Lockheed Details Hybrid Wing-Body Future Tanker

Lockheed Martin is developing short-takeoff, hybrid wing-body tanker for U.S. Air Force next-gen 'KC-Z'

Aviation Week
Lara Seligman

As the U.S. Air Force sets its sights on a more survivable next-generation tanker that will be able to support strike assets in increasingly dangerous battlespace, Lockheed Martin believes it has the answer: a fuel-efficient, hybrid wing-body aircraft that can take off and land on short runways for maximum operating flexibility.

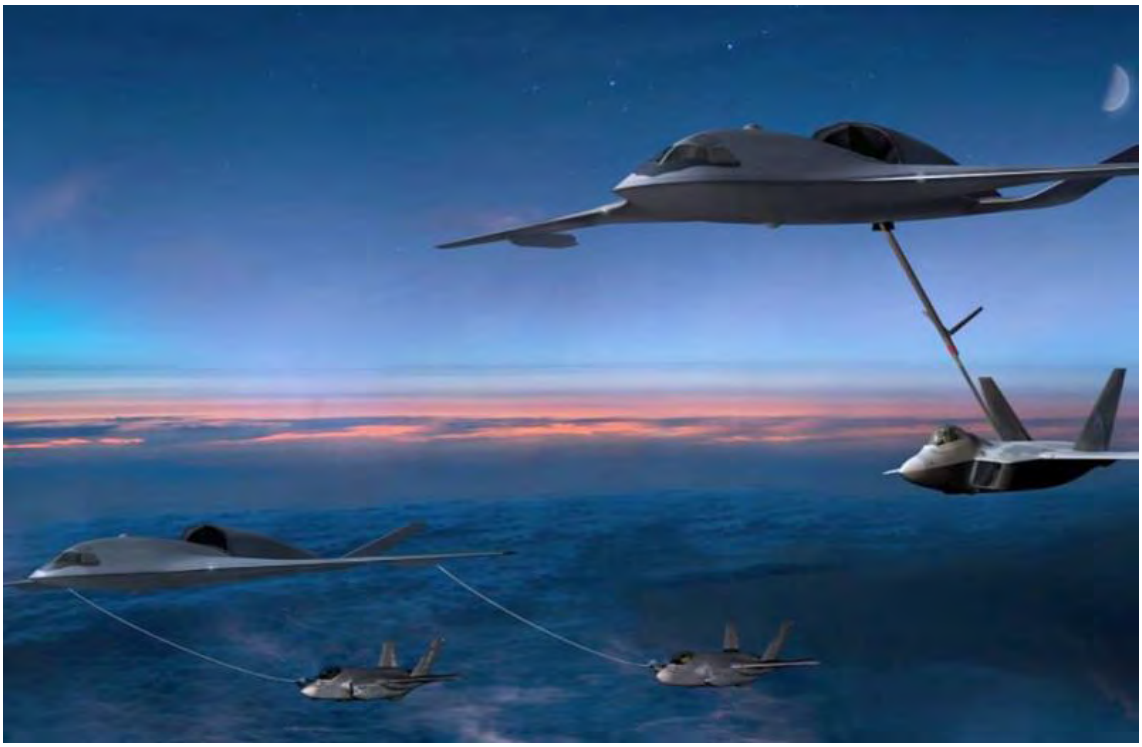
Gen. Carlton Everhart 2nd, chief of Air Mobility Command, recently kicked off an effort to study a next-generation "KC-Z" tanker—one that may look very different from the large-bodied, commercially based KC-10s, KC-135s and KC-46s of today. As adversaries such as Russia and China develop sophisticated surface-to-air missiles (SAM) and antiaircraft weapons designed to foil U.S. forces' ability to penetrate their airspace, the tanker of 2035 and beyond is increasingly vulnerable, Everhart says.

Ahead of an official Air Force study on the future tanker, expected to begin within the next six months, industry is already gearing up to solve this problem.

If you ask Kenneth Martin, Lockheed Martin's principal engineer for advanced mobility, the new battlefield necessitates a lower-signature—if not fully stealthy—refueling aircraft that moves away from the commercial-derivative tankers of years past. The future tanker fleet will need to be able to operate 500-250 mi. from the threat, outside the reach of modern SAMs but well within range of enemy radars and air-launched missiles, Martin calculates. This means the next-generation tanker will need a lower radar cross-section than conventional refueling aircraft, but it does not need to be "quite as pointy and as sharp" as an F-35 or an F-22, he says.

Lockheed's vision builds on the company's Hybrid Wing Body (HWB) concept for a more fuel-efficient future airlifter, which combines a blended wing and forebody for aerodynamic and structural efficiency with a conventional aft fuselage and "T" tail for airdrops. The next-generation tanker may compromise with an "H" tail configuration, which would give the operator robust flight control and stability compared to a pure blended wing-body configuration, such as the B-2 stealth bomber or the V-shaped tails on the F-117 Nighthawk stealth fighter, Martin says.

"It's still going to probably look a lot like an airlifter," Martin says. "It's not going to be a pure flying-wing, delta-wing sort of airplane because it still needs to be an efficient, everyday Air Mobility Command asset."



Lockheed Martin's next-generation tanker proposal may feature embedded engines for a reduced radar cross-section. Credit: Lockheed Martin Concept

Where HWB has large overwing nacelles designed for fuel-efficient, very-high-bypass engines, Lockheed's next-generation tanker proposal may feature embedded engines for a reduced radar cross-section, according to Martin.

"We like the location on our Hybrid Wing Body—the over-the-wing placement—for many reasons: It keeps the engines away from the ground [limiting foreign-object debris]; and, for a tanker, moving the jet wash higher on the airplane is conducive to a benign refueling environment, so I think the engines will end up in a similar location," Martin says. "Whether it is two big engines or four smaller ones mounted in ducts is still something we're working on."

Mindful of the cost of application and maintenance, Martin's team is still assessing the degree of stealth coating needed by the next-gen tanker. They also are weighing use of advanced defensive or offensive countermeasures such as lasers.

Martin says they are still determining the right balance between offensive countermeasures and inherent aircraft survivability. But the tanker's vulnerability problem is not limited to its airframe—the very act of refueling provides a target for enemy radars. He suggests that automating the refueling process will enable quicker, safer operations.

"If we believe Google and others that we'll all be operating self-driving cars, it seems to us the technology is being matured across the entire [science and technology] community to allow significantly more automation," Martin says (see page 69). "We're committing very hard to perhaps not totally eliminating the boom operator but recreating the operator's job to be a systems monitor; it could even be a copilot who is basically monitoring the process."

Tackling the age-old problem of basing is also on Martin's agenda. Large, commercially derived tankers take up valuable ramp space and require lots of infrastructure for care and maintenance, but the number of bases worldwide that can accommodate that type of aircraft is limited. Martin is therefore pushing for a platform that will be able to take off and land in spaces about half the size that a KC-10 or KC-135 requires, which allows the Air Force to more effectively distribute its tanker fleet across the globe.

Lockheed Martin's HWB concept for a next-gen airlifter combines a blended wing and forebody for aerodynamic and structural efficiency with a conventional aft fuselage and "T" tail for air drops. Credit: Lockheed Martin Concept

"If there [are] only 10-15 bases in the entire region where you can take off and land, it limits where aircraft can operate," Martin says. He adds that the idea is to eventually enable tanker operations from smaller, regional airports. "This opens up some options for distributing our forces—putting tankers at more locations—which brings an inherent reduction in vulnerability to attack. It also allows us to fly the tankers with significantly more options for diverting in case of emergency."

To effectively design a short-takeoff-and-landing (STOL) tanker, Lockheed's proposal will draw on the Air Force Research Laboratory's Speed Agile concept demonstration project, a decade-long collaborative effort with NASA, Boeing and Lockheed to develop technology for a stealthy, STOL airlifter capable of delivering loads directly to the battlefield. Speed Agile, which supported the U.S. Army-Air Force joint future theater lift program, ended in 2012 without transitioning to a development program, following the demise of the Army's Future Combat Systems. But Martin regards Speed Agile as a success, noting that Lockheed was able to perfect and verify in large-scale wind-tunnel tests many aerodynamic and propulsion integration tools now being considered for the next-generation tanker.

For now, Martin is working with NASA to outline a path for an ultra-efficient, subsonic demonstration program, which he hopes will feed into a fully-fledged next-generation tanker vision.

“We would like to take that technology and fly it—the aerodynamics, propulsion and structural integration technologies,” Martin says. “I think that really gives us the basis and the low-risk position, technology-wise, to move forward to something that is not, quite honestly, another derivative airliner tanker.”