



U.S. Air Force
Scientific Advisory Board

**DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE
WASHINGTON DC**

**Technologies for Enabling Resilient Command and Control (TRC)
Abstract**

The U.S. Air Force (USAF) Scientific Advisory Board (SAB) study on Technologies for Enabling Resilient Command and Control addresses the emergence of potential adversaries with peer and near-peer capabilities and the broad recognition that our command and control (C2) systems could be vulnerable in a major conflict and that future conflicts will require integration of effects across multiple warfighting domains. In conflicts since 9/11, the USAF has focused continuously in counter insurgency and counter terrorism conflicts in which it could operate largely unchallenged in air, space, and cyber domains. Several potential adversary nations have demonstrated warfighting capabilities in the air, space, and cyber domains that make it clear that Air Force C2 systems will not operate unchallenged in the future.

The study focused on approaches for achieving C2 system resilience and for C2 of multi-domain warfighting. The study assessed current Air Force C2 programs and Air Force, Defense Advanced Research Projects Agency, Federally Funded Research and Development Centers, and industry C2 Science and Technology (S&T) efforts to help identify technologies to consider in the near, mid, and far term. The Study Panel distilled its findings into several recommendations based on rigorous examination of evidence gleaned from multiple briefings and discussions with the USAF and other organizations responsible for command and control. The SAB recommends the Air Force:

- Evolve its current centralized C2 architecture to a globally distributed C2 architecture because centralized C2, as currently executed by the Air Force from Air Operations Centers (AOCs), is vulnerable in a major war against a high-end adversary.
- Equip AOCs and Operations Centers to provide multi-domain situational awareness and support rapid decision making because current Air Force C2 systems provide only a limited capability to execute multi-domain operations.
- Coevolve technologies and CONOPS in its C2 experimentation program to achieve resilient Multi-Domain Command and Control (MDC2) and develop new CONOPS and technology.
- Use innovation from C2 S&T to create Air Force competitive advantage as the Air Force is not effectively leveraging C2 S&T.
- Adapt a commercial software development process (“DevOps”) for warfighting requirements because the development of a resilient MDC2 system is not executable with the current USAF software development process.
- Adapt modern commercial processes for data management and analytics to operational warfighting level to address the lack of a data strategy for operational level C2.
- Develop new approaches for C2 system Test and Evaluation (T&E) as current T&E procedures and technology are not adequate for evolving C2 systems.
- Grow a workforce with MDC2 expertise as that key expertise is generally lacking in the Air Force.