



COMMERCIAL SPACE

SYSTEM ACCESS AND INTEGRITY

DEFENSE SCIENCE BOARD

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Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

May 2024

Executive Summary

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.



DEFENSE SCIENCE
BOARD

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

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR RESEARCH AND
ENGINEERING

SUBJECT: Defense Science Board (DSB) Report on Commercial Space System Access
and Integrity

I am pleased to forward the DSB report on *Commercial Space System Access and Integrity*, co-chaired by General (ret) Ellen M. Pawlikowski and Ms. Mandy Vaughn.

The DSB was asked to study how the Department of Defense (DoD) should best use commercial space systems in support of DoD objectives. The DSB provided recommendations on acquisition models for commercial space systems and evaluated the risks accompanying both U.S. and potential adversary use of these systems.

The DSB made five recommendations:

- Implement an end-to-end framework to better integrate existing and planned commercial capabilities into national security space architectures;
- Integrate evaluation of and provision for commercial space services into institutional processes;
- Incentivize trust and build resilience in commercial providers;
- Develop a suite of capabilities to monitor, assess, and respond to adversary use of commercial space capabilities; and
- Account for the maturity of the market when making decisions on investing, regulating, or buying in the commercial market, avoiding overregulation, investing for market creation rather than monopolization, and minimizing unique requirements.

I fully endorse all the study's recommendations and urge their careful consideration and adoption.

A handwritten signature in black ink, reading "Eric D. Evans".

Dr. Eric D. Evans
Chair, DSB

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OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
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MEMORANDUM FOR THE CHAIR, DEFENSE SCIENCE BOARD

SUBJECT: Report of the Defense Science Board (DSB) Task Force on Commercial Space System Access and Integrity

Attached is the final report of the DSB Task Force on *Commercial Space System Access and Integrity*. The Task Force was asked to study the Department's use of commercial space systems and explore how best they may be further leveraged in support of DoD objectives. Specific questions in the Terms of Reference included:

- Identify the commercial space systems most useful for current and future DoD needs.
- Identify potential enhancements to commercial space systems that will improve resilience or protection against current and future threats.
- Recommend approaches for managing the priorities and governing the use of commercial space systems used for DoD strategic and tactical needs.
- Provide recommendations on models for acquiring commercial space services and products.
- Investigate the potential risks and vulnerabilities associated with adversary exploitation of U.S. use of commercial space systems, or attacks on these systems.
- Investigate the impact and possible mitigations for potential adversary use of commercial space systems against U.S. defense systems.

The study examined the historical and emerging use of commercial space systems in national security applications and explored the best means by which they can be integrated into an inherently resilient, truly hybrid national security architecture. It examined possible models for management and contracting of commercial space services, and institutional impediments to further commercial integration on the parts of both government and industry. It also provided a risk management framework pertaining to potential adversary exploitation of U.S. use of commercial, and for use of commercial by adversaries. Finally, the study made recommendations for the role of government as an economic actor in the commercial space marketplace.

Ms. Mandy Vaughn
Co-Chair

Gen. Ellen M. Pawlikowski, USAF (ret.)
Co-Chair

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DSB Report on Commercial Space System Access and Integrity— Executive Summary

In November 2022, the Under Secretary of Defense for Research and Engineering (USD(R&E)), tasked the Defense Science Board (DSB) to study Department of Defense use of commercial space technology and services to understand how best to leverage these capabilities and manage their associated risks. The Task Force on *Commercial Space System Access and Integrity* convened over the course of six months and examined the following specific questions:

- Identify the commercial space systems most useful for current and future DoD needs.
- Identify potential enhancements to commercial space systems that will improve resilience or protection against current and future threats.
- Recommend approaches for managing the priorities and governing the use of commercial space system used for DoD strategic and tactical needs.
- Provide recommendations on models for acquiring commercial space services and products.
- Investigate the potential risks and vulnerabilities of an adversary's exploitation or attack on U.S. use of commercial space systems.
- Investigate the impact and possible mitigations for potential adversary use of commercial space systems against U.S. defense systems.

The guiding question for the conduct of this study was, “how can the U.S. more effectively use commercial space services and manage any associated risks and vulnerabilities?”

The growth of commercial applications in space has skyrocketed in the last few years. Space *is no longer the domain of nation states, it is a global commercial market*. The term, commercial space, covers a wide spectrum from innovative ideas and concepts that evolve from commercial markets to commercially offered services such as communication and earth sensing. *The DoD can leverage commercial space to provide a more robust and integrated set of capabilities; but in doing so the DoD must understand the implications of a meshed (commercial and DoD specific capabilities) architecture.*

Improving the Use of Commercial Space Capabilities

The Task Force explored several approaches to contracting or managing commercial space services. Government and industry representatives spanning legacy and emerging mission areas, technology development and mission uses provided their perspective on the challenges and opportunities for commercial space. The task force identified recommendations for improving the U.S. use of commercial space capabilities. The bottom line: **Integrated Deterrence requires Integrated Operations.**

Recommendation 1: Implement an end-to-end framework to better integrate existing and planned commercial capabilities into national security space architectures.

- Framework should include architecture analysis, test and evaluation, military operations and planning, capability development, and sustainment and support.

- Develop initial prototype for “integrated commercial C4ISR” to demonstrate end-to-end integration.

Recommendation 2: Integrate evaluation of and provision for commercial space services into institutional processes, including planning, programming, budgeting, and acquisition.

Managing Risks of Commercial Space Capabilities

Increasing the use of, and reliance upon, commercial space systems and architectures introduces risks as those same systems are available for global access and use. The global space market brings with it a unique set of challenges and risks. Despite these, opportunities exist to increase resilience of commercial systems through protection technologies that are consistent with commercial markets and mission.

Recommendation 3: Incentivize trust and build resilience in commercial providers:

- Include “resilience” as part of quality-of-service requirement in commercial contracts and apply resources to shape commercial investments in hardening.
- Establish the “market” for premium pricing for more resilient services.
- Enable tech transfer of key U.S. Government (USG) technologies (i.e., Cyber protection).
- Improve sharing of threat intelligence and timely indications and warnings.

Adversary Use of Commercial

Many of the benefits the U.S. Government can gain from commercial space are commercially available to foreign entities as well. Various mitigation options that could be applied to state and non-state actors in this regime and concluded that response options beyond regulation alone are required.

Recommendation 4: Develop suite of capabilities to monitor, assess, and respond to adversary use of commercial space capabilities.

Government Role in the Commercial Space Marketplace

The government has a very different, and critical, role in the space marketplace that changes based on where in the initial spectrum of development the service or product is, and the maturity of the external market. The role of the government in the commercial marketplace is as a regulator, investor, and customer.

Recommendation 5:

- DoD must account for maturity of the commercial market when making decisions on how it regulates, invests, and buys commercial space services.
- Avoid overregulation of U.S. companies to enable international competitiveness.
- Invest for market creation, not market monopolization.
- Minimize unique requirements when buying commercial services.

Appendix A: Terms of Reference



UNDER SECRETARY OF DEFENSE

3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

- 9 NOV 2022

MEMORANDUM FOR CHAIR, DEFENSE SCIENCE BOARD

SUBJECT: Terms of Reference – Defense Science Board Task Force on Commercial Space System Access and Integrity

The Department of Defense (DoD) increasingly uses access to commercial space systems for imagery, communication, and other purposes. Technological improvements in commercial space technology continues to enhance the quality and accessibility of commercial space products in ways that provide significant value for DoD operational needs. Because of the rapidly improving commercial space capabilities and access, a comprehensive plan for using commercial space systems in the context of classified U.S. space capabilities is needed.

Utilization of commercial space is accelerating throughout DoD at all operational levels. Mounting demand is leading to heightened competition between traditional consumers of space products at the strategic level and users operating at the operational and tactical levels. DoD faces an impending challenge in deconflicting the prioritization of those needs, efficiently managing distributed demand, and optimizing commercial space acquisition activities.

Moreover, space has become a contested environment with emerging and evolving threats to space systems. In addition to direct threats to space architecture, adversaries could disrupt DoD access to space products and services by competing as users of the same systems or by controlling access through economic means. As use of commercial space rises, such threats must be evaluated and mitigated to ensure DoD does not become overly dependent on capabilities that may or may not be available in times of armed conflict.

I am establishing the Task Force on Commercial Space System Access and Integrity (“the Task Force”) as a subcommittee of the Defense Science Board (DSB) to provide advice and recommendations on commercial space systems. The DSB, working through the Task Force, should:

- Identify the commercial space systems most useful for current and future DoD needs;
- Identify potential enhancements to commercial space systems that will improve resilience or protection against current and future threats;
- Recommend approaches for managing the priorities and governing the use of commercial space system use for DoD strategic and tactical needs. Governing options should include government-owned, contractor-operated models, as well as direct purchase or lease of products and services;
- Provide recommendations on models for acquiring commercial space services and products that best balance governmental security, accessibility, and cost factors;

- Investigate the potential risks and vulnerabilities of an adversary's exploitation or attack on U.S. use of commercial space systems. Potential vulnerabilities include privacy corruption, integrity corruption, espionage, and reduction of system availability.
- Investigate the impact and possible mitigations for potential adversary use of commercial space systems against U.S. defense systems.

The Task Force findings, observations, and recommendations will be presented to the full DSB for its thorough, open discussion and deliberation at a properly noticed and public meeting, unless it must be closed pursuant to one or more of the Government in the Sunshine Act exemptions. The DSB will provide its findings and recommendations to the USD(R&E) as the Sponsor of the DSB. The nominal start date of the study period will be within 30 days of the initial appointment of Task Force members. In no event will the duration of the Task Force exceed 12 months from the start date.

In support of this Terms of Reference (ToR) and the work conducted in response to it, the DSB and the Task Force have my full support to meet with Department leaders. The DSB staff, on behalf of the DSB and the Task Force, may request the Office of the Secretary of Defense and DoD Component Heads to timely furnish any requested information, assistance, or access to personnel to the DSB or the Task Force. All requests shall be consistent with applicable laws; applicable security classifications; DoD Instruction 5105.04, "Department of Defense Federal Advisory Committee Management Program"; and this ToR. As special government employee members of a DoD federal advisory committee, the DSB and the Task Force members will not be given any access to DoD networks, to include DoD email systems.

Once material is provided to the DSB and the Task Force, it becomes a permanent part of the DSB's records. All data/information provided is subject to public inspection unless the originating Component office properly marks the data/information with the appropriate classification and Freedom of Information Act exemption categories before the data/information is released to the DSB and the Task Force. The DSB has physical storage capability and electronic storage and communications capability on both unclassified and classified networks to support receipt of material up to the TS/SCI level.

The DSB and the Task Force will operate in conformity with and pursuant to the DSB's charter, the Federal Advisory Committee Act (5 United States Code (U.S.C.), Appendix), the Government in the Sunshine Act (5 U.S.C. § 552b), and other applicable federal statutes, regulations, and policy. Individual DSB and Task Force members and the Task Force as a whole do not have the authority to make decisions or provide recommendations on behalf of the DSB nor report directly to any Federal representative. The members of the Task Force and the DSB are subject to certain Federal ethics laws, including 18 U.S.C. § 208, governing conflicts of interest, and the Standards of Ethical Conduct regulations in 5 Code of Federal Regulations, Part 2635.



Heidi Shyu

Appendix B: Task Force Membership

Co-Chairs

Ms. Mandy Vaughn

Gen Ellen M. Pawlikowski, USAF (Ret.), PhD

Members

Mr. Mike Appelbaum

Dr. Daniel Hastings

Ms. Kari Bingen

Dr. Paul Kaminski

Mr. D. Marshall Brenizer

Mr. John Paul (JP) Parker

Dr. Alison Brown

Dr. Dhanurjay “DJ” Patil

Mr. James Carlini

Dr. Brad Tousley

Ms. Laetitia de Cayeux

Government Advisors

Mr. Tom Ainsworth, *OSD Strategic Capabilities Office*

Executive Secretary

Dr. Lindsay Millard

Defense Science Board Secretariat

Ms. Elizabeth Kowalski, *DSB Executive Director*

Mr. Kevin Doxey, *DSB Executive Director (former)*

Dr. Troy Techau, *Designated Federal Officer (DFO)*

Study Support

Mr. Robert Kolterman, *SAIC*

Mr. Mark Brophy, *SAIC*

Appendix C: Briefings Received

Meeting 1 (14 Feb 2023)

Commercial Systems Program Office Overview
National Reconnaissance Office

Counterspace Cyber Threats to Commercial SATCOM
National Security Innovation Capital (NSIC)

Electronic Warfare Threats to Commercial Space Systems and Services
NSIC

Commercial Remote Sensing Overview
David Gauthier

Commercial Space Efforts
Strategic Capabilities Office (SCO)/ Massachusetts Institute of Technology – Lincoln Laboratory (MIT-LL)

Killer Bee Phase II Study Outbrief
SCO/MIT-LL

Meeting 2 (28-29 March 2023)

CSA Protection and Indemnification
General Counsel, Department of the Air Force

Space Counterintelligence
Office of the Director of National Intelligence

Commercial Space NSSA Protection Policy Discussion
International Conference on Circuit, Systems and Communication (ICCSC)/National Security Space Organization (NSSA)

Space Architecture Integration
*Office of the Assistant Secretary of the Air Force for Space Acquisition and Integration
Director of Architecture, Science, and Technology (SAF/SQA)*

Intelsat and the Hybrid Networks of the Future
Intelsat

Space and Counterspace, China
Defense Intelligence Agency (DIA)

Space and Counterspace, Russia
DIA

Commercial Integration
Maxar

Meeting 3 (5 April 2023)

Discussion with Bill Adkins
House Appropriations

Meeting 4 (17 and 19 May 2023)

Commercial Integration
Inmarsat

U.S. Space Command Perspective
U.S. Space Command

Leveraging Commercial Space for Rapid Capability Delivery
Space Development Agency

OUSDP(P) Perspective
Assistant Secretary of Defense for Space Policy

Air Force Research Laboratory (AFRL) Perspective
AFRL

Zero Trust
Xage Security

Meeting 5 (13-14 June 2023)

Thoughts on Resilience
Marshall Brenizer brief to Position, Navigation, and Timing Task Force, 29 Mar 2023

Discussion with Strategic Capabilities Office
SCO

General Counsel Perspective
Associate General Counsel

Appendix D: Acronyms

C4ISR	Command, Control, Communications, Computers (C4) Intelligence, Surveillance and Reconnaissance (ISR)
DIA	Defense Intelligence Agency
DoD	Department of Defense
DSB	Defense Science Board
MIT-LL	Massachusetts Institute of Technology – Lincoln Laboratory
NSIC	National Security Innovation Capital
SAF/SQA	Office of the Assistant Secretary of the Air Force for Space Acquisition and Integration – Director of Architecture, Science, and Technology
SCO	Strategic Capabilities Office
USD(R&E)	Under Secretary of Defense for Research and Engineering
USG	United States Government