Dragonfire Laser Could Inform Next British Fighter Weapon

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During 2019, British industry will demonstrate a directed-energy laser weapon for potential use on land and sea.

But the team behind the UK's Dragonfire industry consortium developing the weapon is also beginning to consider how such a weapon could be mounted onto a future combat aircraft.

Dragonfire will demonstrate a fiber laser with a 50 kW output in 2019 tests.

Laser will put a focused beam the size of an English penny 5 km away.

The UK's vision for a future combat aircraft—like that shown in mockup form at the Farnborough Air Show in July (*AW&ST* July 23-Aug. 19, p. 38) —envisions the integration of such a weapon, not only for self-defense, but also in target identification and visual range combat.

The energy requirement behind a laser weapon is one of the drivers behind Rolls-Royce's third-stream approach to engine design, incorporating a controllable bleed system capable of providing additional electrical power as well as a core-driven generator.

Dragonfire, a consortium of prime contractor MBDA, Leonardo, Qinetiq and with support from Arke, BAE Systems, GKN and Marshall Aerospace, was selected to develop a UK-sovereign laser weapon technology demonstrator for the UK's Defense Science and Technology Laboratory's £30 million ($39 million) Laser Directed-Energy Weapon Capability Demonstrator (LDEW-CD) back in 2016.

The Dragonfire industry team has packaged the laser into a turret on a naval platform as pictured, but the laser system itself will be installed into several standard shipping containers. Credit: MBDA Concept

Next year, the companies will take their 50 kW-class laser to sites in Shoeburyness, England, and the Outer Hebrides, Scotland, and unleash it against a range of targets, testing the Dragonfire's ability to track targets and focus its beam on a spot no bigger than a British penny some 5 km (3 mi.) away.

The British approach is to use a fiber laser that uses tens of glass fibers through which light is shone. The benefit of this method is that the light is stable. But the challenge comes in aligning and combining the numerous beams into one single powerful parallel beam. It is the UK's approach to combining the beams which is being kept secret for now.

"There is often a perception that more power is better," says Brian Colwill, head of new business at MBDA's new Sparkworks, its Lockheed Martin Skunk Works equivalent leading the development of directed-energy weapons and conducting rapid research.

"But without control, power is nothing. . . . By controlling how well combined the beam is . . . that allows us to make it really efficient," he says.

Keeping the laser on such a narrow spot when a target is potentially moving is one challenge;

keeping the laser pointed on one spot when the slightest vibration can be amplified in terms of movement 5 km away another. And then there is the atmosphere, which can diffract and dilute the power of the laser due to haze or heat shimmer.

As part of its work, the Dragonfire consortium has designed a turret that will house the laser and its associated targeting systems, including an electro-optical camera and a second lower-power laser for imaging and tracking. Adaptive optics help to deal with the atmosphere's impact, as fast-moving, dynamic mirrors like those used on optical telescopes compensate for the variations found in the air due to temperature.

A laser weapon is one of the considerations behind giving a potential future British fighter a third stream in the engine, as well as a core-driven generator to boost electrical output.

Many of the technologies have emerged from the capabilities of the consortia companies. A good number of the algorithms, for control and imagery for example, have come from MBDA's Asraam short-range air-to-air missile; the beam-combining methods result from research by Qinetiq; and Leonardo's experience in laser designators has been invaluable, says Colwill.

Putting the laser on an aircraft will provide a new set of challenges, the biggest one being vibration impacting the accuracy of laser targeting.

"At the moment, we [the Dragonfire consortium] are more focused on land and maritime, but we are not forgetting the air domain," says Colwill.

With two members of the consortium—MBDA and Leonardo—involved in the Tempest industry team tasked with studying future combat air technologies, they are advising the UK defense ministry on size, weight, power and cooling of a potential aircraft laser weapon and the potential roles it could undertake.

Such a system could perform long-range identification of targets, and self defense by dazzling or damaging the seekers on inbound air-to-air missiles, as well as damage and destroy air and ground targets.

Colwill says he is undecided whether the laser would replace or merely supplement the traditional integrated gun. "The obvious benefit of the gun is a flash and a sound, which has its own effect. . . . With the laser, all you get is the whir of a generator."

The next step beyond the LDEW-CD process, which would repackage and integrate Dragonfire onto a ship or land-based platform enabling the technology, is yet to be funded. That would allow the Royal Navy and British Army to explore the concept of use and operations for laser weapons. The future of such weapons looks increasingly brighter however, now that the UK's Weapons, Evaluation & Capability Assurance office has formed a full-time so-called novel weapons team.

"There is a strong pull now that directed-energy weapons can make a big difference on the battlefield," said Colwill. "We are now at that turning point," he suggests.