

National Aeronautics and Space Administration



X-57 Maxwell

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NASA's X-57 Maxwell is an all-electric experimental aircraft designed to demonstrate multiple leading-edge technologies. The goal of the X-57 is to demonstrate that an all-electric airplane can be more efficient, quieter and more environmentally friendly than airplanes powered by traditional gas-powered piston-engines.

The X-57 will demonstrate the use of a high-power distributed electric propulsion system for use on an aircraft, including a 460 volt battery to power 14 motors and propellers. In addition, the X-57 will demonstrate that vehicle cruise efficiency can be optimized by integrating the versatility and efficiency of electric propulsion into the vehicle design.

The X-57 began as a gas-powered Tecnam P2006T General Aviation aircraft in a phase known as Modification I. The wing, which is being reduced to 42% of the original size to significantly reduce drag, will feature wing-tip propellers to reduce the wing-tip vortex at cruise. At low-speeds, the distributed propellers nearly double the wing lift, allowing the X-57 to land as slowly as the original Tecnam P2006T. A test program is planned through a series of modifications, to allow researchers to take a step-by-step approach to demonstrate the technical improvements.

Modification II

For this phase of testing, the airplane's two original wing-mounted, gas-powered engines will be replaced by two electric motors to turn the propellers. The rear passenger seats and cargo area will hold the X-57 battery packs used to power the electric motors. This version will be flown to test the all-new electric propulsion system prior to installing the distributed electric propulsion wing.



Modification III

The X-57's look will dramatically change as the original wing is replaced with a smaller, skinnier "high aspect ratio" wing. The two large electric motors from Modification II will be moved to the wingtips, and 12 pods will be placed under the wing that will eventually hold smaller electric motors for Modification IV. This version will be tested to show X-57's high-speed cruise efficiency.



Modification IV

The final configuration of the X-57 will install 12 small electric motors to the pods under the wing from Modification III. These motors will only be used when the airplane is going slow to increase the flow of air over the wing, providing additional lift during takeoff and landing. As the airplane goes faster, the 12 small motors turn off and the propellers fold back to reduce drag, leaving the two large wingtip motors to provide thrust.



When complete, the X-57 Maxwell test program hopes to have demonstrated how to safely operate an all-electric, zero-emissions aircraft, including its battery and power distribution systems. That knowledge will be helpful to future engineers interested in designing all-electric air vehicles that might be used for everything from urban air mobility to moving passengers and cargo between nearby cities.

Specifications

(based on Modification IV configuration)

Aircraft Weight – Approximately 3,000 pounds

Maximum Operational Altitude – 14,000 feet

Cruise Speed – 172 mph (at 8,000 feet)

Stall Speed – 58 knots (67 mph)

Batteries

- Lithium Ion
- 860 pounds
- 69.1 kilowatt hours (47 kilowatt hours usable)

Cruise Motors and Propellers (2)

- 60 kilowatts, continuous
- 72 kilowatts peak (at takeoff)
- Air-cooled
- Out-runner, 14-inch diameter
- 5-foot diameter propeller
- 117 pounds each, combined weight

High-Lift Motors and Propellers (12)

- 10.5 kilowatts
- Air-cooled
- In-runner, 6-inch diameter
- 5-blade, folding propeller
- 1.9 foot diameter propeller
- 15 pounds each, combined weight