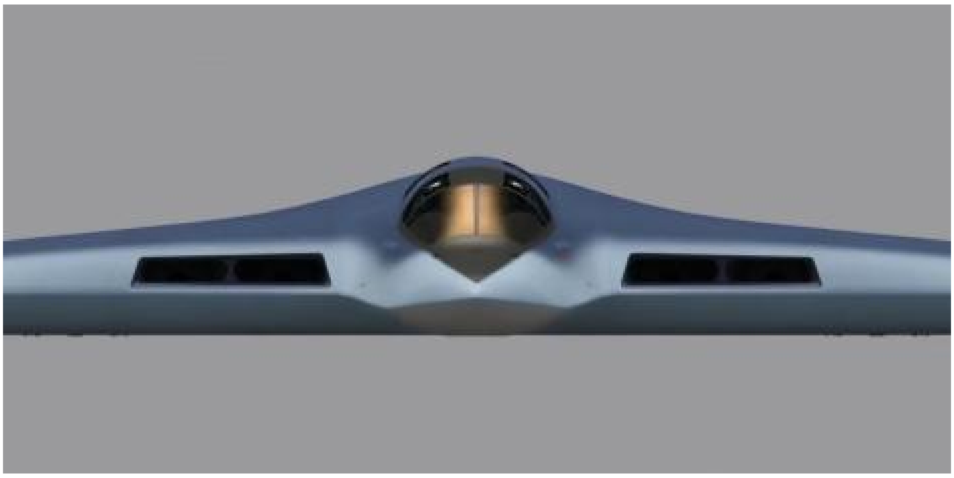
22-Feb-17 – Russia Is Getting a Fleet of PAK DA “Stealth” Bombers

Description

By **Valentin Vasilescu**

Translated by **Alice Decker** for **Algora Blog**



Russia has to update its fleet of strategic bombers if it is to maintain the status quo in nuclear power, where the Russian Federation has the upper hand. The traditional concept of deterrence is built on the “Strategic Triad” — long-range bombers, nuclear-powered submarines, and intercontinental ballistic missiles.

Currently Russia, the US and China have bombers capable of carrying nuclear warheads. China’s bombers have just 25% of the range of Russian and American bombers. And only the US has a fleet of nineteen 5th generation stealth bombers: the B-2 Spirit. ?

In 1999, Tupolev appointed a team of engineers to research and develop technologies to manufacture 5thgeneration bombers. Only, the Russian Air Force didn’t raise the question of making it a stealth bomber until 2007. The technical and tactical specs for the 5th generation bomber were finalized in 2012. In early 2013, the Russian Air Force designated the winner of the design competition for the new Russian 5th generation strategic bomber, the PAK DA (which stands for Prospective Aviation Complex for Long-range Aviation). PAK DA bombers will be built by Tupolev, which specializes in building heavy bombers and civilian transport planes. If everything goes according to plan, the first flight will take place in 2019, production will start in 2020 and the first squadron of twelve PAK DAswill be operational in 2025. The PAK DA planes will be produced only for Russia.

What will the PAK DA will look like?

The PAK DA will most likely be similar to the US B-2 Spirit bomber, that is, a subsonic flying-wing type. It will be invisible to radar and will have a range of 12,000 km without refueling. Propulsion will be provided by four “Product 30” (AL-41F1) engines, without “afterburner,” designed for the 5th generation

Su T-50 (PAK FA) multi-role aircraft; they will have 10,900 kg thrust each. The American B-2 stealth bomber also has four General Electric F118 engines, with 8,700 kg of thrust. The Russians call it the "White Elephant."

Although there has been speculation that the PAK DA aircraft might be supersonic or hypersonic, in these flight modes the PAK DA cannot be invisible to radar. At the speed of Mach 3 to Mach 5 (3,600–6,000 km/h), there is a phenomenon of dissociation and ionization of air molecules in the air surrounding the aircraft. The plasma formed around the aircraft is visible on radar, even if the aircraft itself, a few centimeters away, is invisible. Hypersonic aircraft are less maneuverable and have a high inertia, such that the flight path must largely be pre-calculated. The sensors on hypersonic aircraft are disturbed by the incandescent plasma. Communication with such aircraft is also difficult, for the same reasons. Hypersonic speeds exclude using manual controls; computerized piloting is used, which is most suited to small, possibly unmanned, aircraft.

Stealth Technologies

The Russian designers will have to really master stealth technology and 3D design. The Americans used the most advanced supercomputers to design the shape of the B-2, and it took them from 1980 until 1982. Many useful ideas will be borrowed from the Sukhoi design group's Su-T 50 5th-generation multirole fighter aircraft, which is being flight tested. Since the PAK DA is designed to fly mostly at night, it will be dark in color. Onboard sensors will warn the crew to increase the altitude, as a function of the brightness of the sky. This is used to evade infrared sensors on enemy fighters. The "hotter" the plane is, the easier it is to see against the sky. Certain special situations are resolved by having an onboard computer; for example, in case one or more engines catches fire or when there is a forced landing.

The White Elephant bomber will require about ten times more hours of maintenance to restore its flight capacity than bombers currently in service. This will include fine sanding of abrasions in the special resin which will coat the radar-absorbent fairings. This coating can be damaged by rain mixed with hail that is encountered when flying in the clouds, and it is sensitive to hard landings when the shock is absorbed by the aircraft's load-bearing structure and transmitted to the panels coated with this special paint. Accidental scratches can occur while the jets are on the ground, for example from pebbles kicked up by jets of air from the nozzles of other aircraft, and that also damages their radar invisibility.

The aircraft's design accounts for much of conventional radar invisibility (in the centimeter range), by avoiding angles close to 90? at the vertical and horizontal junction of the wings and the tail with the fuselage, in the shape of the air intakes, etc. Special radar-absorbent paint, as thick as a radar wave is long, also helps reduce the radar footprint. An SAS (Signature Assessment System) will be installed on board the White Elephant which will indicate the extent to which the radar-absorbent coating is degraded. When the radar footprint of the plane compromises its invisibility, portions of the coating will remediated.

The PAK DA's Avionics

The White Elephant's cabin has been designed with the MMI concept ("man–machine interface" or "human computer interface") in mind, which allows the engine to be started without first manually switching dozens of contacts according to a full check list, followed by the pilot activating a pushbutton starter motor. It only takes a unique command, and the on-board computer automatically runs the start algorithm without crew intervention.

The cabin is a “glass cockpit” with an EFIS (Electronic Flight Instrument System) digital display, with color LCDs (MFD-type — multi-function displays) for each of the two pilots. The White Elephant uses an electronicinterface for the flight controls (FBW — digital fly-by-wire). The communication system includes two radio systems, one of which also serves as a data line which transmits information, via satellite, from command and control points on the ground and on ships, and from far away AWACS/AEW warning aircraft.

The conventional navigation subsystem is comprised of a device combining inertial sensors, radio, GPS, and Terrain Contour Matching or TERCOM, which provides a digital map of the area overflown. The subsystem for low visibility navigation and fire control is composed of a common block of FLIR-type (Forward-Looking Infra-Red)and IRST (Infra-Red Search and Track) sensors. A laser rangefinder (mounted in the nose), and a laser projector guidance system for on-board weapons (mounted on the underside of the wing), together constitute the optical equipment for weapons guidance.

The main onboard subsystem for navigation, target discovery and weapon delivery is based on state-of-the-art AESA-type onboard radar (Active Electronically Scanned Array) which has a range of 300 km at an altitude of 10,000 m, which is why it is called a mini-AWACS. All data collected by the AESA radar and acquired onboard via an encrypted data line are processed by an onboard microprocessor. The radio-electronic warfare equipment (EW) consists of a Radar Warning Receiver (RWR) and Missile Approach Warning system (MAW). The EW equipment is an automated command system for the active and passive electronic countermeasures system.

Basic Weaponry on the PAK DA

The bomber does not have hardpoint mountings or weapons stations for bombs or missiles under the wings, which helps minimize the radar exposure. The White Elephant’s entire weapons arsenal is in the bomb bay with hermetically sealed hatches. The PAK DA can carry bombs of different calibers, and guided or unguided, and air-to-ground missiles or air-to-ship and air-to-air missiles. The White Elephant will be armed with ten Kh-101 cruise missiles with conventional warheads containing 400kg of explosives — or with Kh-102s with 250KT nuclear warheads. Both ALCMs (Air-Launched Cruise Missiles) are powered by a turbofan, have a range of 5500 km (over 3400 miles) and a top speed of 970 km/h. with a likely deviation of less than 5m. The Kh-101 has a radar cross-section about the size of a bird, uses radar absorbing materials, conformal antennas, and other stealth technologies.The Kh-101/102 can only be detected from a distance of 24–40 km or less, when it harder to combat.

Over the sea, the ALCM uses an inertial guidance system that allows it to make evasive maneuvers (sudden changes in heading), but only small corrections so as to maintain a flight altitude of 50–100 m and to maintain its direction. Once the ALCM is over the ground, the TERCOM equipment (Terrain Contour Matching) takes over for short- or medium-distance navigation. It has a relief map of the predetermined flight path stored in memory, which it compares with the radar image of the area overflown. It maintains a constant altitude above the ground using a radio altimeter.

At 10 km from the target, a precision control module comes into play, with the GPS coordinates of the targetpre-set. Here the rocket control head takes over for short-range fire-control, that is, a small, millimeter-wave radar that allows it to detect and recognize the target. To verify the accuracy of the strike, a TV camera mounted on the rocket broadcasts (via satellite) the last 10 seconds of the approach to target.

Targets in North America are hard to hit using bombers crossing the Atlantic or Pacific, because of the long distance. Russian bombers, including the PAK DA, can approach America undetected by flying over the North Pole, but, while flying over the Poles, conventional navigation is impossible as there are no landmarks from the ground. There are no radio beacons on the ground or sea in this isolated area of the globe. Inertial navigation systems and GPS lack accuracy. But unlike the American, Russian strategic bomber crews have plenty of experience flying over the North Pole. Russian bomber crews run hundreds of flight training exercises in the Arctic every year.

For example, two Russian Tu-160 Blackjack supersonic strategic bombers took off on October 28, 2013, at Engels airbase in the Volga region, heading for the Barents Sea and then to the North Pole. Both bombers had two crewmen on board, young pilots in training. Beyond the North Pole, the bombers flew parallel to the Pacific coast near the US, Canada, Mexico, Guatemala and El Salvador to Nicaragua. Once they crossed that country, the two Tu-160s flew over the Caribbean Sea, landing at the Maiquetía-Caracas air base in Venezuela. Their flight path covered a distance of over 10,000 km and lasted 13 hours, without any air supply. Throughout the entire mission the two Tu-160 bombers were in strict compliance with regulations of the Chicago Convention of the ICAO (International Civil Aviation Organization) governing the use of international airspace.