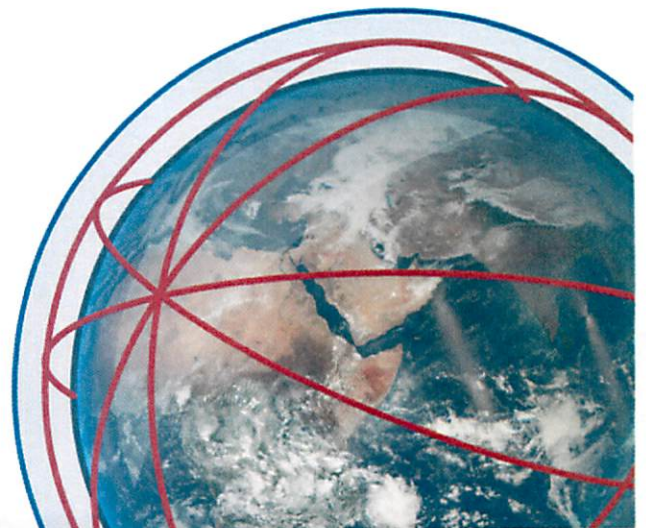




DSB Task Force Report on **Air Dominance**

December 2016



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REPORT OF THE DEFENSE SCIENCE BOARD

EXECUTIVE SUMMARY OF
THE STUDY ON
Air Dominance

December 2016



Office of the Under Secretary of Defense
for Acquisition, Technology, and Logistics
Washington, D.C. 20301-3140

This report is a product of the Defense Science Board (DSB).

The DSB is a Federal Advisory Committee established to provide independent advice to the Secretary of Defense. Statements, opinions, conclusions, and recommendations in this report do not necessarily represent the official position of the Department of Defense (DoD). The Defense Science Board Study on Air Dominance completed its information gathering in April 2016. This Executive Summary was cleared for public release on January 3, 2017.

The Executive Summary is unclassified and cleared for public release.



DEFENSE SCIENCE
BOARD

OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
WASHINGTON, DC 20301-3140

December 2016

MEMORANDUM FOR THE UNDER SECRETARY OF DEFENSE FOR
ACQUISITION, TECHNOLOGY & LOGISTICS

SUBJECT: Final Report of the Defense Science Board (DSB) Task Force on Air
Dominance

I am pleased to forward the final report of the DSB Task Force on Air Dominance. This report offers important recommendations on how the Department of Defense can maintain superiority in the air domain beyond the next decade and into the future.

The study focused on the most effective science, technologies, capabilities, and systems for maintaining air dominance in the context of projected threats and strategies to establish and maintain our freedom of action in the air to support national objectives. This report provides recommendations for advancing critical technologies and capabilities to ensure resilience in air dominance. These recommendations include enabling concepts of operations, doctrine and policy, and tactics, techniques and procedures to support these critical technologies and capabilities.

The study also provides considerations on how to maintain air dominance in a fiscally constrained environment under competition with well-resourced and agile adversaries.

I fully endorse all of the recommendations contained in this report and urge their careful consideration and soonest adoption.

A handwritten signature in black ink, appearing to read "Craig Fields".

Dr. Craig Fields
Chairman



DEFENSE SCIENCE
BOARD

OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
WASHINGTON, DC 20301-3140

December 2016

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Final Report of the Defense Science Board Task Force on Air Dominance

United States air power has been instrumental to success in war and deterrence of war. Joint and coalition warfighting depends on air superiority which is not a birthright. Our national advantage, however, is threatened by globalization and technology proliferation, espionage to steal platform, payload, and infrastructure intellectual property and operational secrets, and increasing investment in weapon systems that aim to undermine U.S. advantages in platforms, sensors, weapons, electronic warfare, as well as command, control, intelligence, surveillance, reconnaissance.

The task force found that global environments that deny access to U.S. forces will require the capability to establish "air superiority" in a localized area and for a period of time as needed to provide freedom of action to achieve campaign objectives. Air superiority was found to differ from "air dominance" over the entire battlespace at all times, which was found to be unachievable at an affordable cost.

To achieve "on-demand air superiority," the U.S. must pursue a cross-domain strategy to counter proliferating anti-access and area denial environments. This strategy should include elements to both maintain the 5th generation aircraft edge and to enhance the 4th generation aircraft improvements, starting with F/A-18 E/F. The strategy should aim to create an integrated and resilient high-capacity battle management command, control, and communications network and to address asymmetries in long-range intelligence, surveillance, and reconnaissance. Finally, a distributed, federated, and trusted capability for modeling, simulation, and analysis using live, virtual, constructive training and testing will be critical to enable the agility and critical choices necessary to offset and outpace the threat.

We believe that all of the recommendations contained in this report are critical for ensuring the Department maintained their air dominance beyond the next decade.

We would like to thank the members of the task force members and the executive secretariat for their significant assistance in enhancing our understanding of the adversary, technology, and strategies essential to ensure air superiority in the next several decades. We are also indebted to the briefers to the task force and the many Defense officials, industry experts, and individual consultants who provided information and insights to enlighten the task force members.



Dr. Mark Maybury
Co-Chairman



Dr. David Whelan
Co-Chairman

Table of Contents

Executive Summary	1
A Strategic Context.....	1
Framing the Study	3
Overarching Conclusion	4
Terms of Reference	5
Study Membership	6
Briefings to the Task Force.....	7

Executive Summary

In October 2014, the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) directed the Defense Science Board (DSB) to conduct a study to "consider the most effective science, technology, capability and systems for maintaining air dominance beyond the next decade."¹

The areas to be addressed included:

- The projected threat environment that will shape requirements for air dominance;
- The nature of air dominance and the essential objectives to maintain it;
- Effective system strategies for advancing critical technologies and capabilities to ensure resilience in an increasingly competitive, congested, and contested operational environment;
- The critical enabling concepts of operations, doctrine and policy, and tactics, techniques, and procedures optimized for the recommended critical technologies and capabilities.

A starting point for the study was the Joint "Air Dominance Initiative" led by the Defense Advanced Research Projects Agency (DARPA) that was completed in 2014.

To address this charge in a timely manner, the DSB assembled a task force composed of national leaders in science and technology with special expertise in air systems technology. The study met from February 2015 through April 2016 to explore concepts for the Department of Defense (DoD) to maintain its air dominance beyond the next decade.

A Strategic Context

Tomorrow's threat, in many ways also today's, is the rapid emergence of anti-access and area denial (A2/AD) strategies advanced by state actors. Future threats include any new state actor that has the fiscal capacity to buy globally available defense capabilities and technologies. The A2/AD threat typically operates with home field advantage, a situation that has strategic implications for U.S. national security policy and DoD investment choices. Some of the asymmetries that A2/AD states may enjoy include:

- interior lines
- the asymmetric advantage of shorter distances and faster access times
- density of defensive weapons systems

¹ Terms of Reference for the Defense Science Board Task Force on Air Dominance. October 9, 2014.

- economy in netting operational force structure

In addition, the adversary may pursue other advantages, some of them associated with asymmetries, such as:

- a differing view of long-term which may be most particular and beneficial to a state actor
- rapidly replicating, stealing, or simply purchasing new technologies
- the aging of U.S. capabilities
- less challenging weapon requirements
- the march of time eroding advantage and accelerating change

A fundamental question is whether air supremacy or air dominance is realistic if U.S. air forces cannot be present in the A2/AD battle space in daylight. Further, will threat decoys and GPS denial tactics require U.S. aircraft to use on-board sensors; and in the process lethally expose themselves? One of the most significant implications of the threat's asymmetries is the conclusion that to establish and sustain air dominance, the U.S. will require incredibly high levels of fiscal commitment, perhaps for decades, to build the capabilities as well as sustain the appropriate force capacity and readiness levels. This commitment will require the U.S. government to reorder its national defense and domestic strategies.

In today's budgetary reality, air dominance throughout any and all Phase III combatant operations may not be fiscally possible. An alternative is to ensure superiority at particular places and for limited time windows. The requirement exists, and will continue to exist, for U.S. air forces to establish air superiority when U.S. leadership chooses to impose it. By sustaining the capacity to do so, the U.S. will also establish a highly credible level of deterrence.

One can look at what the U.S. Army Air Corps and the U.S. Eighth and Allied air forces did in Europe during World War II to establish air supremacy. Of interest, General Dwight Eisenhower brought forward an air campaign plan to General George Marshall in 1942 as part of his duties as the Supreme Allied Commander for European Operations. Eisenhower's plan required the establishment of air superiority at the theater level to ensure the success of the planned landings and invasion into France some time before June 1944—the essential precursor for successful follow-on Allied operations in Western Europe. Eisenhower's plan was to establish the appropriate level of U.S. and allied air power capacity to sustain the air campaign to defeat Germany. This strategy drove U.S. aircraft and arms production; training bases throughout the U.S. for pilot and air crew production; incredible changes in logistical support, modernization and capability improvements in both aircraft and weapons; and much needed operational structure and tactical changes

in the U.S. Army Air Corps. Some historians have made the case that allied air operations, by the spring of 1944 (before D-Day), had reached levels of supremacy or dominance in many parts of Western Europe. German armed forces enjoyed little or no sanctuary. Ironically Germany, because of the aspirations of Hitler, demanded high-level efforts and material investments on improving capability—chasing the next wonder weapon (e.g., the V-2 rocket, ME-262 fighter, or the Tiger Tank).

This brings about a most compelling question for the Secretary of Defense—does the U.S. have sufficient capacity in its current air power force structure for future or even near-term sustained air combat operations? Unfortunately, the short answer is not for long. There are current large, or soon to be large, strike fighter shortfalls in the U.S. Navy, Marine Corps, and U.S. Air Force. This capacity gap is aggravated as production rates of force structure replacements are years behind in schedule and significantly over cost. The current capacity gap is widened by the attendant requirements to meet demand signals from U.S. combatant commanders for air operations in support of counter-terrorism (CT) and counter-insurgency (CI) missions. These requirements are in excess of planned aircraft utilization rates and are taking combat aircraft out of service much earlier than planned. A significant subset of this challenge is the current low number of 5th generation aircraft that can be sustained in a mission-ready status. Exacerbating these challenges is that requirements for U.S. air operations in the CT/CI mission are open-ended and increasing.

Air dominance implies sufficient force capacity and capability to reign supreme against the defined threat. This DSB task force's mission of guiding progress towards air dominance inside a well formed A2/AD threat is unachievable within the current fiscal means. It is, therefore, important to develop a paradigm and fiscal strategy that allows DoD to align research and programming to meet the technical, operational, and strategic gaps resident in the current state of U.S. air power capacity and capability. A key recommendation is to develop the capability to make those decisions.

Framing the Study

To help shape the recommendations, the task force focused these efforts on air dominance in 2025 to 2035. This included the air-to-air kill chain, the suppression and destruction of enemy air defense kill chain, offensive counter-air, counter-adversary kill chains, and counter-air to defend forward bases. More near term concerns were not addressed, including force structure, base support, and infrastructure and supply to support air dominance in the next 3 to 5 years.

Overarching Conclusion

A2/AD environments will require U.S. capability to establish “air superiority” in a localized area and for a period of time as needed to provide freedom of action to achieve campaign objectives. “Air dominance” over the entire battlespace, at all times, is not achievable at an affordable cost.

To achieve “on demand air superiority,” the U.S. must pursue a cross-domain strategy that will ensure sustained advantage in proliferating anti-access and area denial environments. This strategy should include elements to both maintain the 5th generation aircraft edge and to enhance the 4th generation aircraft improvements. The strategy should aim to create an integrated and resilient high-capacity battle management command, control, and communications network and to address asymmetries in long-range intelligence, surveillance, and reconnaissance. Finally, a distributed, federated, and trusted capability for modeling, simulation, and analysis using live, virtual, constructive training and testing will be critical to enable the agility needed to outpace the threat.

For a copy of the full report, please contact the Defense Science Board office.

Terms of Reference



ACQUISITION,
TECHNOLOGY
AND LOGISTICS

THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

OCT 09 2014

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Terms of Reference – Defense Science Board Task Force on Air Dominance

The ability of U.S., coalition, and Partner Nation Forces to establish air dominance in presence operations and conflict in any theater of operations is a key element for achieving strategic and tactical objectives. U.S. Forces have maintained the ability to establish Air Space freedom of action early in all conflicts since the Korean War. This ability provides situational awareness, information dominance, and superior combat support of Army and Naval Forces to defeat enemy forces. Potential adversaries are aware of the significance of these capabilities and are investing heavily to eliminate the U.S. advantage.

The Defense Science Board Task Force on Air Dominance (AD) will consider the most effective science, technology, capability and systems for maintaining air dominance beyond the next decade. The Task Force should identify and recommend, in the context of projected threats, strategies to establish and maintain our freedom of action in the air in support of national objectives.

Specifically, the Task Force will address the projected threat environment shaping requirements for AD; the nature of AD and what objectives are essential to maintain it; the most effective system strategy for advancing critical technologies and capabilities to ensure resilience in an increasingly competitive, congested and contested operational environment; and the identification of critical enabling concepts of operation, doctrine and policy, as well as tactics, techniques, and procedures optimized for these potential new technologies and capabilities. The recently completed DARPA-led Joint "Air Dominance Initiative" results should be used as a starting point for this study.

I will sponsor the study. Dr. Mark Maybury and Dr. David A. Whelan will serve as Co-chairmen of the study. Ms. Danielle Buckon, OUSD(AT&L), Dr. Keith Numbers, AFRL, and Mr. Gregg Sears, OPNAV, will serve as Executive Secretary. CAPT James CoBell, USN, will serve as the DSB Secretariat Representative.

The study will operate in accordance with the provisions of P.L. 92-463, the "Federal Advisory Committee Act" and DoD Directive 5105.04, the DoD Federal Advisory Committee Management Program." It is not anticipated that this study will need to go into any "particular matters" within the meaning of title 18, United States Code, section 208, nor will it cause any member to be placed in the position of action as a procurement official.

A handwritten signature in black ink, appearing to read "Frank Kendall".

Frank Kendall

Study Membership

Co-Chairs

Dr. Mark T. Maybury
Dr. David A. Whelan

The MITRE Corporation
The Boeing Company

Members

Mr. Frank J. Cappuccio
Ms. Natalie W. Crawford
Dr. Jack G. Fleischman
Dr. J. Scott Goldstein
Dr. Paul Kaminski
Mr. Robert A. K. Mitchell
Lt Gen George K. Muellner, U.S. Air Force (Ret.)
ADM John Nathman, U.S. Navy (Ret.)
Mr. Robert M. Stein
Dr. Larry B. Stotts
Mr. Roger Thrasher
Mr. Lee Venturino

Cappuccio & Associates, LLC
RAND Corporation
MIT Lincoln Laboratory
Dynetics
Technovation, Inc.
Private Consultant
Private Consultant
Private Consultant
Private Consultant
Stotts Consulting, LLC
The MITRE Corporation
First Principles, Inc.

Government Advisors

Dr. Steve Bussolari

Air Force Rapid Capabilities Office

Executive Secretaries

Ms. Danielle Buckon
Dr. Keith Number
CAPT (Ret) Gregg Sears

Office of the Secretary of Defense
Air Force Research Laboratory
Office of the Chief of Naval Operations

DSB Secretariat

Ms. Karen Saunders
LtCol Victor Osweiler
CAPT Hugh (Mike) Flanagan

Executive Director
Deputy for Operations, Air Force
Deputy for Operations, Navy

Support Staff

Ms. Stephanie Simonich

Redhorse

Briefings to the Task Force

Air Force

- Air Combat Command
- Air Force Red Team
- Air Force Research Laboratory Sensors Directorate
- F-22 Program Office
- F-35 Program Office
- SAF AQ
- U.S. Air Force Rapid Capabilities Office
- U.S. Air Forces in Europe and Air Forces Africa (USAFE and AFAFRICA)

Navy

- Chief of Naval Operations (CNO) Rapid Innovation Cell
- Naval Air Systems Command
- Office of the Chief of Naval Operations (OPNAV) N2N6
- Office of the Chief of Naval Operations (OPNAV) N81
- Program Element Office for Unmanned Aviation and Strike Weapons, PEO(U&W)
- Program Element Office for Tactical Aircraft Programs, PEO(T)
- PMR-51

Office of the Secretary of Defense/Joint Staff/Defense Agencies

- Defense Advanced Research Projects Agency (DARPA)
- Joint Integrated Air and Missile Defense Organization (JIAMDO)
- National Reconnaissance Office (NRO)
- Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L))

Defense Industrial Base

- Northrop Grumman Corporation
- Boeing Company
- Raytheon Company
- Lockheed Martin