

RUSSIAN AIR FORCE FIELDING

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On 10 October 2014, the common day of materiel acceptance by the Russian Defence Ministry, the Sukhoi company delivered three more Su-35S supermanoeuvrable multirole fighters to the Russian Air Force at the Komsomolsk-on-Amur Aircraft Plant. Thus, as many as 25 out of the 48 aircraft of the type stipulated by the contract landed in 2009 have been fielded with combat units. An air squadron of the 23rd Fighter Air Regiment stationed at Dzyomgi AFB in the Khabarovsk Territory converted to the type in February 2014, and four Su-35S fighters were ferried to the Air Force Training and Operational Evaluation Centre in the city of Lipetsk in late May 2014. Here they are used by the centre's personnel to test new tactics being developed for the advanced fighter and also will be used for the training of the flying and ground crews of RusAF combat units converting to the type.

The Su-35S single-seat supermanoeuvrable multirole fighter is the summit of the evolution of the Su-27 fourth-generation aircraft family. The Su-35S's development involved a wide range of solutions and technologies used under the PAK FA (T-50) fifth-generation fighter development programme. Therefore, despite its outward similarity to the ubiquitous Su-27 and Su-30, the Su-35S is rightfully regarded as an aircraft featuring radically advanced capabilities, which attributes it to Generation 4++.

The advanced fighter's features setting it apart from the rest of the Su-27 family are the latest avionics suite that is based on a digital information management system and the advanced Tikhomirov-NIIP Irbis electronically scanned radar. The latter enjoys the unique aerial target acquisition range and a beefed-up simultaneous multiple-target tracking and engagement capability (tracking 30 and engaging eight aerial targets or tracking four and engaging two ground targets).

The flight tests have proven the basic characteristics of the latest electronically scanned radar, with most of the latter's operating modes having been tested. In particular, test sorties have proven the unique ability of the Irbis to acquire threats at a range of more than 400 km.

The avionics suite of the Su-35S also incorporates an advanced IRST from the Precision Instrument Systems scientific and production company, up-to-date navigation and communication systems and a sophisticated defensive aids suite comprising missile warning and laser warning gear in addition to the traditional radar warning receiver and electronic countermeasures system. The cockpit management system comprises two 15-inch colour multifunction liquid-crystal displays and a large head-up display.

The fighter is powered by a pair of advanced enhanced-thrust 14,500-hp extended-life 117S thrust vector control engines developed by the Lyulka Scientific and Technical Centre

and produced by UMPO JSC. This, coupled with advanced operating algorithms of the integrated aircraft control system, allows supermanoeuvrability in dogfight. Compared to the Su-27, the Su-35S features an increased internal fuel capacity, the mid-air refueling system and drop tanks.

The weapons suite is comprised of both the in-service smart and dumb air-launched weapons and their modernised variants, with drastically innovative missiles and smart bombs to be carried further down the line.

The first two Su-35 prototypes (in export version) started their flight trials in 2008, and August 2009 saw the Sukhoi company and Russian Defence Ministry clinch a long-term deal for a 48-ship Su-35S batch to be delivered prior to 2015.

The first four production-standard Su-35S fighters were made by Sukhoi's Komsomolsk-on-Amur Aircraft Plant (KnAAZ) and delivered between May 2011 and March 2012. They have been undergoing the official tests at the Defence Ministry State Flight Test Centre in Akhtubinsk since 2011. Then in December 2012, the Defence Ministry took delivery of six more production standard aircraft designed for the test programme and, that completed, for the conversion of the air crews of RusAF combat units at the training and opeval centre in Lipetsk. The planes were ferried from Komsomolsk-on-Amur to Akhtubinsk during January through February 2013.



Su-35S fighters delivered to the first RusAF combat unit at Dzemgi AFB in February 2014

The Su-35S programme features the productionising and official trials of the fighter ran concurrently for the first time. Certain modifications to the early production-standard aircraft based on the results produced by the tests were the unavoidable consequence of that – sort of a payback for haste. Therefore, before fielding the aircraft, built in 2012, with the Lipetsk unit, they had had to be modified by the manufacturer using the latest documentation, under which 12 Su-35S aircraft, earmarked for delivery to an Air Force fighter air regiment, were made in Komsomolsk-on-Amur.

The 12 fighters were handed over to the Russian Defence Ministry in a ceremony held at the Komsomolsk-on-Amur Aircraft Plant of the Sukhoi company on 12 February 2014. The significance of the event was highlighted by the participation of Russian Defence Minister Sergei Shoigu, Deputy Defence Minister Yuri Borisov, Air Force Commander-in-Chief Lt.-Gen. Victor Bondarev, Khabarovsk territory Governor Vyacheslav Shport, UAC President Mikhail Pogoyan, Sukhoi Director General Igor Ozar, KnAAZ Director General Alexander Pekarsh, etc.

10 aircraft from the batch were fielded with the 1st squadron of the 23rd Fighter Air Regiment stationed at Dzyomgi AFB in Komsomolsk-on-Amur, Khabarovsk Territory. The remaining two had flown to Akhtubinsk, where they are used in the final phase of the official test programme, with the phase focused on testing advanced weapons in the first place. Instead of the two aircraft, the air regiment at Dzyomgi AFB received two other Su-35S fighters from the batch delivered in December 2012 and modified by the manufacturer since February this year.

The squadron launched regular operation of its advanced Su-35S fighters on 24 March 2014. Prior to that, its air and ground crews had undergone a programme of conversion to the type at a Sukhoi facility, and the regiment had adapted its material and technical resources for the operation of the advanced type. According to the Sukhoi's Su-35 programme director, chief designer Igor Dyomin, the preparations had begun as far back as 18 months before the delivery of the first fighters to the unit. Special ground test equipment had been ordered and tested in Akhtubinsk. Electronic tablets with the operation support software are ready for the introduction into aircraft maintenance routine in combat units. An agreement with RusAF command on the delivery of the advanced ground support system has been reached, and

the afore-said systems have been ordered for several units earmarked for the Su-35S. In addition, a Su-35S integrated flight simulator has been developed to be fielded at Dzyomgi AFB and in Lipetsk in the near future.

As Igor Dyomin rightfully mentioned, however, it is always not so easy for the troops to learn the ropes on advanced aircraft both due to numerous organisational problems and to the need to ensure the reliability of the most complex avionics, which sophistication makes the Su-35S unique in the Russian Air Force so far. To resolve the problems effectively, there are a warranty repair team of the developer, maintenance kits and a technical support team at Dzyomgi AFB. The aircraft have been given a three-year warranty for the first time in this country. All of the above, coupled with the decision to field the air regiment, stationed close to the manufacturer, with Su-35S fighters, facilitates the efficiency of the combat units learning the advanced fighter. As soon as April this year, Dzyomgi pilots flew their Su-35S's "in a very intensive manner", according to Igor Dyomin.

The Su-35S faces a long service, while being at the very beginning of the same. Today, the fighters of the type operated by combat units can fight using their basic weapons suites. However, in line with the concurrent development and full-rate production concept, advanced types of air-launched weapons are being integrated with the aircraft, which will make, in the future, the aircraft more effective in battle. According to Igor Dyomin, several types of modernised and all-new missiles were integrated with the Su-35S's weapons suite during 2013, though not all of the weapons stipulated by the programme had been ready for the tests on board the fighter. Therefore, their tests will continue, with the near-term plans providing for both testing the advanced weapons and expanding the operational envelope of the integrated ones.

Su-35S from Dzemgi AFB taking-off for demo flight, August 2014



Yuri Kabernik

The new batch of Su-35S fighters delivered in October 2014 got a new blue-and-gray livery. Demo flight at Sukhoi's KnAAZ jubilee celebration, August 2014



Late last year, when the bugs inevitable in the official tests were debugged, the customer released its relevant reports and a decision was taken to OK the operation of the Su-35S by the Air Force. Owing to that, the first batch of aircraft of the type was shipped to the fighter air regiment at Dzyomgi AFB. At the same time, the manufacturer, KnAAZ, started modifying the six aircraft, delivered in late 2012, in accordance with the design of the above-mentioned Dzyomgi-delivered fighters (so-called Layout 2013). The six warplanes were returned to the manufacture during January and February 2014, and their modification had been complete. This made the May delivery of the four Su-35S fighters to the RusAF centre in Lipetsk feasible. They arrived here on 28 May 2014.

Lipetsk pilots had an opportunity to get the first impression of the advanced aircraft in the course of the long flight across Russia from Komsomolsk-on-Amur to Lipetsk with stopovers in Irkutsk and Chelyabinsk. The impression was very positive.

Here is the opinion of two Lipetsk-based pilots, who learnt to fly the Su-35S among the first in RusAF and ferried the Centre's aircraft from Komsomolsk-on-Amur to Lipetsk.

Military Test Pilot 1st Class Lt.-Col. Alexei Yamakidi, chief, flight safety division, Lipetsk-based Air Force Training and Operational Evaluation Centre: "I have flown all versions of the MiG-23, MiG-29 and Su-27 fighters. As far as the Su-35S is concerned, I like the way the flight data are shown on its full-colour multifunction LCDs: everything is clear and easy to grasp. The aircraft is easy to control. Owing to the KSU-35 integrated flight control system, control is now easier and the controls are more sensitive. One does not have to apply more force, say, for achieving high g-load. The Su-35S can be piloted almost with two fingers".

Military Pilot 1st Class Maj. Alexei Kurakin, air squadron navigator, Air Force Training and Operational Evaluation Centre: "I like the plane. It is far better than the Su-27 and Su-30 in terms of thrust-to-weight ratio. It can attain beyond-stall angles of attack while retaining its controllability, which enables it to take part in a dogfight without having to be distracted by the cockpit controls. I guess the aircraft is facing bright vistas, given its combat capabilities and manoeuvrability".

The Su-35S arrival to Lipetsk will enable the conversion of RusAF combat units to the type to be intensified, make it more effective and allow the air crews to learn the fighter's drastically sophisticated capabilities, including supermanoeuvrable tactics, upgraded and in-development air-launched weapons and latest avionics.

At present, KnAAZ is manufacturing more production-standard Su-35S planes.

According to UAC President Mikhail Pogosyan, plan for 2014 provides for construction and delivery of 12 fighters of the type while the plan for 2015 – of the final 14 from the 48 ordered. According to the chief designer Igor Dyomin, a new five-year contract for a similar Su-35S batch is supposed to be signed by Sukhoi and the Defence Ministry in the nearest future.

In addition, as is known, a political agreement has been achieved on the feasibility of Su-35 export to China. As all technical and organisational matters are tackled, the contract shall be signed. China is interested in integrating some of its own avionics and weapons into the Su-35. According to the fighters' chief designer Igor Dyomin, only Russian components are used in the production of the Su-35S now. However, the open architecture principle implemented in its avionics suite allows integration of


One of the four Su-35S jets delivered to Lipetsk-based RusAF Training and Operational Evaluation Centre in May 2014



foreign-made systems and complete adaptation of the aircraft to a particular customer's requirements.

In October this year, Russian Vice-Premier Dmitry Rogozin, supervisor of Russia's military industry, said the contract for the export of the Su-35 multirole fighters to China could be signed before year-end. "There will be another session of the Russian-Chinese military-technical cooperation committee in November. I think the issue will be resolved there. I see no urgent problems or unsolvable issues there", Dmitry Rogozin said, adding: "Certain price aspects of the contract are being negotiated now". According to the Kommersant daily, China plans to buy a 24-ship batch of Su-35 fighters initially.

The basic flight and operating characteristics proven in the official trials, ergonomic cockpit management suite, advanced avionics suite based on an open-architecture information management system, and airframe service life extended to 6,000 h (30 years of operation) will enable the Su-35S to remain in service with the Air Force virtually all the way to the middle of the century.

Mention should be made that idea of concurrent Su-35S development, testing and production, which was implemented in Russia for the first time, allowed the construction and testing of more than 10 brand-new aircraft, thus having slashed the time of the development of key design features and technologies as well as the latest design solutions pertinent to the avionics suite wrapped around an innovative information management system. In addition, the approach like this allows the quick use of the results produced for testing the technologies and technical solutions embodied in the PAK FA. This, in turn, ensures a reduction in the time of the development of the fifth-generation fighter for the Russian Air Force. 

Maj.-Gen. ALEXANDER KHARCHEVSKY: "The aircraft proved to be splendid"



Sergey Chirkovskiy

Honoured Military Pilot, Military Pilot-Sniper, Maj.-Gen. Alexander Kharchevsky, chief of the Air Force Training and Operational Evaluation Centre, was among the first Russian Air Force pilots, who learnt to fly the Su-35S supermanoeuvrable multirole fighter. In the Centre under his command, he not only supervises the devising of flight, navigation and tactical manuals for the RusAF Su-35S pilots, but also tests them in flight personally. On 12 August 2014 during the air show in Lipetsk on the occasion of the Russian Air Force Day and on 18 August 2014 at the celebration of the 80th anniversary of the Komsomolsk-on-Amur Aircraft Plant, Alexander Kharchevsky on a Su-35S led the formation of the Russian Falcons aerobatic team, flying a six-ship Su-27 and Su-30 formation, and then he performed Su-35S solo aerobatics.

"The aircraft proved to be splendid. Its airframe is reinforced, which has extended its service life by far. The Su-35S is the same as the Su-27 in terms of aerodynamic configuration, but it is equipped with an advanced control system that, coupled with the thrust vector control capability, gives the plane a considerable shot in the arm in terms of its flight performance and manoeuvrability.

Another feature setting the Su-35S apart from its predecessor is its sophisticated enhanced-thrust engine. In terms of design, it is a AL-31F derivative using fifth-generation technologies.

The Su-35S also embodies some other advanced technologies, e.g. a phased-array radar, an advancedIRST and an expanded weapons suite.

Today in battle, the pilot has to bear an increased psycho-physiological load due to a more complicated logic of using the cockpit management system. To reduce the workload on the pilot, the Su-35S is the first Russian aircraft with the "glass" cockpit, i.e. a novel arrangement of the cockpit controls with the use of wide-angle multifunction colour LCDs.

Our Lipetsk Centre has taken delivery of four Su-35S aircraft for us to devise methodological recommendations for piloting techniques, navigation and tactics. Mention should be made that in 2013-2014, combat unit pilots were given ground school and flight training under our methodological supervision and with participation of Chkalov State Flight Test centre and aircraft industry representatives. The pilots gave raving reports to the flight performance of the plane. The Su-35S fighters entry into the Air Force's inventory and mass operation by combat units will much facilitate efficient training of flying and ground crews in handling the Sukhoi PAK FA fifth-generation aircraft".



Maj.-Gen. Alexander Kharchevsky displaying Su-35S solo aerobatics at the celebration of the KnAAZ 80-years jubilee, Komsomolsk-on-Amur, 18 August 2014

Vitaly Kabernik