

When the [General Atomics Predator](#) unmanned aircraft was introduced in 1995, its 24-hr. endurance was game-changing for the military. Now developers are pushing state of the art in aerodynamics and propulsion to achieve far longer flight times with far smaller vehicles.

In early October, Aerovel's Flexrotor long-endurance vertical-takeoff-and-landing (VTOL) unmanned aircraft completed a 32-hr. 8-min. flight, landing with more than 3 hr. worth of fuel remaining. Vanilla Aircraft, meanwhile, is preparing to attempt a seven-day flight with its VA001 fixed-wing UAV.

The 22-kg (48-lb.) Flexrotor is a tailsitter that takes off vertically like a helicopter then transitions to fuel-efficient wingborne flight, its two-blade proprotor providing both lift in vertical flight and thrust in forward flight.



Flexrotor prepares to fold its landing gear after taking off on a flight that lasted more than 32 hr. Credit: Aerovel

Designed to fly for up to 10 days carrying a 30-lb. payload, the VA001 weighs 600 lb. and has a 36-ft.-span sailplane-style wing and an efficient heavy-fuel engine. The tow-launched

aircraft set the current endurance record for its class of almost 56 hr. in January.

The endurance record for a VTOL unmanned aircraft is 22 hr. 30 min., set in August 2016 by a Latitude Engineering HQ-60 hybrid quadrotor. The HQ-60 takes off vertically like a multicopter and transitions to wingborne flight using a pusher propeller.

For its endurance flight, a Flexrotor called Actea took off with 7.5 kg of gasoline, including 3 kg in a backpack tank. Launch weight included a payload of 1.5 kg. A second Flexrotor was flown in formation to film some of the flight.



*Flexrotor transitions to fuel-efficient wingborne flight, with the proprotor providing thrust.
Credit: AeroVel*

Conditions on the first day were turbulent, with 20-30 kt. of wind. “Actea was holding constant altitude and so gave up a few percent of range, fighting the ups and downs,” says AeroVel President Tad McGeer, adding that performance otherwise met expectations.

McGeer led the design of both the original Aerosonde long-endurance UAV, a development of which now is produced and operated by [Textron](#) Systems, and Insitu’s [ScanEagle](#) long-endurance small unmanned aircraft system.

The Flexrotor flight was 5 hr. longer than the Aerosonde Mk 1’s 2,031-mi. flight across the Atlantic from Newfoundland to Scotland in 1998, and about 10 hr. longer than the ScanEagle’s published endurance. Neither are VTOL UAVs.



Vanilla VA001 takes off on its 56-hr. record flight in January over New Mexico. Credit: Vanilla Aircraft

Aerovel is still developing the Flexrotor, working to achieve and demonstrate a higher mean time between failures before launching production, says McGeer. The UAV can carry a nose-mounted Alticam AC-5 electro-optical (EO) sensor from Hood Technology.

Alternatively, the Flexrotor can carry an Alticam 09EO2 high-zoom EO camera or 09MWIR3.5 mid-wave infrared and EO imager or a Trillium Engineering HD50 5-in. gimbal with infrared sensor. Other payload options include communications relay and signals intelligence systems.

The backpack used for the endurance flight can carry extra fuel or onboard power and Ethernet links to transmit sensor data at video rates over distances exceeding 100 km (62 mi.), says Aerovel.

Vanilla has developed the VA001 with funding support from DARPA. The January flight was cut short by changing weather, and the aircraft landed with more than half its fuel remaining. The attempt at a seven-day flight will be launched from [NASA Wallops Flight Facility](#) on the Virginia coast.