

The image features two military helicopters in flight, silhouetted against a bright, hazy sky at sunset or sunrise. The larger helicopter is in the upper left, and a smaller one is in the lower right. The overall tone is dramatic and emphasizes military readiness.

FIGHTING FOR “FUTURE VER

For close to a decade, rotorcraft advocates in the U.S. military have been laying the research groundwork to replace many of today's helicopters with versions that would employ a revolutionary propulsion concept to-be-decided. **Jan Tegler** looks at the battle to elevate the Future Vertical Lift initiative into an acquisition program and speed up its schedule.

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VERTICAL LIFT”

The image shows two helicopters in flight against a sunset sky. The sun is low on the horizon, creating a bright orange and yellow glow. The helicopters are silhouetted against the bright sky. One helicopter is larger and positioned higher than the other. The overall scene is dramatic and evocative of military operations.

A

Army Chief Warrant Officer 3 Joseph Priester was jolted awake at 4 a.m. by the sound of rocket and motor fire. He sprinted to his OH-58D Kiowa Warrior, a lightly armed reconnaissance helicopter, and took off with his co-pilot from Forward Operating Base Salerno in eastern Afghanistan. They didn't have to fly far. A

group of 30 insurgents about 2 kilometers from the base had launched an attack on the coalition base. At one point, Priester landed in the middle of the fight to pick up a wounded American soldier — his left-seater remaining behind so that the two-seat Kiowa Warrior could transport the wounded man back to the base.

Priester's response to the 2008 attack was emblematic of many of the missions flown by U.S. helicopter crews in the wars in Iraq and Afghanistan. Many could be accomplished by short dashes by light-lift, maneuverable helicopters. Now, however, recognition is growing in the Pentagon that range and speed could turn out to be paramount in the next conflicts.

For years, the Pentagon has been laying the technological groundwork for the possible creation of a joint, multibillion-dollar acquisition program called Future Vertical Lift. Preliminary plans call for the Army, Marine Corps and Navy to each purchase FVL variants founded on a revolutionary propulsion concept still-to-be-decided. The overarching goal would be to double the range and speed of today's helicopters by rolling out conventionally piloted and unmanned versions in the mid 2030s, a schedule that is too slow for some.

At the moment, FVL remains a modestly funded research effort. The White House is proposing to spend \$125 million on FVL and related efforts in fiscal 2019, a request that is making it through the congressional appropriations and authorization process with minimal adjustments up or down. Also, the technological path is being cleared by two demonstration aircraft: the Bell V-280 Valor, which flew for the first time in December, and the Sikorsky-Boeing SB-1 Defiant, which could start flying by the end of the year.

The FVL initiative appears headed for a crossroads. On one path is a multibillion-dollar, joint acquisition program. On the other lies something short of that.



The Army, Marine Corps and Navy are in the midst of analyzing their rotorcraft alternatives for the years ahead in a study that will spill into 2019 and largely determine the path for FVL.

I spoke with Army and Marine Corps leaders, a member of Congress, former Army helicopter pilots and defense analysts to take the pulse of FVL as it approaches this critical crossroads.

Schedule

On the question of timing, the plan to roll out FVL aircraft in the 2030s has not sat well with Army aviation advocates in the Pentagon or on Capitol Hill.



U.S. Army

▲ **A U.S. Army OH-58D** Kiowa Warrior helicopter returns to the flightline after completing a mission as an HH-60 Black Hawk medevac helicopter flies off for another mission in Afghanistan, where many missions could be flown with light-lift, maneuverable helicopters.

One of them is Rep. Anthony Brown, D-Md., a former Army OH-58 pilot whose state is home to the Army's Aberdeen Proving Ground, where rotorcraft research could aid FVL, and Naval Air Systems Command, or NAVAIR, which manages rotorcraft acquisitions for the Navy and Marine Corps.

Brown says he was surprised when he was briefed about the timeline by the Army. Plans still call for releasing the FVL request for proposals in 2021, which is itself a two-year slip from the plan as it stood in the fiscal 2017 budget. That release would put the first FVL aircraft in the hands of pilots in the mid 2030s.

"I must say my first impression was 'Man, this is going to take a long time,'" Brown says.

Earlier this year, the House authorization subcommittee that Brown sits on told the Army to "weigh speeding modernization and fielding" of weapons including FVL.

Brig. Gen. Walter T. Rugen, who manages the FVL initiative from Joint Base Lewis McChord in Washington state, tells me "we have to go faster," which would mean flying operational FVL aircraft within a decade rather than the mid-2030s. He says accelerating FVL "is being pushed at the highest levels, so we enjoy that priority."

Rugen leads the Cross Functional Team that has been assembled to ensure that all relevant subject matter experts are included in the FVL initiative. He sounds cognizant of the complexities and speckled history of other attempts at large joint programs.

“We’re focused on accelerating this capability as much as we can, balancing the risks,” he says of FVL.

On the question of timing, the answers I received from NAVAIR’s PMA-276 office, which manages the Marine Corps light-attack helicopters, are strikingly different from those from the Army.

“The Marine Corps need is currently unchanged,” PMA-276 said when I asked the whether the Marines also would like to see FVL rotorcraft delivered sooner than the mid-2030s.

Also, the Marine Corps explained that the “driving factor” factor in its planning is an aircraft that can carry six to eight passengers and match the V-22 tiltrotors in range and speed to escort them.

An open question remains how these divergent visions of timing would translate into budget planning, once the services finish analyzing their rotorcraft futures early next year.

Richard Aboulafia, who analyzes military aviation spending for the Teal Group in Virginia, cautions that the Army has only a “small window of time” to get an FVL program funded and moving forward. That’s because the Trump administration spike in defense spending would peak in 2019.

If FVL is elevated to an acquisition program, the

stakes would be enormous. Early plans call for producing a family of aircraft to replace such stalwarts as the Army’s UH-60 Black Hawk, the Marine Corps UH-1Y Venom utility helicopter and the AH-1Z Viper attack helicopter. The new aircraft must exceed the performance of those flown by near-peer competitors, meaning China and Russia, which would mean flying about twice as fast and far as most of today’s rotorcraft.

The foundational propulsion technology has yet to be chosen. Two concepts are facing off against each other under a related demonstration initiative, called the Joint Multi-Role Demonstrator program, with funding tracing back to 2013. Vying are the V-280 Valor tiltrotor built by Bell of Fort Worth, Texas, and the SB-1 Defiant, an unusual helicopter built by Sikorsky and Boeing. The SB-1 team says it is “fighting hard” to fly for the first time by the end of this year.

The two concepts could not be more different. The Valor design was partly inspired by the larger V-22 Osprey tiltrotors. The main difference is that the V-22’s engines tilt entirely when transitioning between horizontal and vertical flight, whereas just the gearbox on each Valor engine tilts. “V-22 is the number one in-demand VTOL aircraft within DoD because of its speed and range,” says Keith Flail, Bell’s vice president for advanced tilt-rotor system. “We’re taking all the knowledge from the Osprey — over 400,000 flight hours — and we’ve applied that to Valor, a clean-sheet design with today’s technology.”

▼ **Sikorsky’s S-97 Raider** was developed for the U.S. Army’s Armed Aerial Scout program, which was canceled in 2013. The company is proposing the helicopter, seen in an artist’s rendering, for a future Army reconnaissance role.



Sikorsky

Future Vertical Lift demonstrators

The V-280 Valor and the SB-1 Defiant are competing to become the U.S. military's next-generation rotorcraft, developed through the Army's Future Vertical Lift initiative. The Valor design was partly inspired by the larger V-22 Osprey tiltrotors. The SB-1's two coaxial rotor blades are mounted one above the other and rotate in opposite directions.

Source: Staff research, manufacturers



Manufacturer Bell
Engine GE T-64 on JMR-TD version
First flight Dec. 17, 2017
Weight Declined to provide
Airframe Composites/metal



Manufacturer Sikorsky-Boeing
Engine Honeywell T55
First flight Late 2018
Weight 13,600 kilograms (30,000 pounds)
Airframe Composites/metal

IT'S IN THE NAME

The "280" in the name V-280 Valor highlights the 280-knot (519 kph) cruise speed Bell says this tiltrotor will be able to achieve. First flown in December 2017, the V-280 has logged about 30 flight hours and reached 190 knots (352 kph) in level-flight at this writing.

SB-1 gets at the range and speed problem another way. Its two coaxial rotor blades are mounted one above the other, and they rotate in opposite directions to prevent clockwise or counterclockwise torque on the fuselage. This strategy eliminates the need for a tail rotor (sometimes called an anti-torque rotor) and frees up space for a pusher prop to add speed and maneuverability. The design is based on Sikorsky's experimental X2 that the company flew in 2008. "Not only does our X2 technology preserve all of the best characteristics of traditional single or double-rotor aircraft like the Chinook, Black Hawk and Apache, it betters them in some ways. Yet it can still achieve speeds well north of 200 knots to get to the expanded battle space the government appears to be looking at," says Rich Koucheravy, Sikorsky's business development director.

At the moment, it's not clear whether one or both of these approaches will be chosen as the way forward for FVL. The Marine Corps light-attack helicopter office, PMA-276, says the analysis-of-alternatives is "reviewing multiple aircraft concepts, not just those used for the full scale technology demonstrators."

Perhaps complicating budget matters, FVL is one of six modernization priorities the Army has identified across all domains: air, land, space, cyberspace, electromagnetic spectrum, information and the cognitive dimension. All require significant expenditures.

Speed = Reach

The joint requirements for the FVL aircraft have yet to be written, but the demonstrators are targeting a cruise speed of 230 knots or 425 kph and a range of up to 800 nautical miles or 1,481 kilometers.

Rugen rattles off the broad brushstrokes of what rotorcraft experts want: "We're looking for sweeping improvements in our lethality, agility, survivability, sustainability and what we call reach," Rugen says.

"Reach" alludes to a different kind of fight from the counterinsurgency war that Priestler, the Kiowa Warrior pilot, was thrown into. In future conflicts, the air superiority that U.S. forces have enjoyed could be contested, Rugen says. In that case, dotting the battlefield with forward operating bases and refueling points for rotorcraft won't be practical. Missions would have to cover greater distances, whether for attack, reconnaissance, transport, medevac or special operations.

Speed and range will "get them to the fight rapidly" Rugen explains. Penetrating sophisticated enemy defenses would be done by teaming rotorcraft with an "ecosystem of unmanned aircraft and modular missiles."

The question is which concept — the coaxial SB-1, the V-280 tiltrotor or perhaps another idea — would be best suited.



Maneuverability

Army helicopter pilot Chief Warrant Officer 4 Michael LaGrave, an ex-Kiowa Warrior pilot, says tilt-rotor aircraft “lack the agility at low speed” of traditional helicopters, noting that the Army is the only service which does not operate the Osprey.

Bell officials are aware of this perception, and the company has invited current Army aviators to fly its V-280 simulator. Bell’s Flail says the V-22 is in fact “incredibly agile” at low speed. “We’ve been able to do a lot of things with this next-generation tiltrotor to have even greater agility at low speeds,” he says. “As we go through the envelope expansion we will demonstrate that.”

Sikorsky and Boeing think they have an edge with an aircraft that traces its heritage to previous helicopters. Looking at the initial FVL description, “we realized that while the Army did want the extended range and speed of a fast vertical lift platform, it did not appear they were willing to sacrifice much

“We’re looking at the price point that we have now for procurement and flight hours as our targets.”

— Brig. Gen. Walter T. Rugen, who manages the FVL initiative

in terms of low speed hover and performance in the objective area,” says Sikorsky’s Koucheravy.

That’s why Sikorsky and Boeing based their SB-1 Defiant design on the X2, which was a compound helicopter, meaning it combined the propulsion of rotors and propellers.

Cost

The Army wants this new generation of rotorcraft to cost about the same to operate and maintain as the latest variants in its fleet, from the UH-60V Black



▲ **The Bell V-280 Valor** demonstrator flew for the first time in December 2017.

Hawks to AH-64E Apaches.

"I'll echo what Gen. [James] McConville our vice chief of staff said," says Rugen. "We're looking at the price point that we have now for procurement and flight hours as our targets."

Aboulafia of Teal Group doesn't think it's realistic to think that the FVL aircraft will cost the same as today's versions.

"I don't think you can get this incredible capability for the same or anything like the same price," he says.

Given the costs, funding uncertainty of FVL and the history of joint programs, Aboulafia is skeptical about the future of FVL. He thinks it makes little sense to try to compress diverse demands into one program. "Rather than building one giant mega-cathedral, how about just a small village church?"

If he were the Army or Marines he'd think about a "fall-back" option of continuing with "upgrades or existing new-build helicopters."

"I tell everybody who will listen," Aboulafia quips, "be prepared for a future of 'Black Hawk-N' models, 'Apache-G' models or 'Chinook-Q' models, take your pick."

Aboulafia notes that the Army is continuing to make incremental upgrades to its existing fleet. The service continues to buy the latest version of the Apache, the AH-64E and the UH-60M while upgrading UH-60L Black Hawks with a digital cockpit as UH-60Vs. The Army also has an Improved Turbine Engine program underway to replace the engines in its Black Hawks and Apaches with more powerful, fuel-efficient turbines. Meanwhile, the Marine Corps is continuing to procure the UH-1Y Venom and AH-1Z Viper utility and attack helicopters.

Prioritizing designs

Until this year, the FVL rotorcraft were classified under five "capability sets" — two Light variants, two Medium variants and two Heavy variants. These capability sets encompassed the variety of roles Army and Marine helicopters fulfill, from light attack and reconnaissance to airborne assault and heavy lift roles.

But In March, Army aviation leaders, including Rugen, indicated the service would focus on two FVL variants — a Light future reconnaissance attack aircraft and a long-range assault aircraft similar to the medium-lift SB-1 Defiant or V-280 Valor rotorcraft now progressing through JMR TD.

I had heard speculation that the Army wants an armed scout to be the first FVL variant fielded. I asked Rugen if that was the plan, and he says that's "yet to be determined."

Sikorsky thinks that's a real possibility and is offering its S-97 Raider for the future reconnaissance role. Not part of the current demonstration program, Raider was developed for the Army's Armed Aerial Scout program (canceled in late 2013) to replace the OH-58D. The S-97 has the same coaxial rotor configuration as the SB-1 Defiant.

It remains unclear how the Marine Corps would fit into the FVL initiative, given the statement from PMA-276 that it still likes the 2030s date and that the "driving factor" is not a light FVL but one capable of carrying 6 to 8 passengers and escorting V-22s.

Asked about that, Rugen says the Army shares "significant" interest in a light FVL with U.S. Special Operations Command and the Coast Guard.

Aboulafia of Teal Group contends that Bell's tilt-rotor V-280 is more suited for the type of missions the Marine Corps performs while Sikorsky-Boeing's SB-1 may be more appropriate for Army missions. If FVL is to go forward, "each service should pick one of the aircraft now in development for JMR TD and get going." ★

Staff reporter Tom Risen contributed to this report.