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New 5th generation fighters –the end of the US supremacy?

In 2017 numerous new information surfaced regarding the 5th generation fighter programmes undertaken by the Russian Federation, and People's Republic of China which are, as per the 2018 National Defense Review, and the 2017 National Security Strategy, considered to be main competitors of the US in the international arena.

Russian fighters

In case of the Russian 5th generation fighter programme, a new stage in the development of PAK-FA fighter (also known as T-50 and Su-57 since August 2017) was reached after new features were presented during the July 2017 MAKS Aviation Show. The 8th flying prototype was on exhibition at the airshow, designated as T-50-9. This aircraft, along the two previous prototypes (T-50-6-2 and T-50-8 – all three were revealed between April 2016 and July 2017) is significantly different from the previous constructs and is a noticeably more mature design. A number of external details are different in the new prototypes as contrasted with the old ones. The shape of the ventral fuselage to the back of the place was altered, so were the wingtips, and some of the fuselage panels. Some of the metal skin panels were replaced by composites. Likewise, the tailboom in the aft part of the fuselage was elongated further. The structural integrity of the airframe was also strengthened – this constitutes an important development, especially since the previous airframes had a tendency to suffer from stress fractures during high-g

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manoeuvres, and were provisionally strengthened by installing supporting overlays. It now appears, that the Russians have found a permanent solution to this problem.

The T-50-9 appears to be closer in overall design to the serial production aircraft than its predecessors. If Russian sources are to be taken seriously, the T-50-9 is the first instance when a serial production sensors suite was installed in the new fighter jet. The N036 Byelka X-band multimode AESA radar, with three of five arrays operating in the X-band, and two in the L-band. Employment of the latter should allow for an enhanced detection capabilities of other stealth aircraft. Furthermore, the L402 "Himalayas" electronic countermeasures (ECM) suite, as well as the 101KS Atoll electro-optical (EO) system, used for passive detection and tracking of heat sources and navigation. The 101KS Atoll is composed of 101KS-V Infra-red Search And Track System (IRST), four 101KS-U ultraviolet Missile Warning Sensors (MAWS), and the 101KS-O infrared counter-measure sensors used against heat-seeking missiles. Despite the data suggesting that the target sensor suite has been installed, it is not clear which of those sensors have already been successfully integrated into the airframe.

With no official data available on the topic it is also unclear is whether the newest prototype has been set from its known weakness – sub-par stealth characteristics. Back in 2014 news broke that the RCS of T-50 is anywhere between 0,1 and 1 m2. In comparison, the 2005 introduced F-22A Raptor has the Radar Cross Section (RCS) between 0.01 and 0.001m2, and the F-35A 0,01m2. When it comes to stealth properties the Russians lack capabilities comparable to those of the US, and the RCS of the T-50 is more akin to that of 4+ generation aircraft (Rafale and Eurofighter have RCS of about 1 m2, while the Polish F-16C 1.2 m2). It is possible, that since 2014 T-50's RCS has been lowered by perfecting the aircraft's shape and wide spread usage of panels made from radar absorbent materials, but it is unlikely that this was successful to the extent, that the new construct would match parameters of its US made counterpart. The substandard stealth properties were criticized by – among others – representatives of the Indian government, which is a financial contributor to the project, and is planning a future acquisition of a fighter based on technologies developed for the T-50 (PAK-FGFA).

The engines used by the PAK-FA – which is another vital element of the aircraft design – is suffering from a number of issues, many of which are also yet to be resolved. At the present time, T-50 uses the AL-41F-1 engines, which is an upgraded variant of the engine originally developed for Su-27. Trials of the Saturn izdeliye 30 engine, the target engine for T-50, are still ongoing. In December 2017, a T-50 prototype equipped in the izdeliye 30 engine made its maiden flight, but it is unlikely that testing of the new engine will conclude before 2020.

It appears that T-50, which received the designation of Su-57, and a green light for a production run in August last year, has so far failed to deliver on its promises. The programme is still suffering from major delays. The number of aircraft ordered in the first production run (to be manufactured by 2020) attests to this. While originally the first production run was to consist of 60 aircraft (out of a total initial order of 200), currently only 12 aircraft are on order, all fitted with interim engines. According to the current schedule, a production run of around 150-160 updated will be produced after 2020, as long as engine issues are resolved. The decline in the quantity of aircraft on order could be a result of a number of factors – Su-57's unsatisfactory parameters in its current configuration, poor cost-effect ration when compared with the Su-35 (4+gen aircraft, which the Russians refer to as gen 4++), as well as economic issues plaguing the Russian Federation. In this context, the February 2018 news about Su-57's deployment to Syria appear to be little more than a political demonstration, meant to portray Russia as an equal competitor to the US, which deployed its F-22's into this theatre. This impression is much misguided, however. Russian aircraft is a prototype equipped with onboard technology that has not been tested. It is not even clear, under what status were they operating under, or who were their pilots (Russian Air Force, or Sukhoi test pilots) – what is clear however is that they were not the active duty aircraft of the Russian Air Force.

PLAAF fighter

Chinese 5th generation aircraft programme appears to be at a more advanced stage than its Russian counterpart, with the J-20 fighter entering into limited serial production back in 2015. Since then six aircraft were completed in 2015-2016, followed by another six in 2017 (prior to this three technology demonstrators and five prototypes were built). All twelve aircraft have entered into service of the Air Force of the Chinese People's Liberation Army and are deployed by PLAAF's 176th Air Brigade stationed at the Dingxin AB. The aircraft located at the Dingxin AB are not in active service, and are used for trials and training instead. Furthermore, the current number is a mere drop in the ocean – as per official communiques, China intends to produce between 500 and 700 J-20's (in comparison, the

US currently fields 178 F-22's, and procurement plans for F-35A/B/C dictate completion of 2500 aircraft).

J-20's entry into service means, that the majority of technical and operational requirements of the project have been met, which likely included developing an aircraft capable of facing US 5th generation aircraft. Chinese stealth fighters are unlikely to be facing fuselage structural integrity issues, and are most probably utilising radar absorbent panels. The US estimates indicate, that J-20's RCS is roughly 0.025 m2, less than its Russian counterpart back in 2014. The figure most likely applies to the front of the aircraft. This is because China is yet to deal with the engine issue. So far the J-20's produced are using Russian made AL-31FM2 engines (similarly to the Su-57, this is an upgraded Su-27 engine) – which is a temporary solution. Eventually, the J-20 is to be equipped with two state of the art WS-15 engines, capable of producing a maximum of 180kN of thrust when using the afterburner. The development of the new engine is marred by delays – predictable when the difficulties faced by the more technologically advanced Russians are taken into account. It is probable, that a few more years will pass before the WS-15 enters into production. This is confirmed by the Chinese sources – in September 2017 the sixth J-20 prototype made its maiden flight, fielding – unlike its predecessors – a Chinese made WS-10X interim engine, rather than the target WS-15. The WS-10X was developed for PLAAF's fighters based on Su-27 (J-11, J-15, J-16), making it similar to the AL-31FM2 – with the added value of being domestically produced, allowing the PLAAF's J-20 programme to gain independence from the Russians suppliers. Production run aircraft equipped with the WS-10X engine, designated J-20A should be completed within the next few years, with the J-20B designation reserved for fighters equipped with the target WS-15 engines.

The J-20B will also boast a more advanced electronic warfare capabilities (it is not clear, whether EW suite has been implemented in to current versions of the aircraft), and will be equipped in a more modern gallium nitride or gallium arsenide based radar, far more capable than the currently used KLJ-5. The envisioned standard production line aircraft will also possess superior stealth characteristics. New engines will likely be quipped in square nozzles, rather than the currently used circular ones. Currently fielded aircraft are likely to be equipped in target optoelectronics and countermeasures systems.

At its current development stage, J-20 is not fielded alongside accompanying unmanned aerial systems (UAS), which are to facilitate easier detection of adversary 5th generation fighters. The prospective UAS will be radar equipped. Experts suggest, that J-20 will only be able to operate fully effectively (as in: able to engage in combat with F-22's on an equal footing) when acting as a part of a network centric system. It is not clear, when can this capability be achieved.

China is also developing a separate fifth generation fighter programme – J-31, which bears semblance to the US made F-35, and is likely based on more modest technological solutions than J-20. As of today however only two aircraft have been built, and the fighter likely will not achieve combat readiness before 2024. The development of the J-31 is moving along slow, as the aircraft is designed predominantly with exports in mind, and does not receive government funding.

Conclusion

1. Both the Chinese and the Russian 5th generation fighter programmes have achieved notable progress, but are still far from reaching the desired parameters. This reality is unlikely to change in less than 4-5 years, perhaps even more. Achieving an initial capability and forming an air squadron of J-20, and the deployment of Su-57 to Syria are to a large extent (especially in case of the Russian fighter) PR stunts. All timelines assuming entry into service by mid 2020's surmise, that the aircraft will not suffer from unexpected age of infancy problems – which appear to be unavoidable when it comes to 5th generation fighters, as proven by the development process of F-22 and F-35.

2. It appears, that PRC and Russian Federation aircraft will come up short of their US counterparts, and will not be able to face them in a 1:1 combat. Their parameters (primarily stealth capabilities, but also electronic suite) are not an equivalent to the US aircraft, and what's more, the continuously developed US made fighters will be tried and tested by 2025. Mid 2020's will be a time when the US aircraft will field lasers used not only in a defensive, but offensive role as well. The sensors suite of F-22 and F-35 is continuously upgraded. All of the above taken together means, that the primacy and air-superiority of the US will remain unchallenged.

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