaluation in the ATO. The ATO-P Senior VP is also the accountable authority for ATO-P provided test services. The roles and responsibilities of the ATO-P Senior VP are:

- a) Serves as the ATO's test executive for Solution Implementation to ensure effective representation, communication, and visible accountability of test activities
- b) Provides direction to the Technical Center Director
- c) Ensures the test team's involvement in ATO initiatives from the Mission Analysis Phase through the In-Service Phase of the program lifecycle
- d) Approves the T&E section of the Implementation Strategy and Planning (ISP) document (pending AMS update)
- e) Serves as the primary POC to the Executive Council on T&E issues
- f) Supports in-service decision-making with T&E results and reports

3.2.2 TECHNICAL CENTER DIRECTOR

The Technical Center Director is responsible for the overall operation and administration of the T&E activities under the authority of the ATO-P Senior VP. The Director is responsible for ensuring that all testing is properly performed and applicable regulations are met. The roles and responsibilities of the Technical Center Director are:

- a) Ensures that all T&E activities conducted by the Technical Center test teams are in accordance with FAA, ATO, and Technical Center policies
- b) Directs and oversees the activities of the T&E Group Manager(s) and Technical Strategies and Integration (TSI) Group Manager
- c) Coordinates and confirms all T&E information, status reports, and results provided to the ATO-P Senior VP
- d) Coordinates with other ATO Service Directors to resolve T&E issues that impact their respective domains
- e) Approves Operational Test (OT) Final Test Reports and forwards them to the ATO-P Senior VP
- f) Endorses test section of the ISP and forwards it to the ATO-P Senior VP for final approval
- g) Approves program TEMPs
- h) Supports the ATO-P Senior VP by providing T&E results for in-service decision making

3.2.3 T&E SERVICES AND ATSE GROUP MANAGERS

The T&E and ATSE Group Managers, under the authority of the Technical Center Director, are responsible for the centralized and coordinated management of their respective T&E Teams. The roles and responsibilities of the T&E and ATSE Group Managers are:

- a) Provides direction to their respective Team Managers and are responsible for the conduct of quality DT and OT in accordance with the T&E Handbook
- b) Approves OT Test Plans
- c) Endorses TEMPs and OT Final Test Reports and forwards them to the Technical Center Director for final approval
- d) Endorses DT Test Plans and DT Test Reports
- e) Approves OT Accreditation Reports
- f) Approves the start of the OT phase
- g) Approves waivers to T&E team roles and responsibilities
- h) Collaborates with the TSI Group Manager to ensure the integrity and quality of the test programs
- i) Reports test program status to the Technical Center Director

3.2.4 TECHNICAL STRATEGIES AND INTEGRATION GROUP MANAGER

The TSI Group Manager, under the authority of the Technical Center Director, is responsible for the establishment and maintenance of a quality management system and standardized T&E processes. The roles and responsibilities of the TSI Group Manager are:

- a) Directs and oversees the activities of the TSB
- b) Provides strategic planning for future T&E initiatives
- c) Endorses test plans and test reports
- d) Endorses accreditation reports
- e) Ensures conformance to T&E standards and the resulting integrity of DT and OT test programs
- f) Endorses the start of the OT phase
- g) Endorses waivers to T&E team roles and responsibilities
- h) Acts on and coordinates recommendations and assessments provided by the TSB
- i) Reports on the status of T&E standards conformance to the Technical Center Director

3.2.5 PROGRAM MANAGER

The Program Manager is responsible for the planning, development, and deployment of the overall program. The roles and responsibilities of the Program Manager are:

- a) Serves as a member of the Integrated Test Team (ITT)
- b) Endorses the program TEMP (includes T&E cost and schedule)
- c) Approves the annual T&E Corporate Work Plan Project Scope Agreement (CWP)(PjSA) for a particular program
- d) Reviews and comments on test plans and test reports
- e) Monitors the progress of T&E activities

3.2.6 TEST STANDARDS BOARD

The TSB is a team of subject matter experts from across the ATO chartered to ensure the development of high quality T&E products and services and serve as the principal ATO-P focal point for implementing and administering V&V practices, methods, and policies. It operates as part of the TSI Group under the authority of the Technical Center Director. The TSB monitors DT and OT test activities to ensure quality and process conformance. The TSB reviews and provides recommendations on test strategies, plans, conduct, and reporting. The roles and responsibilities of the TSB are:

- a) Assesses a test program's technical approach and conformance to standards and supports the TSI Group Manager in reporting to the Technical Center Director
- b) Monitors major T&E events (e.g. Test Readiness Reviews, Critical Design Reviews, OT Caucus) for each test program as required
- c) Standardizes quality test processes across ATO-P
- d) Reviews test plans, test procedures, and test reports and provides comments and recommendations to the test team
- e) Functions as a test team advocate to support the resolution of test program issues
- f) Provides T&E process guidance and technical recommendations to the DT and OT Test Directors and the T&E Team Managers
- g) Maintains T&E processes and implements test process improvement initiatives
- h) Supports Quality Assurance (QA) in the conduct of audits to assess T&E standards conformance
- i) Participates in test program meetings (e.g. internal test team meetings, test working group meetings, etc.)
- j) Monitors program ITT activities

The roles and responsibilities of the TSB are defined in more detail in the TSB Charter located in the V&V Repository.

3.3 INTEGRATED TEST TEAM

The ITT is formed for each program at the start of ISP and TEMP development. The ITT is the keeper of the test baseline which is reflected in the TEMP. As the program progresses, the ITT adds elements to the test baseline and updates the baseline and TEMP as needed.

3.3.1 COMPOSITION

The following list contains the typical membership of an ITT. Its composition can vary depending on the size and scope of the program.

- a) DT and OT Test Directors (acting as co-chairs)
- b) Test team members (as appropriate)
- c) Subject matter experts (as appropriate)
- d) System engineering representatives
- e) Program Manager
- f) Program stakeholders (e.g., functional leads, field representatives, and in-service organization representatives)
- g) Independent Operational Test and Evaluation (IOT&E) personnel (for designated programs)

3.3.2 RESPONSIBILITIES

The responsibilities of the ITT are:

- a) Develops high-level test program plans, including scope and costing, for JRC consideration and approval as documented in the U.S. Office of Management and Budget (OMB) attachments (e.g. the ISP) and the TEMP
- b) Conducts ITT meetings as required to develop and assess test strategies for the program
- c) Updates the TEMP as needed
- d) Facilitates the decision to start OT

3.4 T&E TEAM

The T&E Team is responsible for the development and execution of the test program. Each T&E Team reports to a Group Manager (see Paragraph 3.2.3 above). A T&E Team is typically comprised of a T&E Team Manager, DT and OT Test Directors, Test Leads, and Test Team personnel. Based on the program size and scope, these team member positions may be combined as needed. For example, the DT and OT Test Directors may be the same person. However, the roles and responsibilities for each position must remain the same unless waived by management.

Figure 3-2, Typical T&E Team Structure, depicts a generic example of a test team structure. The number of test leads and individual test teams can vary greatly based on the needs of the program. In addition, the leads and test team personnel may support one

or more test teams. For flexibility, test teams may support test program planning, DT, and/or OT as the test program progresses.

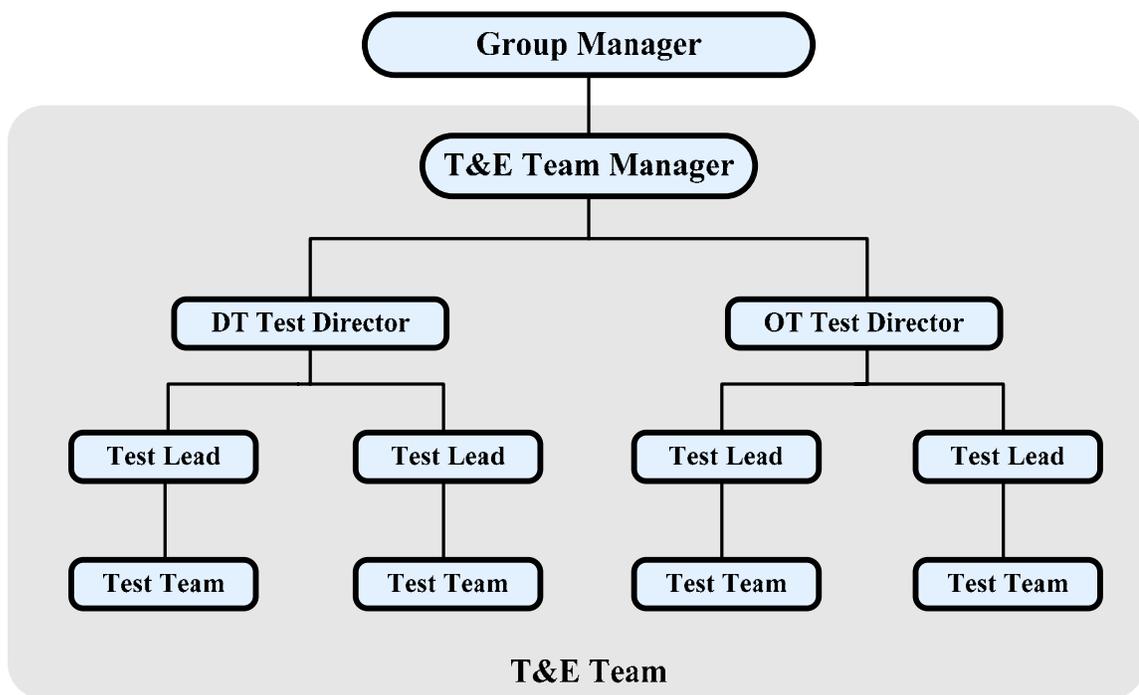


FIGURE 3-2. TYPICAL T&E TEAM STRUCTURE

A T&E Team generally supports one large system (e.g. ATOP, ERAM, WAAS) or several smaller similar systems (e.g. MALSR, ALSF, PAPI). However, as NextGen is implemented, an individual T&E team may test multiple systems across several domains in support of a new capability.

3.4.1 T&E TEAM MANAGER

The T&E Team Manager, under the authority of their respective T&E Group Manager, is responsible for directing and managing their T&E Team. The T&E Team consists of one or more program test teams. The roles and responsibilities of the T&E Team Manager are:

- a) Planning the T&E Team's work
- b) Ensuring the T&E Team's work is completed on time and within budget
- c) Ensures the implementation of quality V&V practices, standards and initiatives
- d) Responsible for the conduct and successful performance of the T&E activities of each test team
- e) Endorses plans and reports prior to submission to the Group Manager

3.4.2 DT TEST DIRECTOR

The DT Test Director, under the authority of the T&E Team Manager, is responsible for the overall planning and completion of the DT phase. The roles and responsibilities of the DT Test Director are:

- a) Provides technical direction for the conduct of DT program operations
- b) Plans and coordinates all program DT test activities
- c) Recommends approval or disapproval of the DT Test Plan and DT Test Reports to the CO after obtaining endorsement from the Group Managers
- d) Recommends approval or disapproval of the DT Test Procedures to the CO
- e) Responsible for the attainment of program DT goals
- f) As Co-chair, facilitates the ITT in conjunction with the OT Test Director
- g) Functions as the primary point of contact for DT testing to the Program Office
- h) Reports T&E status to the Program Manager
- i) Directs and approves contractor test activities as delegated by the Contracting Officer (CO) by means of a Test Director Authority Letter/Letter of Delegation
- j) Responsible for tailoring the established test practices as necessary
- k) Coordinates with Independent Operational Test and Evaluation (IOT&E) personnel for test planning, conduct, and reporting in support of IOT&E processes on designated programs

Refer to the V&V Repository for a sample Test Director Authority Letter/Letter of Delegation.

3.4.3 OT TEST DIRECTOR

The OT Test Director, under the authority of the T&E Team Manager, is responsible for the overall planning and completion of the OT phase. The roles and responsibilities of the OT Test Director are:

- a) Provides technical direction to the test team in the conduct of the OT test program
- b) Plans and coordinates all program OT test activities
- c) Responsible for the attainment of program OT goals
- d) As Co-chair, facilitates the ITT in conjunction with the DT Test Director
- e) Functions as the primary point of contact for OT testing to the Program Office
- f) Reports T&E status to the Program Manager
- g) Responsible for tailoring the established test practices as necessary

- h) Coordinates with IOT&E personnel for test planning, conduct, and reporting in support of IOT&E processes on designated programs

3.4.4 TEST LEAD

The Test Lead, under the technical lead of a Test Director, serves as a primary technical lead for assigned test activities. The roles and responsibilities of the Test Lead are:

- a) Directs activities on specific tests or test areas
- b) Acts to ensure successful execution of a particular test or test area

3.4.5 TEST TEAM

The Test Team, under the authority of the T&E Team Manager, is primarily responsible for development and conduct of each phase of a test program. The roles and responsibilities of the Test Team are:

- a) Functions as the primary team that performs T&E activities for each phase of a test program (DT and OT)
- b) Provides DT technical support by reviewing test plans and test procedures, and by witnessing formal execution of the contractor's test procedures
- c) Develops OT test plans, test procedures, and test reports
- d) Executes OT dry runs and formal runs
- e) Coordinates OT results through ATO-P Management

3.5 SUPPORTING T&E ROLES

3.5.1 OT FIELD PARTICIPANTS

OT Field Participants provide operational expertise to OT. The roles and responsibilities of the OT Field Participants are:

- a) Participate in the planning, preparation, and conduct of OT
- b) Provide support from an operational perspective during OT assessments and problem resolution

3.5.2 FIELD SITE TEST DIRECTOR

The Field Site Test Director is an individual from the operational facility (typically Air Traffic or Technical Operations) who oversees site T&E activities and plans/conducts Field Familiarization (FF). Field Site Test Directors will also provide additional user team members and test participants for site OT and evaluation activities. The roles and responsibilities of the Field Site Test Director are:

- a) Functions as the site representative responsible for coordinating and witnessing Site Acceptance Testing (SAT) activities and site OT activities
- b) Coordinates the execution of all FF activities at a particular field site

3.5.3 CONTRACTING OFFICER

The CO formally approves all test CDRLs, waivers, and deviations delivered or requested

by the contractor. The roles and responsibilities of the CO are:

- a) Acts as the primary FAA authority responsible for defining and approving the program contract
- b) Approves changes to the contract
- c) Directs work to be performed by the contractor
- d) Delegates the direction and approval of contractor test activities to the DT Test Director by means of a Test Director Authority Letter/Letter of Delegation

3.5.4 QUALITY RELIABILITY OFFICER

The Quality Reliability Officer (QRO), under the authority of the CO, is responsible for overseeing the Prime Contractor's test activities to ensure the quality of contractor test activities and to facilitate Government Acceptance. The roles and responsibilities of the QRO are:

- a) Provides on-site support at the contractor's facility under the authority delegated by the CO
- b) Ensures that the contractor's quality control system satisfies the Government's contractual QA requirements
- c) Accepts or rejects systems, equipment, or material in accordance with contractual requirements
- d) Reports program activities and work progress to the CO for the development contract

3.5.5 CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE

The Contracting Officer's Technical Representative (COTR), under the authority of the CO, is responsible for the execution and oversight of program contractual documentation, activities, and deliverables. The roles and responsibilities of the COTR are:

- a) Acts as the FAA authority, delegated by the CO, responsible for the execution and oversight of program contractual documentation, activities, and deliverables
- b) Acts as an agent for the CO by providing contract adjudication and technical direction to the contractor

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4 PROGRAM MANAGEMENT AND CONTROL

Management of T&E programs focuses on maintaining and sustaining quality T&E programs. T&E program management reduces risks and contributes to program success through effective reporting and timely identification of problematic issues. Proper program management will ensure conformance to, in order of precedence: the Verification and Validation Operations Guide, the Test and Evaluation Handbook, the AMS Policy, and the AMS T&E Guidelines. For all T&E programs, T&E program management must consider the following areas throughout the program lifecycle:

- a) Test program structure, as initially identified in the Implementation Strategy and Planning (ISP) document (OMB Exhibit 300, Attachment 3) and further defined in a TEMP (unless the requirement for a TEMP is waived by the ATO-P Senior VP)
- b) Early and continuous test team involvement in program planning and system development which will help to minimize cost overruns, schedule impacts, and major technical issues
- c) Resources required throughout the program lifecycle, which include defining the labor mix and skill sets for both Government and contractor personnel
- d) Resource allocation, including distribution of personnel, equipment, and other test resources
- e) Schedule management, including analysis of the overall program schedule, identification of each test-related task, tracking the duration of T&E activities, and tracking T&E dependencies
- f) Laboratory development and usage, including evaluating and defining laboratory facilities required by the test program. Also included in this area are the development of new laboratory facilities as required, and modifications to, and scheduling of, existing laboratories
- g) Training requirements, including the defining, scheduling, and conduct of all training required by members of the test team. This includes training on the system under test and training required by T&E standards
- h) Program office coordination, including negotiation of tasking, schedules, and funding
- i) Development and collection of test metrics to ensure the validity of the test program and to track the success of test related activities

4.1 T&E PREPARATION AND PLANNING

To prepare for T&E activities, each test program must develop a PjSA each fiscal year in accordance with the T&E Project Management Process document. The PjSA is used to define test team roles and funding requirements, and to identify test team deliverables and milestones. Planning for T&E must focus on using proven, standardized methods to establish the proper technical strategy and reliable cost estimates for a test program.

T&E planning also defines the required commitment of resources and schedules. The processes for T&E planning are detailed in the T&E Handbook. These processes include:

- a) OMB Exhibit 300 Attachment 1 (Program Requirements) development, review, and validation
- b) OMB Exhibit 300 Attachment 3 (Implementation Strategy and Planning) development and review
- c) Prototype tests and early evaluations
- d) TEMP development
- e) Test capability accreditation
- f) DT planning
- g) OT planning

The key planning document used to manage the test program is the TEMP. The TEMP documents the baseline test approach that forms the basis for management of the test program. The ITT is the primary team that develops and manages the TEMP. The initial TEMP is delivered prior to the final investment decision as an OMB Exhibit. The TEMP does not have to be complete at the time of final investment decision, but must define the projected test program strategy, scope, costs, and schedule to support the final investment decision. A completed TEMP is delivered when the system specification is approved.

4.2 TEST STANDARDS BOARD MANAGEMENT

The TSB operates according to the TSB Charter. The TSB interacts with test program personnel via Technical Interchange Meetings (TIM)s and through direct coordination by a TSB Point of Contact (POC). The TSB does not coordinate with the Program Offices unless it is through the Program Test Director or the Technical Center Director. The tasking and activities of those involved with the TSB will be driven by the plans and Work Breakdown Structure (WBS) items documented in the TSB Strategic Business Plan. The following paragraphs describe how TSB personnel and processes are managed to ensure the adherence to quality T&E standards and practices.

4.2.1 TEST STANDARDS BOARD ORGANIZATION

The TSB is comprised of the Chair, core members, ad hoc members, and support members. Figure 4-1, TSB Membership Structure, depicts the organization of the TSB. TSB core members are T&E experts in specialized areas. The specialized areas are currently designated to be In-Service Management, Automation, Communications, Navigation, Surveillance, Weather, and Systems Engineering. The TSB members operate in accordance with the roles, responsibilities, and processes defined in the TSB Charter.

4.2.1.1 TSB CHAIR

The TSB Chair facilitates and directs the activities of the TSB. The Chair reports and provides recommendations from the TSB to the TSI Group Manager in coordination with the TSB's immediate manager. The TSB Chair may also be required to provide status and recommendations on T&E standards matters to the Technical Center Director or to the ATO-P Senior VP, as required.

4.2.1.2 TSB CORE MEMBERS

The core members of the TSB are from a cross-cutting group of Subject Matter Experts (SMEs) that together comprise a critical element of the V&V Protocol of Operations by maintaining and enhancing the T&E infrastructure and processes. Collectively, the core TSB members represent all of the domains and services in the major FAA ATO organizations. Individual core members may represent multiple domains or services. Core members may also represent FAA program stakeholders that are critical to establishing T&E policies. Additional TSB core members may be assigned to represent additional ATO service units as the responsibilities of the TSB expand and the V&V Protocol of Operations matures. The list of active TSB core members will be maintained in the TSB Charter Appendix C.

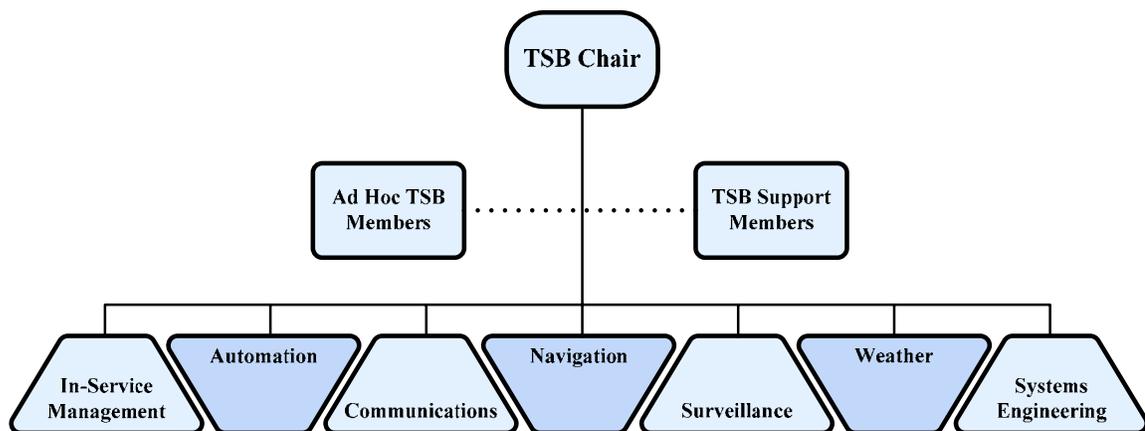


FIGURE 4-1. TSB MEMBERSHIP STRUCTURE

4.2.1.3 TSB AD HOC MEMBERS

When specific activities require specialized expertise, ad hoc TSB members may be required. Ad hoc members serve temporarily to augment the expertise within the TSB. They are expected to attend all TSB meetings and participate in all functions that require their expertise. Ad hoc members are assigned to the TSB after agreement between their Group Manager and the TSI Group Manager. This agreement will include an estimated work level (e.g. 5 hours/week) and duration. Ad hoc members may include SMEs recruited from across the Technical Center, the FAA, and outside of the FAA. Ad hoc specialty areas include, but are not necessarily limited to, the following:

- a) Power quality
- b) Spectrum management
- c) Laboratory management and engineering
- d) Security
- e) Safety
- f) Product quality assurance

- g) Human factors
- h) Air Traffic Control (ATC)
- i) Technical Operations
- j) Simulation and modeling
- k) Legal services

The period of support required for each ad hoc TSB member will be determined by the projected task duration specified by the TSB and the ongoing availability of the ad hoc member. The list of TSB ad hoc members will be maintained in the TSB Charter Appendix C.

4.2.1.4 TSB SUPPORT MEMBERS

Support members of the TSB are vital to its efficient and effective operation. Support members serve in varied roles. Some participate regularly, while others are involved as needed. The following areas represent the primary TSB support member roles:

- a) Project Management (PM)
- b) Administration
- c) Scheduling
- d) Database management
- e) Information technology and web support
- f) Quality Assurance (QA)
- g) Training
- h) Configuration Management (CM)
- i) Process Improvement (PI)

PM support members must participate in all TSB meetings to serve a critical role in the effective management of TSB tasks and initiatives. PM support must provide a PM expert, responsible for coordinating all TSB PM functions, including: documentation of foundational processes, development and management of TSB planning documents, guidance on risk management, and providing direction for integrated T&E schedule management. TSB PM will be performed in accordance with the T&E Project Management Process document.

4.2.2 TSB PROCESS MANAGEMENT APPROACH

The TSB facilitates and oversees the T&E processes. The following paragraphs describe the TSB's approach to managing T&E process implementation and conformance.

4.2.2.1 TSB STRATEGIC BUSINESS PLAN

The TSB will develop a TSB Strategic Business Plan which defines a three-year outlook for TSB deliverables, services, and required resources. This plan will be based primarily on the known test program activities and the associated TSB processes. An integrated TSB schedule of activities and events will be used to provide the major milestone target dates and TSB costs.

4.2.2.2 TEST PROGRAM TECHNICAL INTERCHANGE MEETINGS

The purpose of test program TIMs is to provide a forum for the exchange of test program and standards information between the test team (managers, test directors and test personnel) and the TSB. The TSB will schedule the TIMs for each selected test program at major milestones defined in the program's TEMP. The TSB will collect programmatic and technical information and will provide guidance on test strategies, methodologies and standards. Test-related documents for review include, but are not limited to: the TEMP, schedules, plans, procedures, accreditation reports, the Statement of Work (SOW), and system specifications. The goals of these meetings are to:

- a) Ensure that the strategy for a particular test or test program is consistent with the goals and objectives of ATO-P T&E standards
- b) Ensure that appropriate and sufficient testing is planned and accomplished
- c) Track the progress of the test program
- d) Provide a means for test team feedback to the TSB

The TSB member representing the respective domain takes the lead during the TIM. While all TSB members may comment and offer advice, the lead will guide the TIM activities. The lead will also be the primary POC between the TSB and the Program Test Director.

4.3 SCHEDULE MANAGEMENT

Each test program will maintain test schedules to plan, manage, and status test program activities in accordance with the T&E Project Management Process document. These test program schedules will be the primary source for the TSB to maintain a master schedule. The TSB will plan its oversight activities, events, and reviews based on this master schedule. Additional schedule guidance can be found in the V&V Repository (see paragraph 4.7).

4.4 QUALITY ASSURANCE

Quality Assurance is a formal engineering discipline that independently and objectively provides management with objective insight into processes and associated work products. The process for conducting QA is accomplished in accordance with the T&E Quality Process Description Document.

4.5 T&E STANDARDS CONFORMANCE MANAGEMENT

The T&E standards conformance process is defined in the T&E Handbook. Conformance is managed by the T&E Team Manager and monitored by the TSB. The Test Directors tailor the established test processes to meet specific, unique product or implementation requirements in an efficient manner, while still conforming to the intent of established processes and policies. They have the responsibility to exercise discretion in such tailoring (as defined in the T&E Handbook), and must document the rationale(s) for any deviations.

The T&E standards conformance process is used to monitor conformance to the T&E processes specified in the T&E Handbook and to provide supporting artifacts (conformance checklists) for quality audits. This process will support the identification of required actions to resolve non-conformance issues

4.6 CONFIGURATION MANAGEMENT

CM is a formal engineering discipline that ensures and maintains the integrity of identified Configuration Items (CIs) (e.g. test beds, test tools, test plans, etc.). All identified T&E CIs must be effectively managed and organized in accordance with the ATO-P Configuration Management Process Description Document.

4.7 T&E STANDARDS INFORMATION ACCESS

A web-based system will provide access to documents, news, and other information relevant to the conduct of T&E activities. This web-based tool will be maintained by the TSB and will be a primary information source for TSB operations and T&E standards.

A critical component of the web-based tool is the V&V Repository. The V&V Repository will contain standards, templates, and examples to provide clear direction and ensure commonality across the T&E practices. Test practitioners and SMEs may recommend additions, deletions, modifications, or enhancements to the Repository and/or any of its contents. The TSB will periodically review these recommendations and make appropriate updates to the Repository to continuously improve the applicability and usability of the T&E standards. The V&V repository is located within the ATO-P V&V Portal KSN site (<https://ksn.faa.gov/km/ajpterep/>).

4.8 TSB ISSUES DATABASE

The TSB Issues Database is a tool used solely by the TSB to document, track, and archive test standards issues. Only issues impacting test standards will be opened and documented by the TSB in this database. This database will help to ensure efficient and effective tracking and reporting of issues that may impact the test team's ability to provide quality T&E services. Issue resolution progress will be tracked by the TSB from initial identification until it is closed by the TSB. The TSB Issues Database will be used to support reporting or escalating of T&E issues. The TSB will coordinate with the appropriate Test Director on T&E issues specific to their program. All issues will be assessed by the TSB to determine if any action is required. Issues requiring action by the test team will be reported to the appropriate group managers. When necessary, the Technical Center Director will coordinate with the appropriate ATO Service Director to resolve program issues prior to escalation to the ATO-P Senior VP.

4.9 PROCESS IMPROVEMENT

To maintain quality products and services, the TSB will ensure process improvement by conducting a yearly PI Study. This study involves gathering and assessing information collected continuously throughout the year from the TSB Issues Database, QA Reports, T&E Performance Reports, and Process Improvement Reviews. The TSB will identify improvement areas and recommend changes based on the results from the PI Study. These results and recommendations will be documented in a T&E Process Improvement Report and provided to the Group Managers for review and concurrence prior to final delivery to the Technical Center Director. Accepted recommendations will be incorporated into subsequent versions of all associated process documents (including T&E Handbook and V&V Operations Guide) and training material.

4.9.1 T&E PERFORMANCE REPORTING

T&E and customer satisfaction measurements are collected by the TSB to quantitatively assess the level of success of each test program in order to determine the effectiveness of the T&E processes. The results of these measurements will help to determine where improvements are needed and to promote more efficient T&E processes. When available, metrics data from the measurements will be collected and maintained in a database. This metrics data will be compiled into a T&E Performance Report once per year, and provided to the Group Managers for review and concurrence prior to final delivery to the Technical Center Director and ATO-P Senior VP. The T&E Performance Report will provide input to the TSB PI Study. When possible, comparative T&E metrics data will be extracted from historical data to support the TSB metrics analysis.

4.9.2 T&E PERFORMANCE METRICS

When the data is available, the following performance metrics categories are used to assess the impact and effectiveness of T&E processes:

- a) **Cost Variance** - Cost variance metrics are defined in terms of severe test program cost overruns or underruns compared to those baselined in the TEMP. These metrics will be expressed in terms of dollar cost in excess of, or under, initial budget baselines. At scheduled milestones, when available, updated actual cost information will be compared to the baseline estimates to determine the extent of the variations. Cost variance metrics will aid in determining whether improvements are needed in the cost estimation process.
- b) **Schedule Variance** - Schedule variance metrics are defined in terms of test program milestone date variations and their impacts on test program milestones or on other program milestones as compared to the schedule in the TEMP. Schedule slips are expressed in terms of the number of days beyond the TEMP schedule milestones. When available, the reported metric will be the average number of days of missed milestones. Additionally, significant schedule variations in completing T&E milestones early will be assessed to identify if more accurate T&E schedule estimation processes should be implemented.
- c) **Process Conformance** - Process conformance metrics are defined in terms of the percentages of quality audit items not in conformance with the T&E process for all test programs. The reported metrics will focus on significant or numerous test program nonconformance items and nonconformance trends. This metrics data is available at the completion of quality audits.
- d) **Defect Detection** - Defect detection metrics are defined in terms of the frequency and types of defects detected by the T&E processes. Assessing this metric involves analysis of the trends found in the defects reported by the test program. The metrics data will consist of the number and type of discrepancy/trouble reports as well as the number of Change Requests (CRs) generated after major DT and OT events. This metric will place

more weight on defects that prevent or degrade ATC services. Additionally, in-service defect trends will be assessed to identify defects found during the program's In-Service Management (ISM) phase to determine if they should have been found during DT or OT. Defects encountered during preparation for in-service field implementation and following full field in-service operations will be collected. The final assessment for the defect detection metric will report the percentage of in-service defects encountered compared to the number of defects detected during DT and OT. Changes in the system baseline in between the collection of metrics should be noted and factored into the assessment of the metric.

- e) Customer Satisfaction - Yearly surveys will be distributed by the TSB to customers that are currently receiving T&E services. These surveys will focus on assessing the effectiveness of the T&E process in providing services that fully address program T&E needs.

4.9.3 METRICS DATA COLLECTION PROCESS

Metrics data will be collected, as determined by the TSB, at major T&E event milestones and program milestones within the lifecycle of a system. The data collection process may differ for each test program based on the program size and implementation approach. T&E event and program milestones will be specified in the TEMP and may include, but are not limited to, the following:

- a) Start of system DT activities
- b) Start of Test Readiness Review (TRR) for DT System Testing
- c) Completion of system DT activities
- d) Start of OT TRR
- e) Completion of OT
- f) First site Government Acceptance (GA) or Contractor Acceptance Inspection (CAI)
- g) First site Initial Operating Capability (IOC)
- h) Completion of Independent Operational Test and Evaluation (IOT&E)
- i) First site Operational Readiness Declaration (ORD)
- j) In-Service Decision (ISD)
- k) Second site ORD
- l) Third site ORD
- m) Six months after ORD of the last site

4.9.4 CONDUCT OF V&V SUMMITS

The TSB will plan and conduct an annual summit to discuss and disseminate information about the latest V&V practices and principles. Participation may include personnel from the Technical Center, other FAA organizations, other federal agencies, and private industry. The summit will be a technical forum for discussing T&E techniques and tools that address current and future FAA needs and support effective V&V practices.

4.10 TRAINING STANDARDS AND IMPLEMENTATION

Organizational T&E training standards and implementation will be managed by the TSB in accordance with the ATO-P Technical Center Test and Evaluation Training Process document. Project-specific training will be the responsibility of the Test Directors through coordination with and funding by the Program Office.

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5 ACRONYMS

AMS	Acquisition Management System
ATC	Air Traffic Control
ATO	Air Traffic Organization
ATO-P	Air Traffic Organization NextGen and Operations Planning Services
CAI	Contractor Acceptance Inspection
CI	Configuration Item
CM	Configuration Management
CMMI [®]	Capability Maturity Model [®] Integration
CO	Contracting Officer
COTR	Contracting Officer's Technical Representative
CR	Change Request
CWP	Corporate Work Plan
DT	Development Test
EC	Executive Council
FF	Field Familiarization
GA	Government Acceptance
IOC	Initial Operating Capability
IOT&E	Independent Operational Test and Evaluation
ISD	In-Service Decision
ISM	In-Service Management
ISP	Implementation Strategy and Planning
ITT	Integrated Test Team
JRC	Joint Resources Council
NextGen	Next Generation Air Transportation System
OMB	Office of Management and Budget
ORD	Operational Readiness Declaration
OT	Operational Test
PD	Program Directive
PI	Process Improvement
PjSA	Project Scope Agreement
PM	Project Management
POC	Point of Contact
QA	Quality Assurance
QRO	Quality Reliability Officer
SAT	Site Acceptance Testing
SME	Subject Matter Expert

SOW	Statement of Work
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TIM	Technical Interchange Meeting
TRR	Test Readiness Review
TSB	Test Standards Board
TSI	Technical Strategies and Integration
V&V	Verification and Validation
WBS	Work Breakdown Structure