AeroVironment, Inc.
Unmanned Aircraft Systems Overview

Background

AeroVironment is a technology solutions provider with a more than 40-year history of practical innovation in the fields of unmanned aircraft systems (UAS) and electric vehicles (EVs). Founded by serial innovator Dr. Paul MacCready, the creator of the world’s first human powered airplane and one of Time Magazine’s “Greatest Minds of the 20th Century”, AeroVironment has established numerous world records and has seven of its breakthrough vehicles in the Smithsonian Institution. Today AeroVironment is the world’s leading supplier of hand-launched UAS for tactical intelligence, surveillance and reconnaissance (ISR), and is developing entirely new UAS solutions designed to provide compelling new advantages to military and non-military customers.

Unmanned Aircraft Systems Overview

With more than 25 years of experience developing, supplying and supporting small UAS, AeroVironment is a prime contractor and supplier to all U.S. Department of Defense (DoD) programs of record for this category of UAS and has delivered more than 20,000 new and replacement air vehicles to customers in the U.S. and elsewhere. AeroVironment’s family of small UAS includes Raven®, Wasp™, Puma™ and Shrike™ VTOL™. These backpackable/ man portable, hand-launched unmanned aircraft systems are carried and used by armed forces -- who frequently operate across large geographic areas, often far removed from their bases and dependent mainly on what they can carry in their packs or vehicles – and
deliver front-line, real-time situational awareness to increase combat effectiveness and force protection. By transmitting live, streaming color and infrared video from onboard cameras directly to a common, hand-held Ground Control System with an embedded color monitor, AeroVironment’s UAS provide real-time information that helps U.S. and allied armed forces operate more safely and effectively.

<table>
<thead>
<tr>
<th>Product</th>
<th>Customers</th>
<th>Weight</th>
<th>Nominal Endurance</th>
<th>Payload</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ-11B Raven B®</td>
<td>US Army, Marines, Air Force, USSOCOM, National Guard</td>
<td>4.5 lbs.</td>
<td>90 min.</td>
<td>Gimbaled EO and IR video sensors</td>
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<tr>
<td>Wasp AE™</td>
<td>US Air Force, Marines</td>
<td>2.85 lbs.</td>
<td>50 min</td>
<td>Gimbaled EO and IR video sensors</td>
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<tr>
<td>RQ-20A Puma AE™</td>
<td>USSOCOM, Army</td>
<td>13.5 lbs.</td>
<td>210+ min.</td>
<td>Gimbaled EO and IR video sensors</td>
</tr>
<tr>
<td>Shrike VTOL™</td>
<td>Under evaluation</td>
<td>5.5 lbs.</td>
<td>40 min.</td>
<td>Gimbaled EO and IR video sensors</td>
</tr>
</tbody>
</table>

**Ground Control System**

AeroVironment’s [Ground Control System](#) provides a common command and control solution for the company’s family of small UAS. Small, lightweight, and combat proven, the Ground Control System enables the system operator to monitor and control the air vehicle while also displaying real-time video from its payload cameras to personnel on the ground. In addition, it allows the operator to capture screen images, store and play back data for target assessment, and facilitates real-time re-transmission of video and metadata to an operations network.

When embedded at remote locations, the Ground Control System also can operate as a remote video terminal, providing command centers or monitoring stations with the same
viewing and analysis capability as the UAS operator. It is compact and portable, taking up only a portion of a small backpack, and can be assembled in less than two minutes.

**Digital Communications Architecture**

New Raven, Puma AE and Wasp AE systems now come equipped with a Digital Data Link™ developed by AeroVironment. With digital Raven, Puma AE and Wasp AE systems, users can operate up to 10 times as many air vehicles in the same geographic area as compared to the analog systems they replace. Digital Small UAS also permit beyond line-of-sight operation, the creation of an ad-hoc wireless data network for the battlefield (turning the system into a “flying hotspot”) and secure communications.

**Public Safety UAS**

Small UAS can provide uniquely valuable capabilities to public safety organizations, including the estimated 50,000 law enforcement agencies and fire departments in the U.S. Complementing AeroVironment’s fixed wing systems, the Qube™ small UAS is a vertical takeoff and landing system with a touchscreen tablet controller tailored to law enforcement, first response and other public safety missions. Small enough to fit easily in the trunk of a car, the Qube system can be unpacked, assembled and ready for flight in less than five minutes, giving the operator a rapidly deployable, tactical eye in the sky for a a fraction of the cost of manned aircraft and large unmanned aircraft. In addition to public safety missions, AeroVironment’s family of small UAS can perform missions supporting border security, wildlife and environmental monitoring, infrastructure management, scientific research and agriculture management.

**UAS Mission Services**

AeroVironment’s small UAS provide valuable information to their operators. In some cases customers may wish to acquire the information, but lack the infrastructure to
support and maintain the systems. For those customers, AeroVironment provides mission services, utilizing its highly-trained personnel to operate company-owned systems and deliver the information to customers.

**UAS Training Services**

AeroVironment develops training courses for its customers for a wide range of small UAS applications and tactical situations. Courses are designed to give students a comprehensive understanding of the selected UAS solution, including safety, operational proficiency, aircraft maintenance and air space management, that when applied “in theater” will enable them to accomplish their mission objectives.

**UAS Logistics Services**

AeroVironment’s UAS Logistics services ensure mission success by providing quality products and logistics support anywhere in the world. AeroVironment’s UAS logistics support solutions include planning, upgrades, UAS spares and repair services. Support also is provided in the areas of technical expertise, material management, supply chain management and military and commercial logistics.

**UAS In Development**

AeroVironment is a technology innovator focused on solving important customer problems with practical, new solutions. In addition to a growing product line supporting demand for UAS solutions, AeroVironment cultivates a robust pipeline of new solutions under development to drive growth.

**Switchblade®**

One of the most dramatic capabilities transitioning from development into initial production at AeroVironment is the Switchblade loitering munition system. Switchblade provides a portable lethal strike capability, creating an entirely new type of loitering precision munition to protect U.S. forces.
The backpackable, battery-powered Switchblade launches from a tube, unfolds its tandem wings and transmits back streaming video from color & infrared video sensors directly to the AeroVironment Ground Control System. Upon identifying a hostile target on the handheld video monitor, the operator can designate the target and the Switchblade becomes a weapon – autonomously guiding itself onto the target, detonating its small warhead with high precision and low probability for collateral damage.

Switchblade can rapidly deliver a powerful but expendable backpackable flying intelligence, surveillance and reconnaissance package on a distant target within minutes. The vehicle’s small size and quiet motor make it difficult to detect, recognize and track even at very close range. The Switchblade is scalable and can be launched from a variety of air, ground and sea-based platforms.

**Global Observer®**

AeroVironment currently is developing Global Observer, which represents a new category of UAS – providing stratospheric global persistence with no latitude restrictions. Eight test flights were conducted from 2010-2011.

Global Observer’s unique combination of both extreme flight duration and stratospheric operating altitude is designed to deliver advantages in cost, capacity, coverage, flexibility and reliability that make it a compelling complement to existing near space, aerial and terrestrial assets.
AeroVironment developed Global Observer under a government-funded joint capability technology demonstration (JCTD) program. The purpose of the program was to create and exploit the ability to fly in the stratosphere for up to a week at a time, providing affordable persistence for remote sensing and communication relay that does not exist today. Reaching stratospheric altitudes of 55,000 to 65,000 feet, this revolutionary system with a 175-foot wingspan will carry approximately 400 pounds of payload, including EO and IR sensors and communications relay equipment.

Global Observer uses a specially developed internal combustion engine that burns hydrogen and oxygen to generate electricity to power four efficient electric propeller drive units and all aircraft and payload systems. The Global Observer system, consisting of at least two aircraft trading positions over a designated geographic area, is designed to provide continuous coverage at a significantly lower cost than available alternatives. This persistent capability is designed to address the coverage seams associated with conventional aircraft and satellites.