

The Sikorsky-Boeing Defiant JMR demonstrator reached 205 kt (380 km/h) on June 9. (Sikorsky-Boeing photo)



US Army Keeps FVL Moving Forward

By VFS Staff

The US Department of Defense (DoD) Future Vertical Lift (FVL) initiative is a multi-faceted effort with two next-generation Army rotorcraft acquisition programs, as well as studies underway by the US Navy, US Marines and other services for additional development programs (see the VFS resource page: www.vtol.org/FVL).

The Army's Joint Multi-Role (JMR) technology demonstrators continue their flight testing in support of the development of the Future Long Range Assault Aircraft (FLRAA). The two competitors for the service's Future Attack Reconnaissance Aircraft (FARA) are also progressing with their demonstrators, expected to fly in late 2022.

FLRAA

The two JMR demonstrators continue flying as part of the bridge funding to an acquisition program. In March, the Army announced that it had awarded Competitive Demonstration and Risk Reduction (CDRR) agreements to Bell and Sikorsky-Boeing for FLRAA. Bell has continued to fly its V-280 Valor tiltrotor and the Sikorsky-Boeing team is flying its SB>1 Defiant compound helicopter.

On June 9, the Defiant reached 205 kt (380 km/h). As the aircraft exceeded 200 kt (370 km/h) true airspeed, Sikorsky chief test pilot, Bill Fell said, "Just the beginning here. This thing's got a lot more in it." Fell told reporters on a Zoom call that the engines were putting out less than half their maximum power. He said the company was projecting the SB>1 would reach 250 kt (463 km/h) "within a few months." By that time, the coaxial compound helicopter with integrated tail thruster had accrued 18 hours in the air since its first flight in March 2019 and had reached an altitude of around 10,000 ft (3,000 m).

Bell announced in August that the Bell V-280 Valor third-generation tiltrotor had recently completed five hours of flight over four sorties during an eight-day period. The aircraft had by then accrued nearly 180 total flight hours. The Valor first flew in December 2017 and reached 300 kt (555 km/h) in March 2019.

Meanwhile, GKN Aerospace has revealed new details about its composites development work on the Valor. As a partner in Bell's Team Valor, GKN designed and manufactured the entire thermoset composite V-tail for the JMR demonstrator aircraft.

Last year, GKN provided Bell with a pair of advanced thermoplastic induction-welded "ruddervators" — combination rudders and elevators that are the control surfaces on a V-tail — as well as two compression-molded access panels manufactured from reused thermoplastic waste material from the ruddervators. The company announced that the four replacement plastic components had been flying since late last year, accumulating 12 hours on V-280 test flights by June; these demonstrations reduce risk for the FLRAA program if the Valor is selected for production.

GKN said that the V-280 is one of the first military aircraft successfully flying with thermoplastic components. GKN's design team continues to work with Bell to optimize the V-Tail design to meet customer requirements for the FLRAA program. Advanced thermoplastic components significantly reduce weight, cost and parts count over thermosets.

Rolls-Royce announced on July 21 that it would provide the propulsion system for the production V-280 replacing the General Electric T64s in the prototype. "Rolls-Royce will provide the propulsion solution for the refined V-280 Valor design as well as an advanced infrared suppressor system to deliver greater range and enhanced survivability to the Army. Through early collaboration on the system from the inlet to the suppressor, Bell and Rolls-Royce will deliver a low-risk and reliable integrated propulsion solution to the Army." The announcement did not specify the engine type, but it would likely be a derivative of the Rolls-Royce T406 turboshaft engine that powers the Bell-Boeing V-22 Osprey.

Meanwhile, Karem Aircraft has progressed to the turbine engine test phase of its large, 36-ft (11-m) tiltrotor nacelle (see "Army Decides on FARA and FLRAA," *Vertiflite*, May/June 2020). The company's patented



Bell has continued flying its V-280 Valor demonstrator, with more than 180 hours accrued to date. (Bell photo)

Optimum Speed Tiltrotor (OSTR) technology uses individual blade control (IBC) for primary rotor blade pitch and higher harmonic control. The actuators have passed a series of test conditions exercising cyclic and collective control throughout the rotor speeds consistent with operation of their two-speed transmission. Additionally, the IBC actuators have demonstrated the ability to correct for mast moment offsets, which reduces the maintenance requirements needed for rotor system track and balance. The full-scale, single-rotor tiedown (SRT) article began testing in October 2019 with a 500 hp (375 kW) electric drive, testing a wide RPM range.

The fourth company in the JMR demonstration effort, AVX Aircraft, continues its studies for the coalescing FLRAA requirements. AVX has been refining its Coaxial Compound Helicopter (CCH) design for a decade under JMR. Under the FLRAA design effort, the company is evaluating both CCH and tiltrotor design configurations.

FARA

In March, the Army also selected Bell and Sikorsky to continue into phase two of the FARA Competitive Prototype (CP) program.

Bell announced the nine leading members of its team for its 360 Invictus demonstrator:

- **Astronics Corp.** for a modular framework of airframe power generation, conversion and distribution products
- **Collins Aerospace** for integration of a new generation of avionics hardware and software featuring cyber-hardened and digital backbone solutions to configure and integrate mission systems
- **GE Aviation** for the 3,000 shp (3,300 kW) T901 engine and the aircraft Health Awareness System
- **ITT-Enidine** for the passive Liquid Inertia Vibration Eliminator (LIVE) units for all modes of operation including high speed
- **L3Harris Technologies** for the WESCAM MX-15D, an advanced, stabilized multi-sensor, multi-spectral imaging and targeting system
- **Parker Lord** for rotor dampers, the main rotor centrifugal force (CF) bearing, the tail rotor tension torsion strap, and the active vibration control (AVC) system
- **Mecaer Aviation Group** for a fully retractable, tail dragger landing gear system
- **MOOG** for flight control computer (FCC) electronics, software and flight control actuation, critical components of the Bell fly-by-wire, flight control system (FCS)



Karem is conducting high-speed tiedown tests of its 36-ft (11-m) diameter OSTR rotor.

- **TRU Simulation + Training** for a high-fidelity flight simulator that gives pilots a true sense of the aircraft flight controls

Sikorsky's 11,000-lb (5.5-t) S-97 Raider was scaled up as its Raider X for the 14,000-lb (6.4-t) FARA. The company has been flight testing its S-97 since 2015.

International Interest

On July 14, the US and United Kingdom agreed to work together on joint modernization of the US and British Armies. UK Minister of the Armed Forces James Heappey and US Secretary of the Army Ryan McCarthy signed a memorandum of agreement that covers complementing capabilities from 2023 to 2027. According to the UK Ministry of Defence, the plans focus on:

- **Networks** — the shared development of digital infrastructure to support UK/US operations
- **Long Range Precision Fires** — improving the bilateral capability development
- **Future Vertical Lift** — creating closer affiliation in the development of next-generation rotorcraft capability
- **Soldier and Ground Lethality** — building on the existing collaboration to improve the effectiveness of land forces
- **Assured Positioning, Navigation and Timing** — providing greater coherence in the development of multi-domain technologies

The agreement is a sign of intent to formalize a number of ongoing initiatives between the two militaries, boosting opportunities to co-operate effectively as modern warfare continues to evolve. “Key cutting-edge capabilities have been identified for closer collaboration to help narrow the gaps between UK and US forces so we can operate seamlessly together in future battlespaces,” the MOD said in the news release.

McCarthy noted the following day that the UK was interested in both the transport and attack variants of the FLRAA, explaining on a media call:

[T]he agreement puts together the work plan for our respective services to meet over the next several months and have the back-and-forth where they get to see the capabilities that can best support their needs and how they’re interoperable in nature, how we could co-develop certain capabilities that can help us get the next-generation weapons system but also to be complementary, if necessary, for our forces as we deploy here. There’s obviously a special relationship; we always fight together. So there’s as much potential economic benefits or military benefits. So they’re going to be back and forth a lot with [the US Army Program Executive Office] PEO Aviation and the Future Vertical Lift [Cross Functional Team] CFT, as well as long-range precision fires. The weapons systems today that the US Army is developing are the ones you’re going to look at, like the precision strike missile and the long-range fires portfolio, as well as the attack reconnaissance version of the long-range assault.

So the UK is looking at whether they would recapitalize [the M142 High Mobility Artillery Rocket System] HIMARS or they would go to [Precision Strike Missile] PrSM, for example. On the lift side, they are right-sizing their portfolio of lift platforms today. So they’re on the cusp of another procurement of CH-47 Chinooks, but they’re also looking at, over the long term, what would ultimately be the replacement platform, potentially long-range assault aircraft.

Several nations are believed to have some kind of observer status in the FVL program, but this was the most concrete step forward that has been announced to date.



The Army limited FARA to a 40-ft (12-m) rotor diameter to allow operations in urban canyons, such as shown here with the Bell 360 Invictus. (Bell)



The FARA gross weight limit of 14,000 lb (6.4 t) makes Sikorsky’s Raider X concept nearly 25% heavier than its S-97 Raider demonstrator. (Sikorsky)



UK Minister of the Armed Forces James Heappey (left) and US Secretary of the Army Ryan McCarthy signed an agreement that includes FVL. (US Army photo)