JULY 2015

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Smart motion control

Evolution in defense electronics is causing a paradigm shift in motor control. PAGE 18

Combat vehicles

Army takes another shot at developing modern armored combat vehicle. PAGE 2

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The next wave of unmanned vehicles

Stealthy drones provide crucial surveillance while remaining undetected by the enemy. PAGE 8

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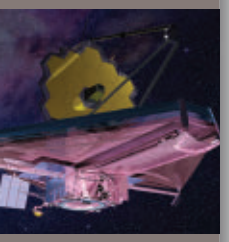
COVER STORY



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BY **JOHN KELLER**, EDITOR IN CHIEF

Army taking another shot at developing a new armored combat vehicle

The U.S. Army is making another attempt at developing a modern armored combat vehicle in the wake of at least two recent disastrous attempts to update the nation's aging fleet of armored personnel carriers, main battle tanks, self-propelled artillery and other military ground vehicles.

Officials of the Army Contracting Command in Warren, Mich., have announced contracts to two combat vehicle manufacturers to develop design vehicle and vetronics concepts for the Future Fighting Vehicle (FFV) — a notional concept that aims at developing enabling technologies that potentially could become part of future ground systems.

The FFV concept-design contacts are going to General Dynamics Land Systems in Sterling Heights, Mich. — designer of the Army's M1 Abrams main battle tank — and BAE Systems Land and Armaments in Sterling Heights, Mich. — maker of the Army's M2 Bradley Fighting Vehicle and M109A6 Paladin self-propelled howitzer.

The Army last month awarded a $28.3 million contract to General Dynamics and a $28.9 million contract to BAE Systems. The companies will complete their 18-month contracts to define FFV concepts in November 2016.

Army officials admittedly are taking it slow with the FFV project — not yet officially a program of record — to avoid some of the pitfalls that spelled the end of the Army's Ground Combat Vehicle (GCV) program early last year, and the Future Combat Systems (FCS) program in 2009.

General Dynamics and BAE Systems won small contracts last summer to capitalize on vetronics and similar technologies they developed for the cancelled GCV program for potential use on a Future Fighting Vehicle.

Tight budgets, rapidly changing requirements, and reliability concerns have led to armored vehicle program cancellations going back 30 years to the Army M247 Sergeant York Division Air Defense (DIVAD) self-propelled, anti-aircraft gun, which was cancelled in 1985 amid rising costs and reliability concerns.

One bright spot on the combat vehicle front is the Joint Light Tactical Vehicle (JLTV) program to replace U.S. military Humvees. The JLTV program is in a 33-month engineering and manufacturing development phase. The three competitors — AM General, Lockheed Martin, and Oshkosh — are vying for the low-rate initial production contract, which the U.S. Army Tank-automotive and Armaments Command (TACOM) expects to award to one contractor sometime this year.

The U.S. Department of Defense (DOD) wants to buy 54,599 JLTVs — 49,099 for the U.S. Army and 5,500 for the U.S. Marine Corps. The U.S. Government Accountability Office (GAO) estimates that the DOD will spend more than $53.3 billion on the JLTV program — $1.1 billion for research and at least $52.3 billion for procurement.

Meanwhile, many of today's U.S. armored combat vehicles are noticeably aging — although periodic technology upgrades have kept them in front-line fighting condition. The Stryker family of eight-wheeled combat vehicles, for example, has been in service since 2002.

The M1 tank has been in the inventory since 1980. The Bradley Fighting Vehicle — the system that GCV was intended to replace — has been in service since 1981. The Army's M109A6 Paladin self-propelled howitzer has been in the inventory since the late 1990s.

Here's hoping the Army's Future Fighting Vehicle program can hit the target where so many others have missed, and will yield capable, affordable combat vehicle technologies for the 21st century.

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Spending more on ruggedized computers can ensure data integrity, survey reveals

BY JOHN KELLER

NASHUA, N.H. — Nine out of ten readers of *Military & Aerospace Electronics* say it's worth the extra money to buy ruggedized computers for aerospace and defense applications, rather than risking the loss of crucial data by using commercial-grade computers, a recent study shows.

International militaries use rugged laptop computers like the Panasonic Toughbook as much to ensure the integrity of their data as they do for computer reliability in the field.

Asked if it is worth spending more money to ensure against the risk of critical data loss, 56 percent of those responding to a survey say they strongly agree, and 35 percent say they somewhat agree. Less than 9 percent were neutral or disagreed.

These results are part of a *Military & Aerospace Electronics* market study on ruggedized computers, which has been conducted since late May. So far 222 readers have responded to the study. You can weigh in on the study online at www.surveymonkey.com/r/9B9M6JL.

Many of the readers who favor spending extra for ruggedized computers say they are speaking from personal experience; 54.3 percent say they or their organizations have lost crucial data due to the failure of a commercial-grade notebook or portable computer.

The majority of those responding, 36 percent, identify themselves as engineers or operations staff. Nearly 16 percent are C-level executives, 12 percent are supervisors or directors, and 11.3 percent are in upper management. The rest are IT specialists, administrators, or public safety directors.

With about 90 percent of respondents voicing a preference for ruggedized computers, one might wonder why only 74 percent actually deploy ruggedized computers or tablets in their environments. The answer is cost.

When asked for some reasons that respondents are not using rugged devices, nearly 62 percent say ruggedized computers are too expensive. Nearly 32 percent blame limited sourcing for not using ruggedized computers, and 26 percent say ruggedized computers are too heavy for their applications.

Other reasons given for not using ruggedized computers are a lack

CONTINUED ON PAGE 6 ➔

IN BRIEF

Lockheed Martin to provide flight computers for Air Force MC-130J

U.S. military microelectronics experts are asking Lockheed Martin to upgrade special-operations flight computers aboard the U.S. Air Force MC-130J Commando II special-operations aircraft, and to manufacture several upgraded airborne computers. Officials of the Defense Microelectronics Activity in McClellan, Calif., plan to award a task order to the Lockheed Martin Mission Systems and Training segment in Owego, N.Y., as part of the Advanced Technology Support Program III, to upgrade the MC-130J Special Mission Processor, improving performance and resolving obsolescence and vanishing vendor issues.

Army orders more Gray Eagle attack drones

U.S. Army officials are ordering 19 MQ-1C Gray Eagle reconnaissance and attack unmanned aerial vehicles (UAVs), as well as 19 satellite UAV control stations. Officials of the Army Contracting Command at Redstone Arsenal, Ala., announced a $121.4 million contract modification to General Atomics Aeronautical Systems in Poway, Calif., for the Gray Eagle attack drones and satellite communications air data terminals. ←

Air Force seeks enabling technologies for future hypersonic munition

BY JOHN KELLER

EGLIN AIR FORCE BASE, Fla. — U.S. Air Force researchers are moving forward with a program to develop a hypersonic munition able to attack and destroy targets quickly over long distances, and pose lethal threats to many different targets in many different locations all at the same time.

Officials of the Air Force Research Laboratory Munitions Directorate at Eglin Air Force Base, Fla., have issued a broad agency announcement (BAA-AFRL-RWK-15-0003) for new enabling technologies to support the High Speed Strike Weapon (HSSW) program. The overall program includes two demonstrations for an air-breathing vehicle and a boost-glide vehicle that focus on near-term enabling technologies that require flight testing. Working on these demonstrations are engineers at Boeing and Lockheed Martin.

Ultimately the program seeks to develop a hypersonic weapon able to attack any target in the world in 30 minutes or less from land- or carrier-based aircraft, submarines, or other platforms. Hypersonic technology would enable U.S. forces to avoid using ballistic missiles that could trigger massive retaliation from adversaries like Russia and China.

The part of the program announced in May centers on maturing technologies in six areas: modeling, simulation, and analysis (MS&A); ordnance; guidance navigation and control and airframe; propulsion; materials and structures and manufacturing; and conceptual design and systems integration.

The demonstration efforts will run in parallel with Boeing and Lockheed Martin technology-maturing efforts; each will provide data and information to eliminate duplication of effort.

The solicitation is open until September 2020, and seeks white papers until then on industry ideas for the six technology-maturing areas. Air Force researchers will invite proposals based on the white papers they like best.

The Air Force is asking industry for simulation, ordnance; guidance, propulsion, and materials for potential application to a future hypersonic weapon.

Each of the six technology areas has a technical adviser, and researchers recommend that companies interested first talk to the adviser their ideas before proceeding with the white paper. Over the next five years, researchers may issue requests for proposals in specific topic areas.

The program's modeling, simulation, and analysis component seeks to develop models to analyze advanced high-speed weapon concepts to highlight technologies worthy of further consideration. Technical points of contact are Pamela Pitchford (850-883-2505 and pamela.pitchford@us.af.mil) or James Weber (937-255-5125 and

CONTINUED ON PAGE 7 ➔

RUGGED CONTINUED FROM PAGE 4

of compatibility with existing equipment; a lack of detail on purchasing specifications; low return on investment; unfavorable upgrade timetables; inconvenient form factors; and problems with service.

For those using ruggedized computers, nearly 48 percent are deploying rugged notebook computers. Nearly 32 percent say they are deploying ruggedized tablet computers, and 27 percent are deploying rugged smartphones. The rest are deploying rugged workstations and large computers.

The applications respondents are serving primarily involves aerospace and defense. Of those responding, 57 percent are involved in military and aerospace, nearly 24 percent are involved in industrial automation, and 19 percent are in homeland security. The rest are involved in public safety, power and utilities, transportation, oil and gas, construction, surveying and cartography, health care, or other industries.

Of these deployments of ruggedized computers, nearly 79 percent say using rugged computers in their applications either are extremely or very important. The rest say it is somewhat important, not important, or not a factor.

There's good reason for the importance they place on rugged and reliable computers. Of those responding, 69 percent say in-field computer failures are catastrophic or critical to their organizations. Twenty-one percent find field failures to be annoying, and the rest say field computer failures are easily handled or are not a factor.

The majority of those responding, 69 percent, say water resistance is the most important feature where it comes to ruggedized computers. Next most important is resistance to shock and vibration. Respondents say their rugged computers must be lightweight, power-efficient, and have the ability to run custom applications.

Other popular features are hot-swap batteries, GPS capability, advanced processors, Bluetooth and satellite communications capability, and the ability to accept mil-spec connectors.

AIR FORCE CONTINUED FROM PAGE 5

james.weber.13@us.af.mil).

Ordnance seeks to develop ordnance technologies for high-speed delivery that can withstand the effects of extreme heating and vibration during cruise, glide, and terminal phases, as well as high terminal velocities and high-Gs; and exploiting the kinetic energy of the high-speed terminal phase. Technical point of contact is Don Littrell (850-882-6802 and donald.littrell@us.af.mil).

Guidance, navigation & control, and airframe seeks to develop guidance to provide maximum range, minimum flight time, and minimum target miss distance, even in GPS-denied environments. Technical point of contact is Virginia Swindell (850-883-2697 and virginia.swindell@us.af.mil).

Propulsion seeks to develop propulsion technologies to enable increased speed and effectiveness of the weapon, such as ramjet and scramjets, boosters, fuels, inlets, and nozzles. The Technical point of contact is James Weber (937-255-5125 and james.weber.13@us.af.mil).

Material, structures, and manufacturing will develop materials for high-speed weapons that will negate or take advantage of high-speed, long-duration flight that protect the airframe help speed the weapon to its target. The technical point of contact is Ken Davidson (937-255-9838 and kenneth.davidson.1@us.af.mil).

Conceptual design and systems integration will develop system- and subsystem-level concepts for a next-generation air-launched weapon. The technical point of contact is John Leugers (850-883-2502 and john.leugers@us.af.mil).

Companies interested should e-mail five-page white papers no later than 30 Sept. 2020 to the Air Force Research Lab at afrl.rwk.baa-workflow@us.af.mil.

For contracting questions, contact Kendall Wagner (850-883-2681 or kendall.wagner@us.af.mil). For security questions, contact HSSW Program Manager John Leugers (850-883-2538 or john.leugers@us.af.mil).

MORE INFORMATION IS online at *http://bit.ly/1SN6lcx*.

The new era of unmanned vehicles

Military drones are coming into common use in the air, on land, and at sea to provide crucial surveillance and reconnaissance while remaining stealthy and undetected by the enemy.

BY **J.R. Wilson**

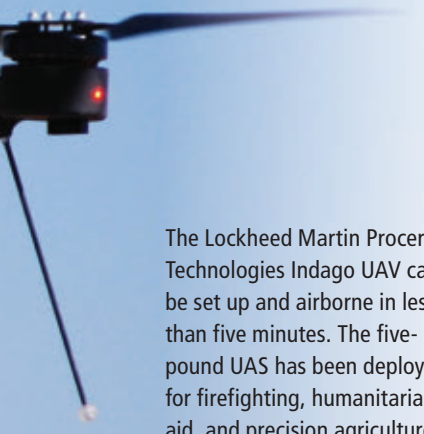
Just as Vietnam was called the helicopter war, the past decade and a half in Iraq and Afghanistan reasonably could be defined as the unmanned aerial vehicle (UAV) war.

From a public perspective, that has meant large UAVs, such as the U.S. Air Force General Atomics MQ-9 Reaper hunter-killer and predecessor MQ-1 Predator. Equally important, however, has been the small manpackable UAVs that weigh less than 15 pounds, are hand-launched, and are small enough to fit into a warfighter's backpack.

"Clearly we learned a ton of lessons on a number of different issues associated with unmanned systems, from reliability to using the data they produced to the maximum, but the most important thing is such systems are now an accepted, expected, and integral part of every military operation today," says Jay McConville, director of business development for unmanned integrated systems at Lockheed Martin Procerus Technologies in Vineyard, Utah.

"The military sees an incredible increase in benefits of using unmanned systems at every echelon," McConville says. "We are responding with new capabilities, more dynamic platforms, longer endurance, and greater communications to enable that expansion."

The primary manpackable application in Southwest Asia has been over-the-hill and around-the-corner reconnaissance — essentially an airborne point man of limited flight time, altitude, and capability. Still, these small UAVs have played a key role in protecting ground forces from ambushes and snipers, as well as providing overall situational



The Lockheed Martin Procerus Technologies Indago UAV can be set up and airborne in less than five minutes. The five-pound UAS has been deployed for firefighting, humanitarian aid, and precision agriculture operations. (Lockheed Martin photo.)

awareness about enemy personnel and non-combatants.

Relying heavily on rugged commercial off-the-shelf (R-COTS) components — and increasingly employing common GCS that could handle multiple small UAVs and even unmanned ground vehicles (UGVs) — the use and requirements for greater capability rapidly rose to the top of individual warfighter and small unit requests to higher command and, through the budget process, Congress.

The Unmanned Systems Integrated Roadmap of the U.S. Department of Defense (DOD) lays out future requirements for all unmanned robotics, including man-packables. For clarity, DOD officially refers to UAVs as unmanned aerial systems, or UAS.

"Next-gen UAS technologies and capabilities being developed include interoperability and modularity; communication systems, spectrum and resilience; security — research and intelligence/technology protection (RITP); persistent resilience; autonomy and cognitive behavior; and weaponry," says Lt. Col. James Hamill, UAS Capabilities Integration Officer at the Marine Corps Combat Development Command.

"Business rules within the UAS

The Lockheed Martin Indago small UAV helped respond to the devastation of Cyclone Pam. (Heliwest photo.)

industry have historically been restrictive in enabling interoperability with other systems through proprietary protections that reduce multimission capabilities of small UAS (sUAS) and associated equipment. Future Marine Corps operations require open-interface sUAS, which may be operated on multipurpose computer tablets, integration of a variety of payloads from multiple vendors, secure communications networks, and affordability."

A global leader in manpackables is AeroVironment in Monrovia, Calif., which has converted a quarter century focus on sUAS into an 85 percent dominance of the U.S. military market for Group I aircraft. Those include the RQ-11B Raven, RQ-20A Puma AE, Wasp AE, Shrike vertical takeoff and landing (VTOL), and Switchblade. AeroVironment doesn't call the Switchblade a UAV, "but it does fit within the same domain," says Steven Gitlin, the company's marketing strategy vice president. "The key difference is where the other platforms provide information to an operator; the Switchblade not only does that but also provides a lethal and highly precise strike capability. Some call it the new word for force protection. The squad, company, battalion on the move, in areas where they don't have access to other systems, can use manpacks to gain situational awareness anytime, anywhere, which has massive implications on effectiveness and safety," he says.

"Combined with Switchblade, if you look at the squad as the tip of the spear, it now has a mini air squadron in a rucksack. Over the years, we've found the manpack technologies are more like standard issue materials than large UAVs, which are managed, maintained, monitored, and coordinated in a manner similar to manned aircraft; the small systems are deployed at a very low level in the force structure, carried and used by the troops who need them."

The effort to withdraw ground combat forces from Southwest Asia, accompanying plans to downsize the military, the planned Pacific pivot are having a complex influence on next-generation manpackable research, development, and acquisition, with industry looking to a rapidly growing civil and commercial market to fill much of the funding slack.

"ISIS is an entirely different challenge than what we might deal with in any future conflict with traditional nation-states. So there is no one-size-fits-all solution. But we do need more and more capable manpackable solutions, especially in urban environments," notes Dave Kroetsch, president and CEO of Aeryon Labs in Waterloo, Ontario, which produces the 5.3-pound SkyRanger and 2.5-pound Scout quadrotor UAVs.

"One of the biggest drivers of technology is the movement toward dismounted urban combat. There's also a cost factor. Putting hundreds of small UAVs in the air costs less than one large UAV and gives you a hundred eyes in the air rather than one. Miniaturization is resulting in multifunction, multimission sUAVs in much smaller form factor."

With growing demand for their capabilities from the military, media, entertainment, real estate, agriculture, infrastructure oversight, homeland security, and many others, the future of UAVs has become "more technology push than

The new multi-mission payload from Lockheed Martin Procerus Technologies can record and live-stream data with a smooth, stable video capability in any weather condition.

requirements pull," says Paul Gelhausen, owner of AVID Aerospace in Yorktown, Va.

While manpackables increasingly are becoming important to dismounted infantry, the expectation is for greater implementation by special operations and homeland security.

"For the military OCONUS [outside the continental United States], special forces are expected to play even more important roles in addressing future conflicts, especially as those develop quickly in far-off locations," says AeroVironment's Gitlin. "So equipment that can increase their capabilities and protect them will become ever more important. And manpacks will provide them a capability very well-suited to that environment."

Civil takes the lead

Industry sees the future of manpackable UAVs as a complicated mixture of small platforms that can carry significant payloads at significant distances. Next-generation small UAVs must have good endurance; find common ground between the military, commercial, and civil markets; and push the envelope on miniaturization, new power technologies, new materials, and innovative flight dynamics. Moreover, industry must achieve these goals at company expense.

Reduced military funding also means a reduction in creativity, which industry hopes to counter through non-military applications,

says Gelhausen of AVID Aerospace. AVID worked with Honeywell to design the 18-pound RQ-16 T-Hawk VTOL, classified as a micro-UAV, but too big for a manpackable. More recently, AVID has developed and demonstrated the EDF-8, a 2-pound, soccer ball-sized ducted-fan VTOL.

"If there are tight budgets for DOD, they will bring in more COTS, as they did with laptops, although there obviously will be some targeted technologies," Gelhausen says. "So we've looked at the police and commercial markets — and 85 percent of their aircraft are VTOL.

"The military has to project force, while civilian law enforcement only has to show force, which does not require the range needed in many military applications, so a hovering vehicle fits nicely. The military also needs reliability out to the end of the logistics chain. The civilian market will not have the same level of survivability — or be willing to pay for it — because the logistics are easier. That also is true to some extent on other elements, such as intelligence and communications."

Pursuing designs that incorporate the best size, weight, power, and cost (SWaP-C) tradeoffs is vital across the customer base. But with a potential massive global demand for sUAS from law enforcement, fire departments, agriculture, oil and gas, media, Hollywood, fish and livestock, forest and wild animal protection, and a growing host of other civilian and commercial markets, the potential combined funding available for future RDT&E dwarfs that of all military customers worldwide.

At present, the non-military market is restrained by severe flight restrictions imposed by government air control agencies, such as the U.S. Federal Aviation Administration (FAA) in Washington. Under current FAA rules, unless a waiver is granted, all UAVs flown in the U.S. National Airspace System (NAS) must remain within line-of-sight control of the operator, making them of little use for remote area monitoring. The FAA is working with industry and global standards organizations, such as the ASTM International Committee F38 on Unmanned Aircraft Systems, to ease those restrictions, although growing concerns over privacy and safety are hampering that effort.

The Windows-based tablet hand controller for Indago features an improved system flexibility and reduced overall weight, while maintaining a four-hour run-time and the flexibility of either an external or integrated datalink option.

"Technologies already available are extremely valuable and can add a lot to industry and first responder capabilities, but the government is not yet comfortable with the level of sense and avoidance UAVs have attained. Nonetheless, moving forward, it is pretty clear these systems will continue to be used commercially — more than 500 companies already have received exceptions from the FAA — and they also will see greater use in civilian search-and-rescue operations," notes Dan Gettinger, co-director of the Center for the Study of the Drone at Bard College in Red Hook, N.Y.

"So the future may be heavily influenced by domestic use as DOD considers how it should invest in new technology and which technologies and what the future operations environment will be like," Gettinger says. "But restrictive laws keep popping up, limiting even existing civil and commercial applications. Even so, the presence of drones in civilian life will continue to be felt in a lot of different ways as advanced sensor packages manifest in law enforcement in a number of different ways."

Military force reductions will mean fewer individual warfighters going into the field. While a reduced user base could equate to a reduced requirement for future procurement of manpackable UAVs, many in industry believe force reduction — and tight budgets — could be a boon for sUAS manufacturers.

"It doesn't matter if the Army is 200,000 or 1,000, that soldier needs the latest and greatest technology to complete the mission," says Rob Semple, senior manager-business development at Exelis in McLean, Va. "If the first platoon is doing one thing and second platoon another — and they are geographically dispersed — both small unit leaders need communications capability [provided by sUAS local comms relay] without being limited by the prioritizations set out by higher command."

Acquired by Harris Corp. in May 2015, Exelis is a battlespace com-

munications networking developer, including the Microsat Man-Packable Mission Command (MiMMC) beyond-line-of-sight communications system.

"Industry does a lot on our own dime to further develop things, making them smaller and lighter. And the military is beginning to see if that capability is out there, rather than going into a 5- or 10-year program of record, we can take what's available off the shelf. So you first have to look at the base requirement from the military, then what it will cost in weight or power to give that to the soldier," Semple says.

Bryan da Frota, CEO and co-founder of Prioria Robotics in Gainesville, Fla., says he believes multiple pockets of development and drivers — military, commercial, and civilian — will benefit each other. At the same time, increasingly COTS-based research could have a significant influence on the future of America's technology edge in UAVs, including manpackables.

"COTS is a fundamental problem with America's position in this maket," da Frota says. "Because of what has happened with how we fund the military and build and develop our programs, sequestration, continuing resolutions, and tight budgets have made it brutally tough on everyone — and given the rest of the world a chance to catch up. In 2001, the market began to grow, so you saw lots of companies getting into UAVs; then as we started to draw down in Southwest Asia and the economy began declining in 2008, a lot of those companies disappeared. Now it has re-blossomed to 10 times bigger than it ever was, but the composition of those companies is different. A few

years ago, for example, you could count the number of European companies with workable products on one hand."

He also predicts a continuing segmentation of the commercial market into consumer and industrial and enterprise class systems.

"What will drive development in those subsegments will be airspace regulations and the ability to gain access to a very crowded space," da Frota continues. "You could probably find a hundred different quadcopters of some type out there now. But most are cheaply made, break easily, etc., so somebody trying to build a business based on those products will run into problems with reliability.

"I see two things pushing development. The industrial side will push for improved reliability and data quality. Meanwhile, now that other entities are starting to get reasonably sophisticated UAVs, the military is asking what to do when someone uses a UAS against us, as well as dealing with counter-UAV efforts aimed at our aircraft."

Aeryon's Kroetsch also believes tight budgets will accelerate the evolution in miniaturization, essentially becoming an advantage for the small system community.

"I think it's an opportunity. These systems are force multipliers — the ability to have a bird's-eye view on the other side of the hill removes the need to put a person out there. But a return to sequestration will affect everyone as an ongoing challenge," Kroetsch says. Adding some advances for military applications, he continues, will come from unexpected quarters. "Computer vision will be one. Some of the 3D sensors such as you find in the xBox are moving from gaming to robotics to the military, driving more capability while requiring less of the operators."

Shrinking tech, shrinking force

Advances in power technology, such as fuel cells, continued evolutions in computing speed, sensors, and communications — combined with SWaP-C — are key to next-gen manpackables across all markets. The key to those is miniaturization far beyond the 2015 state-of-the-art.

"We want to get as much capability into as small a system as possible. The appetite continues to grow for endurance, rapid deployment, reliability, better image quality [and we need] the ability to rapidly integrate different payloads for different missions," says Lockheed Martin's McConville. "Everyone also wants longer, higher bandwidth. Our IP-based digital datalink, being fielded for Indigo, provides a 10-kilometer range for the military and 2-to-5 kilometers for civil use, which are significant ranges for a sUAS.

A soldier launches an RQ-11 Raven unmanned aerial vehicle during training at Joint Base Lewis-McChord, Wash., earlier this spring.

"Another effort is reducing weight in the handheld controller, using a Windows-based tablet, which also allows for more runtime — four hours in that case. So using a common architecture from a software perspective, reducing weight and improving endurance are all important. The mission will push industry to provide capabilities that may get outside what is currently allowed in the U.S."

Lockheed Martin's current sUAS platforms include the five-pound Indigo QuadRotor, which can fly for 45 minutes or more; six-pound fixed-wing Desert Hawk III, with a 90-minute flight time, and three-pound fixed-wing Stalker, with a two-hour endurance — all using current battery technology. With fuel cells, McConville says, they expect to extend the next-generation DH EER and StalkerXE for 8 to 12 hours. But the company's reconfigurable Vector Hawk, a four-pound sUAV capable of VTOL and fixed-wing flight, may represent the future of manpackable design.

Future manpackable designs

"We have a number of sUAS and, in general, are working on a wider variety of payloads to do a number of different operations, not just for the military but also for civil and commercial uses. The Indigo, for example, could service agriculture, first responders, oil and gas, etc., with new payloads," McConville says. "We're also working on a new

A soldier launches a RQ-11B Raven unmanned aircraft in Djibouti last March. (Marine Corps photo.)

concept — Vector Hawk — where we use a standard center body of the aircraft and enable a number of different wing configurations that give the user the ability to be very dynamic. So you don't have to re-invent the aircraft every time you have a different mission.

"The proliferation of payloads, as new users come up with new ways to use small UAVs, will evolve to provide better and more specific data. There will be continued advances in the intelligence of the platforms, their ability to be more responsible and execute more missions due to evolutions in the autopilot and control technologies."

Gelhausen adds that while manpackable aerodynamics have not progressed as much in the past 15 years as have power systems, onboard computing and sensors, the size, weight and capabilities of miniaturized payloads is creating a new paradigm. "The long-term advantage of UAVs is reduced cost and training, due to commonality factors and increasing levels of vehicle autonomy," he says. "From a platform standpoint, continuing development of autonomous control and obstacle avoidance will be major efforts for next-gen systems.

The warfighter needs the UAV for situational awareness; he doesn't want to worry about it hitting a tree. On the sensor side, you already have pocket LIDAR that will give you a 3D image of the area and those will get smaller.

"Being able to do something with the SUAV when it reaches its destination rather than just sensing is another need, from very precise spraying for specific types of weeds on the civilian side to the military being able to shoot something the small UAV has identified. And the more precision we have in doing that, the better. That's where manpackable UAVs give you the edge. Carrying something that has recoil would be difficult on a small platform, but directed energy is getting smaller."

While too late for OEF/OIF, where the requirements were manifested, advances in materials and aerodynamics will bring about a revolution in nano-UAVs in the next two decades, including the long-expressed goal of high-capability platforms the size of small birds or bumblebees. But such advances apply to all UAVs; Prioria, for example, is working with AVID to put a roll-up morphing wing on their manpackable Maveric.

"A morphing wing would bring more precise control to the UAV. A bird constantly changes the shape

of its wings depending on whether it is gliding, climbing, making a turn, landing, etc. You'll never have all that in a UAV, but you can do some things to change the basic aerodynamics to give the aircraft greater capabilities," da Frota explains. "We think that will be ready to field in a year or two.

"The SOTA is flying with cameras transmitting video, but now there's an augmented idea that the UAV is a glorified bus and it's all about the sensor. In the commercial market, you're seeing the next real killer app, which is effectively replacing full motion video with geo-rectified imagery for mapping, 3D modeling, doing different kinds of analysis based on the metadata captured with the image."

With research funded by civilian and commercial customers, such developments quickly will migrate to military users as demands on manpackable combat UAVs continue to grow, despite — in some ways, because — of a tight budget/force reduction environment for the foreseeable future.

"Marines are used to doing more with less, which elevates sUAS as a warfighting capability. With a relatively small investment in materiel and training, any Marine may employ a SUAS asset to establish understanding of their environment and make rapid tactical decisions that contribute to sustaining the initiative over enemy forces," Hamill says. "Each Marine is trained in many facets of military operations to adequately address the range of operations in an Anti-Access/Area Denial (A2/AD) environment.

"We also have realized that one size does not work for all tactical situations and environmental conditions. Air vehicles must be able to operate in rain, wind, hot, cold, and salty environments. And sometimes smaller is not better. More importantly — and the part that many people forget — is the ground control station. Current systems use Toughbook laptops, several cables, hubs and other pieces to function. These need to be made smaller and more simple. Nano-UAS also reduce the combat load of an infantryman."

A Raven drone lies on the ground shortly before being launched to provide overwatch of friendly forces as well as conduct surveillance on enemy forces. (Marine Corps photo.)

Gettinger says he believes miniaturization and increased autonomy, enabling small UAVs to perform more missions with minimal human involvement, will be a force multiplier. "Some people say today's UAVs are the Model T Ford, so it is just a matter of time before they advance significantly. And with force reduction and limited manpower, the need for smaller and smaller portable unmanned systems will become greater, such as the nano bio-inspired systems the military is experimenting with now.

"We're on the cusp of a time when manpackable UAVs are becoming an essential part of the unit, much as radios became central to ground forces. But it is likely to be pretty far into the future before they become a ubiquitous part of every soldier's kit. However, we're seeing UAVs that operate independently of the individual soldier, such as swarms, and the trend in the future will be toward UAVs operating in cooperation with each other. So while you can see a unit having multiple UAVs, not everyone will be able or want to control their own UAVs," Gettinger says.

Changing environments

The change in the threat environment after 9/11 was the catalyst for the adoption of sUAVs. In the post-OEF/OIF world now developing, in which ISIS may become a template for future adversaries, manpackable UAVs are seen by many in industry and the military as not only a continuing but a growing staple for those at the tip of the spear.

"In the previous generation, there was always a concern about small terrorist groups, such as the Red Army Faction, but those were isolated and the primary threat focus was state actors. Post-9/11, it became very difficult to differentiate between the terrorists and civilian populations, where they embedded themselves. So many of the tools deployed to address a state-vs.-state conflict proved not so effective in this new kind of conflict," Gitlin says.

"The tools that proved very effective in this type conflict in part also enabled small teams to gain better situational awareness wherever

they were. Looking ahead at potential future threats, one might conclude that providing organic tools to small teams to enable them to respond rapidly to situations anywhere — be that SOF teams around the globe or first responders in the U.S. — and their ability to gain situational awareness as quickly and accurately as possible will help them deal with those situations."

In the view of warfighters and aerospace industry officials, no matter how different the threats facing the United States and its allies in the 21st Century, the technological edge UAVs — and especially the smallest of those airborne robots — gave them in Southwest Asia undoubtedly will be even more essential going forward.

"There is a growing desire for ISR capability across the force, U.S. and worldwide. Those are not easy to implement on small UAVs, but we do see good progress being made and I think if those prove reliable, you will see a proliferation of that in the future," McConville predicts. "As payloads get better, bandwidth requirements increase; as the missions spread, the requirement for common control will become more and more important, as will the ability to use different unmanned systems collaboratively.

"I don't see any reason why we wouldn't use small UAVs in the future in collaboration with other weapons systems, using networking capability to get data across the battlefield. Using these different capabilities together, either autonomously or semi-autonomous, will greatly increase capabilities. There already are programs in existence merging unmanned and manned assets in the smaller class and, as we improve technologies, I think we will see more of that, as well."

Aeryon's Kroetsch agrees: "There are different classes of SUAS, from those that fit in your backpack to those that fit in your pocket, with different capabilities. From a prevalency perspective, you will see more development in pocket-size. Special ops will deploy with more manpackable systems, with somewhere between 50 and 100 percent penetration of the smallest of those.

"CONOPS may now call for sending out a small team for eyes forward, where in the future instead they would send small UAVs. That will work into everything from how to approach a suspect vehicle to how you do convoys. But in order to bring multiple capabilities into a truly multimission platform, there will need to be a lot of up-front chip design. The smaller you get, the harder it becomes to change components, which are very tightly integrated, so to have a truly integrated product, you can't have a lot of changes of parts."

The future of swarm

Swarm capabilities also will begin to evolve as platforms and navigation systems mature, Kroetsch adds, "but we're still some years away from that, especially in terms of multi-modal capabilities within the swarm. The military is still trying to figure out the CONOPS for single-mission systems; trying to figure it out for a swarm with multiple mission capability using multiple single mission UAVs would be even more difficult."

While the center of growth in demand for small UAVs — and the funding for future research — has shifted to the civil/commercial markets, they have become as essential to the individual warfighter as GPS, radios and personal armor. And with a shrinking force in an increasingly hostile world, the military user will remain a top concern for governments and industry.

"The missions continue to be robust and unmanned systems provide the ability to extend reach and capability, which helps our forces meet those missions with inexpensive platforms that only a few years ago we couldn't do at all. So we can address an increasing mission set in an affordable way," McConville says. "The U.S. and a few other nations have been in the lead, but more and more nations are getting into small UAVs, which will help move the technology forward, in defense and non-defense sectors.

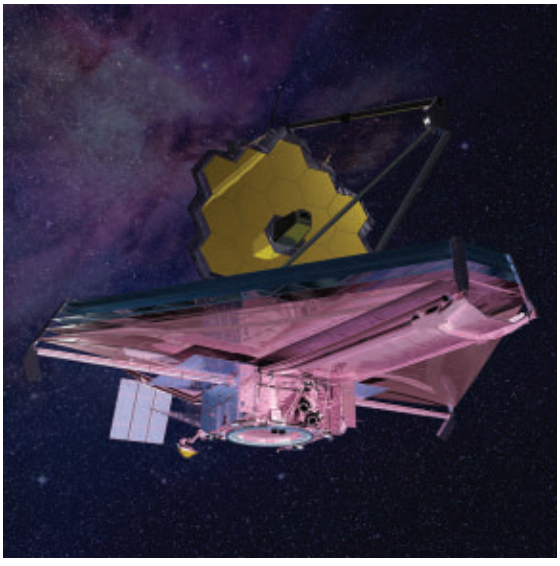
"We want to provide a continually expanding portfolio capability they can apply in many different creative ways without having to reinvent the wheel each time. How they use them will continue to drive new innovations and we want to make sure we make those in ways that are affordable and rapidly deployable.

"We don't want to have a constant proliferation of aircraft, but a proliferation of aircraft capabilities, systems that can be adaptable rather than constantly building new aircraft for every imaginable scenario. We want to apply aircraft already known to be reliable and fielded to bring new capability to the fight rapidly. That requires open architecture and common controls — interoperability."

Moving to smart motion controls

An electronic evolution in aerospace and defense systems is causing a paradigm shift in motor control.

BY **Courtney E. Howard**



The James Webb Space Telescope uses smart motor control devices from Moog. (Image: Northrop Grumman.)

An integral and essential, but often overlooked, component in mission- and safety-critical aerospace and defense systems is getting an upgrade. Engineers and systems integrators are causing a paradigm shift with the adoption of much more advanced and intelligent motor controls in land, sea, air, and space vehicles.

Current and future vehicles, not to mention missions, rely on the precise, reliable, and repeatable movement of critical parts — gun turrets on ground combat vehicles, sensor gimbals packed with the latest electro-optical/infrared (EO/IR) technology on unmanned aircraft systems (UAS), actuators and control surfaces on commercial and military aircraft, and moving panels and instruments on satellites and other spacecraft.

Modern motion

The push toward more-electric, and even all-electric, vehicles is driving the need for intelligent motor controls. Engineers and systems integrators are incorporating more digital, electronic, intelligent, and automated systems in retrofit and forward-fit installations. Smart digital motor-control devices are taking the place of maintenance-intensive hydraulics. As hydraulic systems are phased out and more modern electric systems are ushered in, the need for intelligent motor control — encompassing the latest hardware and software — is stronger than ever.

Smart motor controls are employed not only in the platforms and systems themselves, but also in the making of those solutions, such as in the control of robotic arms and other manufacturing equipment. In fact, the market for intelligent motor control centers — which house several individual motor controllers and associated power electronics — is forecast to reach $5.12 billion by 2018.

Growth in industrial automation is fueling the global demand for motor control centers (MCCs), according to market analysts at Frost & Sullivan in San Antonio, Texas. Intelligent MCCs (iMCCs) add remote diagnostic capabilities and features such as loss detection and predictive maintenance to the traditional MCC, helping to minimize maintenance costs, reduce equipment downtime, and bolster operator safety. Increased adoption of iMCCs is boosting overall market revenues, while MCCs are declining in revenue share because of the safety features and performance, according to authors of Frost & Sullivan's "Analysis of the Global Motor Control Centers Market" report.

The percentage of customers that purchase higher-priced iMCCs is expected to rise in the long term, says Krishna Raman, Frost & Sullivan industrial automation & process control senior research analyst. "With iMCCs set to play an important role in the future of the market, manufacturers have to focus on rolling out these products. Manufacturers must develop iMCCs that can be easily integrated with other communication networks to allow customers to move to an integrated enterprise ecosystem."

All-electric aircraft

Lockheed Martin's F-35 Joint Strike Fighter (JSF) military combat jet and Boeing's 787 Dreamliner commercial jet are two prime examples of the move toward the all-electric aircraft. These more-electric military and commercial aircraft use sophisticated electronics and smart motor controls — rather than hydraulic equipment — in various areas, including primary flight control, high-lift, fuel, power, landing, and even propulsion systems.

National Aeronautics and Space Administration (NASA) researchers at the NASA Langley Research Center in Hampton, Va., are tapping smart motor controls to advance distributed electric propulsion, the name given to ultra-quiet unmanned aircraft propulsion technology. The current technology test bed is the GL-10 Greased Lightning, a hybrid diesel-electric tiltwing unmanned aircraft that harnesses smart motor control technology to hover and fly forward and vertically — and do so quietly.

The current all-electric, battery-powered demonstrator UAS is built at 50 percent scale, with a 10-foot wing span. The prototype sports 10 eight-horsepower electric engines powering 10 electric motor driven propellers: eight on the wing and two on the horizontal stabilizer. Propellers on the leading edge of the wing provide high-speed flow and lift on the wing, and also provide pitch, roll, and yaw control authority during the transition from hover to forward flight. The wings and horizontal stabilizer rotate with fixed motor pods to facilitate vertical take-off and landing (VTOL), as well as vertical flight, eliminating the need for ground support equipment such as launch catapults and landing catch mechanisms.

Distributed electric propulsion on the GL-10 uses low-speed, 18-inch propellers in a speed frequency shifting approach: Digital motor controls spin each propeller at slightly different revolutions per minute (RPMs) to break up the harmonics and reduce noise.

"We can fly this over at 100 feet without being able to hear it on the ground," explains Mark Moore, the GL-10's project lead at NASA Langley.

"We're targeting package delivery and privacy, and no-noise-nuisance applications."

NASA researchers anticipate that this technology can lead to the production and use of reduced-annoyance commercial UAS, as well as stealthy, covert intelligence, reconnaissance, and surveillance (ISR) aircraft. NASA's next distributed electric propulsion project will be a 3,000-pound, four-passenger aircraft with a 31-foot wing span.

Smart motor control in space

The Hubble Space Telescope (HST), launched into space 25 years ago, uses 57 actuators from Schaeffer Magnetics, now Moog Inc., for aperture door rotation and latching, high gain antenna deployment, solar panel latching, primary mirror optical figure control, secondary mirror pointing, optical filter selection for both guidance and observation, and even tape recorder drives for data storage. Today, Moog Inc.'s Space and Defense Group in East Aurora, N.Y., is providing more advanced and intelligent motor controls for the HST's replacement observatory — the James Webb Space Telescope (JWST), slated to launch in 2018.

"Instead of one large primary mirror, JWST uses 18 hexagonal segments that create an effective 6.5-meter diameter primary mirror yielding over five times more light collecting area," a Moog representative describes. Adding to the motor control complexity, JWST will operate much further away from Earth than HST, away from the light and heat given off by the planet.

JWST will operate in a very cold environment requiring rugged, specialized equipment and testing. The telescope's Near InfraRed Camera (NIRCam) uses Moog's cryogenic instrument actuators which allow for positioning while operating at very cold temperatures. Moog is also providing flight vibration dampening hardware in the Integrated Science Instrument Module (ISIM) to isolate loads into the large radiator panels that are critical for the cold operation of the instruments. Another area is the validation that

Engineers used a Moog six degrees of freedom (6-DOF) micropositioning system, which moves a large optical payload, for ground testing and validation of the JWST Primary Mirror, to ensure the 18 mirrors will work together on the ground and in space. A combination of smart motor control and comprehensive software facilitates position control, interference avoidance, and data logging while operating in a vacuum at very cold temperatures.

Military motor control

The A400M multi-role, military air transport from Airbus Military in Barajas, Spain, turned heads during an impressive flight display at the 51st International Paris Air Show in Le Bourget, France, last month. Moog Inc. supplies flight controls for the new-generation military airlifter through approximately 2018.

The Airbus Military A400M is designed for use in strategic, tactical, and in-theatre operations; offers more than twice the payload and

CONTINUED ON PAGE 27 ➔

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Northrop Grumman to fix Triton UAV radar before Navy production decision

PATUXENT RIVER NAS, Md. — U.S. Navy unmanned aircraft experts are asking Northrop Grumman to correct deficiencies in the air-to-air radar system aboard the MQ-4C Triton maritime patrol drone before making a production decision on the Triton by the end of this year.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a $39.1 million contract modification to the Northrop Grumman Aerospace Systems sector in San Diego to enhance and adjust the Triton's air-to-air radar, which is still in development and has not yet been test flown. The contract calls for Northrop Grumman to make adjustments in the current air-to-air radar subsystem design of the Triton unmanned aerial vehicle (UAV) and to demonstrate that its air-to-air radar technology, performance, and manufacturing risks have been mitigated.

Northrop Grumman and its air-to-air radar supplier, Exelis Inc. in McLean, Va., are developing a radar for the Triton that will enable the unmanned aircraft to detect other aircraft in the area for sense-and-avoid functionality, as well as for targeting. The Triton air-to-air radar is the first of its kind, and has been a challenge for Northrop Grumman and Exelis to size such that it is small and lightweight enough to fit on the Triton UAV, officials say.

This order is part of the Triton's system development and demonstration (SDD) phase, part of the Triton research and development that involves mature system development, integration, and demonstration to initial operational test and evaluation (IOT&E) — the last phase before full production.

The Navy is asking Northrop Grumman to fine-tune the drone's air-to-air sense-and-avoid radar before the unmanned aircraft goes to production.

Northrop Grumman is developing the MQ-4C Triton, also called the Broad Area Maritime Surveillance (BAMS) UAV, to fly maritime surveillance missions as long as 24 hours at altitudes of more than 10 miles to enable coverage out to 2,000 nautical miles. The UAV's suite of sensors can detect and classify different types of ships automatically.

The Triton will be a crucial component of the Navy's 21st century strategy for conducting surveillance of surface ship and submarine traffic in the vast Pacific and other oceans around the globe. The Triton UAV will work together with the Navy's P-8A Poseidon manned maritime patrol aircraft. The P-8 is a Boeing 737

Data Link Solutions and ViaSat win airborne tactical data link orders

Officials of the Space and Naval Warfare Systems Command (SPAWAR) in San Diego awarded two contracts to build and maintain Multifunctional Information Distribution System (MIDS) Joint Tactical Radio Systems (JTRS) terminals. The contracts went to the two companies authorized to manufacture MIDS JTRS: Data Link Solutions in Cedar Rapids, Iowa, a joint venture between Rockwell Collins and BAE Systems; and ViaSat Inc. in Carlsbad, Calif. The MIDS JTRS terminal is a four-channel, software-defined radio that delivers existing Link 16 tactical networking and situational awareness with concurrent multi-netting-4 and tactical air navigation (TACAN) functionality.

Raytheon to provide radar for P-8A Poseidon

Radar experts at Raytheon will provide the U.S. Navy with 53 advanced airborne radar systems for the Boeing P-8A Poseidon maritime patrol, surveillance, and anti-submarine warfare aircraft. Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a $152.9 million contract to the Raytheon Space and Airborne Systems segment in McKinney, Texas, to provide AN/APY-10 radar systems for U.S. and Australian P-8A aircraft.

passenger jet modified for surveillance and anti-submarine warfare (ASW) missions.

The Triton's maritime search radar is called the Multi-Function Active Sensor (MFAS), and will provide the UAV with a 360-degree view of a large geographic area while providing all-weather coverage for detecting, classifying, tracking, and identifying points of interest. MFAS is separate from the Triton's air-to-air radar. The MFAS radar first flew on the Triton during testing last April.

Along with the air-to-air and MFAS radar systems, the MQ-4C will carry an electro-optical/infrared (EO/IR) sensor that will provide still imagery and full-motion video of potential threats; an electronic support measures package to identify and geolocate radar threat signals; and an Automatic Identification System (AIS) that will detect and track vessels equipped with AIS responders.

The Triton's SDD phase began in early 2008 with a $1.2 billion contract to Northrop Grumman to design and build two Triton UAVs with mission payloads and communications suites; one forward operating base mission control system; one systems integration laboratory; and one main operating base mission control system. The Triton should be ready to deploy by 2017.

FOR MORE INFORMATION visit **Northrop Grumman** online at *www.northropgrumman.com*.

Thales radar integrated on proposed Scorpion light-attack jet

PARIS—Attack jet designers at Textron AirLand in Providence, R.I., have integrated the I-Master radar from Thales Group in Paris on the Scorpion light attack and intelligence, surveillance, and reconnaissance (ISR) jet aircraft. The addition of the radar into the Scorpion's mission system compliments the ISR sensor suite which already includes an EO/IR capability.

The Textron AirLand Scorpion is a proposed American light attack and ISR jet. A prototype was secretly constructed by Cessna at its Wichita, Kan., facility between April 2012 and September 2013 and first flown on 12 December 2013. It is yet unsold.

Having integrated the multimode radar into Scorpion within two weeks, the first flight trials were in late May. Combined with a visible-light and infrared camera, the Thales I-Master radar adds long-range, wide-area surveillance, and target tracking to the Scorpion light-attack jet. One operator aboard the Scorpion jet operates both sensor payloads simultaneously. Two pilots operate the Scorpion jet, who sit in tandem. The Scorpion is 43.5 feet long, has a 47-foot wingspan, and can carry a 9,450-pound payload of weapons, fuel, and crew. With two Honeywell TFE731 jet turbofan engines, the plane can fly as fast as 450 knots, fly as slowly as 96 knots, has a range of 2,400 nautical miles, and can fly as high as 45,000 feet. The Scorpion has hard points for 6,200 pounds of bombs and missiles, and an internal 3,000-pound weapons bay.

Thales is providing the radar system for the proposed Textron AirLand Scorpion light-attack jet, shown above.

"The combination of I-Master and the Scorpion jet demonstrates a powerful surveillance and strike capability," says Eddie Awang, Thales's vice president in charge of ISR business.

Textron AirLand's Scorpion, which has completed more than 400 hours of flight testing, is designed to be an affordable, multimission aircraft offering diverse capabilities including intelligence, surveillance and reconnaissance, humanitarian assistance, disaster relief, advanced training, and precision strike. The plane has an all-composite structure.

The Thales I-Master radar is a compact, lightweight, all-weather tactical surveillance radar, providing ground moving target indication (GMTI), synthetic aperture radar (SAR), and maritime moving target indication (MMTI) capability. I-MASTER also provides high-fidelity imagery for locating and classifying moving and stationary targets at long ranges over land and sea. The radar is suited for maritime security, border protection, disaster and humanitarian relief, and counter narcotics applications.

FOR MORE INFORMATION visit **Textron AirLand** online at *www.scorpionjet.com*.

General Atomics to build crew simulators

General Atomics will provide the U.S. Air Force with UAV crew simulators and spare parts to help combat drone pilots practice their skills and rehearse missions. Officials of the Air Force Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, announced a $21.1 million order to General Atomics Aeronautical Systems in Poway, Calif., for Predator Mission Aircrew Training Systems (PMATS), simulators that reproduce the aircrew ground stations of MQ-1 Predator and Predator B/MQ-9 Reaper UAVs. The system is currently in operation with the U.S. Air Force.

Companies to build 29,550 unmanned marine vehicles in next decade

Manufacturers worldwide are expected to build 29,550 unmanned marine vehicles worth $15.4 billion over the next decade, say analysts at Forecast International in Newtown, Conn., in the report "Market for Unmanned Naval Surface & Underwater Systems." This study includes torpedoes, military unmanned surface vehicles (USVs), and unmanned underwater vehicles (UUVs). The torpedo segment will be worth $8.1 billion over the next 10 years, with the USV and UUV segments worth $6.1 billion and $1.2 billion, respectively, Forecast International analysts say.

Navy asks Logos for compact unmanned aircraft sensor payloads

LAKEHURST, N.J.—Sensor payloads experts at Logos Technologies LLC in Fairfax, Va., are developing enabling technologies for compact sensor systems for unmanned aircraft like the RQ-21 Blackjack, TigerShark, and RQ-8 Fire Scout for the U.S. Air Force and U.S. Army.

Officials of the U.S. Naval Air Warfare Center Aircraft Division in Lakehurst, N.J., have announced a $32.8 million contract to Logos to capitalize on wide-area airborne surveillance, hyperspectral imaging, high-resolution imaging, and light detection and ranging (LIDAR) technologies for unmanned aircraft sensor payloads.

The Boeing Insitu RQ-21 Blackjack is a catapult-launched unmanned aerial vehicle (UAV) that can be launched and recovered from land sites or surface ships. It is 8.2 feet long, has a 16-foot wingspan, and weighs 135 pounds.

The Navmar TigerShark UAV for reconnaissance and surveillance missions has a wingspan of 22 feet, weighs 260 pounds, has a payload capacity of 50 pounds, and a flight duration of 10 hours.

The Northrop Grumman Fire Scout unmanned helicopter has a maximum takeoff weight of 3,150 pounds, is 24 feet long, has a 27.5-foot rotor diameter, and can fly for eight hours between refuelings.

Logos has developed a variety of UAV sensor payloads, including the Hermes platform-agnostic, multi-sensor, wide-area persistent surveillance pod. It has daylight and infrared cameras, onboard control, and processing hardware.

Logos Technologies is developing technologies for small unmanned sensor payloads for affordable reconnaissance and surveillance.

Logos also makes the Redkite wide-area persistent surveillance system in a small, adaptable pod that weighs less than 30 pounds. Redkite is for manned and unmanned aircraft, and uses an electro-optical camera and onboard processing to provide a constant stream of real-time, geographically tagged images.

The company also makes the Kestrel and LEAPS wide-area motion imagery (WAMI) solutions for deployment on a wide range of platforms. On this contract, Logos will do the work in Fairfax, Va.; Yuma, Ariz.; Raleigh, N.C.; Dallas; Los Angeles; Boston; and Bridgewater, Va., and should be finished by June 2018.

FOR MORE INFORMATION visit **Logos Technologies** online at *www.logostech.net*, and the **Naval Air Warfare Center-Lakehurst** at *www.navair.navy.mil*.

New thermal cameras introduced by FLIR

FLIR Systems in Wilsonville, Ore., is introducing three science-grade thermal cameras—the A6200sc NIR, A8300sc HD MWIR, and A6700sc LWIR—for demanding science and research applications, including electronics development, university research, and non-destructive testing. These cooled electro-optical cameras deliver image quality, standardized interfaces, MATLAB integration, a standard Gigabit Ethernet vision interface to transmit digital video, and GenICam for camera control. Incorporating FLIR's ResearchIR version 4.20 software, the cameras enable researchers and scientists to monitor, acquire, analyze, and share captured thermal data. ResearchIR Max version 4.20 also gives users access to their MATLAB scripts within ResearchIR.

High-speed camera introduced by Photron

Photron USA in San Diego is introducing the FASTCAM Mini WX100 high-definition, 4-megapixel, high-speed camera for military and aerospace research, fluid dynamics, and more. Photron's lightweight, single-body, electro-optical camera is for operation in high shock and vibration environments, such as high-speed military testing. It measures 120 by 120 by 99 millimeters, and weighs 3.5 pounds. It provides 2,048-by-2,048-pixel resolution at rates faster than 1,000 frames per second (fps), 1080 HD pixel resolution to 2,000 fps, and higher frame rates to 80,000 fps at reduced resolution.

Northrop Grumman proposes open-systems, electro-optical sensor pods

WASHINGTON—Electro-optical sensor experts at Northrop Grumman Corp. in Baltimore are introducing an open-systems sensor architecture designed to enable aircraft sensor technicians to swap sensors in theater using the same sensor pod.

Officials of the Northrop Grumman Electronic Systems sector in Baltimore are offering the OpenPod sensor system, which consists of line-replaceable units and a set of interchangeable sensors that can be swapped out in minutes.

Enabled by open architecture principles, OpenPod is the first of its kind to accommodate a range of sensors with one pod, say Northrop Grumman officials, who unveiled the OpenPod concept in Washington.

Changing, integrating, or upgrading sensors on a military aircraft can be expensive, time-consuming, and complex, and the OpenPod sensor system aims to overcome these challenges.

OpenPod first will be available with targeting and infrared search and track (IRST) electro-optical sensor packages at launch, followed by communications, light direction and ranging (LIDAR) sensors, 5th-to-4th-generation communications, and other options in the future, company officials say.

Because the pod allows for sensor changes without modifications to the aircraft or mission computer, technicians can upgrade OpenPod independently of the aircraft.

Northrop Grumman is proposing an open-systems architecture for electro-optical sensor pods to ease field maintenance.

OpenPod is the next step in sensor evolution for users of the AN/AAQ-28(V) LITENING family of advanced targeting systems, according to Northrop Grumman officials. Any LITENING pod can be converted to an OpenPod.

FOR MORE INFORMATION visit **Northrop Grumman** online at *www.northropgrumman.com*.

PRODUCT applications

COMMUNICATIONS

DRS to provide voice communications systems aboard Navy ships

U.S. Navy shipboard electronics experts needed integrated voice communications systems (IVCS) for Navy Arleigh Burke-class destroyers and Ticonderoga-class cruisers. They found their solution from DRS Technologies Canada Ltd. in Kanata, Ontario.

Officials of the Space and Naval Warfare Systems Center Atlantic in Charleston, S.C., have awarded a $1.5 million contract to DRS to provide modernized integrated voice communications systems (IVCS) for cruisers and destroyers. The performance-based contract has a potential value of as much as $55 million, DRS officials say.

The IVCS is a computer-controlled telephone system that consists of two interconnected interior-communications switching centers, dial terminals, network terminals, terminal accessories, and associated cabling, according to DRS officials.

The system can be connected to a ship's announcing system, shore telephone lines, radio communications, and certain battle sound-powered telephone circuits. It will capitalize on the DRS Secure Voice System with a commercial off-the-shelf (COTS) Avaya Aura Communication Manager unified communications platform from Avaya Government Solutions in Fairfax, Va., DRS officials say.

The IVCS equipment also has a qualified electronics rack and power distribution system from Dynalec Corp. in Sodus, N.Y., a specialist in sound-powered telephone technology.

The IVCS is a computer controlled voice communications system that is capable of providing modern, reliable, and survivable interior voice communications in Navy combatant ships, Navy officials say.

FOR MORE INFORMATION visit **DRS Technologies Canada Ltd.** online at *www.drs.com*, and the **Space and Naval Warfare Systems Center Atlantic** at *www.public.navy.mil/spawar/Atlantic*.

INFORMATION TECHNOLOGY

DISA chooses Hewlett-Packard to deliver military Internet content

Military information technology (IT) specialists needed digital content delivery and cyber security over the Defense Information System Network (DISN), the U.S. Department of Defense (DOD) enterprise data, video, and voice network. They found their solution at Hewlett-Packard in Herndon, Va. Officials of the Defense Information Technology Contracting Organization at Scott Air Force Base, Ill., on behalf of the U.S. Defense Information Systems Agency (DISA) at Fort Meade, Md., announced a potential $469 million contract to Hewlett-Packard for Global Content Delivery Services (GCDS).

GCDS, a global platform of military servers, detects and avoids problem spots and vulnerabilities to deliver rich, dynamic, and interactive content and applications. It capitalizes on commercial Internet technology and best practices to deliver DOD Web content and applications across the Nonsecure Internet Protocol (IP) Router Network, Secret Internet Protocol Router Network, and CENTRIX-ISAF. The GCDS enables DISA users to download security patches, check e-mail, view information portals, support decision making, and analyze geospatial data.

With options, the GCDS contract could extend until June 2021.

FOR MORE INFORMATION visit **Hewlett-Packard** at *www.hp.com*.

new PRODUCTS

To submit new products for consideration, contact John Keller at jkeller@pennwell.com.

EMBEDDED COMPUTING

Rugged Xeon D embedded computing modules introduced by Curtiss-Wright

Curtiss-Wright Defense Solutions in Ashburn, Va., is introducing the CHAMP-XDx Xeon D embedded computing family of rugged DSP engine modules based on the Intel Xeon processor D for compute-intensive C4ISR aerospace and defense

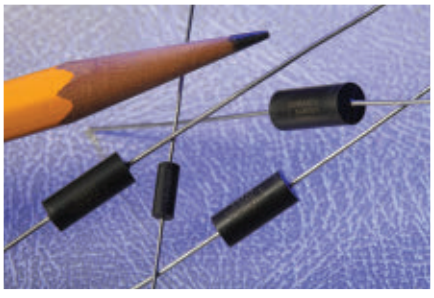
applications. The first members of the CHAMP-XDx embedded computing family, the 3U OpenVPX CHAMP-XD1 and 6U OpenVPX CHAMP-XD2, enable designers of high-performance embedded computing (HPEC) systems to take advantage of the Intel Xeon processor D 3rd generation 64-bit system on chip (SoC) based on Xeon server-class processor technology. These open-architecture commercial off-the-shelf (COTS) modules have high-speed DDR4 memory as well as high-bandwidth PCI Express Gen 3 data paths on the data plane and the expansion plane. The board family makes it easy for systems designers to extend their applications across different platforms while maintaining their investment in software development.

FOR MORE INFORMATION visit **Curtiss-Wright Defense Solutions** online at *www.cwcdefense.com*.

RF AND MICROWAVE

RF inductors for military applications presented by Gowanda

Gowanda Electronics Corp. in Gowanda, N.Y., is introducing five RF and microwave inductors for military, aerospace, and defense RF applications like communications, guidance, security, radar, test and evaluation, and special operations. These thru-hole, wirewound, mold-



ed RF inductors expand the number of QPL-approved MIL-PRF-15305 MS part numbers that can be addressed with Gowanda components. The five series that achieved Qualified Product List status and the seven MS numbers they address include: MRLF19M (MS90539), MLRF21M (MS90542 and MS14052), MLRF22M (MS90540), MLRF24M (MS90541), and MLRF28M (MS75103 and MS91189). The overall performance range provided by the series includes: inductance from 0.47 to 10,000 uH, Q min from 35 to 95, SRF MHz min from 0.95 to 300, DCR Ohms max from 0.06 to 72, and current rating mA DC from 47 to 2400.

FOR MORE INFORMATION visit **Gowanda Electronics Corp.** online at *www.gowanda.com*.

CHASSIS AND ENCLOSURES

Rugged electronics rack with a modular frame introduced by Optima

Optima Stantron in Lawrenceville, Ga., is introducing a broadcast electronics rack with a modular frame for military and aerospace applications. The 12-gauge steel frame oper-

ates in demanding pre- to post-production applications. The 12-gauge steel modular welded frame rack-mount enclosure comes in standard widths of 22, 24, 27, and 29 inches, depths of 36, 42, or 48 inches, and heights from 35U to 48U, with custom sizes available. Various door perforation shapes and sizes can be configured to meet application airflow requirements. With front recesses as large as 7 inches and short side panel options available, the rack accommodates a hot and cold aisle air flow configuration without additional accessories.

FOR MORE INFORMATION visit **Optima Stantron** online at *www.optimastantron.com*.

MOTION CONTINUED FROM PAGE 20

volume of the transports it replaces; and boasts air- to-air refueling capabilities as a donor and receiver. Some of its unique features and functionality can be attributed to unique motor control devices.

Moog is responsible for the design, manufacture, and integration of eight fly-by-wire servoactuators for control of the aircraft's primary flight surfaces. These include: conventional electrohydraulic actuators for the aileron, elevator, and certain spoilers, plus advanced technology electrohydrostatic actuators for positioning additional spoiler panels.

NASA's GL-10 UAS can hover and fly vertically and forward with help from intelligent motor controls. David C. Bowman - NASA Langley

Multimission motion control

Personnel from the U.S. Army's Indirect Fire Protection Capability (IFPC) Increment 2-Intercept Product Office and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC) fired three missiles from a Launch Demonstration Unit to verify tube integrity and missile stack integration of the Multi-Mission Launcher (MML).

The MML next-generation air defense launcher is built on an open system architecture and will be capable of launching a variety of interceptors for comprehensive air defense against a variety of unmanned and cruise missile threats. The truck-based system can be fixed or semi-fixed, and will hold 15 launch tubes able to be fired simultaneously at different threats. MML is designed with intelligent motor control hardware and software to provide 360-degree protection by targeting unmanned aircraft, cruise missiles, artillery, mortars, and rockets.

Trust Automation Inc., a provider of standard and custom motion and motor control systems in San Luis Obispo, Calif., developed the elevation controller system for the MML. The Trust Automation controller interfaces with a heavy-duty, electro-mechanical actuation system to provide precise electronic motion control to the MML elevation axis. The use of digital signal processing (DSP) technology and complex, proprietary software algorithms enable synchronous control for the dual actuation system required to raise and lower the MML pallet, officials say.

"These platforms remain critically important to our national defense and provide the critical resources required by our armed services," says Craig Von Ilten, vice president of business development for the defense industry at Trust Automation.

The three test missile launches included: an Air Intercept Missile 9-X that intercepted an unmanned aerial vehicle (UAV) after launch, as well as a Low Cost Active Seeker and a Mini Hit-to-Kill interceptor that flew ballistic trajectories. The MML is on schedule and on budget to deliver two prototypes for an engineering demonstration in March 2016. The Army plans to field the system in 2019.

"This, yet again, demonstrates a positive step forward for the MML," affirms AMRDEC Director James Lackey. "MML will be critical in providing expanded ground troop area protection capabilities by enabling kinetic kill lethality effects against a variety of advanced, airborne incoming threats." ←

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