

USAF Scientific Advisory Board Study
Enhanced Utility of Unmanned Aerial Vehicles in
Contested and Denied Environments

Study Abstract

Air Force use of unmanned aerial vehicles (UAVs) for intelligence, surveillance, and reconnaissance (ISR) and strike missions over the past decade have primarily been limited to permissive environments; however, future operations may require the employment of UAVs in contested or denied environments in which highly capable integrated air defenses challenge survivability and utility of typical UAVs. While signature reduction is one potential means for achieving increased survivability, there are other approaches that could offer various levels of enhanced utility, either by increasing survivability or by other means. Examples include onboard and offboard electronic protection, disaggregating UAV functions across multiple platforms, or deploying UAVs in numbers that substantially complicate an adversary's defensive capabilities.

Against this background, the Secretary of the Air Force tasked the Air Force Scientific Advisory Board (SAB) to conduct a study titled “Enhanced Utility of Unmanned Aerial Vehicles in Contested and Denied Environments” to address future utility of Air Force UAVs based on an understanding of how these factors interrelate and which combinations of such approaches enable effective operation in various levels of contested or denied operating environments. The SAB conducted this study from January through June 2015.

The Study Panel utilized the Terms of Reference (ToR) accompanying this tasking as a guide toward providing the Air Force with appropriate and actionable recommendations on this topic. The ToR specifically tasked the SAB to:

1. Identify potential future missions for current UAVs in contested and denied environments, including ISR, strike, and other roles in integrated (combined manned/unmanned) operations.
2. Assess anticipated defensive characteristics across a range of potential future operating environments, from weakly contested airspace to anti-access/area-denial environments.
3. Characterize expected survivability of current UAVs across these environments.
4. Identify approaches other than signature reduction that may enhance the survivability of current and future UAVs across these environments and assess their relative efficacy.
5. Assess the technologies needed to enable these approaches, identified current technology gaps, and assessed the magnitude of the effort needed to fill those gaps.
6. Make recommendations regarding the most valuable approaches for achieving enhanced utility of UAVs in future contested and denied environments.

The scope of the study was limited to the MQ-9 and RQ-4 based on decisions the Air Force has already made regarding the MQ-1. The Study Panel received briefings from Air Force and other DoD organizations, FFRDCs, industry, and academia, which informed independent analyses by the SAB that then led to the findings and recommendations from the study.

This SAB study recommends options for upgrading the MQ-9 and RQ-4 to improve survivability and expand the missions they can perform in future threat environments. Such upgrades include a wide range of improvements in (1) communication, (2) positioning, navigation, and timing, (3) self-protection, (4) sensors, (5) weapons, (6) cockpit design, and (7) automation. The Board recommends following a disciplined developmental planning process employing modeling, simulation, and analysis with structured demonstrations to validate the utility of these system upgrades and to support tactics development. The SAB further recommends use of open architectures in these and other enhancements to these platforms. Additional recommendations relate to improving the human/system integration in MQ-9 and RQ-4 cockpits. The Board also recommends advancing the level of automation, not only to increase crew efficiencies, but also to enhance operations in larger integrated strike packages involving collaboration between unmanned and manned aircraft.