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THERE'S A COUNTRY FOR OLD PLANES  
Why Cold War Era Fighter Jets  
Do Not Retire and Are Set  
to Share the Skies With Drones

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# About the Author

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# Introduction

January 2022 saw a fairly symbolic event in the recent history of military aviation: Norway became the first country to completely scrap the F-16 Fighting Falcon<sup>1</sup> fighter jet. It replaced its fighters with the F-35 Lightning II. Thus, the main symbol of the world's most successful fourth-generation fighter jet will pass the baton to a plane that was conceived as its successor. However, it's not as simple as it seems; reports indicate that assembly lines will be restarted for new export contracts including Turkey's purchase bid<sup>2</sup>.

The situation is evolving similarly with a number of fourth-generation platforms: Russia manufactures the Su-27's successors (the Su-30 and Su-35) for export and for the domestic use, the MiG-29 is promoted for export with varied success, while in the US, the latest upgraded F-15 is the most expensive export fighter jet available, and the US Air Force began to purchase them after a 20-year break with plans to procure up to 144 planes. It appears the platforms designed in the 1970s will be in fleets at least until the 2050s, with some estimates suggesting until the 2070s<sup>3</sup>. How did this situation come about? How does this compare to the production of fifth-generation fighter planes and the designing of new planes that journalists and marketing executives have begun calling "the sixth generation?"

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<sup>1</sup> Disregarding Italy, which initially leased these jets for air defence operations in 2003-2012 until enough *Eurofighter Typhoon* jets were delivered. Leasing F-16s stored in the US was cheaper than extending the lease of the *Tornado ADV* British interceptors.

<sup>2</sup> <https://russiancouncil.ru/en/analytics-and-comments/analytics/the-turkish-gambit/>

<sup>3</sup> <https://www.airforcemag.com/f-16s-could-still-be-flying-into-the-2070s/>

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## A bestseller

In the past, post-WWII planes have generally succeeded one another step-by-step in manufacturing and in service, at least in “domestic” air forces and in the richest foreign air forces. Exceptions were quite rare with the most well-known being the MiG-21. Its last “native” modification, the MiG-21bis, was produced by the USSR until 1985 when the MiG-29 and Su-27 began to appear in the air force. Its Chinese successor, the J-7, was manufactured until 2013<sup>4</sup>, which was due to the fact that it took some time for Chinese industry to start high-volume output and upgrade its own JF-17. It actually held the title of cheapest fighter jet for the African and Asian countries. However, in its later years the MiG-21 could not compete directly with cutting-edge planes that were more advanced.

Why such longevity among the Cold War’s last fighter jets? The answer is both the planes themselves and the world around them. It is best explained by an analysis of the US F-16, the most typical and successful representative of this generation in terms of manufactured units and global distribution.

The future F-16 was designed as part of the USAF Lightweight Fighter LWF project. Initial requirements were fairly democratic – following the Vietnam war the “fighter jet mafia” asked the industry for its own MiG-21, a high-maneuvrability mass-produced plane with relatively simple radio electronic equipment. The first models in the 1980s could not even use medium-range air-to-air missiles, which looked pretty archaic even then. This didn’t mean, however, that the US had given up high-tech; this was the domain of the expensive

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<sup>4</sup> A combat, single-seat model. The latest deliveries of *F-7BGI* were to Bangladesh. Limited production double-seat training and combat models for the Chinese Air Force continued through 2017 due to the fact that considerable numbers of *J-7s* were still in use in China, whereas the lifespan of dual-control planes is shorter than regular air force units due to more flight hours.

and sophisticated F-15 Eagle, which the Soviet school of design would have called an extreme parameter jet. It has been forgotten by now, but in the 1970s and 1980s the hype around it was as high as that for the F-22 Raptor in the early 21<sup>st</sup> century. According to promotional mythology<sup>5</sup>, the Eagle had over a hundred victories in air combat and was never downed<sup>6</sup>. The F-16 used part of that expensive plane, primarily the engine unit. In addition, although the jet was being designed with simplicity in mind, it had significant potential for further development.

The F-15 was not to have broad distribution due to its cost and restrictions on advanced technology exports. Even now, since the export of the F-22 Raptor is legally restricted, the F-15 remains the most expensive fighter (more than even the F-35) on the US military fighter aircraft export menu. Meanwhile, the F-16 was being promoted among US allies even at the design stage. An unparalleled “deal of the century” was signed with four European countries: Belgium, Denmark, the Netherlands, and Norway not only became the first customers to receive the jets at the same time as the USAF, but they also took part in the manufacturing.

Active marketing, a low price and confidence in the further development of the programme have actually made the F-16 the primary fighter jet for NATO and other US allies. Israel’s successful use of the plane in an operation to destroy an Iraqi nuclear reactor in 1981 and in Lebanon in 1982 served as excellent publicity for the plane. By the end of the Cold War, over 3,000 jets were manufactured, and sold to 16 countries.

This story laid the foundation for further expansion. The growing number of countries leaning towards US foreign policy will boost demand for the jet even more. Military-technical cooperation is often

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<sup>5</sup> <https://nationalinterest.org/blog/the-buzz/104-0-the-f-15-eagle-the-fighter-no-air-force-can-beat-23853>

<sup>6</sup> The numbers are largely attributable to non-critical perception of the Israel statistics in the 1982 conflict. Nevertheless, it does not tarnish the fact that US engineers designed an aircraft which was ahead of its time. Responding to this with the Su-27 was a serious challenge for its Soviet rivals, who only responded a decade later.

built with close, or apparently, “senior” partners. When the former Warsaw Pact nations joined NATO, they began to gradually convert to Western weaponry including air equipment. The F-16 is still a relatively affordable way for non-wealthy countries to show loyalty and get an aircraft with a US “ecosystem” (armaments, equipment, tanker aircraft, waveforms etc.). Thus, Slovakia came up with \$1.6 billion to purchase 14 new F-16V Block 70s, while Romania bought a number of jets in the secondary market<sup>7</sup>. There have been other large global deals: in 2003, Poland signed a \$3.5 billion contract for 48 planes, which until recently, was the biggest defence deal in Eastern Europe.

In the Cold-War, efforts would have been taken to replace the F-16 in the 1990s. The beginning of this process is evident,<sup>8</sup> but in the early 1990s, these programmes were either suspended or were limited to the concept stage due to sharp reductions in defence spending. The US Air Force could hardly get enough funding to continue developing the F-22. Also, the need to replace the F-16s was less urgent since declining flight hours and air force personnel made it possible to continue with the available fleet while the threat of facing a technologically equal adversary sharply fell. Meanwhile, the F-16’s potential for upgrades was ideal for the local wars the US was waging in the 1990s-2000s. It seemed the US could sustain its technical superiority by releasing a relatively small run of F-22 Raptor fifth-generation fighters designed to gain air superiority followed by replacing the F-16 with the Joint Strike Fighter (JSF) created with experience from

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<sup>7</sup> Romania 17 former Portuguese jets in 2016–2021. Meanwhile, reports in December 2021 indicated that Romania was set to purchase 32 former Norwegian jets.

<sup>8</sup> For example, the USAF Multi-Role Fighter (MRF) programme, which started with preliminary consultations with the industry in 1991, was suspended in 1993 before the tender was officially announced. The MRF-54E, one of the variants designed by *Northrop* for the tender, became widely known among specialists due to its similarity with the Russian Su-75 Checkmate fighter unveiled that year. It should be noted, however, that the number 54 is there for a reason – there were over fifty concepts that looked like anything was possible.

*Flying Wings & Radical Things: Northrop’s Secret Aerospace Projects By Anthony Chong. Chapter7: The End of the Cold War and “The Last Supper”: 1990 to 1994 // Specialty Press, 2016. P. 251–252.*

living in Pax Americana. The JSF was designed to replace a broad range of planes and to be widely distributed around the world, thus enhancing the West's superiority over any opponent.

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## Not quite fifth generation

These plans were not, however, destined to materialise. The US, not to mention the less wealthy countries, need to operate and even purchase fourth-generation jets while quickly designing so-called sixth-generation planes. How did it happen that the fifth-generation planes developed by the US, and probably other countries, are running the risk of becoming the lost generation?

As mentioned above, the normal progression of designing fifth-generation jets has been put off both in terms of customer plans (most defence programmes are moving to the right, especially in aviation) and in the relative “natural process of generational succession” where the fifth-generation planes would have started operations in the second half of the 1990s. If the USSR had remained intact and the arms race with the US had continued, this timeline would have been retained, at least with the first planes, the heavy twin-engine air-superiority F-22A Raptor and the MiG 1.42<sup>9</sup>. The end of the USSR slowed the first programme and brought the latter to an end.

After the Cold War, countries could be divided into those who were incapable of designing fundamentally new aircraft (China and Russia, in time), countries who were capable but less motivated (the

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<sup>9</sup> Winner in the Soviet Multirole Frontline Jet programme which ran parallel to the *ATF* in the US.

US resting on its laurels), and countries with neither the capability nor the motivation (European countries that were slowly and painstakingly finishing their programmes)<sup>10</sup>. All of this provided time for significant upgrades and the chance to proliferate the platforms made during the last years of the Cold War: the F-15, F-16 and the Su-27. But the world has not become safer. On the contrary, there have been even more local wars. But aviation has basically only been used in asymmetrical conflicts, which on the one hand showed the importance and growing capabilities of high-precision weapons (there have been purely air wars like NATO's 1999 Operation Allied Force against Yugoslavia), and on the other hand, lulling operators that upgraded 1980s aircraft into thinking those would be good enough for any purpose.

This is not without common sense. The increase in combat capability within one generation and one family in fourth-generation jets was impressive. We could suggest that their capabilities grew exponentially, but that would be a simplification because in some aspects they received functions that the original versions lacked. This was basically ensured by new on-board electronic equipment (radar stations, passive target detection and electronic warfare devices) as well as the list of weapons. The latest versions of the F-16 or Sukhoi could easily win a missile battle with the basic versions of jets from the same family. And for surface targets, they can use cruise missiles with a range of hundreds of kilometres whereas the original version could only use conventional bombs. Advanced fourth-generation models differ from fifth-generation fighters only in countering an enemy of equal capability, and nobody really knows how that would turn out.

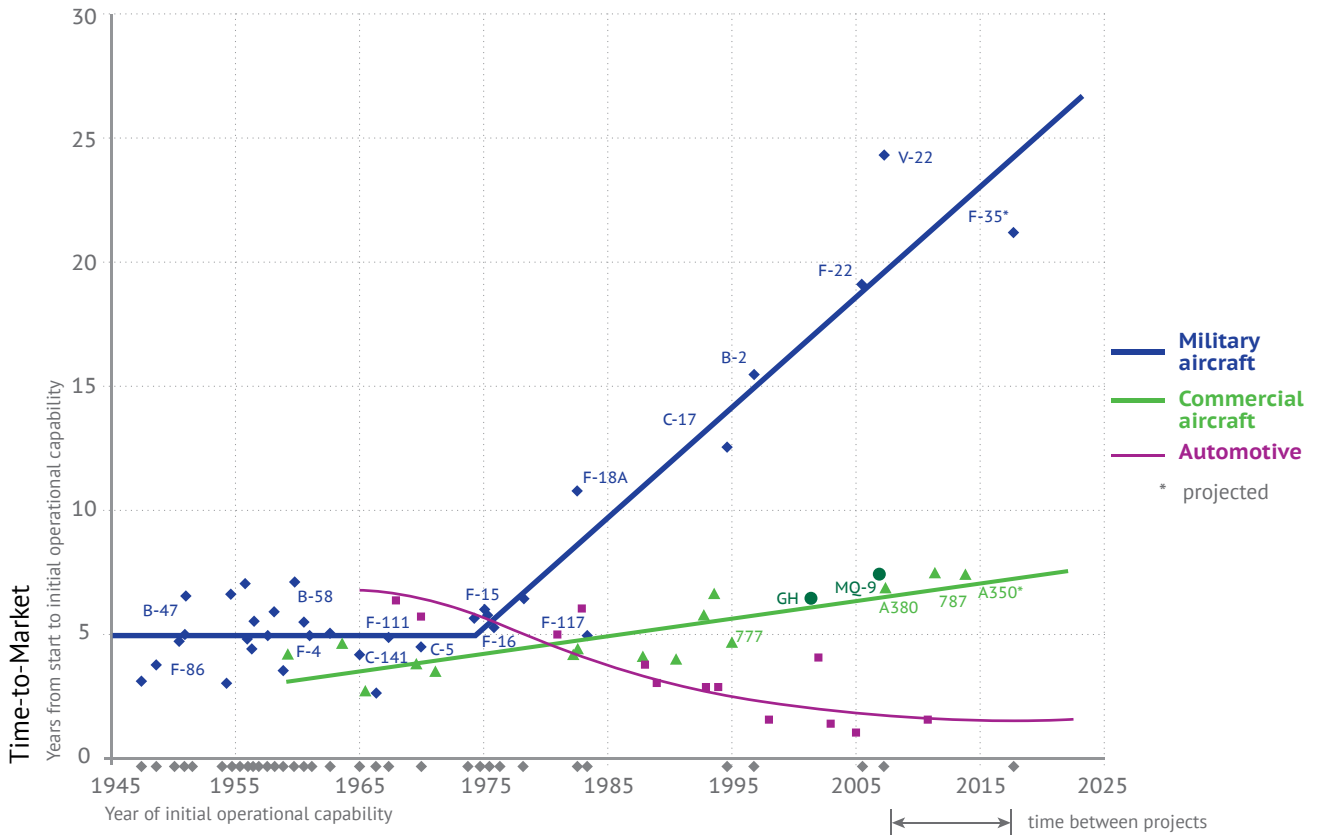
Fourth-generation fighters have become not just flying machines but platforms for electronic equipment and weapons delivery. The amount of electronic components and software continues to increase. However, this process has not made engineering any easier. On the contrary, we see almost lineal growth in the development time needed since

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<sup>10</sup> So-called "Euro ducks" because of the aerodynamic configuration of front horizontal canard surfaces and no tail assembly – *Eurofighter Typhoon*, *Dassault Rafale* and *Saab Gripen*.



POST-WWII NEW START AIRCRAFT DEVELOPMENTS



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Sources: DARPA/TTO 2012 TTM study. D. Patt. "Start" defined as receipt of contract

the mid- to late-1970s to design weapons system (see Diagram). It took three years for the F-15 to achieve full operational capability (IOC) from its initial flight, five years for the F-16, nine years for the SU-27<sup>11</sup> (longer than its US counterparts because the project was radically altered from the initial plans, but from there it also took five years to develop the current Su-27 prototype), and it took fifteen years for the F-22 and F-35. And this is largely a fiction since "operational capability" can be designated on planes with extremely limited functionality. The F-35 became notorious in terms of development time: even though 750 jets have been delivered to customers around the world, certification and

<sup>11</sup> The term IOC is not used in the USSR/Russia. The date of the first regiment going on combat alert was used.

testing have not been completed yet, and no timeline has yet been specified for completion<sup>12</sup>. The F-35 has long been ready as a flying machine, but at this point, its monstrous software is still being tested, bugs are being identified and fixed with patches while the equipment hardware is only now being completed. The delivery schedule for a so-called “release version” (Block 4 version) has also been constantly postponed.

Similar development issues were common with the F-22 (which saw many functions deleted or never realised – the world’s most advanced jet is still promising a helmet-mounted target-acquisition and display system)<sup>13</sup> including the long refining process of Europe’s fighter jets.

Anyone who is convinced that this is peculiar to the “rotting West” will be taken aback, given the notable delays in the Su-57 programme. In 2014, 55 jets were to be delivered to the Russian Air Force before 2020<sup>14</sup>. As of January 2022, only three production planes have been delivered<sup>15</sup>. Russia’s problems are unique in some ways, as much can be blamed on impeded military-technical cooperation with the Western countries in producing and supplying a number of components. However, a huge amount of work on completing new programmes with old methods obviously has a part here.

China’s J-20 is probably the only fighter development programme that has excelled in this respect. The J-20 made its maiden flight in 2011. It was promptly accepted by the air force, and about a hundred of J-20s have been built. However, there is a lack of specific information on any problems due to the closed nature of the Chinese military-industrial complex. China has likely accepted the US approach to F-35 development: launch a production

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<sup>12</sup> <https://breakingdefense.com/2021/12/new-schedule-for-critical-f-35-simulation-tests-coming-in-early-2022/>

<sup>13</sup> <https://www.airforcemag.com/usaf-looks-to-small-businesses-for-some-f-22-upgrades/>

<sup>14</sup> <https://tass.ru/armiya-i-opk/1648653>

<sup>15</sup> The first plane was damaged in an accident shortly before delivery, so four aircraft can be considered released.

version of the basic plane to begin personnel retraining and to gain operational experience, and then finish the technical capabilities after it is in service. The Russian Defence Ministry, meanwhile, has given up this approach, perhaps over its scepticism over the last item in the plan. The J-20's cousin J-31 programme, on the other hand, is unfolding without any noticeable urgency either due to low customer interest or to a different variant to become the first nationally designed ship-born fighter.

The speed with which China made its fifth-generation jet operational, albeit with unknown capabilities, is a problem for US aviation development planners. The US, motivated by this era of local asymmetrical wars, is unexpectedly watching its main opponent acquire a weapon in a crucial area where the F-22 doesn't have a clear advantage, and where the war workhorse and backbone of combat aviation, the F-35, would feel uneasy. It isn't necessary to panic like some US alarmists might over the US falling behind China in air superiority, but clearly the US is losing its comfortable advantage. This problem will not be resolved anytime soon, and no quantum leap is possible by upgrading or adjusting existing fifth-generation platforms.

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## What's next?

The US thought the only response was to urgently design a new generation fighter, which the media dubbed the sixth generation. US efforts in this area are included in the comprehensive NGAD (Next Generation Air Dominance) programme. It has the highest priority – the air dominance jet designed under this programme is to replace the F-22 as early as 2030<sup>16</sup>!

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<sup>16</sup> <https://www.airforcemag.com/new-force-design-ngad-needed-soon-f-22-sunset-begins-in-2030/>

US efforts naturally stimulate responses in various corners of the world, and while China and Russia's programmes are not made public, the European FCAS<sup>17</sup> programmes or the Japanese F-X are evidently referred to as sixth-generation planes by the media. It should be remembered that "generation" is an artificial term coined by marketing executives and aviation historians and journalists. What "sixth" generation plane means exactly has not been defined, while the definition of fifth (and other) generations differ depending on who is describing them. For example, Eurofighter head Alberto Gutierrez refused to refer to any generation when answering a question about FCAS<sup>18</sup> and remarked emotionally that the word generation is an artificial classification made up by Lockheed Martin. It is possible that several decades from now, the US and European fighters currently under design, as well the Russian Su-75 Checkmate, will be retrospectively called "generation 5+."

But let's step back from terminology. It matters more that certain common features and requirements that lead to qualitatively new capabilities are already taking shape. The newest planes will have more powerful radar systems and several surveillance arrays, providing an all-around view in different frequency bands, that will probably become standard.<sup>19</sup> Powerful irradiation will not only confuse enemy radar systems but will also damage an opponent's electronics<sup>20</sup> with funnelled microwave irradiation. Laser weapons will be included, at least for antimissile self-defence, but also probably for combat at close distances. New generation jets will inevitably have much more powerful electrical systems for their on-board equipment, which will require engines that are more powerful.

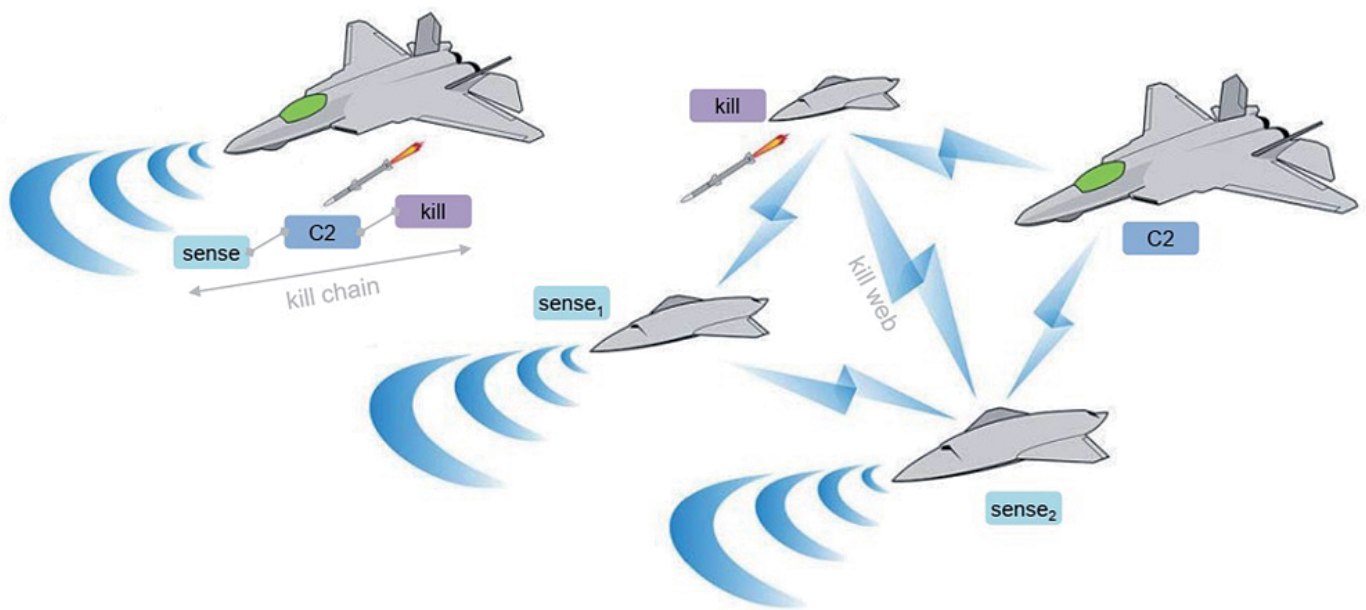
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<sup>17</sup> Two independent programmes under the same name, *Future Combat Air System*, with separate multinational teams: French-German-Spanish and British-Italian-Swedish.

<sup>18</sup> <https://bmpd.livejournal.com/1972880.html>

<sup>19</sup> Only the Su-57 can boast of this so far (little is known about Chinese fighter's capabilities). Additional sideways-looking arrays ("cheeks") were to be installed on the F-22, but they were cut to save cost.

<sup>20</sup> <https://omega.twoday.net/stories/955265/>



Sources: DARPA/TTO 2012 TTM study, D. Patt

There is a lot of talk about qualitative growth in a plane's "intellectual" capacity, of designing a real "electronic second pilot." More than just marketing hype, it would assume the functions a human pilot is incapable of, especially control and battlefield evaluation including tactical solutions. Such areas as electronic and cyber warfare and the use of defensive laser weapons will require reaction times beyond human ability.

Meanwhile, humans will have more to command, too. This is something all the designers of new generation jets (from the US's NGAD and Europe's FCAS to Russia's Su-75 and the Japanese F-X) can agree on: all future fighters will be designed to be part of battle formations alongside advanced UAVs including those built on the same platforms. In fact, FCAS is more than a fighter jet, it is an entire system with various elements including supporting drones (the jet itself is called the NFG in the French-German-Spanish programme and *Tempest* in the British-Italian-Swedish programme). The manned aircraft will be the commanders in small and even larger formations that will include full-scale drones that match the combat capabilities of the fighter jet, and smaller specialised drones, probably launched

from the air, designed as sensor carriers, with jamming devices, communications nodes or missile platforms. The commander will not need active detection technology or even weapons but it will receive information and give orders through a hard-to-intercept and ECM-protected communication system, such as laser transmission. In an air-to-air engagement, the task of destroying the commander will resemble a checkmate in a chess game, but with a difference: nobody can promise that an airborne king's support pieces will surrender.

To ensure this wealth of technology is operative before 2050 the Americans are currently promoting their “new approach to engineering” and “digital design methods” and borrowing managerial experience from the private sector, in particular, the IT-sector. This will make it possible to develop new fighter jets much more quickly, and achievements have already been announced in this respect, albeit not in detail<sup>21</sup>. In addition, within this new approach, the Americans are talking about designing not a single universal platform for the long term within NGAD, but a multitude of platforms that will succeed one another in series with more specific designations that can be adapted to the conditions and requirements of any battle scenario.

It will be almost as difficult for some fifth-generation planes to be refitted at this level as it would be for fourth-generation planes. This is probably the reason the Americans are planning to write off the F-22A soon. Newer fighters like the Su-57 have a certain advantage (replicating the situation with the Su-27, which was designed later than the F-15, which is superior in many respects). However, in Russia, the creation of pilotless models and a “new approach to engineering” are progressing only with regard to Su-75. The many F-35s in service will not disappear, but within a decade they might fall from cutting edge to mediocre status, but still be

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<sup>21</sup> <https://breakingdefense.com/2020/09/secret-ngad-fighter-flies-sets-records-raises-lot-of-questions/>

relatively adaptable to new conditions, while the US's opponents will only have modernised fourth-generation planes in the fighter niche.

Curiously, phasing in new generation jets will force the F-22A into retirement, but not the venerable F-15 or F-16. The former might become a hypersonic weapon carrier, while the latter could pursue simpler, less dangerous missions. Moreover, a conceptual study is underway for using these "reserve soldiers" within the MR-X<sup>22</sup> programme to succeed the F-16, which would likely have lower visibility.

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Design issues, delays and temporarily low demand have led to a situation where fifth-generation fighter jets might become the lost generation as the last planes of the Cold War will pass the baton to their grandchildren rather than children. For Russia, this means that after a period of stagnation it would face the beginning of a new stage in the stormy development and evolution of combat aviation, the likes of which might not have been seen since 1970s-1980s.

The crucial challenge for Russia, which has strong competencies in this area, is to maintain its lead. Those who manage to stay on the podium will be rewarded for their efforts through military-industrial cooperation, will develop their engineering capabilities and aligned scientific areas, and will gain firm guarantees of national security. Although we do not talk about our plans as much as the West might, we can say that work on the Okhotnik UAV and the Su-75 concept are efforts in the right direction.

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<sup>22</sup> <https://www.airforcemag.com/air-force-wants-to-cut-421-old-fighters-buy-304-new-ones/>



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