

Evolution promises a long stealth life

By adding new, exotic weaponry and electronic warfare capabilities to its armoury, Lockheed Martin's F-35 will underpin US Navy and Marine Corps aviation for decades

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The US Naval Air Systems Command (NAVAIR) may have declared initial operational capability for the Lockheed Martin F-35C in February 2019, but the evolution of the stealth fighter – and its US Marine Corps (USMC) cousin, the short take-off and vertical landing (STOVL) B-model variant – is far from over.

To help the aircraft outgun and avoid long-range anti-aircraft and anti-ship missiles from China and Russia, the Joint Strike Fighter (JSF) programme plans to continually update the F-35 Lightning II's internal software and hardware, as well as its ability to carry new sensors and weapons.

New technologies on the horizon include extended-range air-to-air missiles and lasers, as well as continuous software upgrades, which could improve the aircraft's manoeuvrability and its ability to make sense of a torrent of battlefield data.

On the flip side, the JSF programme is working hard to reduce the cost of operating the B and C models. The stealth fighter costs on average \$35,000 per hour to fly – as opposed to the \$18,000 per hour claimed by Boeing for the F/A-18E/F Super Hornet.

All this is going on as the fighter's key characteristic – stealth – is increasingly doubted as a trump card in aerial warfare. Boeing has convinced the US Navy (USN) to buy dozens more non-stealthy Super Hornets. It has also persuaded the US Air Force buy F-15EXs.

For its part, the USMC will become an entirely fifth-generation fleet in 2030. It will hold on to some Boeing AV-8B Harrier IIs until 2028 and legacy F-18 Hornets until at least 2030.

The USMC declared initial operational capability with the F-35B in 2015 by the USMC, and in September 2018 flew its first combat mission – an air strike in Afghanistan – from the amphibious assault ship USS *Essex*.

The USN says its first deployment of the F-35C will not come until 2021. The service

plans to steadily increase the stealth fighter's presence on carrier decks, but will not reach a 50-50 mix of Super Hornets and F-35Cs until 2030.

In light of the prolonged life of fourth-generation aircraft, Boeing has gone so far as to say that the application of Lockheed Martin's F-35 stealth technology has been reduced to niche missions. However, the F-35's role is increasingly seen as an advanced scout and air commander, Rear Admiral Scott D Conn, the navy's director, air warfare, told the US Senate Armed Services Committee on 10 April.

OPERATIONAL ROLE

"I foresee the F-35 forward operating, sensing, collecting and relaying information back to a weapons truck, known as a Super Hornet," he says. "I see the [Northrop Grumman] E-2D involved in relaying critical information to all those fighters out there, while the [Boeing] EA-18 Growler with next-generation jammers is providing coverage. So it's that systems of

systems. It's quite frankly, where the whole is greater than the sum of the parts."

To allow the F-35C to operate beyond its 1,200nm (2,200km)-range limitation as a kind of airborne early warning and control aircraft, the USN envisions it being topped up by Boeing's developmental MQ-25A Stingray unmanned refuelling tanker. That could help keep long-range anti-ship and anti-aircraft threats – weapons increasingly deployed by China and Russia – at arm's length.

The F-35C is particularly well suited for this forward operating role because its stealth, suite of sensors and weapons load allow pilots to react quickly to enemy aircraft, says Douglas Barrie, senior fellow for Military Aerospace with the International Institute for Strategic Studies in London.

"If you can get inside your opponent's decision cycle, you can stand a better chance of winning and surviving. And they stand a greater chance of losing," he says. "Forewarned is forearmed."





Initial operational capability for carrier-based F-35C was declared in February

US NAVAL AVIATION F-35 Lightning II

Lockheed Martin

In addition to killing its own prey, an F-35C could also gather targeting data and call back to a Super Hornet to fire on air or ground targets using long-range missiles, adds Conn.

Flying any aircraft over the Pacific or around the fringes of Russia has become more complicated. Networked radar and missile installations on islands surrounding mainland China, especially sprinkled across the South China Sea, are making covert operations more difficult, even for the F-35.

“They get more angles in which to see US aircraft. Radars which are networked together, coming at the aircraft from different angles with different frequencies, just extends their network and makes it more robust, harder to attack,” says Andrew Hunter, senior fellow in the International Security Program at the Center for Strategic and International Studies in Washington DC. “Obviously, the Russians are very good on the technology and have amazing, capable missiles systems as well as radars. They don’t seem to have quite the same numbers that the Chinese have at this point. They are more fiscally constrained.”

Against such threats, Conn says he still maintains his confidence in the F-35.

“If I had to go over the beach in some areas, it makes more sense to send an F-35 than a Super Hornet,” he says, using a euphemism for flying over the coast of another

sovereign country.

To enable the F-35 to play such a leading role in USN and USMC operations, the JSF programme needs to increase the fighter’s mission capability rate and reduce its life-cycle costs.

All variants of the F-35 should reach an 80% mission capability rate by September 2020, Vice Admiral Mathias Winter, executive officer of the Joint Program Office told the US House Armed Services Tactical Air and Land Forces Subcommittee on 4 April. Currently, the F-35B has a 64% mission capability rate, while the F-35C is at 84%. The JSF is targeting a \$25,000 per flight hour operating cost by 2025.

MAINTENANCE TASKS

Much of the USN and USMC’s ability to cut costs will come with experience flying and repairing the F-35, says Hunter.

“Generally, as we have operated stealth aircraft now for almost three decades, the cost of maintaining them has come down. The materials we have used have come a long way,” he says.

However, Hunter notes: “I don’t expect stealth aircraft will ever be quite as cheap as non-stealth aircraft because there are maintenance tasks you have to do [that] you just don’t have on non-stealth aircraft.”

For Conn, the three top priorities for upgrading the USN’s aircraft fleet are automa-

tion, manned-unmanned teaming and artificial intelligence.

“I see that as accelerating the observe, orient, decide, act [cycle] – to make quicker decisions, provide more lethal actions,” he says. “I see that driving simplicity down to the lowest possible level, because our tactics are overly complex.”

Over the next decade, both F-35 variants are also likely to increasingly be used as electronic warfare platforms, says Barrie. “We will be opening up its capabilities in the electro-magnetic warfare spectrum – how the aircraft can be used in terms of suppression of enemy air defences, destruction of enemy air defences: hard kill or soft kill.”

Other areas to watch include the addition of beyond visual-range air-to-air missiles, such as the MBDA Meteor, which is planned for integration onto the UK’s F-35B fleet. Laser or high-powered microwave weapons, as well as radio frequency warheads, could also appear, says Barrie.

By 2030, the USN wants to be ready for its next aircraft, says Conn. “Then we are going to have to have a [Next Generation Air Dominance] discussion,” he says, naming the USN programme to find its next fighter.

“The [analysis of alternatives] will be complete in the next couple of months. The report [will be] out this summer, which will inform future choices,” he says. ■