

GLOBAL HAWK BLOCK 20 ENVELOPE EXPANSION

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ABSTRACT

This paper reviews the planning, preparation, conduct, and lessons learned from the RQ-4 Block 20 Global Hawk unmanned aircraft system (UAS, Figure 1) envelope expansion flight testing. Unique and uncommon pilot actions were required to ensure the safety and correct aircraft response given the limitations imposed by the autonomous nature of the vehicle and command links. Additionally, atypical and challenging flight test methodologies had to be adopted to conduct envelope expansion testing approximating classical techniques.

The Block 20 is an improved variant of the legacy RQ-4 Block 10. System changes include an enlarged fuselage and new wing with 2^o dihedral, new single-wheel main landing gear with electric brakes incorporating differential braking, new redundant-motor electromechanical actuators, greater electrical and environmental systems capacities, and lesser magnitude changes to guidance, navigation, and control functions to match the altered airframe. These significant changes required the system to be treated as essentially new for the purpose of envelope expansion. Testing began with taxi tests to tune the new electric brakes and shakedown the aircraft. This was followed by first flight and delivery to the test site at Edwards AFB. Work then proceeded with airframe and systems tests emphasizing altitude and duration buildup associated with the Global Hawk's high-altitude/long-endurance surveillance mission. All testing had to be carefully planned around the very specific operational characteristics, autonomous control, and narrow mission profiles of the RQ-4 while leveraging off lessons from prior Global Hawk tests.

As the cost, size, and mission scope of UASs continue to advance, flight testing of these vehicles must keep pace. Adaptation of classical flight test techniques is the desired trend, and testing will be slower in some regards than with manned aircraft. The complexity of the Global Hawk Block 20 and magnitude of the program, combined with the challenging test methodologies, makes this testing experience and derived lessons an excellent example for future test teams.