The Sikorsky-Boeing SB>1 Defiant high-speed compound helicopter demonstrator flew for the first time on March 21, just days before the US Army released a request for information (referred to here as a "Sources Sought Notice") on the Future Long-Range Assault Aircraft (FLRAA).

Originally expected by the end of 2017 but delayed by manufacturing challenges and ground-test glitches, the Defiant’s 30-minute first flight also came just weeks after the Army released its fiscal 2020 budget request that seeks increased funding for the medium-utility FLRAA and the armed-scout Future Attack Reconnaissance Aircraft (FARA).

FARA and FLRAA are the first products of the Pentagon’s Future Vertical Lift (FVL) initiative to replace its helicopter fleets with a family of advanced rotorcraft. FARA, otherwise known as FVL Capability Set 1, is intended to take over the armed scout role performed by the Bell OH-58D Kiowa Warrior until its budget-driven retirement in 2017. FLRAA is intended to replace the Army’s UH-60 Black Hawks, Special Operations Command (SOCOM) MH-60s and the US Marine Corps’ Bell UH-1Y Venoms.

The Army’s budget request lays out plans to spend more than $4.7B on FVL over the future years defense plan (FYDP) that covers fiscal 2020 to 2024. This includes $427M in fiscal 2020 and $2.13B over the FYDP for FARA, and $32M in fiscal 2020 and $984M over the FYDP for FLRAA.

FARA is already in source selection, and the Army plans to award four to six contracts in the April/May timeframe to develop preliminary designs for prototypes. The fast-tracked competitive prototyping program calls for two teams to be selected in fiscal 2020, leading to first flights in late 2022. Engineering and manufacturing development of the winning design could begin in fiscal 2024. Congress added $75M to the fiscal 2019 budget to kick off the FARA program. It also added $20M for the JMR program (as a result of lobbying by VFS), a portion of which will be used to expand the flight envelopes of the two demonstrators. The Army expects shortly to put the teams under contract for the additional flying.

Meanwhile, the Army has added just over $10M to its fiscal 2020 budget request to accelerate FLRAA. Because it is a joint program, the service will have to seek approval from the Office of the Secretary of Defense to accelerate the program schedule.

The Defiant is one of two technology demonstrators built under the Joint Multi Role (JMR) precursor to FLRAA. The rival demonstrator, Bell’s V-280 Valor advanced tiltrotor, first flew in December 2017 and has exceeded its target 280 kt (519 km/h) cruise speed in more than 90 hours of flight testing.

Designed for a cruise speed of at least 250 kt (463 km/h), the SB>1 shares the same rigid-rotor compound helicopter configuration as Sikorsky’s S-97 Raider, but scaled up to the 30,000 lb (13.6 t) gross weight class. The 11,000 lb (5 t) Raider has already exceeded 200 kt (370 km/h) in flight testing.

First flight of the Defiant was delayed due to challenges manufacturing the carbon-fiber spars for its stiff rotor blades and discoveries during ground testing of the propulsion system testbed (PSTB). With the Army-led analysis of alternatives for FLRAA set to finish this quarter, this has raised concerns that the Sikorsky-Boeing team will not have time to provide the Army with data to inform the FLRAA requirement.

But Brig Gen Walter Rugen, director of the Army’s FVL Cross-Functional Team, says Sikorsky and Boeing have already provided 80% of the data required under the JMR technology demonstration. A lot of that data is from the PSTB at Sikorsky’s development flight center in West Palm Beach, Florida, he
says. The Bell Valor team does not have an equivalent to the PSTB — which includes the entire rotor system, engines and tail propeller system anchored to the ground — and instead tested the completed V-280 in tiedown tests in October-November 2017.

On April 4, two weeks after the Defiant finally flew, the Army released the RFI for FLRAA. The solicitation lays out a schedule that would equip the first Army unit with aircraft by the second-quarter of fiscal 2030. The Army would be designated at the lead service with SOCOM “participation,” and the USMC acquisition program following about two years behind the Army. The RFI calls for the following schedule goals for the Army’s FLRAA:

- Contract award in fourth-quarter fiscal 2021
- Preliminary Design Review in second-quarter fiscal 2023
- Prototype first flight in third-quarter fiscal 2024
- Weapon system Critical Design Review in fourth-quarter fiscal 2024

This represents a two-year acceleration from the Army’s previously stated schedule, which called for a Milestone A decision to launch the FLRAA program in fourth-quarter fiscal 2021, release of a request for proposals for a competitive technology maturation and risk reduction phase in first-quarter fiscal 2022, and contract award in second-quarter fiscal 2023.

The RFI also lays out performance and cost goals for FLRAA, including an average unit manufacturing cost target of $43M in 2018 dollars. This is significantly more expensive than the UH-60M Black Hawk, for which Army budget documents give a weapon-system unit cost of $22M in fiscal 2018.

The RFI specifies the Army’s requirements, including a maximum cruise speed of at least 250 kt (463 km/h), with 280 kt (518 km/h) as an objective (with these two numbers bookending the speeds of the SB>1 and the V-280). This compares with 151 kt (280 km/h) for the UH-60M. FLRAA’s unrefueled combat radius is to be at least 200 nm (370 km), with 300 nm (555 km) as an objective. Self-deployment range is to be 1,725–2,440 nm (3,195–4,520 km). The original UH-60A could fly 1,200 nm (2,222 km).

The Army’s FLRAA is required to carry 12 fully-equipped, 365-lb (165-kg) troops. The UH-60M can carry 11 at 290 lb (130 kg) each. Alternatively, the rotorcraft is required to carry an external cargo load of 8,000–10,000 lb (3.6–4.5 t) for 110 nm (204 km) at a minimum of 140 kt (259 km/h). The UH-60M has a hook capacity of 9,000 lb (4 t).

However, the Marine Corps wants a higher speed capability — between 275 kt (509 km/h) and 305 kt (565 km/h) at 90% maximum continuous power and 295–330 kt (546–661 km/h) at 100% intermediate power. This would appear to favor a tiltrotor. Other Marines-unique requirements include the ability to be based on L-class ships. SOCOM-unique requirements include air transportability in a Boeing C-17. Both want aerial refueling capability.

Industry teams are gearing up to bid for FLRAA. While the FARA aircraft is expected to be powered by the General Electric T901 Improved Turbine Engine under development for the AH-64E and UH-60M, but the Army does not have a program of record for a new engine for FLRAA, which is expected to require a 5,000–6,000 shp (3,700–4,500 kW) class turboshaft.

Bell and Sikorsky-Boeing used existing engines to power their JMR demonstrators: General Electric’s T64 in the V-280 Valor and Honeywell’s T55 in the SB>1 Defiant. As FLRAA gathers momentum, Bell has partnered with Rolls-Royce to develop an optimized propulsion system for both the V-280 and its V-247 tiltrotor proposal for the Marine Corps MUX ship-based unmanned aircraft requirement (see sidebar).

Rolls-Royce’s 6,000-shp class AE1100 engine for the Bell Boeing V-22 could form the basis of a propulsion system for FLRAA. The Army, meanwhile, has funded science and technology efforts to develop technology for possible future FLRAA-class powerplants — the Future Affordable Turbine Engine (FATE) with GE, and the Alternative Concept Engine (ACE) with Honeywell-Pratt & Whitney joint company Advanced Turbine Engine Company (ATEC).
While Army aviation leadership portrays the fiscal 2020 budget request as a victory for FVL, it comes at the cost of cuts to existing helicopter procurement programs. These include plans to stop buying new-build AH-64Es and slow the procurement of remanufactured Apaches over the FYDP. The Army also plans to slow procurement of new UH-60Ms and upgraded, digital-cockpit UH-60V Black Hawks over the FYDP. But the biggest billpayer is the Army’s Block II upgrade for the Boeing CH-47F Chinook heavy-lift helicopter. Boeing flew the first of three Block II development aircraft on March 28, but the Army wants to cancel or delay 542 Block II upgrades for regular Army CH-47F and only procure the refit for special-operations MH-47G.

Among other improvements, the Block II Advanced Chinook Rotor Blade (ACRB) restores the lifting capability lost to weight growth over the years.

Justifying the plan, Army leadership says the CH-47F Block I fleet is the youngest in the service and it has over 10% more Chinooks than it needs. Boeing, which expects to deliver the last CH-47F Block I to the Army by 2021 and is under contract for the first eight MH-47G Block IIs, says canceling the upgrade for the CH-47Fs would “hamper soldiers’ abilities to carry critical payloads,” including the up-armored Joint Tactical Light Vehicle and extended-range howitzer.

Learn more about Future Vertical Lift — past, present and future — at www.vtol.org/FVL. Included is the key role that VFS played in initiating and supporting FVL since 2008, aircraft development reports, and the 2016 RFI’s for Capability Sets 1 and 3. A link to the April 2019 Sources Sought Notice is also included.

About the Author
Alan Graham is an aeronautical engineer who has been tracking the development of aerospace technology for nearly a half-century.