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Very best of the next generation

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The F-35s (the Joint Strike Fighter) have thus far completed more than 6000 hours of flight tests and training. Source: Supplied

THERE is a poster on the wall of the Lockheed Martin plant at Fort Worth, Texas. It reads: "Not seeing is believing."

The idea is simple. In the air, if you can't see your enemy, he kills you. This is the poster's droll rendering of stealth technology, the sheath of radar semi-invisibility that cloaks the F-22 Raptor fighter and its first cousin, the F-35 Lightning 11, the Joint Strike Fighter, the plane slated to become the backbone of Australia's air defence.

Stealth comes from several sources. One is the shape of the plane. It needs to be as smooth, as elliptical, as can be. That is very difficult in a combat aircraft, which may need weapons systems, fuel tanks and sensor pods mounted externally.

The F-35 has no such protuberances. I meet my first F-35 in a hangar at Fort Worth. Though I will see them in full flight at Eglin Air Force base in the Florida panhandle a few days later, this first meeting is a powerful encounter. Gunmetal gray, the F-35 looks like some giant bird of prey from the dinosaur age, its wings half folded back in an arrogant pose of cruising and diving. It is supremely self-contained, 8000kg of fuel, several thousand kilograms of weapons, all tucked quietly inside.

Human beings have created very few devices of any kind more sophisticated and complex than the F-35. Standing on the shoulders of all the planes that came before, the F-35 is result of $50 billion more development, with each plane containing nearly nine million separate lines of computer code. It is not only the shape of a plane that produces stealth. The hi-tech super-secret coatings and treatments that cover every

centimetre of the surface make life difficult for opposing radar.

Then there are the secret measures, the classified elements that no one must know, that produce LO and VLO - low observability and very low observability.

It is an exaggeration to say a stealth plane is invisible. When it opens its weapons bay, it creates a signature. When it gets too close, it's observable. The opposition radar designers do what they can to defeat stealth. Technology is always a cat-and-mouse contest.

But stealth also does its job if it merely disrupts the enemy's kill chain. Enemy radar must identify the F-35, track it, send this data to a weapons system, then have that weapons system deliver a strike on the F-35. A fleeting glimpse for the enemy may not be enough to do all that.

"There are typically two sorts of people who believe in stealth," a lean, wiry test pilot tells me.

"The first is those who have flown stealth. The second is those who have flown against it."

For them, not seeing is believing. Another test pilot tells me F-16 pilots hate flying in mock combat against the F-22s, even if it means soft duty in Las Vegas and the Arizona test fields. It's not just that the F-16 always loses. It's more that there's no fun in the encounter. The F-16 pilot never even sees the Raptor. He just gets told his plane has been killed.

F-35s have now done 6000 hours of flight tests and training. Some 58 planes have been built and delivered to customers. The plant at Fort Worth is producing three planes a month.

I drive, in something resembling a golf cart, down the mile-long production line. I see there the two planes Australia has bought, their production points proudly displaying the Australian flag. I touch the wings with their mysterious coatings and cannot believe how slim and light they are, though they are made of titanium. At every point this plane is a work of style and grace.

The Raptor is the king of fighter aircraft, but the F-35 will be the prince, and coming later than the F-22 it will benefit from lessons learned on its predecessor.

If there were no end of money you would design a different plane for every mission.

But there is a limit to money and that's why you have the F-35, a multi-role plane. It will become the main combat aircraft for the US Air Force, navy and marines and, if things go well, for 10 US allies as well.

There are trade-offs involved even for a system as complex and involved as the F-35. It sacrifices some turning ability for stealth. It sacrifices a fraction of manoeuvrability for speed and range. But what is undeniable is that for decades the F-35 will be the most survivable aircraft, the very hardest to kill.

Much of its new capability comes from its integrated sensors, and the ability to share and integrate data with other F-35s, and other air and ground buddies. Each F-35 is a system of systems in itself. A squadron of F-35s is an exponential increase of that capability.

As a result, an F-35 pilot won't really be flying a plane on his own. He will be part of a wolf pack. Targeting will be uniquely precise, and early, because of the fusion of countless data points.

The utility, the centrality, of stealth is evident in the enormous efforts Chinese and Russian military aircraft designers are making to produce their own stealth aircraft. But they are a long way behind. In military matters, hi-tech leadership and manufacturing capability have not fled the US. It remains the gold standard.

The F-35 will remain at the leading edge of military technology for decades. This is ensured in part by the continuous upgrade path for the software. With the three US services, eight international partner nations and two other customers (Israel and Japan) all underwriting the cost, this will be a well-resourced program. It is the sort of upgrade path Australia could never aspire to on its own.

Like every giant step up in technological capability, the F-35 has faced serious problems in development.

The biggest early setback was mis-estimating the weight of the short take-off and vertical landing (STOVL) version.

After the big delay caused by the need to trim the STOVL's weight, congress and the US government became impatient with the program. Washington appointed Lieutenant-General Christopher Bogdan to oversee the program; he is independent of Lockheed Martin and at times fairly caustic about its early management mis-steps. But he is fully confident about the program now.

The marines will take delivery of a combat-ready squadron in 2015. It will then go on permanent deployment with the marines in Japan in 2017. The USAF is likely to follow the marines in 2016. Then there will be an Israeli deployment, then a Japanese deployment. Australia's first combat squadron, assuming we don't change our minds, is due to come into active service in 2020.

The controversies about the F-35 remind me of the derision the F-111 attracted in its development phase. The F-111, of course, went on to become Australia's strategic strike capability for decades.

But whereas there were only about 500 F-111s built, and we were the last to operate them, there will be 3000 or more F-35s and they will be manufactured for decades to come.

This has enormous implications for their ability to be supported and maintained.

Australia is notionally planning to buy 100 F-35s, though this figure is pretty fudgeable.

When you acquire genuine world-leading new technology, there are always alarums and diversions, delays and cost over-runs. We are a wealthy nation with a very small population in a teeming region with more than its share of instability. A key ingredient of our national security doctrine is to maintain a technology edge over our neighbours. But most of the region now has fourth-generation fighters with essentially the same capabilities as our own.

The F-35 is the best of the fifth generation. With constant American software upgrades, it would keep us ahead of the pack for decades.

We would be crazy to go any other way. If we did, not seeing might well become believing, quite bitterly.

Greg Sheridan visited Fort Worth as a guest of Lockheed Martin.