

On target_



Weapons Programs business is well-positioned to address evolving needs of warfighters

By TIM DEATON AND LINDA JAMES

Inside_

Meet Weapons Programs: Two Boeing businesses have come together to better support customer needs. [Page 13](#)

Products: A look at Weapons Programs' product portfolio. [Page 16](#)

Teammates: What does it mean to work in Weapons Programs? Several teammates explain. [Page 18](#)

Q&A: Debra Rub, Weapons Programs vice president, talks about the organization's competitive landscape, challenges and more. [Page 20](#)

Work for the future: Laying the foundation for the weapons of tomorrow. [Page 21](#)

A Harpoon anti-ship missile launches from a U.S. Navy ship. The Harpoon, part of Weapons Programs' portfolio of products, has been in service with the Navy for more than 35 years.

BOEING PHOTO

Equipping warfighters to deliver the right weapon—precisely on target, from distances too far to see, under extreme battle conditions—is business as usual for Boeing's Weapons Programs. However, in the evolving world of warfare, business as usual is not enough. That's why this newly formed Boeing organization is reinventing itself to better meet emerging warfighter needs and deliver even greater capabilities to U.S. and allied forces.

Weapons Programs, part of Boeing Military Aircraft, was formed through the merger of Boeing's legacy Weapons and Integrated Missile Defense (IMD) businesses. That merger combines two strong Boeing entities to provide the synergistic, rapid development of innovative systems that armed forces require today. The long-sustaining production discipline of the legacy Weapons Programs with the advanced technology development activities of both Weapons and IMD businesses is a combination that puts the new organization on target for the future.

"Integrating our extensive knowledge of complex, precision engagement technologies with our world-class experience in producing highly reliable weapons is an outstanding formula for responding to our customers," said Debra Rub, Weapons Programs vice president. "Meeting the needs of the warfighter is not part of our job—it is our job. We are dedicated to understanding and responding to our customers' requirements with innovative solutions that work the first time, every time. It's why we come to work every day."

And it's a commitment that customers have recognized.

"Boeing continues to provide excellent products and support to our Naval warfighters," said U.S. Navy Capt. Mathias Winter, Precision Strike Weapons Program Office (PMA-201). "The strong Boeing/PMA-201 teaming relationship will ensure our Naval, joint and coalition warfighters have these world-class capabilities today and into the future to fight the fight, and win."

DEEP, BROAD CAPABILITIES

Weapons Programs, which generates about \$1.2 billion in annual revenues, delivers all elements of the weapon system throughout its life cycle—from design and development, to delivery of a completed missile and its integration on the launch platform, to post-delivery support of the weapon system.

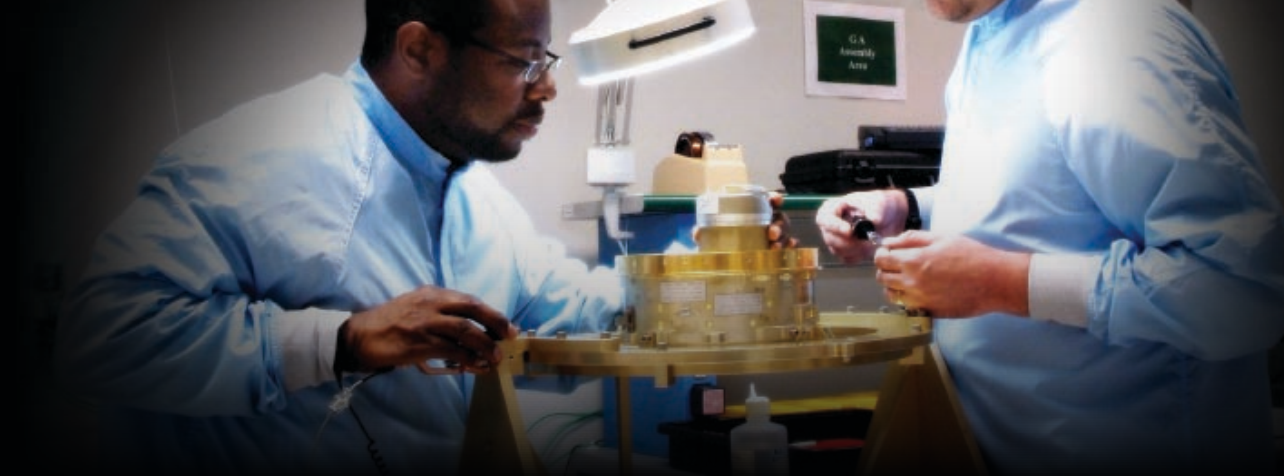
"The merger of our businesses is a perfect example of bringing together the best of Boeing to take our customer focus to the next level," said Rub, who was leading the IMD programs before moving to lead the integrated organization.

Those capabilities address the evolving needs of warfighters and have created results that are pretty explosive and unquestionably accurate. For example:

- When a malfunctioning satellite threatened to crash to Earth in February, bringing with it toxic hydrazine gas, Boeing's Aegis Ballistic Missile Defense team and several industry partners worked with the Navy and the Missile Defense Agency to shoot it down with the kinetic

Integration technicians Edrek Jackson (left) and Jeff Anderson assemble the Standard Missile-3 kinetic warhead Guidance Assembly in Huntsville, Ala.

MIKE MCCORMICK PHOTO



warhead of an Aegis Standard Missile-3 (SM-3). Boeing builds the hit-to-kill kinetic warhead for the sea-based SM-3 system.

- When the military recognized the need for a bomb that could be used in congested urban areas, the Small Diameter Bomb (SDB) team responded with the Focused Lethality Munition (FLM), a highly accurate weapon with an extremely low collateral-damage footprint.

- When the Navy and international allies recognized a gap in anti-surface warfare for over-the-horizon engagement, the Harpoon anti-ship missile team developed the Block III upgrade. Harpoon Block III is the first network-enabled weapon, allowing the warfighter to control the missile throughout its flight.

- When warfighters in the Global War on Terror identified a need for precision targeting of fast-moving ground targets, the Laser Joint Direct Attack Munition (Laser JDAM) was created to engage vehicles moving at up to 70 miles (113 kilometers) per hour. “Boeing’s early investment in Laser JDAM technology laid the foundation for meeting this urgent operational need to intercept high-speed targets,” said Lynda Rutledge, director of the U.S. Air Force’s 708th Armament Systems Group. “Because of Boeing’s strong belief in Laser JDAM, we were able to deliver a capability to the warfighter in 11 months.”

“Boeing has a long history of partnering with our customers to design and build weapons and systems that defend America and its allies. The lives of our warfighters depend on

the work that we do, and we never lose sight of that,” Rub said.

LEAN MATTERS HERE

As Weapons Programs sharpens its focus on understanding and meeting customer demands, it’s maintained its attention to continuously improving the ways it designs and manufactures these products and systems.

“Our strategy is to pull from across programs and the geographically dispersed organization to share ideas and information to speed development and delivery to our customers,” said Tony Ham, director of Production Operations.

Weapons Programs uses several complementary manufacturing formats, from high-volume operations to low-volume processes that require more intricate work. The varying formats are a strength and competitive advantage for Boeing.

“These capabilities allow us to provide competitive solutions to our customers’ needs, regardless of scope or complexity,” Rub said. “Having all of this expertise under one umbrella places us in an enviable position.”

Ham said that the Harpoon and SLAM ER programs, for example, draw upon more than 35 years of missile manufacturing experience, yet continually capitalize on opportunities to incorporate Lean+ processes and improvements. Currently, Boeing produces about 60 Harpoons and 50 SLAM ERs each year.

By contrast, JDAM and SDB are produced in a facility designed and built for high-rate manufacturing. The production lines are the only high-rate lines within Boeing. The company produces 60 JDAMs and 10 SDBs every day on these production lines.

“[SDB] enjoys a great reputation within the Department of Defense as a model weapon acquisition program,” said Air Force Col. Richard Justice, commander of the 918th Armament Systems Group.

To help achieve those production rates, employees are cross-trained on all assembly operations and rotate jobs daily. “There are some great benefits to job rotation. From an ergonomic standpoint, it cuts down on repetitive motion, and it helps alleviate employee boredom from doing the same job day after day,” Ham said.

Another innovation is the use of the Internet to keep the supply lines full on the JDAM line. Webcams have been installed so vendors and suppliers can log on and get a real-time view of how much stock is on hand. When supplies get low, the vendor automatically ships more.

Weapons Programs’ Huntsville, Ala., facility demonstrates a third manufacturing style, where employees meticulously assemble PAC-3 missile seekers and SM-3 missile kinetic warheads. The business is a subcontractor to Lockheed Martin on PAC-3 and to Raytheon on SM-3 for these high-technology products that are the key enablers of the missiles’ hit-to-kill accuracy.

Weapons Programs fast facts_

Headquarters: St. Charles, Mo.

Other sites: Seattle; Huntington Beach and Anaheim, Calif.; Huntsville, Ala.; Washington, D.C.

Approximate annual revenues: \$1.2 billion

Product portfolio:

- Small Diameter Bomb
- Joint Direct Attack Munition
- Harpoon anti-ship missile
- Standoff Land Attack Missile Expanded Response (SLAM ER)
- Conventional Air Launched Cruise Missile (CALCM)
- Aegis Ballistic Missile Defense Standard Missile-3 kinetic warhead
- Patriot Advanced Capability-3 (PAC-3) missile seeker
- Numerous proprietary programs

“Assembling, testing and integrating these very complex electronic components is an intricate, time-consuming task that requires extreme skill,” Ham said.

Demands for increased production, coupled with decreased costs, have created a manufacturing challenge. To help meet that challenge and ensure that Boeing is positioned to rapidly respond to future production requirements, the PAC-3 and SM-3 teams have successfully incorporated manufacturing improvements. Among them:

- Implementing pulse lines that advance the PAC-3 product down the line at predetermined intervals.
- Identifying a process improvement for curing a sealant material that cut the cycle time by one day for each PAC-3 seeker’s critical path. As a result, the team is better able to consistently and predictably meet the customer’s delivery requirements.
- Reconfiguring the PAC-3 factory in Huntsville to implement shop-floor improvements that were identified in a Production Preparation Process (3P) event supported by a “one Boeing” team and a Six-Sigma Black Belt from the customer’s Lean office. The team has substantially altered the product flow within the factory, enabling the shop floor to produce multiple configurations of seekers on a single production line. The Weapons Programs site in St. Charles conducted a similar 3P event in April to explore the possibility of merging the JDAM and SDB production lines to provide greater efficiency and improve utilization of manufacturing space.

“Employee involvement and engagement creates the positive energy needed to implement Lean improvements on this scale,” Ham said.

Employees agree with that philosophy.

“The best thing about employee involvement is that it gives us the ability to have input for how things are set up or designed,” said Billy Collins, integration technician and member of the PAC-3 seeker employee involvement team. “Who better to make suggestions and

have input than the people doing the work.”

In addition, Weapons Programs is constantly exploring technology options to expand its capabilities. The newest addition, a state-of-the-art anechoic chamber in Huntington Beach, Calif., was formally dedicated in May. This Dynamic Advanced Radar Test (DART) site tests seeker engagement and intercept capabilities against tactical ballistic missiles, cruise missiles, air-breathing targets (such as fixed-wing aircraft and helicopters) and emerging threats. The new facility, which includes an anechoic chamber and flight-worthiness test area, doubled the existing chamber’s size and expanded the availability of the technology to a range of programs inside and outside Weapons Programs.

“DART provides a one-stop, full-service capability that supports design, development and qualification testing of our most sophisticated radar-based weapons before taking them to the field, where testing can be very costly,” Rub said.

LOOKING AHEAD

So how will Weapons Programs define its future? According to Rub, the way forward is to build upon current successes while simultaneously looking for new opportunities to establish the foundation for tomorrow.

“Just as with Laser JDAM, FLM and Harpoon Block III, much of our success has arisen by listening to our customers and adapting existing weapons to meet emerging warfighter needs. That will, of course, continue,” she said. “But hand-in-hand with that, we are pulling new and innovative technologies together with the expansive knowledge and expertise from across Boeing to take the business to an even higher level.”

One of the first opportunities to implement that strategy is the Navy’s Anti-Surface Warfare (ASuW) initiative to develop a new cruise missile. Weapons Programs brings a complete nose-to-tail missile design solution to the competition. Boeing’s ASuW design will combine the strengths of the integrated

team’s seeker and warhead capability with its experience in producing cruise missiles.

“That combination, with its inherent gains in synergy and efficiency is what sets Boeing Weapons Programs apart in the industry,” Rub said. “By integrating innovative technologies, proven performance, and an exceptional and committed team, we are positioned to address evolving warfighter needs with cutting-edge weapons and missile-system solutions. This strategy is our foundation for even greater successes.” ■

*timothy.r.deaton@boeing.com
linda.s.james@boeing.com*



Terry Griffin torques the bolts on a Joint Direct Attack Munition Tail Actuator Subsystem (TAS) kit. The TAS helps steer the bomb to the target.

RICHARD RAU PHOTO

Hitting the mark

A look at Weapons Programs' portfolio of products



Aegis Standard Missile-3 (SM-3) Kinetic Warhead

Mission/Role: SM-3 deployed on Aegis cruisers and destroyers defends against short- to medium-range ballistic missile threats in the midcourse phase of flight. Aegis SM-3 has demonstrated the ability to intercept targets with hit-to-kill accuracy during the target's descent phase as well as the more challenging ascent phase. Boeing is responsible for kinetic warhead integration including the guidance unit, the warhead ejector, and the critical-aim-point guidance algorithms and accuracy, which is key to selecting and destroying the target payload.

Location: Engineering – Huntington Beach, Calif.; Production – Huntsville, Ala.

Customers: U.S. Navy, U.S. Missile Defense Agency, 1 International

Factoid: On Feb. 20, the U.S. Missile Defense Agency and the U.S. Navy intercepted and destroyed a nonfunctioning satellite with the Aegis SM-3. The objective was to rupture the satellite's fuel tank to dissipate above the atmosphere about 1,000 pounds of hydrazine, a hazardous material that could pose a danger to people on Earth.

Air-Launched Cruise Missile/Conventional Air-Launched Cruise Missile (ALCM/CALCM)

Mission/Role: Boeing has partnered with the U.S. Air Force to convert surplus ALCMs into non-nuclear CALCMs. The nuclear warheads are replaced with high-explosive, blast fragmentation warheads, and GPS capabilities are added to the missiles.

Location: Seattle

Customer: U.S. Air Force

Factoid: CALCM is dropped from B-52 bombers and has a cruising speed of about 500 miles per hour. The missile is 21 feet long, four feet high and weighs 3,250 pounds.



Joint Direct Attack Munition (JDAM)

Mission/Role: JDAM is a low-cost guidance kit that converts existing free-fall bombs into accurately guided smart weapons. JDAM tailkits incorporate Inertial Navigation System/Global Positioning System guidance to direct the weapon to the target. Laser JDAM adds laser seekers to the weapon to engage and destroy moving targets.

Location: St. Charles, Mo.

Customers: U.S. Air Force, Navy and Marine Corps, 19 International

Factoid: Nearly 200,000 JDAM tailkits have been manufactured since production began in 1998. Laser JDAM was first deployed in-theatre in May.



Harpoon

Mission/Role: Harpoon is the world's most successful anti-ship missile, with more than 35 years of service. The Block II configuration includes GPS guidance for autonomous, all-weather, over-the-horizon and land-strike capabilities. With the advent of Block III, older Harpoons will be retrofitted with a data link package for network-enabled warfare.

Location: St. Charles, Mo.

Customers: U.S. Navy, 29 International

Factoid: Harpoon has a 100 percent hit rate for those fired against enemy ships during conflicts in the Mediterranean and Persian Gulf.



Patriot Advanced Capability-3 (PAC-3) Missile Seeker

Mission/Role: PAC-3 uses hit-to-kill technology to intercept and destroy tactical ballistic missiles, cruise missiles and hostile aircraft through direct body-to-body impact. The PAC-3 Missile seeker provides active guidance data to the missile, which enables the missile to acquire the target shortly before intercept, select the optimal aim point and initiate terminal guidance to ensure target kill.

Location: Engineering – Huntington Beach, Calif.; Production – Huntsville, Ala.

Customers: U.S. Army, Army National Guard, 4 International

Factoid: Currently deployed in Iraq, PAC-3 is the first and only U.S. terminal-phase defense system that can protect against ballistic missiles. The first operational intercept was in the opening hours of Operation Iraqi Freedom, when it scored two intercepts of short-range ballistic missiles that were intended for U.S. military headquarters located in Kuwait.



Small Diameter Bomb (SDB)

Mission/Role: SDB is a low-cost, low collateral damage precision strike weapon. SDB's smaller size, coupled with its four-place carriage, enables more weapons to be carried on each aircraft, thereby improving mission effectiveness against stationary targets. The Focused-Lethality Munition (FLM) variant combines ultra-low collateral damage and pinpoint accuracy for precision strikes on selected targets with limited damage outside the blast zone. The weapon incorporates a carbon fiber composite casing to eliminate fragmentation. The small blast area makes it possible to defeat targets in sensitive areas while minimizing risk to nearby personnel or structures.

Location: St. Charles, Mo.

Customers: U.S. Air Force, 1 International

Factoid: True to its name, the Small Diameter Bomb is only 7.5 inches in diameter, but despite its small size, it can penetrate more than three feet of steel-reinforced concrete.



Standoff Land Attack Missile Expanded Response (SLAM ER)

Mission/Role: SLAM ER is an upgrade to the combat-proven SLAM cruise missile, which is a Harpoon derivative. SLAM ER incorporates GPS guidance and increased range. It is the U.S. Navy's choice for surgical strikes against high-value land targets and ships in port and at sea. SLAM ER has an improved warhead to increase penetration and lethality against hardened targets.

Location: St. Charles, Mo.

Customers: U.S. Navy, 2 International

Factoid: SLAM ER has a range in excess of 150 nautical miles and has a 500-pound titanium penetrator warhead. It is the first missile that can be retargeted after launch. The warfighter can assess the primary target through the missile imaging infrared video display. If the primary target has already been destroyed, the missile can be redirected to another target.



'A great area to learn and grow'__

What does it mean to contribute to Boeing's weapons business? Here are opinions from some teammates in Weapons Programs.



Winfield Kang__

Quality manager, St. Charles, Mo.

"I've worked on other, bigger programs, but I truly enjoy working in the smaller environment of Weapons. You have a closer relationship with everyone, you really rely on each other, and you get to see everything out here, every aspect of the program, from womb to tomb."

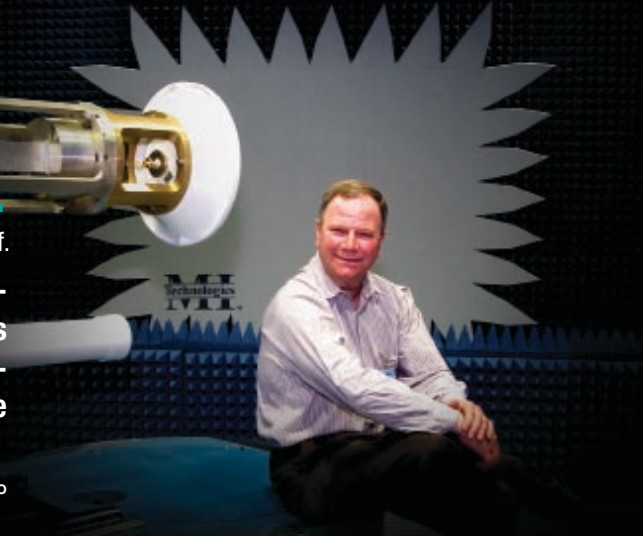
PETER GEORGE PHOTO

Andy Laquer__

Associate Technical Fellow, Huntington Beach, Calif.

"The best part of my job is inventing new capabilities and getting weapons to do things they couldn't do before. We do the same type of things that others do in bigger programs, but we have to solve the same problems, get the same functionality, in a much smaller space—and we have to make it inexpensive. That's the challenge I love."

JOSE OLMOS PHOTO



Megan Richter__

SDB Contracts administrator, St. Charles, Mo.

"I came from the BCFP (Business Career Foundation Program) rotational program and had a say in my final placement. Weapons was my top choice because I like the culture here. This is a great area to learn and grow because it's small enough that you see, do and touch more. In a smaller program, you have many more varied opportunities due to the fewer number of people."

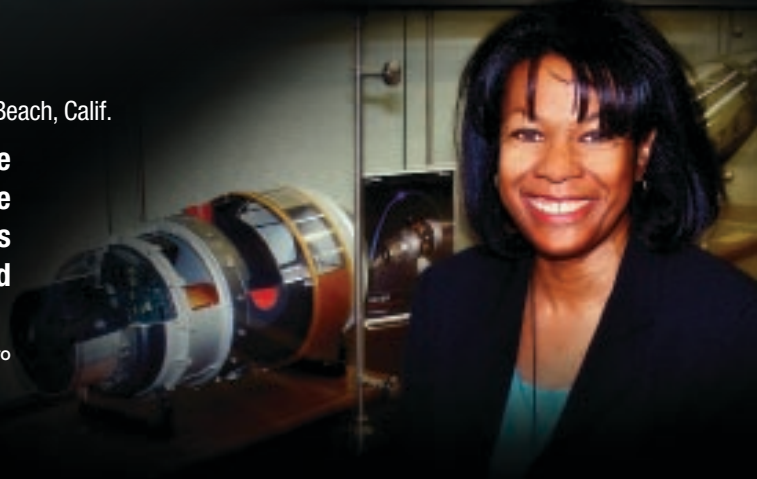
PETER GEORGE PHOTO

Adell **Graham**

Aegis Ballistic Missile Defense guidance processor software lead, Huntington Beach, Calif.

“What we do in software development is not as visible as the hardware. Because software is intangible, it’s a challenge to understand. Software is the ‘brain’ of the weapon that is equally vital to the weapon’s functionality. I am truly satisfied that what I work on contributes to the defense of freedom.”

ROSS MISHIMA PHOTO



Phil **Winn**

Senior business manager, Bombers and Weapons, Seattle

“I came back to this organization because I enjoyed it so much the first time I was here and because this position offered me a new challenge. Because it’s a relatively small program, I get to see everything that’s going on, and we have a close relationship with our customer. We’re successful because we pay a lot of attention to what the customer’s saying, and work to satisfy that need.”

MARIAN LOCKHART PHOTO

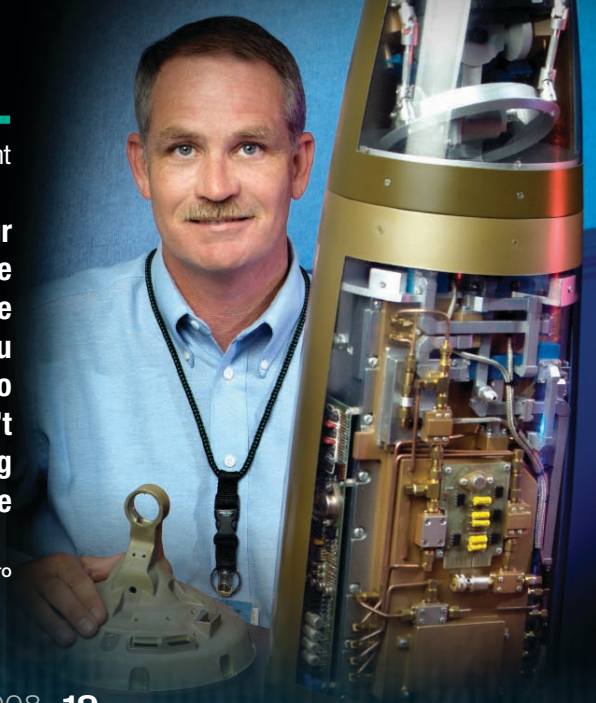


Marc **Hughes**

PAC-3 reliability engineer, Huntsville, Ala. (also a colonel in the U.S. Army Reserve who just spent 15 months in Iraq)

“Reliability is critical when you’re in Iraq. Once you leave the walls (of your camp), everything has to work. When you’re out there, that’s not the place to find out something doesn’t work. I was fortunate that I understood the supply chain from both sides. I have an appreciation of what happens if you have to replace or fix equipment in the field. So although there is a rush to get our products to the troops in the field, I know that if something doesn’t work, it impacts operations and lives. So I ask myself, ‘Is there something we can do here to make sure it works there?’ I don’t want to compromise quality, it’s too important.”

ERIC SHINDELBOWER PHOTO



Passion 'second to none'

Weapons Programs leader: People are key to business's success

Debra Rub was raised in a military family. Perhaps not so coincidentally, she now leads the Weapons Programs business of Boeing. "My personal commitment is to make certain that American warfighters have the best products that we can provide and to ensure that they come home safely to their families," she said. "Every day they put their lives on the line. They sacrifice so much. They deserve nothing less than our very best, every day."

Rub shared her thoughts with *Frontiers* magazine on Weapons Programs, including the competitive landscape and the organization's challenges.

Q: What are your goals for Weapons Programs?

A: This organization is poised for even greater success by becoming an unmatched global leader in weapons and missile-system solutions that will address evolving warfighter missions and needs. That prospect truly excites me, and is where I'm focused. We've brought together the best of technology, innovation, proven performance, and an exceptional and committed team, and integrated those strengths with successful and complex missile-defense programs and weapons businesses. How could we not succeed? And, as we look across the enterprise, it's clear that this organization can offer enabling technologies to help take to the next level some of the larger Boeing platforms and offerings including fighter aircraft, ground mobile platforms, and nontraditional platforms such as Unmanned Aerial Vehicles.

Q: What does Weapons Programs bring to the table that makes it different from competitors?

A: First, awesome technologies integrated into affordable, highly effective systems supported by outstanding, low-cost production in St. Charles, Mo., and Huntsville, Ala. Second, a remarkable level of understanding of weapons that can only come with decades of industry leadership by integrating more missiles and weapons—developed by both Boeing and its competitors—on aircraft and other platforms than any other aerospace contractor. And last, and certainly most important, we listen and respond to our customers', the warfighters', needs with a dedication and passion second to none.

Q: Listening and responding to your customer is harder than it sounds. Is there a secret to our success in this area?

A: No secret at all—just a sincere commitment to building relationships with our customers. That's where it starts. If we aren't attentive to those relationships, we will miss the opportunity to gain essential understanding of what is important to our customers, and in this competitive environment, we may never have another chance. That relationship-building goes beyond understanding the technology requirements. For instance, with our international customers we make it a priority to appreciate our differences, both in mission needs as well as culturally. We seek and find common values and un-

derstanding. Once we achieve that level of understanding and trust, then working together to determine the right solution is simple.

Q: Is there a single capability that will be key to the business' future success?

A: Without question, it's people. I am constantly awed by the incredible people that I have the privilege to work with at Boeing. We have the best and the brightest, and I would challenge anyone to find another aerospace company that not only has the depth and breadth of knowledge, but also possesses the unique ability to translate that knowledge into the most amazing array of defense systems across the globe. We need to realize our success depends upon our reliance on each other, our differing perspectives, our varied experiences and our unique expertise.

Q: What's the biggest challenge of leading an organization that spans the United States, with customers in 29 countries?

A: Open communication and teamwork. Our potential for success has never been so great. Across the organization I have seen an enthusiasm and commitment to building a team that is stronger together than apart, a team that understands how we can truly make a difference for our company and for the men and women who protect us and ensure our freedom.

— Tim Deaton and Linda James



Gen. Duncan McNabb, U.S. Air Force Vice Chief of Staff, visits with Debra Rub, vice president of Weapons Programs for Boeing, during a recent tour of the Weapons facility in St. Charles, Mo.

RON BOOKOUT PHOTO

Taking aim at the future_

Advanced Weapons ensures future products hit targets for cost, delivery, effectiveness

By MARC SKLAR

From the time huge catapults lobbed boulders, military leaders have sought weapons that deliver more force with greater accuracy from a greater distance in a shorter time frame. That's also the goal of Boeing's Advanced Weapons team, part of Integrated Defense Systems' Advanced Systems organization: to develop weapons that will enable the armed forces to act first and reach farther than is possible with today's weapons.

To develop future weapons, Advanced Weapons first listens closely to Boeing's military customers to understand today what their needs will be tomorrow. They then partner with teams across Boeing to define and develop system-level solutions.

"Advanced Weapons focuses on our business portfolio growth, either by innovatively introducing new technologies, winning new initiatives, or enhancing capabilities within existing programs," said Debra Rub, Weapons Programs vice president. "Advanced Weapons is developing and maturing the concepts and technologies that enable our future business growth."

Carl Avila, director of Advanced Weapons and Missile Systems, said making weapons that are part of a network-centric system is increasingly important in weapons development. "They must be tied into near-real-time mission planning and the command and control system," Avila said. "Networking will reach back to the logistics of the delivery of weapons to the battlefield and perhaps eventually to manufacturing."

The budgets for many of these development and technology-development programs can seem small by Boeing standards but can ultimately lead to huge ongoing revenue streams. Advanced Systems therefore has to strike a vital balance.

"We need to be agile and adaptable enough to be a top-notch developer of things never built before. But then we need to embed processes and production planning in our development, so when we hand over a program, our Weapons teammates can execute it flawlessly," Avila said.

A hypersonic projectile is launched from the Electromagnetic Railgun during a U.S. Navy test. EMRG uses electric power rather than propellant to launch the munition.

U.S. NAVY PHOTO



Here are some of the next-generation weapon systems Advanced Weapons is working on:

- **Joint Dual Role Air Dominance Missile.** The U.S. Air Force is developing this next-generation advanced missile that can conduct both air-to-air and air-to-ground missions. In addition to being more lethal and having longer range than existing weapons, JDRADM would give aircrews more flexibility: Crewmembers would not have to decide before a flight how to divide their weapons loads between air-to-air and air-to-ground weapons. Advanced Weapons has won multiple technology-development contracts related to the system, including sensor and other systems.
- **Electromagnetic Railgun.** This hypersonic projectile is being developed for the U.S. Navy. To understand how it works, picture this: A destroyer receives the coordinates of an enemy target hundreds of miles away. Instead of launching a standard shell, the barrel of the ship's electromagnetic railgun is pointed at the target. By diverting electric power from the ship's engine to the gun turret, a 3-foot-long, 40-pound projectile is launched up a set of superconducting rails that develop a powerful electromagnetic force. The projectile leaves the barrel at hypersonic velocity—Mach 7-plus—exits the Earth's atmosphere, re-enters under satellite guidance, lands on the target less than six minutes later and va-

porizes it with kinetic energy alone. Since no propellant is used to launch the projectile, the system makes shipboard operations much safer.

- **Joint High-Speed Strike Weapon.** JHSSW, a program under consideration by the Navy and Air Force, is a high-speed cruise missile for use against targets that must be hit quickly. Advanced Weapons is exploring multiple concepts for high-speed land-attack and anti-ship weapons. Under a Defense Advanced Research Projects Agency and Office of Naval Research contract, the team is developing and testing the HyFly Hypersonic demonstrator vehicle as part of this effort. Hypersonic refers to speeds greater than Mach 5.
- **Massive Ordnance Penetrator.** The goal of this technology demonstration program, funded by the Defense Threat Reduction Agency, is to develop a 30,000-pound conventional penetrating weapon that will defeat a specialized set of hardened and deeply buried targets. The weapon will be carried aboard B-2 and B-52 bombers and deployed at high altitudes. Design features include a GPS navigation system. ■

marc.a.sklar@boeing.com