

= Sukhoi Su @-@ 33 =

The Sukhoi Su @-@ 33 (Russian : ????? ?? @-@ 33 ; NATO reporting name : Flanker @-@ D) is an all @-@ weather carrier @-@ based twin @-@ engine air superiority fighter designed by Sukhoi and manufactured by Komsomolsk @-@ on @-@ Amur Aircraft Production Association , derived from the Su @-@ 27 " Flanker " and initially known as the Su @-@ 27K . Compared with the Su @-@ 27 , the Su @-@ 33 has a strengthened undercarriage and structure , folding wings and stabilators , all for carrier operations . The Su @-@ 33 has canards and its wings are larger than than the Su @-@ 27 for increased lift . The Su @-@ 33 has upgraded engines and a twin nose wheel , and is air refuelable .

First used in operations in 1995 aboard the carrier Admiral Kuznetsov , the fighter officially entered service in August 1998 , by which time the designation " Su @-@ 33 " was used . Following the break @-@ up of the Soviet Union and the subsequent downsizing of the Russian Navy , only 24 aircraft were produced . Attempted sales to China and India fell through . With plans to retire the Su @-@ 33 once they reach the end of their service life , the Russian Navy ordered the MiG @-@ 29K as a replacement in 2009 .

= = Development = =

= = = Background and origins = = =

During the 1970s , the Yakovlev Yak @-@ 38 , then the Soviet Navy 's only operational carrier @-@ based fixed @-@ wing combat aircraft , was found to be unable to undertake its role due to limited range and payload , which severely hampered the capability of the Soviet Navy 's Project 1143 carriers . It was decided to develop a bigger and more potent carrier capable of operating STOL aircraft . During the assessment period , a number of carriers were studied ; the Project 1160 carrier would have been able to operate the MiG @-@ 23s and Su @-@ 24s , but was abandoned due to budget constraints . Design efforts were then concentrated on the Project 1153 carrier , which would have accommodated the Su @-@ 25s and the proposed MiG @-@ 23Ks and Su @-@ 27Ks . Sufficient funding was not secured , and the Navy looked at the possibility of a fifth , and larger , Project 1143 carrier , modified to allow for Yak @-@ 141 , MiG @-@ 29K and Su @-@ 27K operations .

To prepare for the operations of the Su @-@ 27K and the rival MiG @-@ 29K on @-@ board the new carrier , work proceeded on the development of the steam catapult , arresting gear , optical and radio landing systems . The pilots were trained at a new establishment in Crimea , named NITKA , for Aviation Research and Training Complex . In 1981 , the Soviet government ordered the abandonment of the catapult system as part of an overall downsize of Project 1143 @-@ 5 carriers , which also included cancelling the fifth Project 1143 carrier and the Varyag . A takeoff ramp was installed at the complex , where takeoffs would be executed to ensure that the Su @-@ 27Ks and MiG @-@ 29Ks would be able to operate from carriers . Both Sukhoi and Mikoyan modified their prototypes to validate the takeoff ramp . Three Sukhoi T10s (? 3 , ? 24 and ? 25) , along with an Su @-@ 27UB , were used for takeoffs from the simulated ramp . The first of these tests were undertaken by Nikolai Sadovnikov on 28 August 1982 . Flight tests indicated the need for a change in ramp design , and it was modified to a ski @-@ jump profile .

Conceptual designs of the Su @-@ 27K commenced in 1978 . On 18 April 1984 , the Soviet government instructed Sukhoi to develop an air defence fighter ; Mikoyan was ordered to build a lighter multirole fighter . Full @-@ scale design of the Su @-@ 27K soon started as the " T @-@ 10K " under the guidance of Konstantin Marbyshev . Nikolai Sadovnikov was appointed the design bureau 's Chief Test Pilot for the programme . By November 1984 , conceptual design had passed its critical design review , with the detailed design finalised in 1986 . The two prototypes were constructed in conjunction with KnAAPO in 1986 ? 1987 .

== Testing ==

The first Su @-@ 27K prototype , piloted by Viktor Pugachyov , made its maiden flight on 17 August 1987 at the NITKA facility ; the second followed on 22 December . Flight tests continued at NITKA , where Su @-@ 27Ks and MiG @-@ 29Ks demonstrated and validated the feasibility of ski @-@ jump operations . The pilots also practised no @-@ flare landings before making an actual landing on a carrier deck . It was another two years before the Tbilisi , subsequently renamed Admiral Kuznetsov , left the shipyard .

Viktor Pugachyov , piloting the second Su @-@ 27K , became the first Russian to conventionally land aboard an aircraft carrier on 1 November 1989 . It was found that the carrier 's jet blast deflectors were too close to the engine nozzles when raised at an angle of 60 ° ; thus an improvised solution held the deflectors at 45 ° . However , when the aircraft was in front of it for longer than the maximum six seconds , the shield 's water pipes exploded . The pilot , Pugachyov , reduced engine throttle , accidentally causing the detents (blocks used to restrain aircraft from accelerating) to retract and the fighter to move forwards . The aircraft was quickly stopped ; Pugachyov later took off without the use of blast deflectors or detents . Since then , a Kamov Ka @-@ 27PS search @-@ and @-@ rescue helicopter was flown close to the carrier in the event of an accident .

During the following three @-@ week period , 227 sorties were amassed , along with 35 deck landings . Flight testing continued afterwards , and on 26 September 1991 , naval pilots began testing the Su @-@ 27K ; by 1994 , it had successfully passed the State Acceptance Trials . During 1990 ? 1991 , seven production aircraft were rolled out .

== Further developments ==

The first of two known versions of the Su @-@ 33 , the twin @-@ seat Su @-@ 33UB , made its first flight in April 1999 . The aircraft , piloted by Viktor Pugachyov and Sergey Melnikov , flew for 40 minutes near Ramenskoye Airport . The Su @-@ 33UB (Initially named as Su @-@ 27KUB , " Korabelny Uchebno @-@ Boevo " , or " carrier combat trainer ") was planned to be a trainer , but with the potential to fill other roles . Notable improvements over the Su @-@ 33 included a revised forward fuselage and leading edge slats , bigger wings and stabilators

In 2010 , Sukhoi developed an updated version of the Su @-@ 33 ; flight trials began in October 2010 . This modernised Su @-@ 33 was to compete with a potential Chinese indigenous version of the original Su @-@ 33 , and to encourage orders from the Russian Navy . Major upgrades to the aircraft included more powerful (132 kN , 29 @-@ 800 lbf) AL @-@ 31 @-@ F @-@ M1 engines and a larger weapons carriage ; upgrades to the radar and weapons were not possible at the time due to funding constraints . According to military author Richard Fisher , it has been speculated that further modifications to a new production batch would include a phased @-@ array radar , thrust @-@ vectoring nozzles , and long @-@ range anti @-@ ship missiles .

== Design ==

To adapt the original Su @-@ 27 for naval operations , Sukhoi first incorporated a reinforced structure and undercarriage to withstand the great stress experienced upon landing , particularly quick descents and non @-@ flare landings (landings where the aircraft does not ' float ' and slow its decent rate just prior to touchdown) . The leading edge slats , flaperons and other control surfaces are enlarged to provide increased lift and manoeuvrability at low speeds , although the wingspan remains unchanged . The wings feature double @-@ slotted flaps and outboard drooping ailerons ; in total , the refinements enlarge the wing area by 10 ? 12 % . The wings and stabilators are modified for folding to maximise the number of aircraft the carrier can accommodate and to allow ease of movement on deck . The aircraft is outfitted with more powerful turbofan engines to increase thrust @-@ to @-@ weight ratio , as well as an in @-@ flight refuelling probe . The Su @-@ 33 sports canards that shorten the take @-@ off distance and improve manoeuvrability , but have required reshaping of the leading edge root extensions (LERX) . The rear radome is shortened and

reshaped to prevent its striking the deck during high α (angle of attack) landings .

Compared with the rival MiG 29K , the Su 33 's maximum takeoff weight (MTOW) is 50 % higher ; fuel capacity is more than double , allowing it to fly 80 % further at altitude (or 33 % at sea level) . The MiG 29K can spend as much time as the Su 33 on station by using external fuel tanks , but this limits its ordnance capacity . The Su 33 can fly at speeds as low as 240 km / h (149 mph) , in comparison the MiG 29K needs to maintain a minimum of 250 km / h (155 mph) for effective control . However , the MiG 29K carries more air to ground munitions than the Su 33 . The Su 33 is more expensive and physically larger than the MiG 29K , limiting the numbers able to be deployed on an aircraft carrier .

The Su 33 carries guided missiles such as the R 73 (four) and R 27E (six) on twelve hardpoints , supplemented by the 150 round 30 mm GSh 30 . It can carry an assortment of unguided rockets , bombs and cluster bombs for secondary air to ground missions . The aircraft can be used in both night and day operations at sea . The radar used , " Slot Back " , has been speculated to have poor multi target tracking , making the Su 33 reliant on other radar platforms and airborne warning and control system (AWACS) aircraft like the Kamov Ka 31 early warning helicopter . The R 27EM missiles have the capability to intercept anti ship missiles . The infra red search and track (IRST) system is placed to provide better downward visibility .

= = Operational history = =

= = = Soviet Union and Russia = = =

The Su 27K entered service in the mid 1990s . From December 1995 to March 1996 , the Admiral Kuznetsov set sail in the Mediterranean Sea , carrying two Su 25UTGs , nine Ka 27s , and 13 Su 27Ks . However , the aircraft officially entered service 31 August 1998 with the 279th Naval Fighter Regiment of the Northern Fleet based at Severomorsk 3 , by which time it was officially designated the " Su 33 " . The Russian Navy currently operates 19 Su 33s , however in the long term these need to be replaced .

With the break up of the Soviet Union , the Russian Navy was dramatically downsized , with many shipbuilding programmes stopped . Had the Varyag , Oryol and Ulyanovsk been commissioned , a total of 72 production airframes would have been built ; the early airborne warning and MiG 29K would also have proceed , instead of being abandoned . Only 24 examples were built at the time Varyag was sold to China . In 2009 , the Russian Navy announced an order for 24 MiG 29Ks to replace the Su 33 , to be delivered from 2011 to 2015 . However , in 2015 , Major General Igor Kozhin , the Commander of the Navy 's Air and Air Defense Forces , announced that a second fighter regiment would be formed to augment the current force , with the intention that the MiG 29s be used by this new unit , with the existing Su 33s refurbished for further use .

= = = Failed bids = = =

Internationally , the People 's Republic of China was identified as a possible export customer . Russia 's state weapons exporter , Rosoboronexport , was previously negotiating an order of 50 aircraft totalling US \$ 2 . 5 billion . China would have initially acquired two aircraft worth \$ 100 million for testing and then have further options to acquire an additional 12 - 48 aircraft . The fighters were intended to be used with the fledgling Chinese aircraft carrier programme , with the former Soviet carrier Varyag as the centrepiece .

At the sixth Zhuhai Airshow in late 2006 , Lieutenant General Aleksander Denisov publicly confirmed at a news conference that China had approached Russia for the possible purchase of Su 33s , and negotiations were to start in 2007 . On 1 November 2006 , the Xinhua News Agency published the information on its military website that China planned to introduce the Su 33 .

China had previously obtained a manufacturing license for Su @-@ 27 production .

Sukhoi is working on a more advanced version , the Su @-@ 33K , a development to integrate the advanced technologies of the Su @-@ 35 fighters into the older Su @-@ 33 airframe . However , worries over other Chinese intentions emerged when it was reported that China had acquired one of the T @-@ 10Ks , an Su @-@ 33 prototype , from Ukraine , potentially to study and reverse engineer a domestic version . Various aircraft are alleged to have originated partially from the Su @-@ 33 , such as the Shenyang J @-@ 11B and the Shenyang J @-@ 15 . Photos of Shenyang aircraft designers posing in front of a T @-@ 10K carrier based fighter prototype strongly suggest that the J @-@ 15 is directly related to T @-@ 10K . Negotiations stagnated as the Shenyang Aircraft company sought to reduce Russian content in the aircraft , while Sukhoi wanted to ensure a level of income from future upgrades and modifications made to the J @-@ 11 .

India was also viewed as another potential operator of the Su @-@ 33 . The Indian Navy planned to acquire the Su @-@ 33 for its aircraft carrier , the INS Vikramaditya , the refurbished Soviet Admiral Gorshkov , which was sold to India in 2004 . In the end , the rival MiG @-@ 29K was opted for , because of the Su @-@ 33 's outdated avionics . The size of the Su @-@ 33 reportedly led to concerns over potential difficulties in operating it off the Indian carriers , a constraint not shared by the smaller MiG @-@ 29K .

= = Operators = =

Russia

Russian Navy

Russian Naval Aviation

= = Notable accidents = =

17 July 2001 : a Russian Navy Su @-@ 33 crashed during an air show in Russia 's Pskov Region . The pilot , Major @-@ General Timur Apakidze , died in the crash .

5 September 2005 : a Russian Navy Su @-@ 33 's arresting cable broke after a landing on the Admiral Kuznetsov in the Northern Atlantic at high speed . The pilot ejected and was recovered . The plane was initially planned to be destroyed with depth charges to prevent the recovery of classified equipment . However , this did not take place as the aircraft did not carry sensitive equipment . The crash was captured on video .

= = Specifications = =

Data from KnAAPO , Sukhoi , Airforce @-@ technology.com , Gordon and Davison , Williams

General characteristics

Crew : 1

Length : 21 @. @ 94 m (72 ft)

Wingspan : 14 @. @ 70 m (48 @. @ 25 ft)

Height : 5 @. @ 93 m (19 @. @ 5 ft)

Wing area : 62 @. @ 0 m ² (667 ft ²)

Empty weight : 18 @, @ 400 kg (40 @, @ 600 lb)

Loaded weight : 29 @, @ 940 kg (66 @, @ 010 lb)

Max. takeoff weight : 33 @, @ 000 kg (72 @, @ 752 lb)

Powerplant : 2 × AL @-@ 31F3 afterburning turbofans

Dry thrust : 74 @. @ 5 kN (16 @, @ 750 lbf) each

Thrust with afterburner : 125 @. @ 5 kN (28 @, @ 214 lbf) each

Wingspan , wings folded : 7 @. @ 40 m (24 @. @ 25 ft)

Performance

Maximum speed : Mach 2 @. @ 17 (2 @, @ 300 km / h , 1 @, @ 430 mph) at 10 @, @ 000 m (33 @, @ 000 ft) altitude

Stall speed : 240 km / h (150 mp / h)

Range : 3 @, @ 000 km (1 @, @ 864 mi)

Service ceiling : 17 @, @ 000 m (55 @, @ 800 ft)

Rate of climb : 246 m / s (48 @, @ 500 ft / min)

Wing loading : 483 kg / m ² ; (98 @. @ 9 lb / ft ²)

Thrust / weight : 0 @. @ 83

Maximum g @-@ load : + 8 g (+ 78 m / s ²)

Landing speed : 240 km / h (149 mph)

Armament

1 × 30 mm GSh @-@ 30 @-@ 1 cannon with 150 rounds

Up to 6 @, @ 500 kg (14 @, @ 300 lb) of munitions on twelve external hardpoints , including :

6 × R @-@ 27R / T / ET / EM and 4 × R @-@ 73 air @-@ to @-@ air missile

Kh @-@ 31A Krypton anti @-@ ship missile

Various bombs and rockets

Electronic countermeasure (ECM) pods