

COCKPIT F-35 IS CALLED REVOLUTIONAIR

Combat Forces was acquainted with the (JSF) cockpit demonstrator of the Lockheed Martin F-35 Lightning II at air base Gilze Rijen in The Netherlands. The cockpit is presented as being ahead of its time, but what's so special about it? At a first sight, we see only a few instruments like handles (throttle and stick) and a layout completely dominated by one large computer screen, and that's exactly the secret, all what you would expect is missing.

SENSOR FUSION

Anyone who tries to understand the "revolution" first needs to know something about what the phenomenon JSF is capable of it in 'combat' circumstances. There is talk of a 5th generation stealth aircraft and its design is commonly known, but other capabilities such as ability to super cruise and sensor fusion are less known and understood by the layman. Already 10 years of operational experience with the F-22 Raptor is the basic foundation and the United States are far ahead on other countries that have only stealth aircraft in development. In the background lots of progress was achieved in creating superiority in software and sensors.

Does the Raptor have 2 million lines of software codes in processing, the F-35 is already at 8.6 million lines. The power of computer and its software has increased dramatically, and not only that, also the sensors were getting better and better. A target is seen at a great distance, while the F-35 remains absolutely unseen. With high precision a missile can be fired at the opponent, or precision bombs like JDAM and the enemy would not have known that you have ever been there. And this all in a sort of 'gaming' monitor. Stealth is no longer a luxury in the modern air battle but a necessity for survival.

COMPUTER REDUCES WORKLOAD

The F-35 is a plane 'driven by software'. If in former times a modernization was to be executed of an F-16 or F-18 it mostly concerned some new computer hardware and instruments, now this has changed completely and will only happen with the JSF in replacing or adding new software to enable more process power. Like the F-16 it is expected that design and the use of advanced materials will persist for decades and it is foreseen in the design that this success will be prolonged in the F-35. Considering even better and faster software in future one can say that the F-35 is purchased on software growth. Because essential information, such as system information which does not require critical decision from the pilot at any time it is regulated autonomously by the computer, the pilot has much less important decisions to make and he can lay his attention entirely on tactics.

A large 20x50 inch display consisting of large liquid crystal touch screens with sophisticated color symbols and icons provides a new set of images in various layers. Just with your fingertips on the screen. Under the touchscreen are 12 smaller screens and under that various other images again. This technique was already implemented in the first YF-22 proto-version but not chosen for the F-22 Raptor, in the meantime now dramatically developed for the F-35. Actually, the whole system consists of two identical and merged working displays in which one can take over the other in case of failure.

The choices on what is presented to the pilot and what the computer holds behind in own management is extensively checked and thought over by test pilots of all the participating developing countries. Pilots could easily be overwhelmed by data which effected the concentration on the tactical level and therefore ingenious people looked for solution. Sensor fusion means to take the human out of the decision process where possible and only to provide information he needs to proceed the attack. All data are synthesized and provides on one single comprehensive display and the pilot doesn't care where the data came from but only care about what is presented to him and this is complete shift with the classical running of the cockpit. Sensors, radar, electronic warfare, electro-optical sensors are synthesized in a system called

Distributed Aperture System (DAS). Pilot control of the aircraft is utilized by hands-on-throttle-and-stick (HOTAS). All kinds of buttons are situated on the controls like all essential flight movements but also weapon handling. Those controls are also 'active' by providing continuous feedback and permit real-time control. According to our demonstrating Canadian test pilot Billie Flynn, the plane can turn up to 9G with 'thrust vectoring by the engine exhausts and enables an "angle of attack" of 70 degrees as possible, a kinetics technique that has not been seen by others.

AS CLEAR AS POSSIBLE

Direct Voice Input is used to have control on some instruments by using the voice. However it is very effective it takes time to pronounce words and so it is only used for some flight controls and processes not to be changed immediately what they called 'house keeping' functions. The display enables very clear awareness where you are in the moment and communicates in color symbols. Green messages are advisory, yellow messages needs pilot attention and red messages requires direct pilot interference. In the same way green indicates friends in the air, yellow for unidentified aircraft and red for identified opposing aircraft. The F-35 is the first production aircraft with a virtual head-up display projected on the screen of the helmet and can be projected in every direction which is very useful for weapon handling like attacks with rockets. This helmet mounted display (HMD) also boosts the awareness in the dark thanks to connection to 360 degree surround infra-red sensors and night cameras. The F-35 is going to be a real treat to fly and it is only in the beginning of its active operational life.

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