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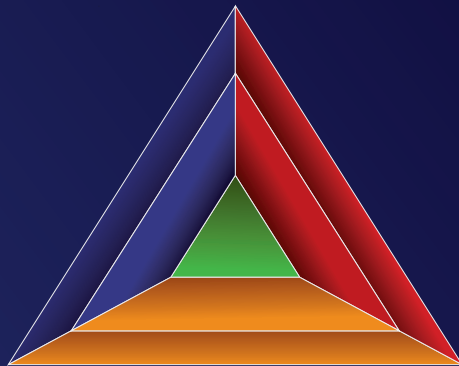
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The Evolution of AFOTEC's Six Core Test Principles

by Dr. Stephanie M. Smith



6P



EARLY OT INVOLVEMENT

TAILOR TO SITUATION

CONTINUOUS FEEDBACK

STREAMLINE PROCESS & PRODUCTS

INTEGRATED & COMBINED TEST

ADAPTIVE

The Evolution of AFOTEC's Six Core Test Principles
by Dr. Stephanie M. Smith

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Executive Summary

The personnel of the Air Force Operational Test and Evaluation Center, (AFOTEC), Kirtland Air Force Base (AFB), New Mexico, codified the center's six core test principles in 2018. These principles (now known as 6P) consisted of: early involvement of operational testers in the acquisition process; tailoring the test effort to the situation or program at hand; providing continuous feedback; streamlining processes and products where practicable; integration of developmental test and evaluation (DT&E) and operational test and evaluation (OT&E) efforts; and staying adaptive. They arose in the context of a mindset of continuous improvement in the Air Force and in acquisition. Two of these principles also had roots in the earliest history of the operational test activities of the center and the acquisition system. AFOTEC's discussions of early involvement, sometimes used interchangeably with early influence, and sometimes defined in opposition to it, dated to the center's founding in 1974. The notion of integrating developmental and operational test, or contractor-led, developmental, and operational test, held a more equivocal place in the center's test philosophies between 1974 and the early 2000s. Particularly early on, when AFOTEC had neither established its utility or its full independence, the idea of integrating developmental and operational test and evaluation seemed liable to detract from resources available for operational test, or to imperil AFOTEC's autonomy. Such qualms slowly waned following the designation of the center as a direct reporting unit (DRU) to the Chief of Staff of the Air Force in 1991. An examination of the origins of the six principles and how these values evolved within the center reveals their importance to the longstanding value of AFOTEC, and its contributions to the betterment of the Air Force acquisition system.

Introduction

The Air Force established and activated the Air Force Test and Evaluation Center (AFTEC) on January 1, 1974 as a separate operating agency to conduct operational test and evaluation on Air Force assets. On April 4, 1983, the Air Force re-designated AFTEC as the Air Force Operational Test and Evaluation Center, emphasizing its unique mission. Finally, as of February 5, 1991, AFOTEC's organizational status rose as the center went from a separate operating agency to a Direct Reporting Unit (DRU), reporting to the Chief of Staff of the Air Force.¹ This made AFOTEC one of the military services' fully independent Operational Test Agencies (OTA) and removed it from the oversight of other functions within the Air Force acquisition process. Independence from the using major commands (MAJCOM), developers, and users of the products of the acquisition system meant that AFOTEC could truly act as an honest broker within acquisition,

An examination of the underpinnings of the center's approach to operational test and evaluation and its reform might not at first appear to yield much of interest in terms of the overall impact to the Air Force or to the acquisition system. After all, operational test and evaluation formed only a small part of the Air Force acquisition system as a whole, and took place at the end of a long process. As the center's strategic plan for CY2020 pointed out, the six core test principles codified by AFOTEC personnel did not represent anything new to the test community or to acquisition. AFOTEC Technical Advisor Mr. Jeffrey J. Olinger, with 44 years of Air Force experience, agreed with this assessment.² The introduction to the center's 2020 Operational Test and Evaluation guide pointed out that they should not "strike anyone as ... ground-breaking." However, the six principles had also proved fundamental to AFOTEC's operations in recent years, and their codification laid out in "its most simplistic form...a common understanding... that enables these six guiding principles to be worked and achieved and ultimately deliver combat capability faster."³

In addition, as the sole Operational Test Agency for the Air Force, AFOTEC led its operational test enterprise. The center also had a voice as one among the five military service OTAs under the Department of Defense. AFOTEC's policies on making operational test and evaluation faster and more relevant evolved within and contributed to a

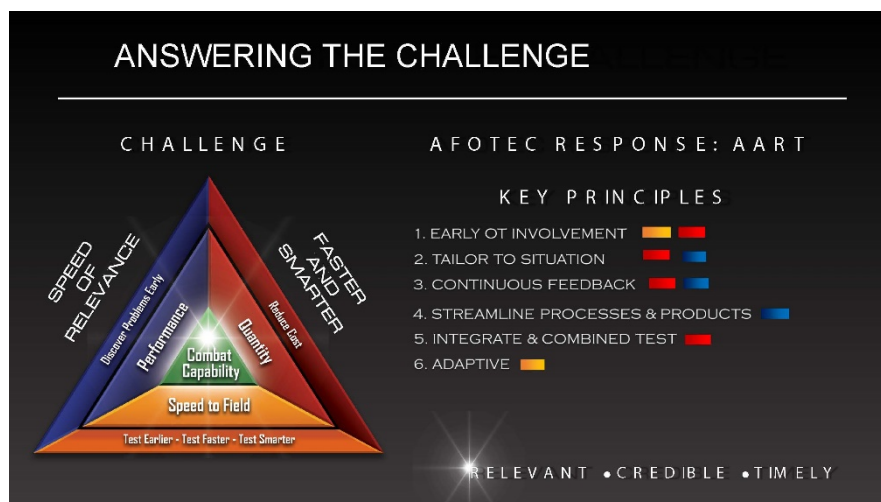
larger conversation on the value of Air Force operational test and evaluation and of the Department of Defense's acquisition system. These took place within cyclically recurring attempts to reform or improve acquisition.

Discussions on the efficiency and reform of the acquisition system only intensified during periods when defense budgets and acquisitions shrank, such as the 1970s. This pattern held true throughout the next few decades. This included during the acquisition scandal that followed Operating ILL WIND in the late 1980s, when the Federal Bureau of Investigation examined corruption by U.S. civilians, military officials, and private defense contractors.⁴ A similar pattern recurred in the 1990s with the so-called peace dividend and concomitant decrease in defense budgets and in aircraft procured.⁵ The same held true in the aftermath of the Darleen Druyun/Boeing acquisition scandal of the early 2000s.⁶ These developments also took place against the backdrop of a rise in the complexity of aircraft systems, which led to significantly increased acquisition costs, such as in the fifth-generation aircraft systems the F-22 and the F-35 Joint Strike Fighter and increasingly longer acquisition timelines.⁷ As AFOTEC Commander Maj Gen Matthew T. Molloy noted in 2016, such lengthy acquisition programs created “a mismatch between what we designed in 1992 and what we fueled in 2005.”⁸ The history of discussions within AFOTEC of improving acquisition and the center's place within it relied upon—and waxed and waned with—the prevalence of such discussions in the acquisition community and the Air Force.

Likewise, preoccupation within the center with the disadvantages of the fifth core test principle, integrated test, appeared most acute during the period between the organization's establishment in 1974, and its elevation in status from a separate operating agency to a Direct Reporting Agency in 1991.⁹ This decision alleviated concerns regarding AFOTEC's independence, insulating the center from control or influence by developers, warfighters, or MAJCOMs). It freed center leadership to more readily consider the role of integrated developmental and operational test in the center's operations and in acquisition reform.

The Six Core Test Principles

Illustration 1: AFOTEC Key Test Principles



Slide, excerpt from Brgf, AFOTEC to DOT&E, “AFOTEC Adaptive Relevant Test Pilot Projects,” [n.d.]..

The six core principles of test originally emerged as the AFOTEC Adaptive Relevant Test Principles (AART) in 2019 under AFOTE Commander Maj Gen Michael T. Brewer, who noted, “We started this on the back of a napkin,

almost literally.”¹⁰ They later had become known simply as Adaptive Relevant Test (ART) principles. By 2020 and the tenure of AFOTEC Commander Maj Gen James R. Sears, Jr., they became known simply as the six core test principles or 6P. The principles consisted of the following: early involvement in test programs by operational test personnel; tailoring the effort to the situation, i.e., to the size and scope of the particular project; providing developers and customers continuous feedback; streamlining processes and products; integrating and synchronizing test between developmental and operational test teams; and remaining adaptive.¹¹

General Brewer’s philosophy of the six core test principles started with what he saw as the task at hand—delivering combat capability to the field. From there he asked, “what do we need to do to do that better?”¹² The six core principles seem to have first appeared in their full expression in a briefing to the Director, Operational Test and Evaluation, Office of the Secretary of Defense (DOT&E), the Honorable Robert F. Behler. The briefing also incorporated the term “the speed of relevance,” which had originated with the 2018 National Defense Strategy.¹³ In response to the admonitory tone of Mr. Behler’s 2017 OT&E report, the briefing from June 2018 mapped the core principles to issues raised in the DOT&E report, demonstrating how 6P supported the DOT&E vision for Air Force operational test and evaluation.¹⁴

While the 2018 strategic plan created under the aegis of General Brewer did not explicitly name the six core test principles, it included the speed of relevance as one of the center’s goals.¹⁵ The plan for meeting this goal included an objective to develop and apply the six core principles. Under the direction of AFOTEC Vice Commander Col Timothy J. Timmerman, Objective 2 called for the creation and implementation of AFOTEC Adaptive-Relevant Testing.¹⁶

The first AFOTEC principle of early involvement affirmed the need for operational teams to engage with and influence acquisition programs from inception. This meant more than just conceiving of early involvement as oversight or collaboration, i.e., having a seat at the table. Instead it meant shaping test plans and events to accommodate the data required to answer test objectives.¹⁷

AFOTEC’s second principle, tailoring to the situation, provided operational test teams the flexibility to adjust test programs and approaches to meet the demands for rapid acquisition and agile development. Streamlining products and processes, while closely linked to the principle of tailoring to the situation, focused on shifting bureaucratic barriers to the acquisition, enabling fielding of systems and weapons “at the speed of relevance.”¹⁸ The speed of relevance referred to the sometimes lengthy acquisition process for large weapons and aircraft systems. These had sometimes taken decades to field, making them largely irrelevant in coping with current threats.¹⁹ The 2018 National Defense Strategy had called for acquisition to “deliver performance at the speed of relevance.”²⁰

The call for continuous feedback, the third core test principle, simply meant that operational testers would engage with customers and users throughout the test, beyond just providing required data only in advance of various milestone or decision points. This would ensure timely communication of relevant test information to stakeholders about the program at hand.²¹ While it had no deep roots in AFOTEC history, the third principle obviated any view of operational test as simply a final examination or last hurdle for a test program, or connoting a bottleneck impeding the fielding of weapons systems.

AFOTEC’s fourth core test principle, the streamlining of test and evaluation process and products, appeared to have originated with DOT&E, the Honorable Mr. Robert F. Behler’s 2016 annual report on operational test and evaluation. This report included a reference to the importance of early problem discovery. Early discovery translated into advocating for early testing by both developmental and operational test and evaluation to avoid costly problems continuing in development, while building knowledge on the system’s performance.²²

Breaking down the stovepipes separating the various types of test, as described in principle five, would allow cooperation between the primary stakeholders in the test and evaluation community. This included contractor, developmental test, and operational test. While enhancing trust and communication across the test program, this principle would also aid in testing earlier and better.²³

Finally, AFOTEC's overarching sixth principle, remaining adaptive, helped speed products to the field within a flexible framework of test and cumulative amassing of knowledge. This principle preserved the independence of operational test agencies as the honest brokers within the test and acquisition communities, while again focusing on the "speed of relevance."²⁴

General Brewer and his staff then promulgated the six principles across AFOTEC. Moreover, center leadership also persuaded the Operational Test Agencies of the other military services to sign a memorandum to the Director, Operational Test and Evaluation endorsing the core principles.²⁵ Their adoption signaled the significance of these ideas to test and to reform of the acquisition process. By 2019, when the OTAs signed a joint memorandum on the six core test principles, these ideas had existed for some time.²⁶

Early involvement and the integration of developmental and operational test as principles for improving test and acquisition, constituted the only principles previously documented in the history at AFOTEC. AFOTEC personnel had long argued that building in test requirements early saved time and money. Early discovery of problems allowed the early identification of solutions, and proved a more cost effective approach than making the same discoveries later. AFOTEC personnel had also at times posited the utility of a holistic view of test versus separate contractor, developmental, and operational test phases.²⁷

Emphases on early involvement, and integrated developmental and operational test, ebbed and flowed with the defense budget and the need for greater effectiveness and efficacy during periods of budget constraints. Early involvement had both the longest history and the most positive connotation within AFOTEC, while the idea of collapsing distinctions or timelines between developmental and operational test raised concerns within the center early on after its establishment. Integrated test and evaluation appeared to threaten the independence of the center or its budget for operational test even some years after AFOTEC became a direct reporting agency in 1991. Both concepts originated specifically from the unique mission of operational test within the acquisition enterprise, which perhaps accounted for their early formulation compared to the other four principles. Discussions of the other four principles did not previously appear in the center's history, but stemmed instead from outside the center in 2016 and beyond, as well as originality by the center's leadership and staff.

The center's guide to best practices in operational test provided glimpses of the evolving conversation around the organization's test philosophy and principles. The second edition of the AFOTEC OT&E guide, published August 18, 2001 under Maj Gen William A. Peck, Jr. (March 3, 2000 –February 25, 2003), included mention of combined developmental and operational test. It did so in the context of an Air Force push toward seamless verification, which involved "eliminating the seams"²⁸ between the contractor, developmental, and operational test. The fourth edition, published 1 November 2005, discussed both minimizing the distinctions between various forms of test and evaluation, and early involvement as an aid to more timely delivery of combat capability.²⁹ The eleventh edition of the OT&E guide dated April 2020 and published under General Brewer incorporated the six principles developed under his aegis. The foreword noted that 6P, combined with the guide, provided "an overarching test framework" for delivering combat capability.³⁰

Early Involvement

Discussions of early involvement, sometimes used interchangeably with the phrase early influence, and at other times defined in opposition, appeared in center documents as early as 1975, shortly after the center's establishment in 1974. The frequency of discussions of early involvement also far outweighed those of other core principles. This principle remained central to discussion of reforming test and acquisition both before and after the establishment of AFOTEC.

The first expression of the importance of early involvement in planning for major acquisition programs originated with Commander of the Air Force Test and Evaluation Center Maj Gen Howard W. Leaf. The center's fourth Commander, General Leaf served in that capacity from October 1976 through May 1980. General Leaf represented the first to serve in an extended capacity as center Commander. (AFOTEC's first Commander had served only eight months, and its second barely 12 months.) General Leaf played a considerable role in regularizing AFOTEC's approach to operational test and evaluation. Indeed, the drive to normalize the center's early involvement in acquisition planning occupied much of the attention of its leadership during the first five years of AFOTEC's existence.

As part of an initiative in 1977 to improve the center's ability to conduct its mission of operational test, Major General Leaf emphasized the need for early involvement by the operational testers of AFOTEC in the acquisition process, in order to positively impact the process. General Leaf recognized that involving AFOTEC early on in the acquisitions process would produce changes for the better.³¹ This process by which AFOTEC at the time received notice to perform operational test and evaluation did not include early involvement in acquisition, had inhibited planning, and "mitigated against the kind of realism and thoroughness...required of AFOTEC."³²

Over the next few years under the leadership of General Leaf, AFOTEC settled on a definition of what early involvement entailed. This included incorporating AFOTEC comments in draft Program Management Directives, which constituted the official Air Force documents directing acquisition responsibilities to the appropriate major commands. In 1978, AFOTEC also cooperated with Air Force Systems Command in proposing a revision of Air Force Regulation (AFR) 80-14, which governed all Air Force test and evaluation. An August 1978 draft included early involvement by AFTEC in the acquisition process, and defined the relationship between developmental and operational test in combined test.³³ The Air Staff did not immediately accept the draft regulation, finally approving a one-year trial of the approach on 3 November 1978.³⁴

AFOTEC Chief Technical Advisor (1974-1999) and later Chief Scientist (2000-2005), Dr. Marion Williams, also discussed early involvement in 1986. Dr. Williams found early operational test and evaluation infeasible and unwise when based solely upon modeling and simulation. He did favor early planning, allowing AFOTEC personnel to better forecast requirements and build comprehensive test programs, thereby uncovering any issues with the test schedule that might prevent gathering of OT&E data in time to inform milestones. Such reviews would also ensure that plans included only defined and testable requirements.³⁵

General Leaf's definition of early involvement did not survive the 1980s. Major General Michael D. Hall, who commanded AFOTEC from August 30, 1985 through June 29, 1987, instead endorsed a view of early involvement as nothing more than conducting advance planning for operational test. General Hall, a former deputy director of Operational Test and Evaluation for the Office of the Secretary of Defense noted May 8, 1986 that "early and full understanding of operational requirements, concepts, testing methodologies and criteria can significantly contribute to reducing acquisition risk."³⁶

The next discussion of early AFOTEC involvement under Major General Peter D. Robinson, AFOTEC Commander between January 19, 1990 and July 18, 1991. For General Robinson, the involvement of AFOTEC in the requirements process of acquisition remained a key area for commander emphasis. This included ensuring the inclusion of meaningful requirements that AFOTEC would find “clearly testable,” and participating in a combined test force. Combined test forces provided OT an earlier look at systems under test, and fostered a positive relationship between the developmental and operational test communities. AFOTEC senior leaders during this period also tied early involvement to the feasibility of concurrent acquisition strategies.³⁷ Major General George B. Harrison’s (December 13, 1993 –June 22, 1997) view of early involvement aligned closely with his predecessor’s, focusing on “trying to get in early enough so that we bring some testability to the process.”³⁸

Major General Jeffrey G. Cliver, AFOTEC Commander between June 23, 1997 and March 2, 2000 became the next to address the concept of AFOTEC and “earlier involvement.” He planned to install AFOTEC liaisons in key places in addition to those already in place in 1998 at Hanscom and Wright-Patterson Air Force Bases. This included sending an AFOTEC liaison to the U.S. Atlantic Command (ACOM), who would also work in the U.S. Navy’s Operational Test and Evaluation Test Force (OPTEVFOR), to provide AFOTEC perspective of and influence on test programs.³⁹ General Cliver therefore relied upon fostering inclusion of the center viewpoint on requirements by giving AFOTEC a seat at the table, an approach to early involvement that later center leaders would reject.

General Cliver’s successor, General Peck reverted to the usual AFOTEC definition of early involvement. He noted AFOTEC’s attempts to continuously improve early involvement efforts, defining early involvement as providing recommendations drawn from operational test experience to foster the inclusion of realistic requirements in acquisition plans. General Peck also stated that AFOTEC’s experience could facilitate acquisition through early involvement, noting that this would benefit the acquisitions community, ensuring the collection of essential data required for operational test.⁴⁰ Definitions of early involvement remained in flux, however.

By 2006, center leadership had rejected having an action officer voicing AFOTEC concerns to the acquisition community as a workable definition of early involvement.⁴¹ Major General Robin E. Scott, who served as AFOTEC Commander between June 15, 2005 and May 31, 2007, instead considered early involvement as having the AFOTEC Commander signing off on requirements, acquisition strategies, and other acquisition documents.⁴² The testers at AFOTEC had also begun referring to an “Early Influence Phase” of acquisition.⁴³

Maj Gen Stephen T. Sargeant (July 12, 2007 –October 21, 2010) tied the notion of early involvement to the availability of test assets and resources. Without early involvement, operational testers had found that they could not evaluate key performance parameters (KPPs), due either a lack of required test facilities, or to untestable or unmeasurable parameters.⁴⁴

Major General David J. Eichhorn (October 22, 2010 –September 12, 2012), extensively discussed early involvement, and both its benefits and pitfalls. He warned of the perils of early involvement in 2010: “The more our hands are dirty up front, the more we are married to the solution and the less likely we will be to criticize it.”⁴⁵ General Eichhorn still saw early involvement as a form of risk management, however, in that it saved both time and money in identifying and solving issues early the acquisition process. This type of early involvement kept the center from seeming like the enemy when its personnel delivered bad news: “in order to overcome the perception of being naysayers, early influence, early involvement, and early discovery are absolutely critical.”⁴⁶

General Molloy’s (June 18, 2015 –May 18, 2018) view of AFOTEC’s role in the acquisition process also encompassed early involvement. Although AFOTEC did not define requirements, he pointed out that the center did influence the acquisitions process through “the competencies that we build, shape, and inform...if we have the right competencies, and we ask the right kind of questions at the right time in the acquisition kill chain, we can really

shape and inform the health of programs. That all starts at the very beginning—early involvement.”⁴⁷ General Molloy also discussed his philosophy on early involvement with reference to the Ground-Based Strategic Deterrent (GBSD), a replacement for the Minuteman III. With GBSD, AFOTEC “will have been an endemic part of it from the beginning of the program.” AFOTEC, he argued, performed very well given inclusion “at the very inception of a program...defining them to testable and measurable things and using our operational experience and voice.”⁴⁸

General Brewer’s view of early involvement once again roundly rejected the notion of merely having a seat at the table during planning, or observing developmental test evaluation. Instead, in his estimation, involvement equated to participation in shaping the initial test, to ensure that “operational test objectives can be met.”⁴⁹

Integrated Developmental and Operational Test

Integrated or concurrent developmental and operational test constituted the fifth of the AFOTEC six core principles, and the only other to have a lengthy history within the center. Unlike the concept of early involvement, however, integrated test did not always sit well with operational testers, particularly in the years shortly after the establishment of the center in 1974. Early AFOTEC leaders worried that integrating developmental and operational test could imperil the independence of AFTEC, the budget available for operational test, or the efficacy of initial operational test and evaluation. In general, few early Commanders advocated integrated or combined developmental and operational test events.

Many of AFTEC’s test events early in its history, for practical reasons, took place in combined developmental and initial operational test and evaluation (IOT&E) events. Major General Richard G. Cross, Jr., the second Commander of AFOTEC (August 26, 1974 –August 31, 1975), emphasized the threat posed to fully independent IOT&E in 1975. He saw other disadvantages to combined developmental and operational tests, as well: “If we are to impact the acquisition process and prevent expensive modification, IOT&E must take place as early as possible. Sharing the dollars for testing with DT&E limits the amount of IOT&E that can be done.”⁵⁰

General Cross also noted friction between AFOTEC and Air Force Systems Command (AFSC)—later replaced by Air Force Materiel Command—over integrated developmental and operational test and evaluation. He maintained that Air Force Systems Command would prefer AFOTEC “play a more passive role” during combined developmental and operational test events. He contended this risked reducing AFOTEC’s role to merely looking “over the shoulder of the developmental testers.”⁵¹ He also tied the question of integrated, concurrent developmental and operational test to advocating for early involvement, which would ensure AFOTEC could make a valid input to the test and evaluation process.⁵²

However, Maj Gen Robert A. Rushworth (November 10, 1975 – September 30, 1976) saw integrated test differently. In 1976 and 1977, the Government Accounting Office (GAO) criticized combined developmental and initial test and evaluation, arguing that it did not meet Department of Defense (DoD) direction and intent in creating the center. Personnel of the GAO maintained that combined test tended to impair the autonomy AFOTEC required. The center’s leadership maintained the utility of this approach, particularly early on in a program, as it saved time and resources, while allowing early operational insights when program offices could still correct issues easily.⁵³

A negative view toward combined developmental and operational test recurred for some time after the establishment of AFOTEC. In 1984, for example, Air Force Systems Command proposed having a combined developmental and operational test director to oversee collaborative test efforts. The center and other using commands, however, disagreed, fearing such a move would undercut AFOTEC’s independence. AFOTEC only became a direct reporting agency in February 1991.⁵⁴

Dr. Marion Williams weighed in on the concepts of combined developmental and operational test in 1998. Especially under declining defense budgets, he believed that AFOTEC would continue to take advantage of both contractor testing and developmental testing, and if required, conduct only a short dedicated operational test phase. Dr. Williams also predicted that in some cases, the center would execute no dedicated OT&E: “you can get by...using somebody else’s test as long as the data’s taken...in a realistic environment.”⁵⁵

General Peck, who shepherded the center through the turn of the twenty-first century, viewed test integration in a positive light. He tied the integration of developmental and operational test and evaluation to reducing duplication of effort. He also argued that in an era of Base Realignment and Closing (BRAC) decisions, integrating developmental and operational test could contribute to better utilization of Air Force test capabilities and assets. Later in his time as Commander, General Peck touted combined developmental and operational test as a way to “plant the seeds on what is required for the systems to work in their operational environments.”⁵⁶ A 2002 Secretary of the Air Force for Acquisition (AF/TE) initiative to streamline acquisition via “seamless verification,” or integrating test, provided General Peck the opportunity to break down the barriers between contractor, developmental, and operational test.⁵⁷

By the time General Sargeant had assumed command of the center in July 2007, any doubts among operational test leadership regarding the value of concurrent developmental and operational test and evaluation had long since vanished. In his view, once developmental testers had completed a test plan, AFOTEC could then ascertain the availability of production-representative systems for operational test. This would also allow operational testers to approach developmental test organizations with plans to make their test scenarios more operationally relevant, in turn allowing them to judge suitability and effectiveness, or buy down dedicated operational test schedule and/or assets.⁵⁸

AFOTEC Commander General Eichhorn agreed in 2010 that integrated developmental and operational test saved time and money, and argued that it had other benefits, as well. Integrated DT and OT testers might only enhance their credibility when speaking with one voice. In addition, he noted that integrated DT and OT allowed operational testers to identify problems early on in the process, before a system under test had reached production, and could only save money on modification or refurbishment costs.⁵⁹ In 2011, General Eichhorn proclaimed the value in AFOTEC’s unique ability within the test community to partner with developmental test, to “coordinate, communicate, collaborate,” and thereby improve test and acquisition.⁶⁰

General Eichhorn had also refined his opinion of what types of programs benefited most from combined or integrated developmental and operational test and evaluation. The extent to which integrated developmental and operational test and evaluation could take place in a program depended upon the system under test. He argued that fully integrated developmental and operational test worked best in tests of upgrades to existing system. New systems, however, required the expertise of those in the developmental test and evaluation community, whom he believed best understood the risks inherent in testing an entirely new system.⁶¹

General Brewer (May 18, 2018 – April 6, 2020) echoed General Peck and the earlier trend in the early 2000s toward “seamless verification” in his view of the integration of developmental and operational test and evaluation. He argued for erasing the differences between developmental and operational test to “instead talk about testing for which there are developmental objectives and operational test objectives, instead of the idea of this sequential approach.”⁶²

Influences on the Development of 6P

The development of the AFOTEC six core test principles resulted from original ideas and those already under discussion within test and evaluation and Air Force acquisition. No clear antecedents for all six core test principles exist in the records of AFOTEC. However, discussions of improving acquisition and operational test during this period reflected similar concerns addressed by the AFOTEC six core principles. In his 2015 annual report as the Director of Operational Test and Evaluation the Honorable Dr. J. Michael Gilmore asserted the critical importance of finding and addressing problems in articles under test before production and deployment.⁶³ In a 2016 report on the state of the Department of Defense's acquisition system, the Honorable Mr. Frank Kendall, Under Secretary for Defense, Acquisition, Technology, and Logistics observed "there is no 'acquisition magic'—no easy solution or set of solutions that will miraculously" change acquisition for the better. Attempts to legislate acquisition magic often produced unwanted results, either by increasing rigidity and bureaucracy or by leading to needless risk-taking.⁶⁴

In the same vein, the December 2016 annual DOT&E report by the Honorable Dr. J. Michael Gilmore emphasized early problem discovery as a key component of operational test and evaluation.⁶⁵ His successor, the Honorable Mr. Robert F. Behler agreed on early discovery, and supported attempts at integrating developmental and operational test and evaluation, but stressed the latter had not gone far enough. The Honorable Mr. Behler cited numerous instances wherein operational and live fire evaluations could benefit from the test data acquired by the developmental test and evaluation community, and concomitant examples in which developmental testers could benefit from "greater operational realism. Incorporating operational factors in DT&E and conducting early operational assessments aids in early discovery of problems and performance shortfalls."⁶⁶ AFOTEC's six core principles arose from within this milieu, citing early involvement and discovery, integration of developmental and operational test, and adaptability and tailoring to the situation that avoided rigidity and overly bureaucratic solutions to issues in OT&E.

In 2017, General Molloy discussed early involvement and integrated test in the foreword to the tenth edition of the AFOTEC Operational Test and Evaluation guide: "Our early involvement ...helps us avoid late discovery of system shortfalls." Of integrated test and evaluation, General Molloy also observed that combined DT and OT allowed AFOTEC testers to "leverage results from developmental testing to satisfy operational test objectives earlier," with a greater likelihood of success while better supporting the warfighter.⁶⁷ Furthermore, in a 2017 interview with *Airman Magazine*, General Molloy noted that AFOTEC's early involvement could bring an operational mindset to the development of weapons systems.⁶⁸

Another influence on the development of 6P came in late September 2017, when Mr. Dan Telford and Mr. Rick Searle of the AFOTEC Directorate of Intelligence, Analysis, and Assessments (AFOTEC/A-2/9) penned a talking paper recommending AFOTEC incorporate lessons from agile software development into the effort to "respond to the pace of need"⁶⁹ in fielding systems for the warfighter.⁷⁰ They hoped agile development would prove scalable and applicable to large, geographically-separated teams working on large, multi-stage acquisition projects, as well as the small, co-located developments teams that invented the approach. The two also laid out the changes possible if test and evaluation incorporated agile concepts. These changes including identifying issues early on in programs, and making test continuous vice discretely phased—both suggestive of core principles one and three—early involvement and continuous feedback. Such concepts helped set the stage for the development of 6P.⁷¹

The leadership of the AFOTEC Commander in the operational test enterprise constituted another factor that helped set the stage for the creation of the six principles. Like his predecessors, General Brewer frequently discussed reforming and improving test and evaluation and acquisition, as well as a penchant for systematizing solutions. For example, while he served as Commander, 412th Test Wing (July 13, 2012—March 31, 2015) at Edwards AFB, Calif., General Brewer introduced the idea of action plan to the 412th Test Wing. The first plan included concepts that

would later become principles two and four. The wing's FY2014 action plan, completed in September 2013, discussed tailoring and streamlining test and evaluation processes. Moreover, once General Brewer had taken command at AFOTEC May 18, 2018, he quickly expressed frustration at the sense that the center had lost its relevance. Required to conduct Operational Test and Evaluation at the end of major programs often already in use under concurrent program development and test and evaluation, AFOTEC's OT&E reports had come to seem superfluous to General Brewer. Early involvement along with agile and streamlined operational test and reporting seemed to provide the solution.⁷²

On April 2, 2019, Secretary of the Air Force Dr. Heather Wilson released the FY2018 report on U.S. Air Force acquisitions. The report echoed numerous others in referencing the National Defense Strategy and the projected return to great power competition, as well as emphasizing speed, prototyping, and experimentation in meeting the challenges ahead. Secretary Wilson also promoted a shift to incorporating concepts from agile software development, and highlighted the importance of delivering the "minimum viable" solution. The development of the six core principles reflected not only the cumulative impact of acquisition reform efforts, but the influence of this and similar reports detailed herein.⁷³

Speedier acquisition and fielding of systems to the warfighter formed a principal motive for AFOTEC personnel to codify and adopt the six core principles appeared in a February 2019 briefing, expressed as testing earlier, faster, and smarter, while also working at the "speed of relevance." That phrase originated with the 2018 National Defense Strategy, and referred to the push to more quickly provide new or upgraded systems and weapons to the field to enhance the warfighter's combat capability. The six principles also "answered the challenge" posed by Section 804 of the Fiscal 2016 National Defense Authorization Act, which the Air Force implemented to permit non-traditional methods of acquisition and rapid prototyping strategies.⁷⁴

Illustration 2. Why Adaptive Relevant Test



Slide excerpt from Brgf (U), AFOTEC/CC, "301 Kickoff Speed of Relevance," 20 Feb 2019.

Another implicit motivation appeared in an image entitled simply "Why...". This particular image tied the interests of deployed Airmen and their families, particularly those from the center, to the application of the six core principles. This implied the importance of reforming and improving the way AFOTEC did business due to the potential for a direct, positive impact on the mission of center personnel on deployment, as well as a potential benefit to the warfighter at large.⁷⁵

Evolution of AART to 6P



U.S. Code, Title 10 defined OT&E as “the field test, under realistic combat conditions, of an item (or key component) of weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability for use in combat by typical military users; and the evaluation of the results of such test.” Upon taking command in 2018, General Brewer expressed concerns regarding the utility of AFOTEC’s final operational test and evaluation efforts. He cited the publication of the AFOTEC detachment 6’s operational test and evaluation report on the USAF F-35A variant, which took place only after the both the U.S. Marine Corps and U.S. Navy had declared initial operational capability (IOC) with the F-35B and F-35C variants. AFOTEC’s OT&E report on the F-35A, therefore proved immaterial to the DoD, the Marines, and the Navy. He worried that too narrow a focus on a final operational test could result in reports that constituted nothing more than a rubber stamp.⁷⁶

An October 2018 briefing by General Brewer discussed a solution for ensuring AFOTEC’s relevance by examining the elements of operational test and evaluation with a focus on speeding capabilities to the field while improving performance. The briefing argued that AFOTEC could improve performance and speed to the field in Air Force systems under test. If not, General Brewer wondered facetiously whether AFOTEC’s activities therefore constituted nothing more than recreational—vice operational—test. Moreover, in laying out his intent, General Brewer made clear his concern for AFOTEC’s relevance, warning against the possibility that the “O” in OT could stand for ‘Optional.’” The solutions he presented included what would become four of the six core test principles, including remaining adaptive, tailoring to the situation, very early OT involvement, and integrating developmental and operational test and evaluation.⁷⁷

A briefing on the six core test principles for presentation to the Honorable Mr. Behler correlated the six principles with his vision for operational test and evaluation, as he had discussed in his 2017 annual report to Congress on operational test released in January 2018. Several of the six core principles addressed this vision. These included collaborating with DT&E to conduct OT&E earlier in the system development and acquisition process, as well as taking an iterative, incremental approach to acquisition and test and evaluation.⁷⁸

Illustration 3: ART Supports the DOT&E Vision

AFOTEC’s ART Principles Support the DOT&E Vision

 <p>Software Intensive Systems and Cybersecurity</p> <ul style="list-style-type: none"> • “Collaboration across entire system lifecycle” 	<p>Conduct OT&E Earlier in System Development</p> <ul style="list-style-type: none"> • “Adopt a combined test approach” • “Tailor to speed & risk of program” 	<p>Adapting T&E for Emergent Technologies</p> <ul style="list-style-type: none"> • “Emergent tech accelerating & challenging T&E” • “T&E infrastructure improvements needed” 	<p>Improving Our Testing Environments</p> <ul style="list-style-type: none"> • “Fixing T&E infrastructure and modern battlespace emulation will require greater use of M&S” • “Must understand limitations of M&S” • “Result: more efficient/effective model-test-model process”
 <ul style="list-style-type: none"> ✓ Continuous Feedback ✓ Integrate & Synchronize Test ✓ Streamline Processes & Products ✓ Early OT Involvement 	<ul style="list-style-type: none"> ✓ Early OT Involvement ✓ Continuous Feedback ✓ Integrate & Synchronize Test ✓ Tailor to Situation 	<ul style="list-style-type: none"> ✓ Adaptive ✓ Tailor to Situation ✓ Streamline Processes & Products 	<ul style="list-style-type: none"> ✓ Early OT Involvement ✓ Adaptive ✓ Tailor to Situation

← Early OT Involvement • Tailor to Situation • Continuous Feedback • Streamline Processes & Products • Integrate & Synchronize Test • Adaptive →

Excerpt from AFOTEC briefing to DOT&E on how the six core test principles related to the DOT&E vision.

The 2018 AFOTEC strategic plan, created in December 2018 under General Brewer’s command in an environment attuned to speed and agility, contained the first appearance of the term AART. In an attempt to further

the AFOTEC goal of achieving the speed of relevance, the center staff explicitly included in the plan the creation and implementation of the six core principles as one objective toward that goal. The desired end state for the speed of relevance would mean a more responsive AFOTEC, achieved via means of “streamlined, rapid, integrated, and innovative processes.”⁷⁹

General Brewer introduced the six key principles at the AFOTEC Spring Commander’s Summit in April 2019. His presentation included several key points, such as the assumption that AFOTEC would carry out holistic test versus separate contractor, developmental, and operational test phases, and that independent operational test did not mean separate or isolated. AFOTEC would pursue early operational representation, as opposed to waiting to conduct operational test of production-representative systems at the end of programs. In this context, General Brewer called for a shift away from defining criteria for entrance into Initial Operational Test and Evaluation to emphasizing exit criteria while eliminating pass/fail criteria. He also assumed, as had General Eichhorn, that an early increase in test resources to discover issues would only save program costs in the long run.⁸⁰

General Brewer recognized the cultural change that would have to take place for the six core principles to take hold. Therefore, as part of his effort to embed agile test principles within the center, AFOTEC conducted a Continuous Process Improvement (CPI) event on test and the speed of relevance, which concluded with an out brief at the spring AFOTEC Commander’s Summit.⁸¹ AFOTEC conducted the Continuous Process Improvement event to determine the requirements and optimal structure for the center to meet the speed of relevance, according to a CPI charter that listed the six principles.⁸²

The AFOTEC CPI team identified problems in meeting the speed of relevance that included a lack of product and process flexibility, the roles of AFOTEC HQ of oversight versus support, and resource limitations, while recommending some initial solutions. These included eliminating briefing requests, tasking order updates, and test plan deviation memoranda; consolidating programs status updates, and revising AFOTEC guidance to encourage flexibility in test planning and reporting. The team’s most significant recommendation involved having each AFOTEC detachment create an early test strategy for each program, called an Operational Test Roadmap, in order to present the test strategy for input and vectoring by senior leaders. CPI participants also selected pilot programs that would apply the six core principles, to help program managers gain additional insight into the approach. The pilot programs included: the Protected Tactical Enterprise Service (PTES); the Nuclear Planning and Execution System (NPES); the Advance Pilot Trainer (APT); the F-35 Block 4; B-2 DMS; and the B-21 *Raider*. Finally, the AFOTEC CPI team outlined quick fixes and sizable tasks for the AFOTEC HQ Directorates and detachments to undertake.⁸³

An attempt led by General Brewer to normalize the six core principles approach to operational test among the Service Operational Test Agencies commenced when in April 2019, AFOTEC personnel participated in a workshop that included the military services’ Operational Test Agencies, held at the U.S. Army’s Fort Huachuca.⁸⁴ OTA representatives Mr. Dan Telford and 2Lt Stuart A. Corbett from AFOTEC, along with personnel from the U.S. Marine Corps Operational Test Activity (MCOTEA), the Naval Command Operational Test and Evaluation Force (COTF), and the U.S. Army Test and Evaluation Center (ATEC) led a discussion on agility. The presentation by AFOTEC personnel distinguished between agile development and traditional acquisition procedures, which included both traditional acquisitions and middle-tier acquisitions. Permitted by the language of Section 804 of the FY2016 National Defense Authorization Act (NDAA), Section 804 or Middle-Tier Acquisitions provided for both rapid prototyping and rapid fielding. Mr. Telford and Lieutenant Corbett contrasted the Section 804 approach with principles of agile development, which they had extrapolated from commercial agile software development efforts. AFOTEC’s presentation followed with the principles of AFOTEC Adaptive Relevant Test.⁸⁵

General Brewer subsequently began an aggressive campaign to persuade the leadership of the other Service OTAs to endorse the six principles.⁸⁶ This effort included the U.S. Marine Corps Operational Test Activity, the Naval

Command Operational Test and Evaluation Force, the U.S. Army Test and Evaluation Center, as well as the OTA for the Defense Information Systems Agency (DISA), the Joint Interoperability Test Command (JITC). Attaining unanimous agreement among the OTA leadership would allow General Brewer to present a united front on the six principles to the Honorable Mr. Behler on behalf of the operational test and evaluation community. By May 31, 2019, General Brewer had secured the agreement of all the OTAs with memorandum that emphasized a renewed focus and energy in the application of the ideas that made up the six principles, as well as a consensus across the military services.⁸⁷

In October 2019, AFOTEC held a Rapid Improvement Event (RIE) on the six core principles. Participants reviewed AFOTEC policies, guidance, and common practices to identify roadblocks impairing or preventing the integration and institutionalization of the six core principles. The RIE provided “actionable recommendations” to the OTA Commanders/Directors and the Director of DOT&E. The team completed the event at the fall 2019 OTA Commanders’ Roundtable, held November 19 through 20, 2019, with a briefing to DOT&E.⁸⁸

The eleventh edition of the AFOTEC Operational Test and Evaluation Guide, published April 2, 2020, also included the six core principles in their entirety, and provided a thoroughgoing explanation for their development. The foreword to this version, signed by General Brewer, reads in part:

By conducting early operational testing and evaluation...we find and fix problems sooner to deliver combat capability at the “speed of relevance.” We provide early, continuous and cumulative feedback that identifies deficiencies, informs warfighters, and influences national resource decisions without delay. The integrated test approach is key to early engagement and preventing wasteful duplication.... This guide provides test teams standard starting points from which they can deviate as they tailor and streamline tools and methods to suit each system under test.⁸⁹

General Brewer and AFOTEC Vice Commander Col Matthew T. Magness even published a guest editorial on the topic of the six test principles in the journal of the International Test and Evaluation Association in June 2020. In the editorial, they noted that six principles would help the test community meet one of the top priorities of the Joint Chiefs of Staff, “to re-inject ‘speed’ into the requirements and acquisition processes.”⁹⁰

The concurrence of all the Service OTAs, as well as the presentations directly to the Honorable Mr. Behler culminated in the endorsement of the six principles by DOT&E in his annual report on 2019 operational test and evaluation, released December 20, 2020. The Honorable Mr. Behler touted the six principles in his FY2019 report to Congress on the state of OT&E, as General Brewer had hoped he would.⁹¹ The report detailed each of the six principles, while concurring with General Brewer’s assertion that operational test should not “be limited to a ‘final exam.’”⁹²

AFOTEC eventually began shortening the AART appellation used to refer to the six principles to Adaptive Relevant Test, in order to facilitate use by the other Service OTAs.⁹³ By 2020, AFOTEC Commander General Sears had adopted the moniker in use by the other OTAs, the six core test principles, or 6P.

Conclusion

Discussions of making test and evaluation, or indeed the entire Air Force acquisition system, more effective and efficient rose during periods of strain on defense budgets, and fell during periods of full funding. So too, did discussions of specific measures of more effective operational test, such as concepts of early involvement or integrated developmental and operational test and evaluation. The twenty-first century brought new challenges from

peer competitors, and a concomitant emphasis on agility and speed in acquisition. This led to a codification of principles of efficient operational test at AFOTEC, beginning in 2018.

Two of the six core principles emerged in AFOTEC's earliest history as concepts for improving or reforming operational test and evaluation and the acquisition system. Early involvement or early influence, while its definition changed during AFOTEC's history, had the longest history and widest support of any of the AFOTEC six core principles. The definition of what early involvement or influence actually entailed changed over time, depending in part upon the defense budget and the outlook for acquisition. Support for integrated test and evaluation evolved along with an independent AFOTEC as of 1991, when the Air Force designated the center a direct reporting unit to the Chief of Staff of the Air Force, but the notion of integrated test continued to seem to pose a potential threat to AFOTEC for some time afterwards.

The six core principles emerged from the milieu and mission of the Air Force and of the center, and AFOTEC personnel who thought deeply about test and evaluation and the acquisition system. Other influences included the leadership of General Brewer, and the inspiration provided by the call to act at the "speed of relevance" supplied by the 2018 National Defense Strategy. In addition, the universal applicability of the six core principles to the OTAs of all the military services, as well as their endorsement by the Director of Operational Test and Evaluation cemented their place in operational test and evaluation. Their adoption by the rest of the operational test and evaluation community attested to their practical utility and the need for them in a time of intense peer-to-peer competition and increasingly rapid adoption of new technologies posing ever-greater threats.

Notes

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- ² Disc (U), Mr. Jeffrey Olinger, AFOTEC/CA with Dr. Stephanie M. Smith, AFOTEC/HO, 4 May 2021.
- ³ See Plan (U//Dist. A), AFOTEC/CC, "Strategic Plan: AFOTEC Vision 2020," Dec 2019, Hist of AFOTEC, Jan-Dec 2020 (CUI) CF 3010, (info used is U).
- ⁴ Irwin Ross (U), "Inside the Biggest Pentagon Scam," FORTUNE Magazine, January 11, 1993, SD 2022.
- ⁵ Study (U), Rand Corp., "Why Has the Cost of Fixed-Wing Aircraft Risen? A Macroscopic Examination of the Trends in U.S. Military Aircraft Costs Over the Past Several Decades," 2008, pp 2-3, SD 2001.
- ⁶ Thesis (U), Jeffrey Branstetter, "The Darleen Druyun Debacle: Procurement, Power, and Corruption," George Washington University Law School, in partial satisfaction of the requirements for the degree of Master of Laws, Aug 2005, SD 2002.
- ⁷ Study (U), Deloitte, "Can We Afford Our Own Future? Why A&D Programs are Late and Over-Budget — and What Can Be Done to Fix the Problem," 2009, pp 5-7, SD 2003; Study (U), Rand Corp., "Why Has the Cost of Fixed-Wing Aircraft Risen? A Macroscopic Examination of the Trends in U.S. Military Aircraft Costs Over the Past Several Decades," 2008, pp 46-7, SD 2001.
- ⁸ Transcript (U), Maj Gen Matthew T. Molloy, AFOTEC/CC, intvw with Dr. Barron Oder, AFOTEC/HO, 16-17 Feb 2016, SD 2004.
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- ¹² Brfg (U//Dist. A), AFOTEC, "AFOTEC Msn Brief: No Videos," 1 Oct 2020, in Hist of AFOTEC, Jan-Dec 2020 (CUI//SP-CTI//Dist. E//OPSEC/PRVCY/SP-CTI/EXPT/LES/MFC), CF 1060 (info used is U//Dist. A). Note: this publication uses the terms 6P or the six core principles vice AART.
- ¹³ Transcript (CUI), Maj Gen Michael T. Brewer, AFOTEC/CC, with Dr. Stephanie M. Smith, AFOTEC/HO, 21 Jan 2020, in Hist of AFOTEC, Jan-Dec 2020 (CUI//SP-CTI//Dist. E//OPSEC/PRVCY/SP-CTI/EXPT/LES/MFC), CF 0002 (info used is CUI).
- ¹⁴ Summary (U), DoD, "Summary of the 2018 National Defense Strategy of the United States of America: Supporting the American Military's Competitive Edge," 19 Jan 2018, in Hist of AFOTEC, Jan-Dec 2020 (CUI//SP-CTI//Dist. E//OPSEC/PRVCY/SP-CTI/EXPT/LES/MFC), SD 2030 (info used is U).
- ¹⁵ Brfg (U), AFOTEC to DOT&E, "AFOTEC Adaptive-Relevant Testing (AART) Pilot Projects," 14 Jun 2018, SD 2005; Rpt (U), the Honorable Robert F. Behler, DOT&E, "FY 2017 Annual Report," Jan 2018, SD 2014; Summary (U), DoD, "Summary of the 2018 National Defense Strategy of the United States of America: Supporting the American Military's Competitive Edge," 19 Jan 2018, in Hist of AFOTEC, Jan-Dec 2020 (CUI//SP-CTI//Dist. E//OPSEC/PRVCY/SP-CTI/EXPT/LES/MFC), SD 2030 (info used is U).
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- ¹⁷ Plan (U//Dist. A), AFOTEC, "Strategic Plan," Dec 2018, SD 2006. NOTE: The center did not produce a 2017 strategic plan.
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- ¹⁹ *Ibid.*
- ²⁰ Memo (U), Maj Gen Michael T. Brewer, HQ AFOTEC/CC, et al., to the HON Robert F. Behler, DOT&E, "Operational Test Agencies Six Core Test Principles," 31 May 2019, in Hist of AFOTEC, Jan-Dec 2019 (U//FOUO//Dist. E//EXPT//MFC), CF 1010 (info used is U); Disc (U), Mr. Jeffrey Olinger, AFOTEC/CA with Dr. Stephanie M. Smith, AFOTEC/HO, 4 May 2021.

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- ²² *Ibid.*
- ²³ Rpt (U), the Honorable Robert F. Behler, DOT&E, "FY 2016 Annual Report," Dec 2016, SD 2007.
- ²⁴ *Ibid.*
- ²⁵ *Ibid.*
- ²⁶ Memo (U), Maj Gen Michael T. Brewer, HQ AFOTEC/CC, et al., to the HON Robert F. Behler, DOT&E, "Operational Test Agencies Six Core Test Principles," 31 May 2019, in Hist of AFOTEC, Jan-Dec 2019 (U//FOUO//Dist. E//EXPT//MFC), CF 1010 (info used is U).
- ²⁷ *Ibid.*
- ²⁸ Brfg (U), AFOTEC/CC, "301 Kickoff: Speed of Relevance," 20 Feb 2019, Hist of AFOTEC, Jan-Dec 2020 (CUI//SP-CTI//Dist. E), CF 1010 (info used is U).
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- ³² Hist of AFTEC, 1 Jan – 31 Dec 1977 (U), p 3.
- ³³ Hist of AFTEC, 1 Jan – 31 Dec 1978 (U), p 19.
- ³⁴ *Ibid.*
- ³⁵ Hist of AFTEC, 1 Jan – 31 Dec 1979 (U), p 38.
- ³⁶ Ppr (U), Dr. Marion Williams, Air Force Operational Test and Evaluation Center Chief Scientist, "Early OT&E," 18 Apr 1986, SD 2021.
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- ⁴¹ Transcript (U//DL), Maj Gen William A. Peck, Jr., AFOTEC/CC intvw with Mr. Charles Janson, AFOTEC/HO, 26 Mar 2002, in Hist of AFOTEC, Jan-Dec 2001 (U//FOUO//Dist. E), SD 1-8 (info used is U//DL); Brfg (U), AFOTEC, "We Can Help," 28 Jan 2003, in Hist of AFOTEC, Jan-Dec 2001 (U//FOUO//Dist. E), SD 1-012, (info used is U).
- ⁴² Transcript (U), Maj Gen Robin E. Scott, AFOTEC/CC, intvw with James L. Burrett, Air Force Operational Test and Evaluation Center Office of History and Research, 24 Apr 2007, SD 2009. NOTE: General Scott characterized this type of involvement as "going to meetings and eating doughnuts."
- ⁴³ Transcript (U), Maj Gen Robin E. Scott, AFOTEC/CC, intvw with James L. Burrett, Air Force Operational Test and Evaluation Center Office of History and Research, 24 Apr 2007, SD 2009; Transcript (U), Col Alison R. Hill, AFOTEC/CV, intvw with James L. Burrett, Air Force Operational Test and Evaluation Center Office of History and Research, 17 Jul 2007, SD 2010.

- ⁴⁴ Transcript (U), Maj Gen Robin E. Scott, AFOTEC/CC, intvw with James L. Burrett, Air Force Operational Test and Evaluation Center Office of History and Research, 24 Apr 2007, SD 2009.
- ⁴⁵ Transcript (U), Maj Gen Stephen T. Sargeant, AFOTEC/CC, intvw with Dr. Gary R. Lester, Air Force Operational Test and Evaluation Center Office of History and Research, 9 Sep 2009, SD 2011.
- ⁴⁶ Transcript (U), Maj Gen David J. Eichhorn, AFOTEC/CC, intvw, with Dr. Gary R. Lester and Dr. Barron Oder, AFOTEC/HO, 17 Dec 2010, in Hist of AFOTEC, Jan-Dec 2010 (U//FOUO//Dist. E), SD-1-020 (info used is U).
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- ⁵³ *Ibid.*
- ⁵⁴ Hist of AFTEC, 1 Jan – 31 Dec 1977 (U), p 5.
- ⁵⁵ Hist of AFTEC, 1984 (U), pp 43-44.
- ⁵⁶ Transcript (U), Dr. Marion Williams, AFOTEC Chief Scientist, intvw with AFOTEC/RS, ca. 1998, SD 2020.
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- ⁵⁸ Transcript (U//DL), Maj Gen William A. Peck, Jr., AFOTEC/CC, intvw with Ms. Lisa M. Dales-Gonzalez, AFOTEC/HOH and Mr. John P. Williamson, AFOTEC/HOI, 28 Jan 2003, in Hist of AFOTEC, Jan-Dec 2002 (U//FOUO//Dist. E), SD 1-016 (info used is U//DL).
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Glossary

6P	six principles, or six core test principles
AART	AFOTEC Adaptive Relevant Test
ACOM	U.S. Atlantic Command
AFB	Air Force Base
AFR	Air Force Regulation
AFSC	Air Force Systems Command
AF/TE	Headquarters, U.S. Air Force, Director of Test and Evaluation
AFTEC	Air Force Test and Evaluation Center
AFOTEC	Air Force Operational Test and Evaluation Center
Apr	April
APT	Advance Pilot Trainer
ATEC	U.S. Army Test and Evaluation Center
BRAC	Base Realignment and Closing
CC	Commander
COTF	Naval Command Operational Test and Evaluation Force
COMOPTEVFOR	Naval Command Operational Test and Evaluation Force
CPI	Continuous Process Improvement
CUI	
Dec	December
DISA	Defense Information Systems Agency
DL	distribution limited
DoD	Department of Defense
DOT&E	Office of the Secretary of Defense, Director, Operational Test and Evaluation
DRU	Direct Reporting Unit
DSC/P&O	Director of the Office of Operations and Readiness
DT	developmental test
DT&E	developmental test and evaluation
GAO	Government Accounting Office
GBSD	Ground Based Strategic Deterrent
Gen	General
HO	History Office
IOC	Initial Operational Capability
IOT&E	Initial Operational Test and Evaluation
JITC	Joint Interoperability Test Command

KPPs	key performance parameters
Maj	Major
MAJCOM	major commands
MCOTEA	U.S. Marine Corps Operational Test Activity
NDA	National Defense Authorization Act
NPES	Nuclear Planning and Execution System
OPTEVFOR	Naval Command Operational Test and Evaluation Force
OT	operational test
OT&E	operational test and evaluation
OTA	Operational Test Agency
PTES	Protected Tactical Enterprise Service
RIE	Rapid Improvement Event
U	unclassified

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The Evolution of AFOTEC's Six Core Test Principles

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