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THE SITREP: FUTURE ATTACK RECONNAISSANCE AIRCRAFT: THE “KNIFE FIGHTER”

In the Army’s ambitious modernization drive, one of the most desirous pieces is the Future Attack Reconnaissance Aircraft. To replace the retired OH-58D Kiowa, a design that dated back to Vietnam, the Army wants a next-generation armed scout aircraft—not just a conventional helicopter—with speed, range, survivability, and even autonomy that is presently unattained by any military production rotorcraft in the world. And industry is striving to meet the aspirations through the use of technologies like advanced materials, fly-by-wire controls, pusher propellers, double coaxial rotors, and more fuel-efficient and powerful engines developed under the Improved Turbine Engine Program.

“Our number one priority, what we need first and foremost, is an attack reconnaissance capability,” said Secretary of Defense Mark Esper in April at the Brookings Institution, at the time he was still the Army secretary. “That’s an aircraft that has the speed, range, (and) survivability to penetrate robust air defense systems (and) get deep behind the enemy.”

Such an aircraft would be expected to play several roles such as clearing airspace, controlling drones, calling in artillery fire and airstrikes, and directing other aircraft. The Army also envisions the armed scout having the ability to operate unmanned, said Esper.

“The plan is to have the capability to go semi-autonomous if not fully autonomous with all of our vehicles,” he said. “Just think what that does on the battlefield from a tactics perspective. If I can get my attack reconnaissance aircraft unmanned, I (would) worry less about the missions it conducts because I’m not putting pilots’ lives in jeopardy.”

The organization charged with making reality of Esper’s plan for next-generational helicopters is the Army Futures Command, a new four-star organization that became operational in July 2018 and now counts about 24,000 personnel. It focuses on six modernization priorities that run the gamut of the Army’s warfighting missions, with Future Vertical Lift aircraft like the FARA as Priority No. 3. (No. 1 is long-range missiles and artillery, No. 2 is next-generation combat vehicles, No. 4 is the mobile and expeditionary Army network, No. 5 is air and missile defense, and No. 6 is soldier lethality).

Along with Futures Command, the Future Vertical Lift Cross-Functional Team (CFT) at Redstone Arsenal, AL, is responsible for developing FVL. That portfolio includes the FARA scout, the Future Long-Range Assault Aircraft (a transport), various drones, and a program to develop a Modular Open System Architecture (MOSA), which is an open-architecture, plug-and-play capability that is meant to ease further upgrades in the future.

– Barry Rosenberg
Contributing Editor, Breaking Defense



The AVX Aircraft Company/L3Harris FARA concept features a compound coaxial design with dual ducted fans for forward and reverse thrust.

THE NEXT-GENERATION SCOUT

The first helicopter program is the Future Attack Reconnaissance Aircraft (FARA) for armed reconnaissance missions. That role is presently met by some of the Army's AH-64 Apache heavy attack helicopters, designed as heavy gunships but pressed into the light scout role since the retirement of the service's Kiowa Warrior helicopters in 2012. The FARA scout aircraft would also conduct electronic warfare and is envisioned to fly autonomously without human pilots on at least some missions. When the FARA squadrons become operational around 2030, the Army will likely return the Apaches to their intended heavy attack role.

The second program under FVL is the Future Long-Range Assault Aircraft (FLRAA). It is a transport program to carry light forces and equipment farther and faster than the Black Hawk helicopters it is scheduled to replace. Both FARA and FLRAA competitions are moving forward simultaneously.

"Army Aviation must operate in highly contested/complex airspace and degraded environments against peer/near peer adversaries capable of an advanced integrated air defense system," states the Army's solicitation for FARA development and procurement. "The Army currently lacks the ability to conduct armed reconnaissance, light attack, and security with improved stand-off and lethal and non-lethal capabilities with a platform sized to hide in radar clutter and for the urban canyons of mega cities.

"To close this gap, the Army envisions an optionally manned, next generation rotorcraft with attributes of reduced cognitive workload, increased operational tempo through ultra-reliable designs and extended maintenance free periods, and advanced teaming and autonomous capabilities."

Teamed with unmanned systems and various air launched effects, the FARA platform is expected to be the centerpiece of the integrated air defense system breaching team to provide freedom of maneuver in a multi-domain battle.

"This platform is the knife fighter of future Army Aviation capabilities, a small form factor platform with maximized performance," the solicitation states. "Critical to this envisioned platform is a resilient digital backbone designed to allow rapid capability advancement in subsystems and software and affordable life cycle management. This purpose built aircraft will be fielded at echelons above division but other variants could be fielded across all aviation formations."

Earlier this year, the Army awarded FARA Phase 1 Competitive Prototype contracts to five companies: a partnership of AVX and L-3, Bell Textron, Karem, Sikorsky, and Boeing.

AVX Aircraft Company/L3Harris: The team will offer a compound coaxial design with dual ducted fans for forward and reverse thrust, which is says will meet 100

percent of the Army's mandatory requirements and exceed 70 percent of them. It is a single-engine design paired with a wing for lift during high-speed forward flight. Other features include: fly-by-wire side-by-side cockpit; MOSA-based digital backbone and avionics systems; and a form factor that meets C-17 loading and Navy DDG destroyer shipboard size limits through manually folding blades and wings. AVX is responsible for the clean-sheet design, with L-3 offering systems engineering and weapons, sensor and communications systems integration, and full-rate production capabilities.

Bell Textron: Its entrant is the Bell 360 Invictus, which will incorporate technologies from other airframes. Its rotor system, for example, is from Bell's 525 Relentless helicopter that has been tested at speeds in excess of 200 knots. Bell says that incorporating such systems into the Invictus will deliver a low-risk path to FARA development. Other features include: lift-sharing wing to reduce rotor lift demand in forward flight; fly-by-wire control system; and MOSA enabled by a digital backbone from Collins Aerospace.

Karem Aircraft: Karem specializes in tiltrotor technology and has developed a new system under the Army's Joint Multi-Role Technology Demonstration program. (AVX has also received funding under the demonstration program for technology development.) Karem recently added Northrop Grumman and Raytheon to its team in July. Karem will offer its active variable speed rotor. They will be augmented with Northrop Grumman's manned and autonomous military aircraft development, system integration, production, and support expertise, and Raytheon's systems architecture, mission equipment, and weapons capabilities.

Sikorsky: Now a subsidiary of Lockheed Martin, the company will offer a version of its S-97 Raider demonstrator. The compound helicopter features Sikorsky's X2 technology (which won the Collier Trophy in 2010), with a pusher propeller at the back for high-speed thrust complementing two main rotors rotating in opposite directions (which balances the aircraft's torque and removes the need for a tail rotor). Raider also incorporates fly-by-wire and other technologies that enable the aircraft to operate at high speeds while maintaining low-speed handling qualities and the maneuverability of conventional single main rotor helicopters, according to Sikorsky. Raider can reach speeds of more than 220 knots.

Boeing: The company has kept details of its FARA candidate under wraps. While they're also competing for the FLRAA transport, their entry for that mission--the SB>1 Defiant--is built in conjunction with Sikorsky, their

competitor on FARA, and relies on Sikorsky's compound helicopter technology. So Boeing will have to come up with a different design for FARA.



The S-92 Raider will form the basis of Sikorsky's FARA entry.

Sikorsky was awarded \$938 million for the detail, design, build, and test phase, while the four other competitors received between \$732 million and \$790 million each. In this first phase, the companies were given nine months to develop preliminary designs and provide the DoD with the data and insight required for a down-select to two or possibly more companies based on available funding.

The awards were made under the DoD's Other Transaction Authority instrument that lets it engage industry and academia for a broad range of research and prototyping activities. OTA's are typically defined by what they are not: they are not standard procurement contracts, grants, or cooperative agreements. As such, they are generally not subject to the federal laws and regulations that typically apply to government procurement contracts.

"Using the OTA capability authority has given us lots of flexibility and made us more responsive to the timelines that the CFTs have driven us to in terms of getting a contracting capability in place to meet their specific requirements," Joe Giunta, senior contracting officer at Army Contracting Command-Redstone, said in an article written by Army Combat Capabilities Development



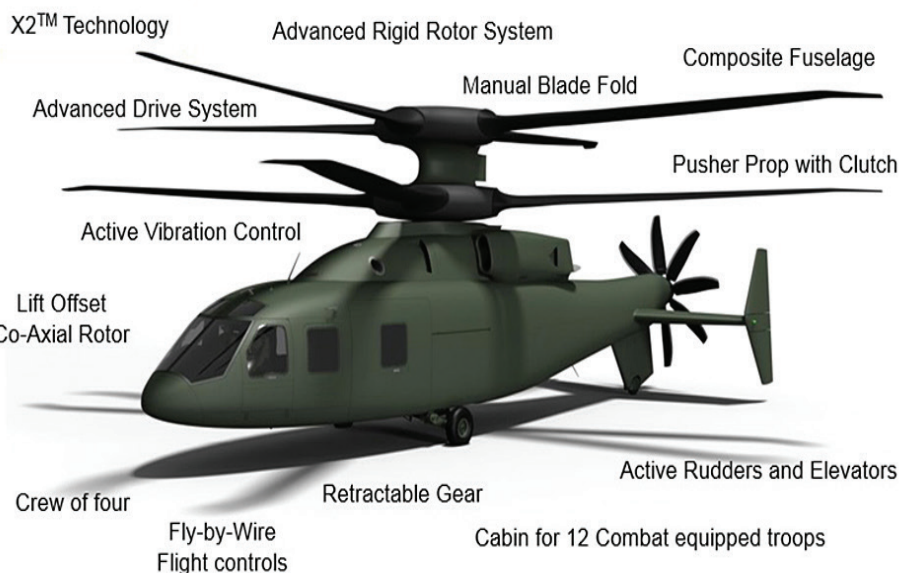
Bell 360 Invictus will reduce costs by incorporating systems like the rotor system from Bell's 525 Relentless.

Command Aviation & Missile Center public affairs. “We only make awards based on their progress as observed by the government. There are defined milestones. If those milestones are hit early and the government is satisfied with those milestones, the program can proceed quicker than what was anticipated.”

Final design and risk review of the remaining competitors’ aircraft is scheduled for late 2020, at which point the DoD will determine whether to continue or terminate

the program. Approximately 24 months are allocated for the aircraft build, including subsystem testing, with an anticipated first flight in November 2022.

For FARA and future Apaches, the Congressional Budget Office predicts the following scenario for procurement: 6 aircraft per month beginning in 2028, increasing to 30 per year starting in 2032, and continuing steady at that rate of production in following years. The CBO pegs the average per-helicopter cost for FARAs at \$40 million each through 2050.



Aircraft features of the Boeing, Sikorsky Defiant, which they have proposed for FLRAA.

At the same time, the Army is expected to continue buying AH-64E Apaches through 2025 (so there will be a gap from 2026-2027 when neither Apaches nor FARAs are procured).

“With input from the Army, CBO projected procurement of 30 FARAs per year but made no judgment about which ones would augment the current force and which would replace retiring Apaches,” stated the CBO. “The Army might instead limit FARA purchases to the number needed for armed reconnaissance missions and develop a new aircraft that is larger than the FARA to replace the Apache for heavy attack missions. That approach could result in costs that are higher than CBO’s projections.”

APPLYING NEXT-GENERATION TECHNOLOGY TO THE ARMY'S NEW SCOUT HELICOPTER

Troy Gaffey is the CEO of AVX Aircraft Company. He was formerly chief engineer and senior vice president of research and engineering at Bell Helicopter. He is one of the most experienced executives and vertical lift aeronautical engineers in the aircraft industry today. Gaffey has been instrumental in the design and development of numerous civilian and military helicopters, and has extensive expertise in the areas of project management, tiltrotor design/technology, rotorcraft aeromechanics, and test and evaluation.



1 What is the value of the AVX teaming arrangement with L3Harris, and how will it meet the major innovations in the FARA program that the Army is seeking?

The teaming of AVX Aircraft and L3Harris provides a powerful team of experts to design, build, test, and produce the FARA aircraft. AVX brings the legacy helicopter design experience needed to go from aircraft concept through design, flight test, and production. L3Harris brings the financial resources, engineering depth, aviation systems, processes, tools, and facilities to bring the AVX concept to reality.

As for innovation, the L3Harris MOSA (Modern Open System Architecture) is the heart of the mission system and key to the planning for development. Its open architecture enables use of modern technology being fielded now, while being able to integrate future sensors and mission capability as they mature without having to re-engineer the entire system.

2 What is the difference between the AVX coaxial rotor and the Sikorsky coaxial rotor?

The main difference is in the degree of rigidity in the rotor system. The Sikorsky rotor system is extremely rigid while the AVX rotor system is a soft-in-plane system. There is more flex in the AVX system. The advantage of the AVX design is that it eliminates much of the vibration inherent in a rotor. That in turn translates to less wear and tear on the rotor system components. That then further translates to lower costs for maintenance over the lifetime of the parts, as well as potential safety of flight issues.

Further, a feature of the transmission is that it is a flat-pack design, which means it is all contained on and in the roof of the aircraft. This provides for an open cabin that allows mission commanders considerable mission flexibility in how they utilize the aircraft. The AVX L3Harris compound coaxial helicopter (CCH) design allows multiple configurations that include troop transport, internal weapons storage, and extended range fuel tanks that allow for self-deployment.

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3 What is the advantage of a CCH design over a conventional helicopter?

In summary, the CCH design provides increased performance, an affordable cost, smaller footprint, and an ability to operate in a confined urban environment while meeting required performance objectives. The CCH concept enhances performance in both hover and high-speed flight.

Other advantages include:

- Increased high/hot hover capability
- Coaxial rotor power required to hover is 15-18% less than single rotor + tail rotor
- Increased cruise speed, range, and endurance
- Less susceptible to brownout due to takeoff and landing attitude
- Fans can be used to decelerate, eliminating the need for flare to a hover
- Easier and safer to fly than conventional helicopter



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