

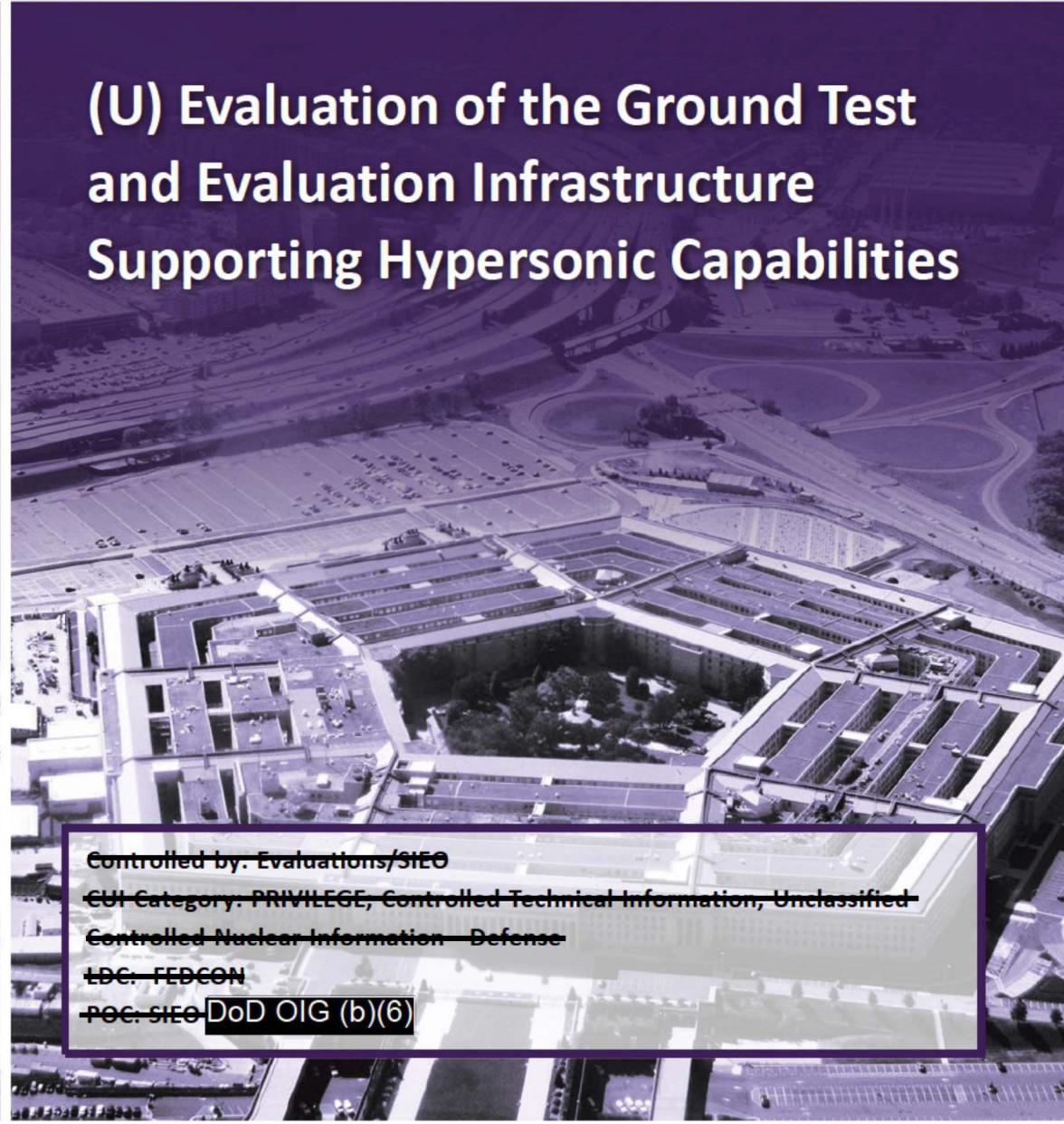
~~CUI~~



INSPECTOR GENERAL

U.S. Department of Defense

FEBRUARY 1, 2022



(U) Evaluation of the Ground Test and Evaluation Infrastructure Supporting Hypersonic Capabilities

~~Controlled by: Evaluations/SIEO~~

~~CUI Category: PRIVILEGE, Controlled Technical Information, Unclassified
Controlled Nuclear Information—Defense~~

~~LDC: FEDCON~~

~~POC: SIEO~~ DoD OIG (b)(6)

INTEGRITY ★ INDEPENDENCE ★ EXCELLENCE

Released by the DoD OIG FOIA Office
under FOIA request DODOIG-2022-000445

on 5/5/2023

~~CUI~~





(U) Results in Brief

(U) Evaluation of the Ground Test and Evaluation Infrastructure Supporting Hypersonic Capabilities

February 1, 2022

(U) Objective

(U) The objective of this evaluation was to determine whether the DoD has sufficient ground test and evaluation facilities with the capability and capacity to support environmental testing for the DoD's planned hypersonic weapon systems development.

(U) Background

(U) Hypersonic weapon systems, primarily hypersonic glide vehicles or hypersonic cruise missiles, travel five or more times the speed of sound through the atmosphere. Unlike ballistic missiles, hypersonic weapon systems do not follow a ballistic trajectory and can maneuver en-route to their destination.

~~(CUI)~~ To develop hypersonic weapon systems, the DoD is focused on enhancing existing test capabilities to support acquisition testing of near-term and mid-term hypersonic weapon systems. ~~(CUI)~~ OSD/JS (b)(3)

~~(CUI)~~

(U) Finding

~~(CUI)~~ OSD/JS, AFMC (b)(3)

~~(CUI)~~ OSD/JS, AFMC (b)(3)

(U) Additionally, the Test Resource Management Center has identified additional high-priority improvements in capability and capacity at the Arnold Engineering Development Complex facilities, which will be completed over the next six years, that are required to support the development of hypersonic programs across the DoD.

~~(CUI)~~ OSD/JS, AFMC (b)(3)

- ~~(CUI)~~ OSD/JS (b)(3)
- (U) In response to advancements made by strategic competitors, DoD increased the demand for hypersonic ground test and evaluation facilities and began reprioritizing hypersonic weapon system development since the mid-2010s. As a result of reprioritization, three hypersonic weapon systems are simultaneously in development within the Department of Defense.



(U) Results in Brief

(U) Evaluation of the Ground Test and Evaluation Infrastructure Supporting Hypersonic Capabilities

(U) Finding (cont'd)

- ~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

(U) Recommendations

(U) We recommend that the Under Secretary of Defense for Research and Engineering develop a plan to implement the strategies identified in the Test Resource Management Center's "Fiscal Year 2018-Fiscal Year 2028 Strategic Plan for Department of Defense Test & Evaluation Resources," and the additional projects the Arnold Engineering Development Complex has identified through the Service Program Objective Memorandum process to improve hypersonic ground test and evaluation capability and capacity. This recommendation will support the DoD's focus on enhancing existing test capabilities to support hypersonic weapon systems development.

(U) We recommend that the Director of the Test Resource Management Center revise the strategic plan to incorporate options to eliminate all ground test and evaluation capability and capacity shortfalls necessary for hypersonic weapon system development.

(U) We recommend that the Commander of the Arnold Engineering Development Complex develop an integrated scheduling and tracking process to document all unfilled test requests, test delays, cancellations, and the reasons for the delays and cancellations, for all Arnold Engineering Development Complex test and evaluation facilities. The process should also track conflict resolution between programs competing for the same test time and facility. This recommendation will allow the Arnold Engineering Development Complex to accurately project demand and determine test capacity shortfalls.

(U) Management Comments and Our Response

(U) The Acting Deputy Director for Research and Engineering Advanced Concepts, responding for the Office of the Under Secretary of Defense for Research and Engineering, as well as the subordinate Test Resource Management Center, agreed with our report. Therefore, the recommendations to the Office of the Under Secretary of Defense for Research and Engineering and the Test Resource Management Center are resolved but will remain open.

(U) The Acting Deputy Director for Research and Engineering Advanced Concepts also provided a Consolidated Comment Matrix that provided updates to some of the data collected during our fieldwork. We adjusted our report to reflect his updates.

(U) The Commander of the Arnold Engineering Development Complex agreed with the recommendation to develop an integrated scheduling and tracking process to document all unfilled test requests, test delays, cancellations for all Arnold Engineering Development Complex test and evaluation facilities. The Commander of the Arnold Engineering Development Complex estimated this action will be complete by the end of the 2nd quarter of FY 2022. Therefore, this recommendation is resolved but will remain open.

(U) Please see the Recommendations Table on the next page for the status of the recommendations.

(U) Recommendations Table

(U) Management	Recommendations Unresolved	Recommendations Resolved	Recommendations Closed
Under Secretary of Defense Research and Engineering	None	1	None
Test Resource Management Center	None	2	None
Arnold Engineering Development Complex	None	3	None (U)

Please provide Management Comments by March 4, 2022.

(U) Note: The following categories are used to describe agency management’s comments to individual recommendations.

- **(U) Unresolved** – Management has not agreed to implement the recommendation or has not proposed actions that will address the recommendation.
- **(U) Resolved** – Management agreed to implement the recommendation or has proposed actions that will address the underlying finding that generated the recommendation.
- **(U) Closed** – DoD OIG verified that the agreed upon corrective actions were implemented.





**INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
4800 MARK CENTER DRIVE
ALEXANDRIA, VIRGINIA 22350-1500**

February 1, 2022

(U) MEMORANDUM UNDER SECRETARY OF DEFENSE RESEARCH & ENGINEERING
ASSISTANT SECRETARY OF THE ARMY FOR ACQUISITION,
TECHNOLOGY & LOGISTICS
ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH,
DEVELOPMENT AND ACQUISITION
ASSISTANT SECRETARY OF THE AIR FORCE FOR ACQUISITION,
TECHNOLOGY & LOGISTICS
COMMANDER, AIR FORCE TEST CENTER

(U) SUBJECT: Evaluation of the Ground Test and Evaluation Infrastructure Supporting
Hypersonic Capabilities (Report No. DODIG-2022-056)

(U) This final report provides the results of the DoD Office of Inspector General's evaluation. We previously provided copies of the draft report and requested written comments on the recommendations. We considered management's comments on the draft report when preparing the final report. These comments are included in the report.

(U) Agency Responding Officials met the intent of the recommendations presented in the report; therefore, we consider the recommendations resolved and open. As described in the Recommendations, Management Comments, and Our Response section of this report, we will close the recommendations when Agency Responding Officials provide us documentation showing that all agreed-upon actions to implement the recommendations are completed.

(U) DoD Instruction 7650.03 requires that recommendations be resolved promptly. Therefore, please provide us within 30 days your response concerning specific actions in process or alternative corrective actions proposed on the recommendations. Send your response to [DoD_OIG_\(b\)\(6\)@dodig.mil](mailto:DoD_OIG_(b)(6)@dodig.mil).

(U) If you have any questions, please contact [DoD_OIG_\(b\)\(6\)](mailto:DoD_OIG_(b)(6)@dodig.mil) at [DoD_OIG_\(b\)\(6\)](tel:7036977000) (DSN [DoD_OIG_\(b\)\(6\)](tel:7036977000)).

A handwritten signature in black ink, appearing to read "Randolph R. Stone".

Randolph R. Stone
Assistant Inspector General for Evaluations
Space, Intelligence, Engineering and Oversight

(U) Contents

(U) Introduction

(U) Objective 1

(U) Background 1

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted] 5

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted] 6

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted] 18

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted] 23

(U) Recommendations, Management Comments, and Our Response 24

(U) Appendixes

(U) Appendix A. Scope and Methodology 27

 (U) Use of Computer-Processed Data 28

 (U) Prior Coverage 28

(U) Appendix B. Other Matters of Interest 29

(U) Management Comments

(U) Office of the Under Secretary of Defense for Research and Engineering 31

(U) The Arnold Engineering Development Complex 32

(U) Acronyms and Abbreviations 34

(U) Introduction

(U) Objective

(U) The objective of this evaluation was to determine whether the DoD has sufficient ground test and evaluation (T&E) facilities with the capability and capacity to support environmental testing for the DoD's planned hypersonic weapon systems development.¹

(U) Background

(U) Hypersonic weapon systems, primarily hypersonic glide vehicles and hypersonic cruise missiles, travel five or more times the speed of sound through the atmosphere.² Unlike ballistic missiles, hypersonic weapon systems do not follow a ballistic trajectory and can maneuver en-route to their destination. Hypersonic weapon systems challenge space-based and terrestrial detection and defensive capabilities because of their speed, maneuverability, and low altitude of flight.

(U) Strategic Competitors' Impact on Hypersonic Weapon Systems Development

(U) China and Russia have a number of hypersonic weapon programs and are expected to field an operational hypersonic glide vehicle—potentially armed with nuclear warheads. China has a robust research and development infrastructure devoted to hypersonic weapons. Additionally, Russia has conducted research on hypersonic weapons technology since the 1980s; however, it accelerated its efforts in response to U.S. missile defense deployments in both the United States and Europe.³

(U) DoD's Hypersonic Ground Test and Evaluation Infrastructure

(U) In recent years, the United States has focused on the tactical capability hypersonic weapon systems bring to theater or regional conflict, developing offensive hypersonic glide vehicles and hypersonic cruise missiles with short

¹ (U) Ground T&E facilities conduct environmental testing. Environmental testing provides conditions (such as, altitudes, Mach numbers, pressures, temperatures, and dynamic conditions) that must be replicated to adequately mature and demonstrate hypersonic technologies to the readiness levels needed for successful development of future defense-related systems.

² (U) There are two primary categories of hypersonic weapons: Hypersonic glide vehicles are launched from a rocket before gliding to a target. Hypersonic cruise missiles are powered by high-speed, air-breathing engines, or "scramjets," after acquiring their target.

³ (U) Congressional Research Service, Hypersonic Weapons: Background and Issues for Congress, March 17, 2020.

(U) to intermediate ranges, as well as defensive interceptor missiles.⁴ To develop hypersonic weapon systems, the DoD is focused on enhancing existing test capabilities to support acquisition testing of near-term and mid-term hypersonic weapon systems. The development of hypersonic weapon systems is intended to ensure continued military superiority and strike capability for the United States, including freedom of movement and freedom of action in areas protected by Anti-Access/Area Denial defenses.⁵

~~(CUI)~~ OSD/JS (b)(3) [Redacted]

(U) The six Arnold Engineering Development Complex (AEDC) hypersonic ground T&E facilities considered for this evaluation are part of the Major Range and Test Facility Base, which is a designated core set of DoD T&E infrastructure and the associated workforce that provides T&E capabilities to support DoD acquisition.⁷ The Director, Test Resource Management Center (TRMC), under the authority of the Under Secretary of Defense for Research and Engineering, oversees the Major Range and Test Facility Base. The Secretaries of the Military Departments maintain, operate, upgrade, and modernize the Major Range and Test Facility Base for use by DoD acquisition programs.

~~(CUI)~~ OSD/JS (b)(3) [Redacted]

⁴ (U) Congressional Research Service, Hypersonic Weapons: Background and Issues for Congress, March 17, 2020.
⁵ (U) DoD FY 2018 – FY 2028 Strategic Plan for DoD T&E Resources, March 2019.
⁶ (U) Mach number is the speed of an object that approaches the speed of sound, the flight Mach number is nearly equal to Mach 1. Speeds greater than five times the speed of sound – Mach 5, are considered to be hypersonic speed.
⁷ (U) DoD Directive 3200.11, “Major Range and Test Facility Base,” December 27, 2007, Incorporated Change 2, October 15, 2018.
⁸ (U) The AEDC is part of the Air Force Test Center, a subordinate command of the Air Force Materiel Command. Located at Arnold Air Force Base in Tullahoma, Tennessee, the AEDC is the nation’s largest aerospace test facility complex.

(U) Hypersonic Weapon System Acquisition Programs in Development

(U) The following table depicts offensive hypersonic weapon systems the DoD has in development.

~~(CUI)~~ Table 1. DoD Hypersonic Weapon Systems in Development

(CUI) Name	Organization	Description	Planned Fielding Date
Long-Range Hypersonic Weapon	Army	OSD/JS, AFMC (b)(3)	FY 2023
Conventional Prompt Strike (CPS)	Navy		FY 2025, on nuclear-powered guided missile submarine FY 2028, on a nuclear-powered attack submarine
Air-Launched Rapid Response Weapon (ARRW)	Air Force		FY 2022

* (U) Multiple sources were used for the creation of the table. The sources include: Report No. GAO-21-378, DoD Should Clarify Roles and Responsibilities to Ensure Coordination across Development Efforts, March 2021.

(U) Source: The DoD OIG.

(U) Hypersonic Missile Defense

~~(CUI)~~ OSD/JS, AFMC (b)(3)
[Redacted text block containing approximately 10 lines of blacked-out content]

(U) Finding

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

- ~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

- ~~(CUI)~~ OSD/JS (b)(3) [Redacted]
- ~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(U) We reviewed T&E data provided by the hypersonic Service program offices and MDA on testing delays and cancellations at AEDC facilities in Tullahoma, Tennessee; Alamogordo, New Mexico; and White Oak, Maryland, for T&E events from FY 2018 to FY 2020. OSD/JS, AFMC (b)(3)

[Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

⁹ (U) Office of the Secretary of Defense – Test Resource Management Center, Report on the Ability of the U.S. Test and Evaluation Infrastructure to Effectively and Efficiently Mature Hypersonic Technologies for Defense Systems Development and Plan for Proposed Improvements and Modernization, February 2015. The X-15 program began in 1959 and concluded in 1968. The Saturn V was used in the Apollo program in the 1960s and 1970s, with its final flight occurring in 1973.

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) The AEDC officials told us that in addition to equipment reliability, obtaining replacement parts is a challenge. During our site visit to the Aerodynamic and Propulsion Test Unit, which supports hypersonic weapons system development by providing high-speed test environments for ramjets, scramjets, and directed energy lethality testing, an AEDC official told us the replacement parts must often be custom-manufactured when equipment breaks down. Custom manufacturing is often required because the parts are no longer in production due to the age of the equipment. Furthermore, some custom-manufactured replacement parts require up to six months to procure, which can have a significant impact to operations.

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) OSD/JS (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) OSD/JS (b)(3) [Redacted]
(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) OSD/JS (b)(3) [Redacted]
(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

¹⁰ (U) J5 Phoenix - An AEDC Hypersonic Test Capability Improvement project, which will upgrade the former J5 Large Rocket Motor Test Facility at Arnold Air Force Base to support hypersonic scramjet testing.

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

(U) OSD/JS (b)(3)

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

¹¹ (U) Study on the Hypersonic T&E Ground and Flight Test Infrastructure, Workforce, and Inland Corridor Options, Institute for Defense Analyses, December 2020.

~~(U)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]

~~(U)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) Programs Compete for Limited Hypersonic Test and Evaluation Resources

~~(U)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

~~(U)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

¹² (U) The former Program Manager, Office of the Secretary of Defense Conventional Prompt Global Strike Program, told us that he was the last program manager for the hypersonics program when it solely resided within OUSD. The CPS program, previously called Conventional Prompt Global Strike (CPGS), began in 2008 as a long-range system before changing in FY 2013 to an intermediate-range system.

¹³ (U) Department of the Air Force - Report to Congressional Committees, Assessment of Air Force Test Center, dated March 2021.

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]

(U) High-Enthalpy Aerothermal Test Arc Heated Facilities

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]

(U) Propulsion Wind Tunnel 16 Transonic

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]

¹⁴ (U) Enthalpy is a thermodynamic quantity equivalent to the total heat content of a system. It is equal to the internal energy of the system plus the product of pressure and volume.

¹⁵ (u)AFMC (b)(3) [Redacted]
 [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]

(U) Hypervelocity Wind Tunnel 9

(U) Hypervelocity Wind Tunnel 9, an AEDC test facility located in White Oak, Maryland, provides aerodynamic simulation critical to the development of hypersonic systems, including critical altitude regimes associated with strategic missile systems and advanced defensive interceptor systems, and hypersonic vehicle technologies. Tunnel 9 is capable of testing up to speeds of Mach 18.

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

~~(U)~~ AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) The AEDC Leadership Efforts to Address Capability and Capacity Shortfalls

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]

- ~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
- ~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
- ~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) The TRMC Strategic Plan for DoD Test and Evaluation Resources

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(U) We reviewed the Central Test and Evaluation Investment Program and determined that it included numerous projects to improve capability for hypersonic weapon systems development, including:

- (~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
- (~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

¹⁶ (U) The Central Test and Evaluation Investment Program provides OSD funding and a mechanism for the development and acquisition of new test capabilities to satisfy multi-Service testing requirements. It oversees the acquisition and integration of all training and associated test range instrumentation and development related policy.

- (~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]

(~~CUI~~) OSD/JS (b)(3) [Redacted]

¹⁷ (U) Noncompetitive Conversion: Several Government-wide appointing authorities permit or require agencies to noncompetitively convert employees to career or career-conditional appointments from excepted service or temporary appointments. In addition, some agencies may have their own conversion authority based on specific provisions of law. Direct-Hire Authorities: Using OPM-approved government-wide or agency specific direct-hire authorities, agencies may appoint candidates to positions without regard to the requirements in title 5 U.S.C. Sections 3309 through 3318. In order for an agency to use direct hire, OPM must determine that there is either a severe shortage of candidates or a critical hiring need for a position or group of positions.

~~(CUI)~~ OSD/JS (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) The DoD Reduced Activity in Hypersonic T&E Facilities

(U) In the early 2000s, DoD T&E organizations significantly reduced activity at hypersonic T&E facilities due to the lack of requirements for hypersonic weapon systems. According to AEDC officials, the Global War on Terror efforts realigned funds, which affected AEDC operations. The demand for AEDC’s T&E facilities was low, which in turn prevented the AEDC from adequately justifying the funding required to sustain or improve capability and capacity.

(U) The 2015 TRMC Report stated that the marginal maintenance and modernization activity at hypersonic T&E facilities was due to the absence of a DoD acquisition program or acquisition strategy for hypersonic-related systems that includes the requisite infrastructure. The lack of a comprehensive acquisition program or strategy placed proposed hypersonic T&E infrastructure investments at a disadvantage relative to other DoD budgeting priorities.

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]

(U) The DoD Increased Demand for Hypersonic T&E by Reprioritizing Hypersonic Weapon Systems due to Increasing Strategic Competition

(U) OSD/JS (b)(3) [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]
 [Redacted]

(U) Specifically, the 2018 National Defense Strategy summary shifted the United States to focus on the threats posed by strategic competitors such as China and Russia, stating that “the U.S. competitive military advantage has been eroding and that terrorism is no longer the primary concern.”¹⁸ The 2018 National Defense Strategy summary states that new technologies, including hypersonics, will be necessary to ensure the U.S. will be able to fight and win the wars of the future. The 2018 National Defense Strategy summary states that long-term strategic competitions with China and Russia are the principal priorities for the DoD. It further states the DoD requires both increased and sustained investment to modernize key capabilities, because of the magnitude of the threats China and Russia pose today, and the potential for those threats to increase in the future.

¹⁸ (U) Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military’s Competitive Edge.

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS (b)(3) [Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]

(U) OSD/JS, AFMC (b)(3) [Redacted]

~~(CUI)~~ OSD/JS (b)(3)
[Redacted]

(U) OSD/JS, AFMC (b)(3)
[Redacted]

¹⁹

~~(CUI)~~ OSD/JS, AFMC (b)(3)
[Redacted]

(U) Scheduling and Tracking Shortfalls at the AEDC

(U) AEDC lacks an integrated scheduling and tracking process to document all unfilled test requests, test delays, cancellations, and the reasons for the delays and cancellations, for all AEDC T&E facilities. Additionally, AEDC has no process to track conflict resolution between programs competing for the same test time and facility. While AEDC officials told us they have systems and procedures for scheduling, we could not confirm their implementation and execution because the AEDC did not provide supporting documentation for scheduling. The lack of an integrated scheduling process prevents the AEDC from accurately projecting demand and determining test capacity shortfalls.

(U) Scheduling

~~(CUI)~~ OSD/JS, AFMC (b)(3)
[Redacted]

¹⁹ (U) "Study on the Hypersonic T&E Ground and Flight Test Infrastructure, Workforce, and Inland Corridor Options," December 2020.

~~(CUI)~~ OSD/JS, AFMC (b)(3)
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3)
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3)
[Redacted]

(U) Tracking

~~(CUI)~~ OSD/JS, AFMC (b)(3)
[Redacted]

²⁰ (U) The G Range, built in 1963, provides shock and weather effects with an ability to provide realistic flight-test conditions simulating higher altitudes.

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]


~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

~~(CUI)~~ OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3)



(U) Recommendations, Management Comments, and Our Response

(U) Recommendation 1

(U) We recommend that the Under Secretary of Defense for Research and Engineering, in coordination with the Service Components, develop a plan to implement the strategies identified in Test Resource Management Center’s “Fiscal Year 2018-Fiscal Year 2028 Strategic Plan for Department of Defense Test & Evaluation Resources,” and the additional projects the Arnold Engineering Development Complex has identified through the Service Program Objective Memorandum process to increase hypersonic ground test and evaluation capability and capacity.

(U) Office of the Under Secretary of Defense for Research and Engineering Comments

(U) The Acting Deputy Director for Research and Engineering Advanced Concepts, responding for the Office of the Under Secretary of Defense for Research and Engineering, agreed with our report as a whole. The Acting Deputy Director for Research and Engineering Advanced Concepts provided a Consolidated Comment Matrix that provided updated information, which we incorporated into the report. Since the Consolidated Comment Matrix did not include information on the individual recommendation, we only included the cover page that established the concurrence of the Office of the Under Secretary of Defense for Research and Engineering in the Management Comments section of the report.

(U) Our Response

(U) By agreeing with the report as a whole, the comments from the Office of Under Secretary of Defense for Research and Engineering addressed the intent of the recommendation; therefore, the recommendation is resolved and open. We also reviewed the Consolidated Comment Matrix and resolved each individual recommended change to determine if it should be included in the final report. We will close the recommendation when the Office of the Under Secretary of Defense for Research and Engineering provides us a copy of the updated plan.

(U) Recommendation 2

(U) We recommend that the Director of the Test Resource Management Center revise the strategic plan to incorporate options to eliminate all ground test and evaluation capability and capacity shortfalls necessary for hypersonic weapon system development.

(U) Office of the Under Secretary of Defense for Research and Engineering Comments

(U) The Acting Deputy Director for Research and Engineering Advanced Concepts, responding for the Office of the Under Secretary of Defense for Research and Engineering, as well as the subordinate Test Resource Management Center, agreed with our report as a whole. The Acting Deputy Director for Research and Engineering Advanced Concepts provided a Consolidated Comment Matrix that provided updated information, which we incorporated into the report. Since the Consolidated Comment Matrix did not include information on the individual recommendation, we only included the cover page that established the concurrence of the Office of the Under Secretary of Defense for Research and Engineering in the Management Comments section of the report.

(U) Our Response

(U) By agreeing with the report as a whole, the comments from the Office of Under Secretary of Defense for Research and Engineering addressed the intent of the recommendation; therefore, the recommendation is resolved and open. We also reviewed the Consolidated Comment Matrix and adjudicated each individual recommended change to determine if it should be included in the final report. We will close the recommendation when the Office of the Under Secretary of Defense for Research and Engineering provides us with the revised strategic plan.

(U) Recommendation 3

(U) We recommend that the Commander of the Arnold Engineering Development Complex develop an integrated scheduling and tracking process to document all unfilled test requests, test delays, cancellations, and the reasons for the delays and cancellations, for all Arnold Engineering Development Complex test and evaluation facilities. The process should also track conflict resolution between programs competing for the same test time and facility.

(U) Arnold Engineering Development Complex Comments

(U) The Commander of the Arnold Engineering Development Complex agreed with the recommendation to develop an integrated scheduling and tracking process to document all unfilled test requests, test delays, cancellations for all Arnold Engineering Development Complex test and evaluation facilities. The Commander of the Arnold Engineering Development Complex estimated this action will be completed by the end of the 2nd quarter of FY 2022.

(U) Our Response

(U) The comments from the Commander of the Arnold Engineering Development Complex addressed the intent of recommendation; therefore, the recommendation is resolved and open. We will close the recommendation after we review the centralized database to verify that it meets all elements of the recommendation.

(U) Appendix A

(U) Scope and Methodology

(U) We conducted this evaluation from April 2020 through November 2021 in accordance with the “Quality Standards for Inspection and Evaluation,” published in January 2012 by the Council of Inspectors General on Integrity and Efficiency. Those standards require that we adequately plan the evaluation to ensure that objectives are met and that we perform the evaluation to obtain sufficient, competent, and relevant evidence to support the findings, conclusions, and recommendations. We believe that the evidence obtained was sufficient, competent, and relevant to lead a reasonable person to sustain the findings, conclusions, and recommendations.

(U) To identify hypersonic weapon systems T&E requirements, we interviewed the Office of the Secretary of Defense, Principal Director for Hypersonics, and the Joint Hypersonic Transition Office. We also interviewed officials from the TRMC, program managers at the Army, Navy, Air Force, and MDA program offices, as well as officials from Sandia National Laboratory to determine hypersonics T&E requirements and obtain information on the resources needed to meet those requirements.

(U) We obtained and reviewed a list of DoD ground T&E facilities and the capabilities supported at each facility used for hypersonic weapon system test and development. We obtained and reviewed plans and assessments conducted by Institute for Defense Analyses and the TRMC of the adequacy of the hypersonic ground T&E infrastructure. We also obtained additional assessments and documentation from the AEDC and Service Components pertaining to capability gaps in the DoD’s ground T&E infrastructure to determine if DoD’s existing test facility capability is adequate to meet the needs of all elements of the DoD.

(U) During our site visit to the AEDC, we met with officials responsible for operating and maintaining the specific equipment associated with hypersonic testing. We reviewed the AEDC’s assessments of both capability and reliability rates with respect to the equipment from the AEDC and the Service Component program offices, as well as the sufficiency of funding for evolving testing requirements.

(U) We observed and asked facility managers at the AEDC about the material condition of equipment associated with hypersonic testing. Through interviews with the Service Component program offices, we determined whether there have been any negative impacts on hypersonic testing processes as a result of the

(U) material condition of those facilities. We obtained documentation specific to the AEDC facility to include briefings on facility capability and capacity gaps, modernization plans, and projected demand, associated with the hypersonic T&E.

(U) This report was reviewed by the DoD Components associated with this oversight project to identify whether any of their reported information, including legacy FOUO information, should be safeguarded and marked in accordance with the DoD CUI Program. In preparing and marking this report, we considered any comments submitted by the DoD Components about the CUI treatment of their information. If the DoD Components failed to provide any or sufficient comments about the CUI treatment of their information, we marked the report based on our assessment of the available information.

(U) Use of Computer-Processed Data

(U) We did not use computer-processed data to perform this evaluation.

(U) Prior Coverage

(U) During the last 5 years, the U.S. Government Accountability Office issued one report that addressed hypersonic weapon systems:

(U) GAO

(U) Report No. GAO-21-378, "DOD Should Clarify Roles and Responsibilities to Ensure Coordination across Development Efforts," March 2021.

(U) The DoD has not documented the roles, responsibilities, and authorities of the multitude of its organizations, including the Services Components that are working on hypersonic weapon development. The GAO recommended that the DoD define and document the roles, responsibilities, and authorities of the leadership positions and organizations in DoD responsible for the development and acquisition of hypersonic weapons.

(U) Appendix B

(U) Other Matters of Interest

(~~CUI~~) OSD/JS (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(~~CUI~~) OSD/JS, AFMC (b)(3) [Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]
[Redacted]

(U) In its management comments, the Acting Deputy Director for Research and Engineering Advanced Concepts recommended that program offices document all impacts, including risk, cost, and schedule. Although outside the scope of our evaluation, we concur that it is important for program offices to document all impacts to hypersonic weapon systems development to fully understand shortfalls in hypersonic T&E capability and capacity.

(U) Management Comments

(U) Office of the Under Secretary of Defense for Research and Engineering

UNCLASSIFIED//~~FOUO~~
COORDINATION RESPONSE

COMPONENT COORDINATOR RESPONSE

December 7, 2021

SUBJECT: DRAFT REPORT - EVALUATION OF THE GROUND TEST AND
EVALUATION INFRASTRUCTURE SUPPORTING HYPERSONIC
CAPABILITIES Choose an item.

On behalf of my Component, my formal response to this report is: concur if the following
recommended comments are adjudicated.

My point of contact for this action is [REDACTED]

X



Double-click the 'X' to insert a digital signat...
or print and sign a hard copy.

Coordinating Official's Name: Terence G. Emmert
Coordinating Official's Position Title: Acting, DDRE(AC)
Coordinating Official's Component: OUSD R&E

(U) The Arnold Engineering Development Complex



~~CUI~~
DEPARTMENT OF THE AIR FORCE
WASHINGTON, DC

OFFICE OF THE ASSISTANT SECRETARY

17 December 2021

MEMORANDUM FOR DEPARTMENT OF DEFENSE INSPECTOR GENERAL

FROM: HQ AEDC/CC
100 Kindel Drive, Ste A303
Arnold AFB, TN 37389

SUBJECT: Arnold Engineering Development Complex Response to DoD Office of Inspector General Draft Report, "Evaluation of the Ground Test and Evaluation Infrastructure Supporting Hypersonic Capabilities" (Project No. D2020-DEV0SN-0106.000)

(U) 1. This is the Arnold Engineering Development Complex response to the DoDIG Draft Report, "Evaluation of the Ground Test and Evaluation Infrastructure Supporting Hypersonic Capabilities" (Project No. D2020-DEV0SN-0106.000). The CC concurs with recommendation 3 in the DoDIG report; however, the CC partially concurs with the remainder of the report as written and welcomes the opportunity to provide some minor corrections to a few of the findings detailed in the DoDIG report.

(U) 2. The AEDC/CC in coordination with SAF/AG will correct issues identified in this report and develop and implement a corrective action plan outlined in the following recommendations:

(U) a. RECOMMENDATION 3: The DoDIG recommends that the Commander of the Arnold Engineering Development Complex develop an integrated scheduling and tracking process to document all unfilled test requests, test delays, cancellations, and the reasons for the delays and cancellations, for all AEDC test and evaluation facilities. The process should also track conflict resolution between programs competing for the same test time and facility. This recommendation will allow the Arnold Engineering Development Complex to accurately project demand and determine test capacity shortfalls.

~~(S)~~ b. AEDC RESPONSE: The AEDC/CC concurs with recommendation 3. ~~(S)~~
OSD/JS, AFMC (b)(3)

~~(S)~~ c. OSD/JS, AFMC (b)(3)

~~CUI~~
Controlled by: AEDC/TP
CUI Category: OPSEC
Distribution/Dissemination Control: N/A
POC: ~~(S)~~ ~~(S)~~

~~CUI~~

(U) The Arnold Engineering Development Complex (cont'd)

~~CUI~~


OSD/JS, AFMC (b)(3)



~~CUI~~ d. OSD/JS, AFMC (b)(3)



(U) 3. The AEDC/CC point of contact for implementation of recommendation 3 is 


GERAGHTY JEFFR Digit ally signed by
EY.THOMAS GERAGHTY,JEFFREY.THOMAS
 2021.12.20 15:23:33 -0500
JEFFREY T. GERAGHTY, Colonel, USAF
Commander

~~CUI~~

(U) Acronyms and Abbreviations

- AEDC** Arnold Engineering Development Complex
- ARRW** Air-Launched Rapid-Response Weapon
 - CPS** Conventional Prompt Strike
- MDA** Missile Defense Agency
- PWT** Propulsion Wind Tunnel
- T&E** Test and Evaluation
- TRMC** Test Resource Management Center

Whistleblower Protection

U.S. DEPARTMENT OF DEFENSE

Whistleblower Protection safeguards DoD employees against retaliation for protected disclosures that expose possible fraud, waste, and abuse in Government programs. For more information, please visit the Whistleblower webpage at <http://www.dodig.mil/Components/Administrative-Investigations/Whistleblower-Reprisal-Investigations/Whistleblower-Reprisal/> or contact the Whistleblower Protection Coordinator at Whistleblowerprotectioncoordinator@dodig.mil

For more information about DoD OIG reports or activities, please contact us:

Congressional Liaison

703.604.8324

Media Contact

public.affairs@dodig.mil; 703.604.8324

DoD OIG Mailing Lists

www.dodig.mil/Mailing-Lists/

Twitter

www.twitter.com/DoD_IG

DoD Hotline

www.dodig.mil/hotline

~~CUI~~



DEPARTMENT OF DEFENSE | OFFICE OF INSPECTOR GENERAL

4800 Mark Center Drive
Alexandria, Virginia 22350-1500
www.dodig.mil
DoD Hotline 1.800.424.9098

~~CUI~~