

AeroVironment Inc.

August 2017

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Analytical Overview

Strategy: AeroVironment faces a tough time ahead as it grapples with cutbacks in the military budget for its mini-UAS and the prospect of increased competition. Replacing the company's US military business with new markets for its products will be the company's biggest challenge over the next several years.

The company's strategy is to maintain its position as the dominant producer of mini UAS for the US military while building a market position in international, law enforcement, homeland security and other civil UAS. It is also seeking to broaden its product range with a commercial UAS service and is exploring the potential for growth in high-altitude, long-endurance solar-powered UAS.

Strengths: AeroVironment has the enviable position of being an extremely strong competitor within the mini-UAS market space.

The company is known for having a strongly innovative corporate culture. Management has been aggressive in ensuring that proposals have the

backing they need to win competitions.

AeroVironment's reputation and customer intimacy give it a position in US military mini-UAVs that would make it difficult to displace. The large inventories of its existing systems make it difficult to purchase competitors' UAVs, which require different training and logistics.

The company's size appears to have been a strong advantage so far, enabling it to be nimble while maintaining low overhead. It has repeatedly beat larger UAS companies to become the sole supplier to the Department of Defense for all mini UAV programs of record.

AeroVironment has managed its growth well, soaring from \$48 million in 2005 to a peak of \$325 million in 2012 before slipping to \$252 million in 2014, an impressive 18% compound annual revenue growth rate. The UAS portion of the business achieved 21% annual revenue growth over the period. Since then growth

has stagnated due to weak US government purchases.

The company has done a good job of developing its product portfolio. The company has worked to develop its UAS to be reliable and easy to use, with a common interface for multiple UAS including the Puma, the Raven, and the Wasp. It also has worked to ensure that they are designed with manufacturing in mind.

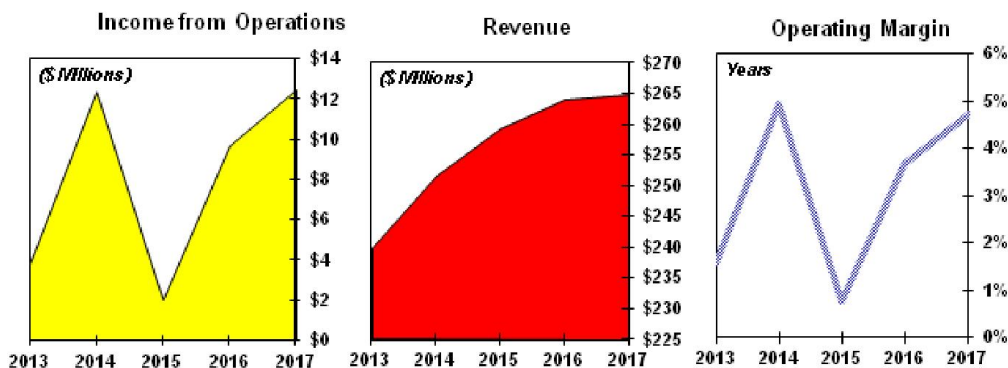
AeroVironment has a strong balance sheet with no debt and considerable cash, short and long-term investments.

The company has been extremely successful in maintaining high levels of company-funded research and development as well as customer-funded research.

Weaknesses: AeroVironment's UAV business remains heavily dependent on the US government with 55% of sales going to the US government in 2017.

In recent military budgets, the US Army has been including only a mod-

Operating Income/Revenue Comparison



est sums for purchasing upgraded payloads and includes no funding for the purchase of new UAS. As a result in fiscal 2013, UAS sales began to decline.

The company has found it difficult to build its international presence. Competitors such as Elbit Systems with its Skylark are proving to be tough competition outside the United States.

Barriers to entry are much lower for mini-UAS than for larger systems. As a result, many countries are seeking to build their own systems.

The company's ability to predict future sales and profitability are limited. The nature of the company's business tends to be more unpredictable than other defense companies because it is difficult to predict the rate of adoption of its systems, some of which are new and revolutionary. It is also dependent on a relatively narrow range of military products and, as noted, is heavily dependent on the US military budget.

Opportunities: AeroVironment has been very successful in boosting its exports of UAS over the past two years.

AeroVironment's position as dominant supplier to the U.S. military offers promise in building a position with allied militaries such as the United Kingdom or Australia.

Plans for joint production of a UAS in India offer promise for tapping into a potentially large market. The Indian UAS market has been primarily the preserve of Israeli companies so far.

In another important opportunity, AeroVironment is gearing up for the competition to provide the US Army with its Lethal Miniature Aerial Munition System, a program of record planned for 2018. AeroVironment already is selling its Switchblade, a man-portable, lethal mini UAV. The Switchblade loitering munition offers potential as a UAV that can hit its target with limited collateral damage. The UAV is configured so that it can

be scaled up to attack larger targets such as vehicles rather than just troops.

In addition, the US Army is now considering creating a family of three sizes of mini UAVs rather than the single one now used by military units. This family concept, with a common ground station and modernized digital data links, could improve the attraction of having a mixture of UAVs rather than relying on only the Raven. AeroVironment hopes to make Wasp, smaller than the Raven, and Puma, larger than the Raven, into elements of this future Army family of systems.

The Marine Corps has already decided to incorporate the Raven, Puma and Wasp into its force as a family of systems.

Spiral upgrades for deployed systems and new production also offer potential for the company. The Raven was earlier upgraded with higher efficiency propulsion motors and higher resolution cameras. Its latest upgrade is of a new modular, gimbaled sensor payload for the Raven. The new payload will improve the UAV's video and provide better target tracking capability. Now the Puma is undergoing spiral upgrades.

The US Army has been considering new missions for Ravens such as detecting and identifying chemical, biological or radiological threats. Other potential missions include: signals intelligence, multispectral imagery, short wave infrared, long wave infrared, targeting, geospatial intelligence, hyperspectral imagery, and communications relay.

Miniaturization of payloads also offers potential to increase the usefulness of AeroVironment's UAVs. New payloads could be added as well such as synthetic aperture radar for the Puma.

Deliveries of Puma have been rapidly increasing with deliveries to U.S. Special Operations Command.

US homeland security sales are promising over the long-term although near term they remain uncertain due to restrictions on the use of UAS in civil aerospace.

AeroVironment has been working on penetrating the low-cost, high-altitude, long-endurance UAS market. It is working on getting funding for its Global Observer and exploring the potential for work in solar systems, an area in which it was a pioneer in the past. Either approach would offer considerable potential to provide persistent surveillance and communications coverage at any point on the globe at a fraction of the price of satellites.

The US government is projected to purchase \$3 billion to \$5 billion of annual commercial satellite capacity within ten years. This potentially could be provided more cheaply by Global Observer.

Commercial solutions could offer AeroVironment the potential for expanding sales of its UAVs as well as potential service offerings providing turnkey UAS operations in oil and gas, mining, agriculture and other industries.

Threats: AeroVironment is facing cuts in demand for its UAVs as the military has reduced involvement in overseas conflicts in Iraq and Afghanistan. The military is deferring additional purchases of mini-UAVs due to the large numbers already in inventory and the diminished needs as fewer troops are deployed in conflicts.

AeroVironment's dominant position mean that some within the U.S. military would like to see greater competition. This may offer some potential for companies interested in the sector, such as Lockheed Martin or Israel's Elbit Systems, to emerge as competitors in the mini UAS segment.

Israeli companies offer intense competition overseas. Smaller companies like Germany's EMT and a large

number of national companies compete for mini UAS contracts.

Success of the company's initiatives to develop commercial UAS work and US border security work hinge on continued progress by the Federal Aviation Administration in opening US airspace.

AeroVironment's hydrogen-powered, high-altitude, long-endurance Global Observer UAS is moribund following a crash in April 2011 at the end of its four year test program. During the \$120 million demonstration program Global Observer failed to achieve its goal of proving that it

could fly for five days straight. Efforts to achieve a resumption in government funding appear to have failed.

Research that keeps AeroVironment on the cutting edge also is expensive for a small company. In fiscal 2017, the company spent 12% of revenues on research.

The privacy debate has had created serious problems in the development of a public safety market.

Profitability has been under pressure in recent years for the past several years.

Business: AeroVironment is the main provider of mini UAVs to the US Army, Marine Corps and the Navy. The U.S. Army has used the Raven extensively for convoy surveillance, perimeter protection and battle surveillance in Iraq and Afghanistan. In fiscal 2017, AeroVironment derived 86% of its \$264.9 million of annual sales from UAVs. The remainder came from the company's business in efficient energy systems such as electric vehicle fast charging and architectural wind for building energy generation.

Teal Group Analysis

AeroVironment's dominant position in US mini UAVs.

AeroVironment may be a relatively small defense company, but it is a giant in mini-UAS. The company has repeatedly beaten larger companies in small UAV competitions. Those victories have made it the company to beat in competitions for US military small UAS..

AeroVironment already is the largest player in mini-UAS, experiencing explosive growth since 2004. The company has achieved a 14% compound annual revenue growth rate from fiscal 2004 to 2017 despite stagnation in growth for the past three years.

AeroVironment has delivered 25,000 new and replacement mini-UAS. Its mini-UAS are used by all US ground forces, including the Army, the Marine Corps, the Air Force and the Navy. As of July 2017, 40 countries had purchased its mini-UAS systems. The foreign countries include: Australia, Italy, Czech Republic, Spain, Netherlands, Thailand, Lebanon, Saudi Arabia, Estonia, Norway, Uganda, Sweden, Romania, Singapore, United Kingdom, France, Malaysia, Hungary, Japan, Kenya, Yemen, Colombia, Canada, Tunisia, Macedonia, Bulgaria, Uzbekistan, Lithuania, Burundi and Egypt.

In January 2007 AeroVironment successfully completed the initial public offering of its stock raising \$80.5 million. The stock offering gave the company greater flexibility going forward in expanding its operations or making acquisitions.

The company has prepared the foundations for further growth. Its small UAV facility in Simi Valley, CA, has been expanded and can produce up to 1,000 small UAVs aircraft per month.

AeroVironment's mini-UAS are launched by one person and operated with a hand-held control unit. Carrying electro-optical or infrared sensors, they can travel as much as 20 miles at speeds as high as 50 miles per hour. Each system consists of a ground-control station and three air vehicles.

The challenge for AeroVironment now is to translate its strong position in military UAS, with products sold around the world, into a civil and commercial presence. The company is examining new markets and applications for their UAVs, including allied militaries, loitering munitions, commercial sales, border security and law enforcement.

AeroVironment does have some key advantages. It offers far greater scale than almost all of its competitors of-

fering military and commercial mini-UAS. It also has a very strong financial position with profitability and no debt, again not a characteristic of most of its competitors. That gives it the ability to invest in research and gives customers a sense of commitment and continuity for the future. It assures them that spare parts and upgrades will be available in the future.

On the negative side, AeroVironment is used to dealing with military sales in which cost is often of less concern than performance. In the commercial market, cost is of foremost concern.

AeroVironment sees possible growth in 2018 revenue, but relatively stable profit. For fiscal 2018, AeroVironment projects that it will achieve \$280 million to \$300 million in annual revenue. That compares to \$264.9 million in 2017 for the fiscal year ending April 30.

The company is projecting that profitability will be between 45 cents and 64 cents per share in 2018. That compares to 54 cents in 2017 and 39 cents in 2016.

Profitability has also been depressed in recent years by investments in potential growth opportunities connected with Switchblade and other military mini-UAS and commercial UAS.

In coming years, AeroVironment's success in growing its business will depend on its continued success in several areas. First, it needs to continue to increase its rapidly rising international sales. Second, it needs to win the Army LMAMS competition. Third, it will depend on whether it can develop business in the rapidly growing commercial UAS services sector.

An indication of how much Unmanned Aerial Systems has grown is shown by the fact that in fiscal 2004, UAS accounted for \$30.4 million of AeroVironment's total sales of \$47.7 million. At that time, it represented approximately 64% of total corporate sales.

AeroVironment's UAS sales amounted to \$229 million in 2017, approximately 86% of sales.

International sales have taken off over the past two years. As US military sales have fallen over the past several years, international has come to the rescue.

Since allied troops in Afghanistan and Iraq were able to see benefits of AeroVironment's mini-UAS in action, the company is focusing on increasing its international sales. That effort has borne fruit. In fiscal 2017, AeroVironment reported \$95.4 million in international sales, representing 36% of total company sales.

That compared to \$74 million in 2016, about 28% of sales and \$23.3 million in 2015, approximately 9% of sales. New customers include Malaysia and the Philippines.

AeroVironment expects the increase to continue in the future. International markets are a decade behind the United States in their adoption of UAS, but now foreign militaries are focusing on their requirements.

AeroVironment has achieved considerable gains in recent years. International sales amounted to 7% of sales from fiscal 2011 to fiscal 2009. In 2007 and 2008 international sales

amounted to 6% of total sales, up from 5% the previous year.

Obviously a number of factors are involved in lag in international adoption. UAS are still relatively new and foreign militaries are taking time to include them in their own procurement plans. Until the recent pressure on US sales, AeroVironment had been heavily focused on meeting the rapidly growing needs of the US military. In addition, gaining government approval for export of UAS to a number of countries can be slow and difficult. Israeli competitors have been particularly aggressive in the market. A number of countries are interested in developing their own domestic small UAS, which is easier to produce than the much more complicated larger UAS.

Still, there have been a series of competitions in which AeroVironment beat its competition. It beat Elbit Systems' Skylark I in Denmark, Netherlands, Spain and Italy. In Denmark and the Netherlands, it also beat Germany's EMT.

Building a production facility in India. In an effort to tap into the potentially large Indian market, Dynamatic Technologies Limited and AeroVironment inaugurated the pilot production facility for the development of the next generation unmanned aircraft system, Cheel.

The governments of India and the United States selected a next-generation unmanned aircraft system based on AeroVironment's market-leading family of small UAS as a collaborative project under the India-United States Defense Technology and Trade Initiative (DTTI). The project named 'Cheel' will be jointly developed and produced by Dynamatic Technologies and AeroVironment in India.

Preparing for Army LMAMS competition and other new Army and Navy programs. AeroVironment is investing to prepare for the US Army's Lethal Miniature Aerial Mu-

niton System (LMAMS) program, which will be competed in early 2018.

The Army has plans for a program of record that could result in production of as many as 2,500 units annually. In all, the US Army plans to buy 25,000 of the loitering weapons systems over 15 years.

So far, AeroVironment has dominated the business of providing a backpackable, kamikaze UAS that can be guided into its target. Its Switchblade, which carries three pounds of explosives, has been the most mature system available.

Switchblade and its derivatives accounted for \$86 million in revenue in 2017.

The prospect of a new competition for LMAMS has brought in a number of new competitors. AeroVironment may be in the forefront of the technology now, but other major defense manufacturers are working to win the LMAMS competition.

Raytheon is working with an Israeli company to produce its Hero 30, which has four hours of endurance and carries a small warhead.

Lockheed Martin Corp. will be offering its Terminator.

Textron will compete with the BattleHawk and IA Tech, a small Gainesville, Fla. UAS manufacturer offering the SkyStinger.

Still, repeated delays in launching a program mean that inventories of AeroVironment's products are building up for the Army. With more than 2,500 Switchblade systems already purchased, the Army is likely to be reluctant to put in place another logistical system and new training for another system.

There are other US Army opportunities as well. The Army's Soldierboard sensor is planned to be a small deployable UAS, smaller than existing systems. The Army's short-range micro UAS would be a vertical takeoff hovering UAS for which

AeroVironment would offer its Shrike.

There are substantial opportunities beyond the Army as well. The US Navy has purchased AeroVironment's Blackwing, a small, tube-launched unmanned aircraft system that deploys from under the surface of the sea, on manned submarines and unmanned underwater vehicles. Blackwing builds on AeroVironment's experience with small unmanned aircraft systems (UAS) and its Switchblade to provide the Navy with a low cost, submarine-launched UAS.

Strong push into the commercial UAS market. In commercial UAS, AeroVironment sees the potential to offer both hardware and services to satisfy commercial demand.

In its push into commercial services, AeroVironment is focusing on energy (oil and gas critical infrastructure and electric utility power line inspection) and agriculture. It has pilot programs in both areas, both domestically and overseas to develop its market offerings.

AeroVironment is developing complete offerings in both areas. It will work with not just its own systems, but other aircraft as well, including manned and VTOL UAVS. It can provide electro-optical, LIDAR, multispectral and photogrammetry sensors. It will then use algorithms and models to turn that data into real time information. For critical infrastructure that involves monitoring oil pipelines using LIDAR data that can be converted into 3D models and electro-optical colorized 3D models that can show whether oil pipelines are shifting to identify possible future break points. It is also working on solutions that include power line status reports and monthly mining volumetrics.

In agriculture, AeroVironment is doing evaluations using the NDVI vegetation index. Near infrared sensors show green healthy plants as well as

yellow stressed plants to a degree not visible to the human eye. If plants are stressed, inputs can be modified to add water, fertilizer or to make other interventions.

Rolling out its new commercial drone. In its latest steps to build up its position in the commercial UAS market, AeroVironment launched a new easy to use drone that links to a cloud-based data analytics platform.

AeroVironment announced its Quantix drone in November 2016. The new drone has a fixed wing, multi-rotor hybrid design that will provide it with the vertical take-off and landing capability of multirotors combined with the range and reliability of fixed-wing aircraft, according to the company.

The drone is oriented towards the agricultural market. In a single flight its sensors will capture high-resolution color RGB (Red, Green, Blue) and multispectral NDVI (Normalized Difference Vegetation Index) imagery. It will use the AeroVironment Decision Support System, a cloud-based data analytics platform designed to provide actionable intelligence.

Before the release, AeroVironment already began using the Quantix in a pilot program with farmers and universities. The project surveyed tens of thousands of acres for two years, focusing on crops that include almonds, walnuts, corn, grapes, beets, strawberries and tomatoes. The pilot program tested analytics for canopy cover, early disease detection and yield prediction.

AeroVironment is targeting not just agriculture but also energy, utilities and transportation with its new UAS. The company already provides UAS services to the energy and utilities industries with its existing drones.

The design of the new drone is quite promising. It is generally seen as a type of system with considerable promise within the industry. One drone can provide horizontal and ver-

tical inspection capabilities. This promises to become increasingly important as airspace is opened too beyond visual line of sight operations.

Early experiences in commercial use. AeroVironment's most visible project in providing commercial services has been its work for BP in Alaska. In June 2014, BP PLC, the world's third largest oil company, signed a five-year contract to use UAS at its oil operations in Alaska. It was the first large-scale, government approved commercial use of unmanned aircraft in the United States. It was a hard-fought win in which AeroVironment beat 12 other companies competing for the work.

In July 2014, AeroVironment's Puma AE received approval from the US Federal Aviation Authority to be used in commercial missions in the Arctic. The "restricted category" certification allows it to be used for missions such as oil spill monitoring and ocean surveys in the North Slope region of the Arctic.

AeroVironment used the Puma AE to capture and analyze data on operations at BP's Prudhoe Bay oil field, one of the largest oil fields in North America. AeroVironment produced three-dimensional maps of the field's roads, pipelines and well pads, among other tasks.

In a sign the work was going well, the FAA increased the authorized Alaska operating area more than fivefold. In addition, BP added pipeline inspection to the scope of its services contract for calendar year 2015. At presstime, whether work with BP is continuing was not clear.

In addition to its work with BP, AeroVironment has been working with utilities such as Duke Energy and Virginia Dominion Power. AeroVironment has found that its work can supplement existing helicopters, replace them and in other cases augment them such as in very close inspections of isolators or powerlines. In other cases,

AeroVironment has done work that could not even be done by helicopters. One product involved identifying possible trees of limbs that could hit powerlines if they fell. AeroVironment developed volumetrics that created zones around the powerlines that showed which trees or limbs needed to be cut.

AeroVironment has also worked with BNSF on railway track inspections.

The focus is primarily on the United States since AeroVironment has a limited overseas presence, but it does have commercial projects overseas as well.

Challenges for AeroVironment in the commercial UAS market are considerable. AeroVironment faces tough competition in the commercial market.

Major aerospace companies, including Airbus, Boeing Insitu and Textron, are offering commercial UAS services. In addition, there a number of well-funded venture capital start-ups such as Airware and Precisionhawk are also offering services.

AeroVironment plans to offer its own services by the end of 2017 in what is a very competitive environment. It promises to be adjustment for AeroVironment to offer the low-cost systems and services needed to capture the commercial market. The military, its traditional customer, tends to focus more on performance than cost in its buying.

In addition, part of the targeting is wrong with a focus on agriculture. The agricultural market is adopting UAS technology slowly. It is a very fragmented market with low profit margins on a number of drops. There is considerable skepticism among farmers about the applicability and utility of UAS technology to their operations.

Border security offers potential. AeroVironment also sees strong potential in border security. It envisages

offering a family of UAS in coming years.

AeroVironment would like to translate its position as the leading supplier for mini-UAS for the US military into a leadership role in homeland security.

AeroVironment was a participant in the first phase of the Department of Homeland Security's Robotic Aircraft for Public Safety (RAPS) Program. The Department of Homeland Security's Directorate of Science and Technology leads an effort to test UAS that might be used for homeland security and law enforcement in the United States. The goal is to create a "Consumer Reports" of UAS.

AeroVironment was one of 17 companies that tested their systems. Individual systems were tested in various scenarios that would be encountered by police, firefighters and border patrol. They were rated based on how they fared on a set of standardized test categories. Their operations use is evaluated as to ease of use and video output. These detailed ratings are shared with possible governmental users. Many of the details are not shared outside of government and first responders due to the proprietary information provided by the companies.

AeroVironment tested two VTOL systems, its Shrike, a system originally designed for the military, and its Qube, a version of the Shrike designed for civil users.

AeroVironment also is interested in selling its systems to the Coast Guard. AeroVironment and a team for the National Oceanic and Atmospheric Administration (NOAA) were contracted to provide the US Coast Guard ice breaker Polar Star with a Puma AE unmanned aircraft system and a flight crew for the annual joint Operation Desert Freeze, the military component of the larger, civilian-managed US Antarctic Program to re-supply the National Science

Foundation's McMurdo Station in January 2016.

The Department of Homeland Security is still evaluating how it would use UAS. It has been using much larger Predator UAS to patrol the Northern and Southern land and sea borders. It is the only type of UAS in service with the Department of Homeland Security so far.

In other homeland security roles, mini-UAS could be used in natural disasters to assess damage and aid rescue efforts.

AeroVironment sees specific homeland security applications for many of their existing UAS. Mini-UAS such as the four-pound, hand-launched Raven, offering less than 90 minutes of flight, could be stored at a border outpost or in the trunk of a car to be launched as needed. The Wasp or the Shrike could be used in situations in which a UAS needs to be carried in a backpack for shorter flights.

The Puma UAS could be used for maritime surveillance, offering 150 minutes of flight. The Aqua Puma, another variant, could be used for salt water landings.

Even the Global Observer or a solar-powered high-altitude long-endurance system would have homeland security applications. The week-long endurance of the Global Observer or the several-month long endurance of a solar powered system would allow the use of such as system for border security or maritime surveillance.

Interest in the public safety market but privacy concerns slow adoption. AeroVironment is interested in expanding into other commercial and civil applications for its UAVs as the market begins to open up.

As the the Federal Aviation Agency beings to open up national airspace, the use of small UAS weighing less than 55 pounds is expected to increase dramatically. The use of UAS by law enforcement is expected dra-

matically increase in coming years, particularly in light of their lower operating costs compared to helicopters.

With almost 20,000 local law enforcement agencies in the United States, there is strong potential for the growing proliferation of UAVs in the next decade. Exactly how large the market will be however remains uncertain. It will be a small portion of the size of the military UAV market even if half of those agencies buy UAVs. Individual UAVs being offered in the market range in price from \$25,000 to \$300,000. However, it appears that the low end of the market will be more promising because of budgetary pressures on state and local public agencies.

In October 2011, AeroVironment introduced the Qube portable UAS for use in public safety applications such as law enforcement and first response.

The \$50,000 Qube, which weighs less than four pounds and was designed to fit in the trunk of a car, can be unpacked, assembled and ready for flight in less than five minutes.

AeroVironment has a pilot program for selected public safety agencies to use and become familiar with the operation of the Qube.

In 2014 the Ventura County Sheriff's Department became the first local law enforcement agency on the West Coast to legally begin using a UAS. Since then it has used the system for a variety of missions, including locating illegal marijuana plantings.

So far, small companies have led in the race to begin to tap into the emerging market for law enforcement UAVs. Draganfly Innovations, a Saskatoon, Canada UAS company that began as a hobby shop company and began building larger systems, has sold its helicopter UAS to several local police departments in the United States and Canada. The Seattle, Washington Police Department, the Regina Police Department and the Royal Canadian Mounted Police's

E-Division have also purchased the Draganflyer X6.

Other major UAV companies are also trying to target the law enforcement market.

In August 2012, Lockheed Martin Procerus Technologies unveiled a new small vertical take-off and landing unmanned aircraft system intended for the military and first responders. The rugged, five-pound VTOL quad rotor, dual-sensor platform provides an extended hover, perch and stare capability in crowded areas unreachable by fixed-wing unmanned aircraft systems. The UAS has a gimbal mount with electro-optical and infrared sensors and a laser illuminator to provide continuous 360-degree panning capability.

Boeing's Insitu introduced a product specifically for the public safety market in August 2011. The Interceptor, a short-range tactical rotorcraft system, can fit in the trunk of a car and is easy to launch and recover. The UAS weighs less than four pounds and can hover silently overhead for more than 20 minutes.

In February 2011, Israel Aerospace Industries, the largest defense company in Israel, revealed its Ghost vertical-takeoff and landing UAV. The 8 pound system is designed to be able to fly inside of buildings, flying for up to 30 minutes carry a 500 gram payload.

While UAV use by local law enforcement will be increasing in coming years, US police officials note that there are factors, in addition to tight budgets, that will limit the trend. There are considerable concerns about invasion of privacy by governmental use of the systems. There are also concerns about crashes that could endanger citizens and property.

The privacy debate about the use of unmanned systems by law enforcement has led several agencies in areas such as Seattle to actually discontinue their use.

Grasping for a strategy in high-altitude, long-endurance aircraft.

AeroVironment continues to be interested in high-altitude, long-endurance aircraft although its strategy appears to be shifting from working on hydrogen-powered systems such as Global Observer to solar-powered systems.

Solar-powered systems offer tremendous promise for providing low cost internet access to remote areas of the world that currently have no such access. The systems will provide months of coverage without the aircraft landing.

Facebook and Google both purchased companies to aid them in developing the technology in their quests to bring internet to the world. Airbus has begun low-rate production of its own system.

AeroVironment has done work on solar-powered systems in the past and appears to be examining ways it might enter the market.

The company's Global Observer hydrogen-powered aircraft has been moribund for several years following a crash. The company continues to look for funding from US government customers. The Department of Homeland Security is a prime target since the Global Observer could offer persistent border and maritime surveillance.

Still, the outlook has gotten more uncertain due to the success of solar-powered systems. While they carry considerably smaller payloads, they are emerging as a more proven technology that will stay aloft for months at a time.

Teaming with Lockheed Martin on Global Observer does not appear to have resulted in any success.

AeroVironment reached agreement with Lockheed Martin, the world's largest defense company, to pursue international opportunities for AeroVironment's Global Observer high altitude long endurance unmanned aircraft system.

The agreement, which was announced in February 2014 at the Defense Expo in New Delhi, seeks to combine Lockheed Martin's expertise in systems integration and AeroVironment's knowledge of unmanned aircraft solutions. It appears to focus on giving AeroVironment credibility in international markets. Lockheed Martin will work on integrating communications and intelligence, surveillance and reconnaissance payloads on Global Observer to support its use in a surveillance role and as a temporary battlefield network-communications node.

AeroVironment faced a serious setback in the Global Observer program when one of the two prototypes it was developing crashed on its ninth test flight in 2011. Afterwards it purchased the remaining prototype from the US government and has been working to compete it.

The company estimates that hydrogen-powered Global Observer could offer it an important new growth market. Estimated at having the potential for more than \$1 billion of sales, this high-altitude, long-endurance UAS would be intended to provide year round persistent intelligence, surveillance, reconnaissance and communications. AeroVironment projects that the market for such a system could be larger than the current company's sales. The aircraft, with its 175 foot wing span, is intended to be equivalent to a 12-mile high, low cost satellite. It would provide coverage of as much as 600 miles diameter. The Global Observer would fly at 65,000 feet for five to seven days before needing refueling.

In addition to intelligence and communications applications for defense and homeland security, the Global Observer could be used for disaster recovery, storm tracking and wildfire detection and tracking. It is under development for the US Army's Special Operations Command. A system of two would alternate over any part of

the globe to maintain intelligence or communications coverage at all times at a particular point of the globe. Global Observer will fly at an altitude of 55,000 to 60,000 feet. It will cover a 600 mile diameter area. This project was expected to complete its \$120 million JCTD demonstration in early 2011. As of October 2010, the first plane completed its initial flight testing and the second plane was in production. The plan was to continue flight tests of the vehicle and subsequently test its military utility, which would examine different payloads. AeroVironment then planned to build five aircraft annually under low rate initial production for US government customers.

The most immediate demand for the Global Observer came from a military requirement for system that can provide communications relay for several days continuously. Global Observer crashed on its ninth test flight in 2011. Since then, US government interest in the program has waned. AeroVironment has continued to seek a customer to fund a resumption of the program, with the Department of Homeland Security emerging as a key possibility. Yet there are no signs of any government interest in continued work on the hydrogen-powered system.

Boeing, which lost in the original competition for Global Observer, has forged ahead with its own competitor, the hydrogen-powered Phantom Eye. It was funding its work with company-research money in an indication of the potential it sees in the program. Yet in the end Boeing too stopped work on the technology, raising serious questions about its technical feasibility..

AeroVironment seeking international opportunities for Global Observer. AeroVironment has developed teaming relationships to address international opportunities.

In Turkey, AeroVironment is working through its joint venture, Altoy,

our memorandum of understanding with Aselsan and others.

In June 2014, Aselsan, a Turkish defense electronics specialist, with AeroVironment, Inc., and Altoy Defence Industries, a Turkish joint venture partially owned by AeroVironment.

The team is pursuing integrated security systems for existing and future pipelines in Turkey under a program of the Turkish Ministry of Defense.

Loss in the DARPA Tactically Exploited Reconnaissance Node (TERN) competition. Northrop Grumman beat competitor AeroVironment to move ahead to the third phase of DARPA's Tactically Exploited Reconnaissance Node (TERN) program. Under the \$93 million phase three contract awarded in October 2014, Northrop Grumman will do final design, fabrication and a full-scale, at-sea demonstration of the system.

The DARPA program is intended to demonstrate the ability to launch medium-altitude long-endurance MALE UAS from US Navy surface combatants such as the Littoral Combat Ship or destroyers. The initial flight test is planned for 2018.

AeroVironment and Northrop Grumman succeeded in winning the second phase of the TERN, a program to equip small naval vessels with a medium-altitude, long-endurance capability. In September 2014, DARPA selected AeroVironment for the TERN. The 12-month, \$19 million phase II effort seeks to conclude with subscale flight demonstrations prior to a planned phase III award decision. Phase III is expected to choose between Northrop Grumman's design and AeroVironment with the winner to build a prototype. AeroVironment saw the TERN program as offering the potential to greatly expand the company's product line.

Army firms up plans for its new family of systems, potentially benefiting Puma AE. The US Army en-

visages a family of systems that would rely heavily on AeroVironment's UAS.

The family of systems will include three elements: the Long Range Reconnaissance Surveillance System, the Medium Range Mobile System and the Short Range Micro System.

Ravens are planned to be used for the Medium Range Mobile System with current plans calling for a total of 3,604 systems. That would appear to an increase from the 2,358 systems requirement previously established as the US Army requirement, 84% of which had been delivered as of the end of April 2013.

The real boost for AeroVironment comes with the Long Range Reconnaissance Surveillance System, which has a total of 1,213 approved for the Army. That could translate into additional purchases of the Puma, Army inventories of which currently stand at approximately half that total.

In a setback for AeroVironment, the Short Range Micro Systems looks like to be a quadcopter rather than the AeroVironment Wasp.

The US Army began testing the family of systems concept in Afghanistan. An Army brigade used the Raven with the larger Puma and the smaller Wasp as the family. That effort ended in early 2011.

While the concept of the family of systems has taken root in the Army, there is still no funding for the additional systems that would be requirement to implement it. The next step will be for the Army to simply field what is has and seek to find money later for the Short Range Micro and additional Long Range Reconnaissance Surveillance Systems.

US Army plans to increase competition. Adding to the pressure on AeroVironment is a drive by the US Army to increase competition in its procurements of mini-UAS. In January 2013 the Army awarded a \$248 contract for mini-UAS that

AeroVironment split with four competitors, including Lockheed Martin Corp., Elbit Systems of America and privately-held Altavian and Innovative Automation Technologies, LLC. Work is to be completed by December 20, 2017.

The Army solicitation dated Aug. 30, 2012 noted that much of the requirement for AeroVironment's systems has already been fulfilled. "The Army currently has fielded 1,798 RQ-11B systems and 325 RQ-20A [Puma] systems and has a requirement to sustain and maintain this existing fleet. The Army has met 92% of the RQ-11B Army Acquisition Objective (AAO), and has met 83% of the anticipated need for RQ-20A," according to the solicitation.

"Additionally, the current fleet has pre-planned spiral upgrades such as the Gimbal payload, which will be competed and retrofitted under this effort. The need exists to complete the AAO; maintain, sustain and upgrade the fleet; and procure future SUAS Systems as required by the Department of Defense, Other Government Agencies and foreign countries. While the current systems fielded are the RQ-11B and the RQ-20A, alternative Medium and Long Range SUA systems may be procured to meet the anticipated future requirement of approximately 300 Medium and approximately 150 Long Range SUA systems with spare/repair parts," according to the solicitation.

As a result, the solicitation opens the door not only to the completion of the US Army requirements of AeroVironment's systems, but also to the procurement of other small unmanned systems that may offer greater range or other capabilities than AeroVironment's systems.

In a further effort to spur competition, the US Army has its Tactical Open Government Architecture (TOGA) in development. The new software would not be dependent on any particular piece of hardware. Mini-UAVs could then be purchased

as off-the-shelf pieces of equipment so new UAVs for each of the different UAV requirements could be purchased from different companies. Small numbers of UAVs could then be purchased to meet annual requirements for attrition rather than simply making periodic large purchases.

Obviously this would be a serious threat to AeroVironment by making it much easier for the US Army to purchase competitors' UAVs. AeroVironment's dominance would be undermined even in areas such as the Army's Medium Range Mobile System if other systems can be easily used right alongside the Raven.

Competitive strength in mini UAVs. AeroVironment has been the victor in each of the last four open US military competitions, making its systems the only mini-UAS programs of record for the US military. In 2001 AeroVironment and BAI Aerosystems defeated up to 10 other UAV manufacturers to the final development of the Navy-Marine Corps' Dragon Eye portable UAV. Subsequently, the Marine Corps' chose AeroVironment to build the Dragon Eye in November 2003.

In October 2005, the US Army competition for a small unmanned aerial vehicle that could be carried in a back-pack ended with the victory of AeroVironment's Raven B over L-3 BAI Aerosystems' Evolution Extended Time (XTS) SUAV. This SUAV will be dedicated for use by brigade and company commanders. The Army plans to purchase as many as 1,328 of the systems, which include a ground-control station and three air vehicles.

In December 2006, AeroVironment won an Air Force contract worth up to \$45 million over five years to buy as many as 1,000 Battlefield Air Targeting Micro Air Vehicles (BATMAV), a smaller UAV than the Raven. It was the first military program of record for micro UAVs.

Most recently, the US Special Operations Command (USSOCOM) selected Puma AE as its All Environment Capable Variant (AECV) solution to the Small Unmanned Aircraft System (UAS) requirement. AeroVironment received a one year contract with four one-year options worth up to \$200 million.

AeroVironment executives attribute the company's prowess in winning competitions to its willingness to go all out for the win. That has involved spending corporate research and development funding to support bids.

For example, when AeroVironment won the Global Observer Advanced Concept Technology Demonstration, it beat Boeing by building a one-third scale model of the UAV.

The emergence of an increasingly competitive environment in mini UAS. A growing number of companies are seeking to displace AeroVironment as the dominant provider of mini UAVs. In the \$248 million contract cited earlier, the US Army broadened the number of companies that from which it would buy mini UAVs to five. Among them, Lockheed Martin has been strengthened its position in mini UAS by purchasing Procerus Technologies. Elbit Systems is a major competitor overseas which is now working to penetrate the US market. Altavian, a smaller company, is already providing UAVs to support civil works projects in Florida and Puerto Rico and has an agreement with ISR Group to support its systems. IA Tech is another small, private UAV company offering at least four different UAVs.

Now AeroVironment must compete with the other four companies for task orders under the three-year umbrella contract with two one year extensions.

Clearly there are looming challenges for AeroVironment in the competitive environment. Despite its dominance in the mini UAV market, it will face increasingly serious challenges

from larger companies as well as from emerging smaller companies. Interest in the segment is growing because of its potential for new, emerging markets in federal civil applications, local law enforcement and commercial applications.

Companies such as Lockheed Martin and Honeywell formerly may have seen the market as a relative backwater with limited sales, but as their interest has increased. As larger companies become increasingly interested in AeroVironment's market niche, they are able to bring tremendous technical, financial, research and marketing capabilities to bear in the market. They may be able hire key employees by offering strong compensation packages. Larger companies may also offer services that lessen the role of AeroVironment in future contracts. For example, AAI performed training on AeroVironment's Raven UAVs for the U.S. Army earlier.

With their large procurement clout, big companies may also be able to get more ready access to materials in short supply. In 2005 AeroVironment had difficulties getting needed supplies, particularly nylon composites used for mini UAVs, due to worldwide shortages.

Lockheed Martin promises to be one of AeroVironment's most serious competitors in coming years. With its purchase of Procerus Technologies in January 2012, Lockheed Martin signaled that it plans to mount a strong push into the mini-UAV market.

Lockheed Martin's Desert Hawk UAV provided security for US Air Force bases until being displaced by the Raven. It has continued to sell more advanced versions of the Desert Hawk to the UK military. In addition, Lockheed Martin competed unsuccessfully with AeroVironment on the US military requirement which has been met by the Puma.

After its purchase by Lockheed Martin, Procerus unveiled a new un-

manned quad rotor vertical take-off and landing (VTOL) system. The rugged, five-pound VTOL quad rotor, dual-sensor platform includes an extended hover, perch and stare capability. The system is intended to provide military, civil and commercial customers with aerial reconnaissance in crowded areas that cannot be reached by fixed-wing unmanned aircraft systems. The VTOL's gimbal mount includes electro-optical and infrared sensors and a laser illuminator.

Lockheed Martin, may be one of the more formidable competitors, but there are also others. Honeywell, winner of the Class I Future Combat Systems competition, made a strong push into AeroVironment's market niche with its RQ-16A Micro Air Vehicle (MAV). In January 2008, the US Navy announced that it would purchase 185 RQ-16A to support operations in Iraq. The MAV has been used to inspect suspicious vehicles or areas for improvised explosives. Since then the cancellation of the US Future Combat Systems program has undercut the program, by eliminating US Army plans to upgrade and purchase additional systems. Yet Honeywell continues to market its systems in international markets and for other applications such as law enforcement.

Prioria Robotics of Gainesville, Fla., won a contract to supply the Canadian Department of National Defence with Maveric mini-UAVs, a breakthrough for the small competitor of AeroVironment. AeroVironment and Lockheed Martin also competed unsuccessfully for the contract.

The competition was particularly noteworthy because it was one of the first times AeroVironment has lost in an open competition. It gives Prioria Robotics the credibility it needs to mount a more aggressive challenge to AeroVironment.

Prioria Robotics offers the Maveric, a fully autonomous, mini-UAV carried and launched by a single-person. The lightweight composite UAV has bendable, carbon fiber wings that al-

low it to be carried in a six--inch tube. The Maveric is a hand-launched UAV used for reconnaissance.

Israel's Elbit is keen to get into the US market. In 2009 it created UAS Dynamics, a joint venture with General Dynamics Corp. to boost its prospects for the Skylark II close-range tactical UAV. Elbit's Skylark I mini manpack system, a direct competitor to AeroVironment's products, has been sold to the Australian, Canadian and French militaries. The Elbit-General Dynamics lost that competition. In December 2011, Elbit purchased General Dynamics' stake in UAS Dynamics, planning to continue its marketing efforts for mini-UAVs in the United States on its own.

AeroVironment executives say that the Israeli system often has been offered at lower prices. Skylark I also has a gimbaled payload rather than the fixed camera system of the AeroVironment UAVs. While the Israeli optics is quite good, it is not as durable as AeroVironment's, which is built for crash landings. The US military sought fixed cameras because gimbaled systems are more difficult to maintain in rugged conditions.

Yet AeroVironment has begun to respond to Elbit's challenge by adopting its own gimbaled payloads on its UAV family. All future systems will have gimbaled payloads to improve their ability to follow a target.

There are other Israeli systems too that could compete with AeroVironment in international markets although they have not yet been prominent. Israel Aerospace Industries/Malat offers the BirdEye 400, a 5-pound flying-wing UAV, that carries the MicroPOP stabilized micro payload under its belly. That helps maintain the view of the target.

AeroVironment is clearly aware of the need to retain its technological edge in such an environment. It has been increasing its company-funded research and development spending over the past several years. Com-

pany-funded research in the 2012 fiscal year totaled \$37.2 million or 15% of revenue, an extremely high proportion for any defense company.

Yet AeroVironment also faces a challenge in competing with large companies' research budgets.

AeroVironment has been aided in competing with larger companies by US government research contracts. In fiscal 2017, customer-funded research amounted to \$42.4 million or 16% of sales. That is down from \$79.9 million or 24.5% of sales in 2010, a period in which there was heavy investment in the Global Observer program. Still, it is an important boost for the company's own research funding. In 2017, company-funded research and development amounted to \$31.8 million or 12% of sales.

U.S. government contracts may also add to the risks posed to AeroVironment by competition. Some contracts allow the federal government to release technical data without any constraint on a potential recipient. They may also allow the royalty-free use of inventions developed under U.S. government contracts. Obviously such provisions lower the barriers to entry for competitors.

Mini-UAS family. AeroVironment produces four different mini-UAS systems. With their portability, limited cost and minimal infrastructure needs, they are designed for small units. They allow low altitude intelligence, reconnaissance surveillance and communications relay.

AeroVironment's mini UAVs include:

- **Raven B.** Used by the US Army and Special Operations Command, the Raven has a range of six miles and a flight time of 90 minutes. It is lighter and has greater range and flight time than predecessors such as the Dragon Eye and Swift. It has a 55 inch wingspan and weighs 2.4 pounds.

Under a 2005 contract, AeroVironment became the sole provider of Raven to the US Army. The US Army raised its requirement for Ravens in 2010 from 2,182 new systems to 2,358. As of the end of April 2013, AeroVironment delivered 84% of those systems. As of mid-2009, an analogue Raven cost \$100,000 to \$150,000 for three aircraft and two ground controllers (the typical size of a Raven system). The digital version of the Raven runs about 10% more.

- **Wasp.** Used by the US Army, Marine Corps, Navy and Special Operations Command, the Wasp is the smallest of AeroVironment's products. With a 29 inch wingspan, it weighs only one pound. It is quieter, smaller so it may have different missions than a Raven. It is designed for rapid assembly and launch with a range of 2.4 miles and a flight time of 30 minutes. The US Air Force awarded a 2006 contract for the Block III Wasp, known as BATMAV, for up to \$45 million over five years. As of April 30, 2008, orders of \$29.2 million had been made.
- **Puma AE.** The US Special Operations Command (USSOCOM) selected Puma AE as its All Environment Capable Variant (AECV) solution to the Small Unmanned Aircraft System (UAS) requirement. This is AeroVironment's largest small UAV. It has a 9.2 foot wingspan. The 13 pound UAV can operate over land or water for up to two hours with a high resolution gimbaled electro-optical and infrared sensor package. It can land in water. USSOCOM awarded a one year contract with four additional one-year options valued at up to \$200 million in August 2008. The Puma is also used by the US Army and the Navy.
- **Shrike VTOL.** The Shrike is a man-packable, vertical take-off and land micro air vehicle (VTOL

MAV) system. It is a small, portable, reliable and rugged unmanned aerial platform designed for front-line day/night intelligence, reconnaissance and surveillance (ISR). Shrike VTOL operates in hover-and-stare or perch-and-stare modes, transmitting real-time persistent ISR to small unit commanders or police agencies. It can be operated manually or programmed for autonomous operation, utilizing the system's advanced avionics and precise GPS navigation. It can fly for more than 40 minutes with a communications range of 5 kilometers.

- **Switchblade.** This hand-held mini UAV is able to destroy a target using detonation of an onboard explosive. An operator is able to launch Switchblade and guide it to its target using a ground control unit. In urban warfare this would be useful in attacking snipers, mortar launchers and machine guns. AeroVironment, announced in September 2013 that it has received US Army orders valued at \$36.7 million under a contract for Switchblade tactical missile systems, ancillary equipment and support. Switchblade can be deployed from submerged submarines, ground vehicles, dismounted forces, manned and unmanned aircraft. Competitors suggest that the UAV may be of limited effectiveness against moving vehicles due to a limited explosive charge. That could leave some of the market open for competitive products. However, Switchblade was designed to be scalable so it does have the potential to carry a larger explosive payload.

Increasing its focus on the aftermarket. AeroVironment has been expanding its support activity to sustain an increasing number of deployed systems. These services include training, spares and repairs.

New combined payloads are being installed on UAS to enable them to do both infrared and electro-optical imaging on the same flight rather than being forced to select one or the other payload.

Past UAV digitization work. A series of upgrades are already under way on the Raven, including a digital data link. This digital network module enables a switch from the current analog technology used on AeroVironment's mini UAS. It would allow transmission between mini UAVs and their operators as well as reduce bandwidth needs, thereby increasing the number of UAVs that can work in close distances.

The US Army ordered 50 Raven RQ-11B UAVs with AeroVironment's new Digital Data Link in February 2009. The \$16.76 million contract also provides for initial spares packages and Digital Data Link retrofit kits for 206 existing Raven systems. Deliveries of the digital Raven systems began in October 2009.

As of June 2010, 295 Ravens had Digital Data Links. Of the remaining fielded 1,300 systems, approximately 800 conversions were planned by the end of 2010.

With 1,300 analog systems in the Army's inventory, there is the potential for the company to earn \$65 million to \$78 million from the conversion of analog Ravens to digital Ravens.

The Digital Data Link ensures security of the information being transmitted, but also allows the operation of more UAVs within a limited area. Compression of the digital video enables it to handle four times the digital video in the same bandwidth as the older analog data links. The digitized Raven can also act as a limited communications relay.

Following the successful upgrade of Raven, AeroVironment began production of digital Puma. In August 2010, the United States Special Oper-

ations Command awarded a contract delivery order valued at \$35.3 million for new digital Puma All Environment unmanned aircraft systems and training services. Work is scheduled to be performed within several months.

Additional UAV upgrades. Other upgrades for the Raven include higher efficiency motors and higher definition cameras. Higher definition cameras enable the Raven to fly higher while also improving its imagery.

In addition, AeroVironment has been working with Smiths Detection and the US Army Edgewood Chemical Biological Center and other US Department of Defense laboratories on using the Raven to detect and identify chemical agents. The US Army has not yet made a decision on deployment of the system.

Unsuccessful international teaming to broaden the product line.

AeroVironment, Inc. entered into a strategic relationship with Sweden-based CybAero AB to develop and distribute a Tier II vertical takeoff and landing (VTOL) unmanned aircraft system in response to requirements from multiple customers. The relationship announced in 2015 gave AeroVironment exclusive rights to provide CybAero AB systems to United States customers and to government customers in NATO and other countries. AeroVironment agreed to purchase up to \$3 million in convertible notes from CybAero to facilitate the company's growth. Man-portable, hand-launched systems such as AeroVironment's RQ-11B Raven, RQ-20A Puma AE and Wasp AE that weight less than 20 pounds comprise the Tier I segment. Tier II UAS include heavier, larger and longer endurance systems with longer range, such as CybAero's VTOL offering. CybAero's VTOL system would compete against systems such as the Schiebel Camcopter.

AeroVironment sold off its investment at a loss in 2015 in an apparent end to the relationship.

Financials

Below is a five-year selected financial summary of AeroVironment. The company operates under a fiscal-year cycle ending on April 30th.

(\$ Millions)	2013	2014	2015	2016	2017
Revenue	240.1	251.7	259.4	264.1	264.9
Income from Operations	3.8	12.4	2.0	9.7	12.5
Net Income (Loss)	10.4	13.7	2.9	9.0	12.5
Funded Backlog	59.4	65.9	64.7	65.8	78.0
Total Assets	363.5	385.0	397.4	410.4	432.5
Shareholders Equity	315.2	342.5	348.9	361.3	382.0

US Government Sales

In fiscal 2017 AeroVironment received 18% of its revenue from the US Army and other organizations in the Department of Defense that place orders through the Army. Another

37% comes from other US government agencies and government sub-contractors. Purchases by foreign, commercial and consumer customers

accounted for the remaining 45% of sales.

Below is a five-year summary of AeroVironment's US Government sales.

(\$ Millions)	2013	2014	2015	2016	2017
US Government Sales	168.0	188.8	NA	166.4	145.7
% of Total Sales	70%	75%	NA	63%	55%

Competitions

The following is a selection of programs for which AeroVironment has either won or lost a competitive contract, as well as pending procure-

ments for which it is competing. Only those competitions in which Teal Group can readily identify the competitors are listed.

Wins

DARPA Tactically Exploited Reconnaissance Node Phase II—DARPA down selected AeroVironment and Northrop Grumman to follow their successful phase I concept design efforts with a phase II preliminary design for the Tactically Exploited Reconnaissance Node, or Tern. The 12-month, \$19 phase II AeroVironment effort seeks to conclude with subscale flight demonstrations prior to a planned phase III award decision. DARPA and the U.S. Office of Naval Research envision a new concept of operations using smaller ships as mobile launch and recovery sites for medium-altitude

long-endurance UAS. Tern aims to make it much easier, quicker and less expensive for the Navy and Marine Corps to deploy persistent intelligence, surveillance and reconnaissance and strike capabilities. Phase I awardees included: AeroVironment Inc. with a \$2.3 million contract, Northrop Grumman, \$2.8 million; Aurora Flight Sciences, \$2.8 million; Carter Aviation Technologies, LLC, \$2.2 million; and Maritime Applied Physics Corp. with a \$2.2 million award. [10/14]

Sweden Puma and Wasp UAVs—AeroVironment received a

firm fixed-price order for 12 hybrid small unmanned aircraft systems (UAS) from the Swedish Defence Materiel Administration (Försvarets Materielverk) on behalf of the Swedish Army. Elbit is believed to have competed for the contract unsuccessfully. [6/12]

Lethal Miniature Aerial Munition System—This Air Force program to satisfy an urgent operation requirement is intended to use a mini UAV with a warhead to covertly locate, track, and engage time sensitive, fleeting targets. Both tube-launch or hand-tossed versions of expendable,

electro-optically guided weapons will be tested. Three companies were selected following demonstrations to continue and provide weaponized systems for further testing. Companies selected included: AeroVironment (Switchblade), IA Tech (Point and Toss) and Textron Defense Systems. A concept from MBDA known as TiGER was rejected. [12/10]

Nano Air Vehicle Phase II—The Defense Advanced Research Projects Agency (DARPA) awarded AeroVironment a Phase II contract extension in April to design and build a flying prototype for the Nano Air Vehicle (NAV) program. As part of this program AeroVironment has accomplished a technical milestone never before achieved: the controlled hovering flight of an air vehicle system with two flapping wings that carries its own energy source and uses only the flapping wings for propulsion and control. AeroVironment achieved the milestone in December 2008 with the successful 20-second flight of the 'Mercury' interim test vehicle. The nano aircraft is capable of climbing and descending vertically, flying sideways left and right, as well as forward and backward, under remote control. The goals of the NAV program are to develop an approximately 10 gram aircraft that can hover for extended periods, can fly at forward speeds up to 10 meters per second, can withstand 2.5 meter per second wind gusts, can operate inside buildings, and have up to a kilometer command and control range. The NAV program was initiated by DARPA to develop a new class of air vehicles capable of indoor and outdoor operation. The Phase II effort will focus on optimizing the aircraft for longer flight endurance, establishing the transition capability from hover to forward flight and back, and reducing its size, weight, and acoustic signature. The Phase II, \$2.1 million NAV extension contract is scheduled to continue through summer 2010.

Lockheed Martin was offering its Samarai, which was part of the Phase I program. Two other unidentified companies also competed. [7/09]

Netherlands Raven Small UAS—The Netherlands Ministry of Defence, acting through its Defense Materiel Organization (DMO), awarded AeroVironment, Inc. a contract for RQ-11B (Raven) small unmanned aircraft systems. The order includes new aircraft systems as well as training, logistics support, and airworthiness certification. Each Raven system typically consists of three aircraft, a ground control station, a remote video terminal, system spares, and related services. The total award value is \$7.7 million and is fully funded. Israel's Elbit Systems and Germany's EMT offered losing bids in the competition. [5/08]

Spanish Raven UAVs—The Spanish Ministry of Defense purchased 27 espionage UAVs to reinforce the protection of Spanish troops in Afghanistan and Lebanon. This contract is independent from the one that was awarded last April for the purchase of four UAVs. The contract is valued at approximately 3,090,000 euros. The Control of Logistical support of the Army will receive nine systems Raven (Crow) 11Ba, each one of which consists of three vehicles. Israel's Elbit Systems offered a losing bid in the competition. [12/07]

Denmark Raven Small UAV—The Danish Army Operational Command placed an order with AeroVironment, Inc. to supply RQ 11 B, Raven B small Unmanned Aircraft Systems (UAS). The order includes 12 systems, logistics support and training services, for a total value of \$2.4 million. Three of the Raven B systems are planned for delivery to the Jægerkorpset (Army Special Forces), with the remainder destined for troop testing by deployed units at the Danish Army's Artillery Training Center. Israel's Elbit Systems and

Germany's EMT offered losing bids in the competition. [9/07]

Global Observer Stratospheric UAV—The United States Special Operations Command (USSOCOM) awarded AeroVironment, Inc. a contract for the development and military utility assessment of its Global Observer unmanned aircraft system (UAS). This contract initiates a Joint Capabilities Technology Demonstration, or JCTD. The JCTD is sponsored by multiple U.S. government organizations. The contract calls for the development of up to three Global Observer aircraft over the next three years to demonstrate the ability to operate in the stratosphere for up to 7 days without landing. The basic contract, which will be funded under a cost-plus fixed-fee arrangement, provides for the development and delivery of the initial Global Observer aircraft, and is valued at approximately \$57 million. The contract also includes options for the development and delivery of up to two additional Global Observer aircraft, resulting in a potential contract value of \$108 million. Boeing lost the competition. [9/07]

Army Small UAV—The U.S. Army competition for a small unmanned aerial vehicle that could be carried in a backpack ended with the victory of AeroVironment's Raven B over L-3 BAI Aerosystems' Evolution Extended Time (XTS) SUAV. This SUAV will be dedicated for use by brigade and company commanders. The Army plans to purchase as many as 1,328 of the systems, which include a ground-control station and three air vehicles. [10/05]

Dragon Eye—In 2001 AeroVironment and BAI Aerosystems defeated up to 10 other UAV manufacturers to the final development of the Navy-Marine Corps' Dragon Eye portable UAV. Subsequently, The Marine Corps chose AeroVironment to build the Dragon Eye in November 2003.

Losses

DARPA Tactically Exploited Reconnaissance Node Phase III—The Defense Advanced Research Projects Agency (DARPA) and the Office of Naval Research awarded Northrop Grumman Corporation the third phase of the Tern unmanned systems program. Phase three plans to include final design, fabrication and a full-scale, at-sea demonstration of the system. Tern seeks to develop an autonomous, unmanned, long-range, global, persistent intelligence, surveillance, reconnaissance (ISR) and strike system intended to safely and dependably deploy and recover from small-deck naval vessels with minimal ship modifications. The Northrop Grumman Tern team includes its wholly owned subsidiary Scaled Composites, as well as General Electric (GE) Aviation, AVX Aircraft Company and Moog. Northrop Grumman competed against AeroVironment to win the contract. [1/16]

Canadian Mini-UAV—Prioria Robotics of Gainesville, Fla., won a contract to supply the Canadian Department of National Defence with Maveric mini-UAVs. The Maveric is a fully autonomous, mini-UAV carried and launched by a single-person. The lightweight composite UAV has bendable, carbon fiber wings that allow it to be carried in a six--inch tube. The Maveric is a hand-launched UAV used for reconnaissance. The air vehicle weighs 1.1 kilograms and can fly for up to an hour. The Maveric is made mostly of lightweight materials. The UAV is carried into the field inside a small tube. AeroVironment offered the Raven. Lockheed Martin offered the Desert Hawk. [7/10]

Vulture—The Defense Advanced Research Projects Agency (DARPA) selected Aurora Flight Sciences, Boeing and Lockheed Martin as contrac-

tors for the first phase of the Vulture program. The Vulture contractors will design and develop an unmanned aerial system able to fly on station and perform its mission for five years without interruption. The Vulture program envisions a system carrying a 1,000-pound payload drawing five kilowatts of power that is able to stay airborne for an uninterrupted period of at least five years while remaining in the required mission airspace 99 percent of the time. During the program's first phase, a 12-month analytical effort, the three contractor teams were to conduct trade studies to determine the design concept that best satisfies the operational tasks and optimizes design capability. They will also explore various vehicle configurations while concentrating on reliability and mission assurance design aspects. The phase will conclude with a concept design review of sub-scale and full-scale demonstration vehicles and the supporting technology development plan to reduce risk on key technologies. The Vulture program will focus on developing innovative technologies and approaches for in-flight energy collection or refueling and ultra-reliable systems or systems able to be repaired in-flight. Other new technologies that will be developed and that are key to the ability of the Vulture system to provide the desired mission reliability include multi-junction photovoltaic cells, high specific energy fuel cells, extremely efficient propulsion systems, in-flight precision autonomous materiel transfer and docking, extremely efficient vehicle structural design, mitigation of environmentally induced loads, and innovative vehicle control concepts. A system able to remain on station for five years could have utility in a variety of missions such as communications relay, surveillance and reconnaissance, and

signals intelligence. In the program's second phase, DARPA contractors will refine the demonstrator designs, continue technology development and risk reduction efforts, and conduct an uninterrupted three-month flight test of a sub-scale demonstrator. The third and final phase of the program will consist of a flight test of the full-scale demonstrator vehicle, during which the Vulture system will demonstrate the ability to operate continuously for 12 months. In a surprise, AeroVironment lost the competition although it had considerably more experience in the field than its competitors. Seven years before the award, AeroVironment flew an unmanned solar-powered plane dubbed Helios for NASA setting an altitude record.. That effort in part inspired the DARPA program. AeroVironment executives believed that part of the loss may have stemmed from the need to also use expertise to support the company's Global Observer ACTD bid. [4/08]

French Special Forces Skylark UAV—Elbit Systems was selected to supply the Skylark I UAV system to France's Special Forces. AeroVironment is also believed to have been among the 10 companies competing for the mini UAV contract. [3/08]

Polish Small UAV—Israel's Aeronautics won a \$3 million contract to supply six Orbiter mini UAV systems to the Polish Army in July 2007. That followed an earlier sale in 2005 of Orbiter sales to the Polish Special Forces, which used the systems successfully in Afghanistan. In winning the Polish competition, Aeronautics beat eleven other competitors. It is believed that AeroVironment and Elbit Systems were among those competitors. [7/07]

Contracts

Contracts In

US Marine Corps Puma—AeroVironment received a firm fixed-price order valued at \$13 million for RQ-20A Puma AE small unmanned aircraft systems (UAS) and initial spares packages for the United States Marine Corps. The Marine Corps employs the Puma AE system as the long-range solution for its small unit remote scouting system (SURSS), complementing the AeroVironment RQ-11B Raven and RQ-12A Wasp AE UAS. [10/15]

Raven Exports—AeroVironment was awarded a firm-fixed-price contract totaling \$18.5 million to supply initial RQ-11B Raven unmanned aircraft systems, spare parts and contractor logistics services to seven allied nations through the Foreign Military Sales (FMS) program. [8/15]

US Army Raven and Puma Sustainment—AeroVironment received since May 1, 2015 ten orders from the US Army totaling \$47.1 million for RQ-11B Raven and RQ-20A Puma AE unmanned aircraft systems sustainment. This total value includes seven orders awarded on July 23 totaling \$35.2 million. [8/15]

Spanish Raven—AeroVironment received a contract from the United States Army totaling \$3.4 million for RQ-11B Raven unmanned aircraft systems to supply the Spanish Ministry of Defense via the Foreign Military Sales (FMS) program. [8/15]

Switchblade Tactical Missile System Support Services—AeroVironment received a \$4.3 million cost plus fixed fee award and \$7.1 million option on September 25, 2014 for Switchblade tactical missile system support services from the United States Army Close Combat Weapons Systems office. The award increased the funded value of an existing contract for Switchblade tactical missile systems to \$63.8 million. In addition, options totaling \$38.3M

increased the total contract ceiling to \$102.1 million. The award and option provided for the continuation of services to support American forces through training, refurbishments and project management support. [12/14]

DARPA Tactically Exploited Reconnaissance Node Phase II—DARPA selected AeroVironment and its to follow its successful phase I concept design effort with a phase II preliminary design for the Tactically Exploited Reconnaissance Node, or Tern. The 12-month, \$19,035,007 phase II effort seeks to conclude with subscale flight demonstrations prior to a planned phase III award decision. DARPA and the U.S. Office of Naval Research envision a new concept of operations using smaller ships as mobile launch and recovery sites for medium-altitude long-endurance (MALE) UAS. Tern aims to make it much easier, quicker and less expensive for the Navy and Marine Corps to deploy persistent intelligence, surveillance and reconnaissance (ISR) and strike capabilities. [10/14]

US Army Raven and Puma Spares—The US Army awarded AeroVironment, Inc three firm fixed-price orders totaling \$27,178,075 for RQ-11B Raven and RQ-20A Puma AE unmanned aircraft systems (UAS) spare parts. The company received two orders on August 29, 2014 and one on September 18, 2014. Delivery is anticipated within 12 months. These latest orders increased the total value of orders for Raven and Puma AE UAS spare parts and Raven upgrades received since May 2014 to \$77.6 million. [9/14]

Marine Corps Wasp—The US Marine Corps awarded AeroVironment, Inc. a firm fixed-price order valued at \$21,779,408 for RQ-12 Wasp AE small unmanned aircraft systems (UAS) and initial spares packages. The United States Marine Corps,

which recently unveiled its next generation small UAS family of systems, is adding RQ-12 Wasp AE as the short-range, or micro, solution to the existing small UAS portfolio made up of the AeroVironment RQ-11B Raven and RQ-20A Puma AE. Puma AE is the USMC's long-range solution. AeroVironment received the order from ADS, Inc. on behalf of the United States Marine Corps through the Defense Logistics Agency (DLA) Tailored Logistics Support (TLS) program. Delivery is scheduled within 12 months. [9/14]

Army Raven and Gimbaled Payloads—AeroVironment, Inc. received \$13.8 million of incremental funding on March 30, 2013 from the United States Army for continued performance of a contract action with a not to exceed value of \$65.5 million. The order includes RQ-11B Raven systems, new miniature gimbaled payloads and initial spares packages, and is funded from the Army's fiscal 2012 procurement budget. Delivery of systems, spares and payloads is scheduled for completion by July 25, 2013. [4/13]

Marine Corps Wasp—NAVAIR's Program Office for Navy & Marine Corps Small Tactical Unmanned Aircraft Systems (PMA-263), working collaboratively with the United States Army's Counter-IED Program Office, awarded a contract on Sept. 21, 2012 for AeroVironment Wasp AE small unmanned aircraft systems, initial spares packages, training services, and one year of contractor logistics support. The PMA / Army team worked jointly to award the contract to PAR Government Systems Corporation, which in turn secured the systems and services from AeroVironment for a total value of \$12 million. Delivery was scheduled to occur within four months of contract award. [1/13]

Army Raven and Puma IDIQ Contract—AeroVironment, Inc. and four other companies to compete for future US Army small UAS requirements under a new Firm Fixed-Price Indefinite Delivery Indefinite Quantity (IDIQ) contract with a \$248 million maximum value. The contract will enable the continued procurement of AeroVironment's RQ-11B Raven and RQ-20A Puma AE systems as well as competing medium- and long-range small unmanned aircraft systems. [1/13]

Navy/Army Puma—NAVAIR's Program Office for Navy & Marine Corps Small Tactical Unmanned Aircraft Systems (PMA-263), working collaboratively with the United States Army's Counter-IED Program Office, awarded a contract on Sept. 21, 2012 for AeroVironment Wasp® AE small unmanned aircraft systems, initial spares packages, training services, and one year of contractor logistics support. The PMA / Army team worked jointly to award the contract to PAR® Government Systems Corporation, which in turn secured the systems and services from AeroVironment for a total value of \$12 million. Delivery was scheduled to occur within four months of contract award. [9/12]

Army RQ-11B Ravens—AeroVironment received \$16.5 in additional US Army funding to perform on under a contract action with a total projected value of \$65.9 million. The company announced the initial \$15.8 million funding of that contract action on June 1, 2012. The overall contract action includes RQ-11B Raven systems, new miniature gimballed payloads and initial spares packages and is funded from the Army's fiscal 2012 procurement budget. The payload integrates an electro-optical and infrared video sensor for improved tracking. It is also a modular payload unlike existing Raven systems. Delivery of systems, spares and payloads is scheduled for completion by June 30, 2013. [9/12]

Army RQ-11B Ravens—AeroVironment received a \$15.8 million from the United States Army as the initial portion of a contract action with a total projected value of \$66.9 million. The order includes RQ-11B Raven systems, new miniature gimballed payloads and initial spares packages, and is funded from the Army's fiscal 2012 procurement budget. Delivery of systems, spares and payloads is scheduled for completion by April 30, 2013. [6/12]

Army Lethal Miniature Aerial Munition System—AeroVironment received a contract modification effective March 20, 2012 from the U.S. Army Close Combat Weapons Systems (CCWS), Program Executive Office Missiles and Space (PEO MS). The \$5,108,160 modification to the existing contract includes engineering services, operational Switchblade systems and operator training. AeroVironment will work with ATK, its munition subcontractor, to produce and deliver the systems. This order added to a prior \$4.9 million order for a total value of \$10 million. [5/12]

Air Force Puma—AeroVironment received a firm fixed-price order valued at \$2,431,440 on April 5, 2012 from the U.S. Air Force for Puma AE small unmanned aircraft systems through an existing U.S. Army contract. Delivery is scheduled within two weeks. [4/12]

Raven Logistics Support—AeroVironment received a new \$11,095,872 cost-plus-fixed-fee sole source contract award on March 1, 2012 from the United States Army. The order comprises Army, Marine Corps and Foreign Military Sales contractor logistics support for Raven systems. The logistics support services are scheduled to be delivered through Feb. 28, 2013. [3/12]

Air Force Switchblade—AeroVironment received an order from the United States Air Force for Switchblade loitering munition systems and services. The \$4,167,777 extension to an existing contract in-

cludes engineering services, operational Switchblade systems and operator training. AeroVironment will work with ATK (NYSE: ATK), its munition subcontractor, to produce and deliver the systems. [2/12]

Army Puma Logistics Support—AeroVironment, Inc. (NASDAQ:AVAV) today announced that it has received a \$7,298,530 cost-plus-fixed-fee contract from the United States Army. This contract establishes a not-to-exceed amount for digital Puma® All Environment (AE) unmanned aircraft systems (UAS) contractor logistics support services in support of a Joint Urgent Operational Need Statement. The services are scheduled to be provided within the next 12 months. [10/11]

Air Force Raven—AeroVironment received a \$6.9 million order from United States Air Force for Raven Unmanned Aircraft Systems. The order includes new digital Raven® small unmanned aircraft systems and initial spares packages. The systems and spares packages are scheduled for delivery within the next several months. The Air Force Security Forces plan to employ Raven systems to enhance situational awareness and security at bases worldwide. This initial order will provide systems for training of Air Force personnel to support broader deployment. [9/11]

Army Raven Logistics Support—AeroVironment received a \$15,909,962 cost-plus-fixed-fee contract order on September 1, 2011, under an existing contract with the U.S. Army. The order comprises Army contractor logistics support for Raven systems. The logistics support services are scheduled to be delivered within the next several months. [8/11]

USSOCOM Puma—AeroVironment received a firm-fixed-price contract delivery order valued at \$65,532,394 for new digital Puma All Environment (AE) unmanned aircraft systems and initial spares packages. The items were pro-

cured through the existing United States Special Operations Command (USSOCOM) All Environment Capable Variant (AECV) indefinite delivery/indefinite quantity contract. Deliveries are scheduled to be completed over the next several months. [8/11]

US Army Digital Raven—The US Army awarded a firm-fixed-price contract order valued at \$8,373,995 under a follow-on contract. The order comprises new digital Raven small unmanned aircraft systems and initial spares packages. [5/11]

USSOCOM Puma—United States Special Operations Command (USSOCOM) awarded a firm-fixed-price contract delivery order valued at \$11,500,000 for new digital Puma, All Environment (AE) unmanned aircraft systems (UAS), initial spares packages and training services. The items were procured under the existing All Environment Capable Variant (AECV) indefinite delivery/indefinite quantity (IDIQ) contract. Deliveries are scheduled to be completed over the next several months. Each Puma system consists of three air vehicles and two ground control systems. The air vehicle carries an integrated electro-optical and an infrared gimbaled video payload, is designed for enhanced durability in land and maritime environments and can operate effectively in foul weather and over rugged terrain. Its quiet operation, stabilized imagery and precision landing capability make Puma systems easy to operate and recover. The Puma air vehicle weighs 13 pounds, is battery powered and has a flight endurance of two hours. [4/11]

US Army Digital Raven—The US Army awarded a firm-fixed-price contract order valued at \$14,773,816 under an existing contract. The order comprises digital Raven® small unmanned aircraft systems retrofit kits. Work is scheduled to be completed by December 2011. [4/11]

US Army Digital Upgrade Kits—AeroVironment, Inc. received a firm fixed-price order valued at \$7,800,003 under an existing contract with the US Army on January 25, 2011. The order comprises 919 digital module upgrade kits for the U.S. Marine Corps. The upgrade kits allow digital Raven unmanned aircraft systems to operate using a different frequency band than provided by the stock configuration. Work was scheduled to be completed by April 30, 2011. [1/11]

US Army Digital Raven and Marine Corp Digital Retrofit Kits—AeroVironment, Inc. received an order valued at \$46,226,984 under an existing contract with the U.S. Army. The order comprises 123 new digital Raven small unmanned aircraft systems (UAS) and initial spares packages as well as 186 digital retrofit kits for the U.S. Marine Corps. The order also includes 339 digital retrofit kits for the U.S. Army. Work was scheduled to be performed within a period of 12 months. [12/10]

Norwegian Ravens—The Norwegian Defense Logistics Organization awarded a \$4.86 million contract to AeroVironment for new Raven® small unmanned aircraft systems, spares, training services and logistics support. Delivery of the systems is scheduled for early calendar 2011. [11/10]

Digital Puma—The US Army awarded AeroVironment a \$17,197,960 cost-plus-fixed-fee letter contract. This contract establishes not-to-exceed amounts for digital Puma All Environment unmanned aircraft systems contractor logistics support, training and accounting. The services are scheduled to be delivered within the next 12 months. [11/10]

Digital Puma—United States Special Operations Command awarded a contract delivery order valued at \$7,231,440 for new digital Puma All Environment unmanned aircraft systems and training services. The items were procured under an existing in-

definite delivery/indefinite quantity (IDIQ) contract. [10/10]

Digital Puma—United States Special Operations Command awarded a contract delivery order valued at \$35,265,66 for new digital Puma All Environment unmanned aircraft systems and training services. The items were procured under an existing indefinite delivery/indefinite quantity (IDIQ) contract. Work is scheduled to be performed within a period of several months. [8/10]

Digital Raven—AeroVironment, Inc. received an order valued at \$11,198,967 under an existing contract with the U.S. Army. The order comprises 63 new digital Raven small unmanned aircraft systems (UAS), services supporting the Army's evaluation of the small UAS Family of Systems concept and additional engineering services. [5/10]

Digital Raven—AeroVironment received a \$6,781,162 firm fixed-price order for 51 digital Raven systems, initial spares packages and contractor logistics support for the U.S. Marine Corps. On April 12, 2010, AV received an additional \$12,294,916 firm fixed-price order for 216 retrofit kits to upgrade existing analog Raven systems with AV's digital data link. [3/10]

Digital Raven—AeroVironment announced that it received firm fixed-price orders valued at \$20,731,992 for digital Raven; unmanned aircraft systems (UAS) and digital retrofit kits, and \$17,141,648 for Raven system spare parts, repairs and training services for the U.S. Army and Marine Corps. The Raven system and retrofit order represents a portion of the \$121 million appropriated for RQ-11 Raven system procurement in the 2010 Department of Defense Appropriations Act, which was signed into law in December 2009. The orders were released under the existing U.S. Army joint small UAS program of record for AV's Raven. This program allows for contract additions from the Army, Marine

Corps, Special Operations Command and other U.S. military services. The items and services provided under these awards on this multi-year contract are fully funded and are scheduled to be delivered over the next 12 months. [2/10]

Raven Digital Datalink Upgrades—AeroVironment received a \$23.9 million firm fixed-price order under an existing contract. This contract modification includes digital Raven systems and kits to upgrade existing analog Raven® systems currently being used by the U.S. Army and U.S. Marine Corps with AeroVironment's digital data link. Deliveries of the digital Raven systems began in October 2009. The total potential value of this order is \$66.6 million, of which \$42.7 million is not yet funded but has been added to the maximum potential value of the contract supporting this program. [12/09]

Nano Air Vehicle Phase II—The Defense Advanced Research Projects Agency (DARPA) awarded AeroVironment a Phase II contract extension in April to design and build a flying prototype for the Nano Air Vehicle (NAV) program. As part of this program AeroVironment has accomplished a technical milestone never before achieved: the controlled hovering flight of an air vehicle system with two flapping wings that carries its own energy source and uses only the flapping wings for propulsion and control. AeroVironment achieved the milestone in December 2008 with the successful 20-second flight of the 'Mercury' interim test vehicle. The nano aircraft is capable of climbing and descending vertically, flying sideways left and right, as well as forward and backward, under remote control. The goals of the NAV program are to develop an approximately 10 gram aircraft that can hover for extended periods, can fly at forward speeds up to 10 meters per second, can withstand 2.5 meter per second wind gusts, can operate inside buildings, and have up to a kilometer

command and control range. The NAV program was initiated by DARPA to develop a new class of air vehicles capable of indoor and outdoor operation. The Phase II effort will focus on optimizing the aircraft for longer flight endurance, establishing the transition capability from hover to forward flight and back, and reducing its size, weight, and acoustic signature. The Phase II, \$2.1 million NAV extension contract is scheduled to continue through summer 2010. [7/09]

Global Observer Joint Capability Technology Demonstration—US government agencies exercised an option for the assembly of a third Global Observer aircraft. In all six contract options have been exercised since the program began with a total value of more than \$120 million. The initial \$57 million contract was awarded in September 2007. The Joint Capability Technology Demonstration is intended to demonstrate the utility of a hydrogen-powered UAV for intelligence, surveillance and reconnaissance missions up to seven days at altitudes from 55,000 to 65,000 feet. [6/09]

RQ-11B Raven UAVs with Digital Datalinks—The US Army ordered 50 Raven RQ-11B UAVs with AeroVironment's new Digital Data Link. The \$16.76 million contract also provides for initial spares packages and Digital Data Link retrofit kits for 206 existing Raven systems. [2/09]

RQ-11 Raven UAVs—The US Army ordered \$41.7 million of additional Raven small UAVs for its fiscal 2009 requirements by exercising an option under an existing contract. Each Raven system consists of three aircraft, two ground control stations and spares. Deliveries are to be within a year. [2/09]

UAS Based on Wasp—The Defense Advanced Research Projects Agency (DARPA) awarded AeroVironment, Inc. (AV) \$4.6 million in funding to develop a small Unmanned Aircraft

System (UAS) capable of performing "hover/perch and stare" missions. The Stealthy, Persistent, Perch and Stare (SP2S) UAS is based on AV's small Wasp UAS, a one-pound, 29-inch wingspan battery-powered air vehicle that is being procured and deployed by both the U.S. Air Force and the U.S. Marine Corps. The goal of the Stealthy, Persistent, Perch and Stare program is to develop the technology to enable an entirely new generation of perch-and-stare micro air vehicles capable of flying to difficult targets, landing on and securing to a "perch" position, conducting sustained, perch-and-stare surveillance missions, and then re-launching from its perch and returning to its home base. [8/08]

Small UAS Contract—The U.S. Special Operations Command (USSOCOM) selected Puma AE as its All Environment Capable Variant (AECV) solution to the Small Unmanned Aircraft System (UAS) requirement. The one-year Indefinite Delivery Indefinite Quantity (IDIQ) contract, with four one-year options, has a maximum value of \$200,000,000, and provides for the purchase of aircraft, ground control systems, spares, repairs and training under a combination firm fixed-price, cost-plus-fixed-fee and cost reimbursable arrangement. The initial delivery order is valued at \$6 million and is fully funded. [7/08]

Raven Small UAS—The Netherlands Ministry of Defence, acting through its Defense Materiel Organization (DMO), awarded AeroVironment, Inc. a contract for RQ-11B (Raven) small unmanned aircraft systems. The order includes new aircraft systems as well as training, logistics support, and airworthiness certification. Each Raven system typically consists of three aircraft, a ground control station, a remote video terminal, system spares, and related services. The total award value is \$7.7 million and is fully funded. [5/08]

Nano Air Vehicle Development—The Defense Advanced Research Projects Agency (DARPA) awarded AeroVironment, Inc. a Phase II contract to design and build a flying prototype for the Nano Air Vehicle (NAV) program. AeroVironment completed a preliminary design review at the end of its Phase I, \$1.7 million program. Phase II, which was initiated in March, is a new six-month, \$636,000 development program that will culminate with the demonstration of a rudimentary, three-inch flapping-wing air vehicle system. Following a successful demonstration, DARPA has the option to extend the program for an additional 18 months which could increase the Phase II contract value. [5/08]

Raven Small UAS & Support Services—The U.S. Army placed an order with AeroVironment, Inc. for additional RQ-11B (Raven) small unmanned aircraft systems (UAS) and associated services by the exercise of an option under an existing contract. Each Raven system typically consists of three aircraft, a ground control station, system spares, and related services. The total award value is \$45.8 million and is fully funded. The option was submitted under the existing U.S. Army joint small UAS program of record for AV's Raven and will provide systems for the Army and Marine Corps. This program allows for contract additions from the Army, Special Operations Command and other U.S. military services. The items provided under this one-year option on the multi-year contract are scheduled to be delivered within one year of the contract award date. [1/08]

Raven UAVs—The Spanish Ministry of Defense purchased 27 espionage

UAVs to reinforce the protection of Spanish troops in Afghanistan and Lebanon. This contract is independent from the one that was awarded last April for the purchase of four UAVs. The contract is valued at approximately 3,090,000 euros. The Control of Logistical support of the Army will receive nine systems Raven (Crow) 11Ba, each one of which consists of three vehicles. [12/07]

BATMAV Contract—The U.S. Marine Corps ordered \$19.3 million in BATMAV (Battlefield Air Targeting Micro Air Vehicle) systems, each consisting of two Wasp III micro air vehicles, AV's Advanced Battery Charger, spares and support services. The order followed a successful Marine Corps evaluation of Wasp systems provided by the Defense Advanced Research Projects Agency, or DARPA. The Marine Corps will procure the BATMAV systems through the Air Force BATMAV contract, which was awarded to AV in December 2006 and provides a means for other U.S. armed services to procure these systems. The Marine Corps plans to issue Wasp III systems to the battalion for deployment at the platoon level, representing a basis of issue that is lower in the force structure than that of AV's Raven small unmanned aircraft system. The U.S. Air Force selected Wasp III as the micro UAS for its BATMAV program. [11/07]

Global Observer Stratospheric UAV—The United States Special Operations Command (USSOCOM) awarded AeroVironment, Inc. a contract for the development and military utility assessment of its Global Observer unmanned aircraft system (UAS). This contract initiates a Joint Capabilities Technology Demonstration, or JCTD. The JCTD is sponsored

by multiple U.S. government organizations. The contract calls for the development of up to three Global Observer aircraft over the next three years to demonstrate the ability to operate in the stratosphere for up to 7 days without landing. The basic contract, which will be funded under a cost-plus fixed-fee arrangement, provides for the development and delivery of the initial Global Observer aircraft, and is valued at approximately \$57 million. The contract also includes options for the development and delivery of up to two additional Global Observer aircraft, resulting in a potential contract value of \$108 million. [9/07]

Raven Small UAV—The Danish Army Operational Command placed an order with AeroVironment, Inc. to supply RQ 11 B, Raven B small Unmanned Aircraft Systems (UAS). The order includes 12 systems, logistics support and training services, for a total value of \$2.4 million. Three of the Raven B systems are planned for delivery to the Jægerkorpset (Army Special Forces), with the remainder destined for troop testing by deployed units at the Danish Army's Artillery Training Center. [9/07]

Raven Logistics Support—The U.S. Army has ordered \$16.4 million in contract logistics services (CLS) in support of its Raven small unmanned aircraft systems (UAS). These logistics services are to include refurbishment, reconstitution and repair work, as well as the migration of systems to the latest configuration during the completion of refurbishment. [9/07]

Export Sales

The following is a selection of defense- or aerospace-related contract awards to AeroVironment for products or services bound for countries

other than the US. International sales for AeroVironment accounted for approximately 36% of total revenue for the fiscal year 2017, com-

pared to 28% in 2016 and 9% in the previous year. As of July 2017, AeroVironment had sold to 40 coun-

tries, often small quantities used for trials.

Note: FMS signifies Foreign Military Sales.

Australia—The Australian Defence Force selected AeroVironment Wasp AE for its AUD \$101 Million Small Unmanned Aircraft Systems Program. AeroVironment will provide Wasp AE systems over three years with multi-year training and support with a total contract value to AeroVironment of up to USD \$36.5 million for hardware and services over the program lifespan. Under the contract, Australian partners XTEK, General Dynamics Mediarware and Sentient to provide added capabilities for Wasp AE and local support for the Australian Defence Force. [6/17]

Undisclosed—AeroVironment was awarded a firm-fixed-price contract totaling \$18.5million to supply initial RQ-11B Raven unmanned aircraft systems, spare parts and contractor logistics services to seven allied nations through the Foreign Military Sales (FMS) program. [8/15]

Spanish Raven—AeroVironment received a contract from the United States Army totaling \$3.4 million for RQ-11B Raven unmanned aircraft systems to supply the Spanish Ministry of Defense via the Foreign Military Sales (FMS) program. [8/15]

Denmark Pumas—The Danish Acquisition and Logistics Organization

awarded AeroVironment a firm fixed-price order of \$9.6 million to supply the Danish Armed Forces with the company's Puma AE™ small unmanned aircraft systems (UAS). AeroVironment was selected following a competitive evaluation. This follows the first \$2.4 million Danish Army order for Raven B systems in 2007. [6/12]

Sweden Puma and Wasp UAVs—AeroVironment received a firm fixed-price order for 12 hybrid small unmanned aircraft systems (UAS) from the Swedish Defence Materiel Administration (Försvarets Materielverk) on behalf of the Swedish Army. [6/12]

Norwegian Ravens—The Norwegian Defense Logistics Organization awarded a \$4.86 million contract to AeroVironment for new Raven® small unmanned aircraft systems, spares, training services and logistics support. Delivery of the systems is scheduled for early calendar 2011. [11/10]

Netherlands Raven Small UAS—The Netherlands Ministry of Defence, acting through its Defense Materiel Organization (DMO), awarded AeroVironment, Inc. a contract for RQ-11B (Raven) small unmanned aircraft systems. The order includes new aircraft systems as well as training, logistics support, and airworthiness certification. Each Raven system typically consists of three air-

craft, a ground control station, a remote video terminal, system spares, and related services. The total award value is \$7.7 million and is fully funded. [5/08]

Spanish Raven UAVs—The Spanish Ministry of Defense purchased 27 espionage UAVs to reinforce the protection of Spanish troops in Afghanistan and Lebanon. This contract is independent from the one that was awarded last April for the purchase of four UAVs. The contract is valued at approximately 3,090,000 euros. The Control of Logistical support of the Army will receive nine systems Raven (Crow) 11Ba, each one of which consists of three vehicles. [12/07]

Denmark Raven Small UAV—The Danish Army Operational Command placed an order with AeroVironment, Inc. to supply RQ 11 B, Raven B small Unmanned Aircraft Systems (UAS). The order includes 12 systems, logistics support and training services, for a total value of \$2.4 million. Three of the Raven B systems are planned for delivery to the Jægerkorpset (Army Special Forces), with the remainder destined for troop testing by deployed units at the Danish Army's Artillery Training Center. [9/07]

Joint Ventures/Teaming

Turkey's Aselan, Altoy Defence Industries and Aviation Collaboration on Global Observer

Aselsan, a Turkish defence industry leader, announced it signed a Memorandum of Understanding with AeroVironment, Altoy Defence Industries and Aviation Inc., a Turkish joint venture partially owned by AeroVironment. The agreement es-

tablishes the first step towards future collaboration on civil and military avionics, electronics and electro-optical systems, sensors and communication systems. Solutions for Intelligence Surveillance and Reconnaissance applications such as elec-

tro-optical cameras, avionics and communication systems for AeroVironment's Global Observer – High Altitude Unmanned Air Vehicle would be developed and presented to target international markets by ASELSAN. [6/14]

CybAero AB

AeroVironment secured exclusive rights to Sweden's CybAero AB's

larger, higher flying, longer endurance vertical takeoff and landing

(VTOL) unmanned aircraft system (UAS) in United States, NATO and

other countries. AeroVironment will invest up to \$3 million in CybAero convertible notes under the agreement. [12/12]

Research and Development

In-house R&D

AeroVironment's customer-funded research and development is at its lowest level in at least five years. Company-funded research and development fell to \$31.8 million in 2017, from a peak of \$46.7 million in 2015. Customer-funded research and development fell to \$42.4 million in 2017 from a recent peak of \$52.8 million in 2016. That is down from the \$79.9 million or 24.5% of sales in 2010, a period in which there was heavy in-

vestment in the Global Observer program.

AeroVironment receives customer funding for a new small UAS known as the Stealthy Perch and Persistent Stare, or SP2S. The goal of the SP2S program is to develop the technology to enable a new generation of perch-and-stare micro air vehicles capable of flying to difficult-to-access locations, landing on and securing to a "perch" position, conducting sus-

tained surveillance missions and then re-launching from their perch and returning to their home base. With 12% of its company revenues spent on company-funded research and development, AeroVironment spends several times the percentage of revenues of the typical US defense company.

Below is a five-year summary of AeroVironment spending in this area.

(\$ Millions)	2013	2014	2015	2016	2017
Company-funded R&D	37.2	25.2	46.7	42.3	31.8
Company-funded % of rev.	15	10	18	16	12
Customer-funded R&D	38.4	27.6	36.3	52.8	42.4
Customer-funded % of rev.	16	11	14	20	16

Acquisitions/Divestitures

Altoy

In February 2017, the Company completed the acquisition of 36% of the common shares of Turkey's Altoy for cash consideration of \$625,000,

which increased its interest from 49% to 85% and provided the Company with control over Altoy. As a result, Altoy became a consolidated subsidiary of the Company on the date of the

acquisition. Altoy aims to market and distribute small UAS in Turkey.

Divisions/Subsidiaries

Unmanned Aircraft Systems

85 Moreland Road Simi Valley Calif.

AeroVironment's has two UAV facilities are being moved to this location. Its small UAS manufacturing is done at an 85,000 square foot manufacturing facility in Simi Valley, California. That facility, established in 2005, is

able to produce 1,000 aircraft monthly.

Another 105,000 square foot manufacturing, research and development facility in Simi Valley is used to spe-

cialized testing and production of the Global Observer. AeroVironment is occupying the site under a five year lease. In addition, AeroVironment has lease arrangements with several test flight fields in California.