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Buk missile system

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9K37 Buk NATO reporting name: SA-11 Gadfly, SA-17 Grizzly, SA-27 Gollum, SA-N-7 Gadfly Buk-M1-2 air defence system in 2010From left to right: Buk-M1-2 TAR, TELAR and TEL vehicles in 2010TypeMedium range SAM systemPlace of originSoviet Union; later RussiaService historyIn service1980 presentUsed by9K37 Buk OperatorsWars Russo-Georgian War Russo-Ukrainian War War in Russo-Ukrainian war (2022 present) Second Nagorno-Karabakh War 2026 United States intervention in Venezuela Production history -Antey:Kalashnikov: MMZ (GM chassis) : Naval: The Buk (Russian: " "; "beech" (tree), BOOK) is a family of self-propelled, medium-range surface-to-air missile systems developed by the Soviet Union and its successor state, the Russian Federation, and designed to counter cruise missiles, smart bombs and rotary-wing aircraft, and unmanned aerial vehicles. In the Russian A2AD network, Buk is located below the S-200/300/400 systems and above the point defense Tor and Pantsir. A standard Buk battalion consists of a command vehicle, target acquisition radar (TAR) vehicle, six transporter erector launcher and radar (TELAR) vehicles and three transporter erector launcher (TEL) vehicles. A Buk missile battery consists of two TELAR (four missiles apiece) and one TEL vehicle, with six missiles for a full complement of 14 missiles. The Buk missile system is the successor to the NIIP/ Vympel 2K12 Kub (NATO reporting name SA-6 "Gainful"). The first version of Buk adopted into service carried the GRAU designation 9K37 Buk and was identified in the West with the NATO reporting name "Gadfly" as well as the US of ( ) designation SA-11. With the integration of a new missile, the Buk-M1-2 and Buk-M2 systems also received a new NATO reporting name Grizzly and a new designation SA-17. Since 2013, the latest incarnation "Buk-M3" is currently in production and active service with a new designation SA-27. A naval version of the system, designed by MNIIRE Altair (currently part of GSKB Almaz-Antey) for the Russian Navy, received the GRAU designation 3S90M and will be identified with the NATO reporting name Gollum and a designation SA-N-7C, according to Jane's Missiles & Rockets. The naval system was scheduled for delivery in 2014. A Buk missile was used to shoot down Malaysia Airlines Flight 17 over Ukraine in 2014. of the 9K37 "Buk" started on 17 January 1972 at the request of the of the . The development team included many of the same institutions that had developed the previous 2K12 "Kub" (NATO reporting name "Gainful", SA-6), including the Tikhomirov Scientific Research Institute of Instrument (NIIP) as the lead designer and the Novator design bureau, which was responsible for the development of the missile armament. Agat [ru] were employed to develop radar-homing capacities In addition to the land-based system, a marine system was to be produced for the Navy: the 3S90 "Uragan" (Russian: " "; hurricane) which also carries the SA-N-7 and "Gadfly" designations. KubKvadratSoviet/RussianExport Kub-M1Kub-M Kub-M3 BukUraganShtil Buk-M1Buk-1 (Kub-M4) Buk-M1-2Gang GangeBuk-M1-2A Buk-M2UralBuk-M2EBuk-M2EKEzhShtil Buk-M3SmerchShtil-1 The Buk missile system was designed to surpass the 2K12 Kub in all parameters, and its designers, including its chief designer Ardalion Rastov, visited Egypt in 1971 to see Kub in operation. Both the Kub and Buk used self-propelled launchers developed by Ardalion Rastov. As a result of this visit, the developers came to the conclusion that each Buk transporter erector launcher (TEL) should have its own fire control radar, rather than being reliant on one central radar for the whole system as in Kub. The result of this move from TEL to transporter erector launcher and radar (TELAR) was a system able to shoot at multiple targets in multiple directions at the same time. In 1974 the developers determined that although the Buk missile system is the successor to the Kub missile system, both systems could share some interoperability. The result of this decision was the 9K37-1 Buk-1 system. Interoperability between Buk TELAR and Kub TEL meant an increase in the number of fire control channels and available missiles for each system, as well as faster entry of Buk system components into service. The Buk-1 was adopted into service in 1978 following completion of state trials, while the complete Buk missile system was accepted into service in 1980 after state trials took place between 1977 and 1979. The naval variant of the 9K37 "Buk", the 3S90 "Uragan", was developed by the Altair design bureau under the direction of chief designer G.N. Volgin. The 3S90 used the same 9M38 missile as the 9K37, though the launcher and associated guidance radars were exchanged for naval variants. After the 9S90 system was tested, between 1974 and 1976 on the Kashin-class destroyer Provorny, it was accepted into service in 1983 on the Project 956 Sovremenny-class destroyers. No sooner had the 9K37 "Buk" entered service than the of the authorised the development of a modernised 9K37 which would become the 9K37M1 Buk-M1, adopted

into service in 1983. The modernisation improved the performance of the system radars, its "probability of kill" and its resistance to electronic countermeasures (ECM). Additionally a digital target classification system was installed, relying on spectral analysis of returned radar signals. This targeting system is of different nature and purpose when compared to an IFF system. A Buk-M1-2 SAM system 9A310M1-2 TELAR at 2005 MAKS Airshow Another modification to the Buk missile system was started in 1992 with work carried out between 1994 and 1997 to produce the 9K37M1-2 Buk-M1-2, which entered service in 1998. This modification introduced a new missile, the 9M317, which offered greater kinetic performance over the previous 9M38, which could still be used by the Buk-M1-2. Such sharing of the missile type caused a transition to a different GRAU designation, 9K317, which has been used independently for all later systems. The previous 9K37 series name was also preserved for the complex, as was the "Buk" name. The new missile, as well as a variety of other modifications, allowed the system to shoot down ballistic missiles and surface targets, as well as enlarging the "performance and engagement envelope" (zone of danger for potential attack) for more traditional targets like aircraft and helicopters. The 9K37M1-2 Buk-M1-2 also received a new NATO reporting name distinguishing it from previous generations of the Buk system; this new reporting name was the SA-17 Grizzly. The export version of the 9K37M1-2 system is called "Ural" (Russian: " "); this name has also been applied to M2, at least to early, towed, export versions. The introduction of the 9K37M1-2 system for the land forces also marked the introduction of a new naval variant: the "Ezh", which carries the NATO reporting name SA-N-7B 'Grizzly' (9M317 missile). was exported under the name "Shtil" and carries a NATO reporting name of SA-N-7C 'Gollum' (9M317E missile), according to Jane's catalogue. The 9K317 incorporates the 9M317 missile to replace the 9M38 used by the previous system. A further development of the system was unveiled as a concept at EURONAVAL 2004, a vertical launch variant of the 9M317, the 9M317ME, which is expected to be exported under the name "Shtil-1". Jane's also reported that in the Russian forces it would have a name of 3S90M ("Smerch") (Russian: " ", English translation: 'tornado'). The Buk-M1-2 modernisation based on a previous more advanced developmental system referred to as the 9K317 "Buk-M2" featured new missiles and a new third-generation phased array fire control radar allowing targeting of up to four targets while tracking an additional 24. A new radar system with a fire control radar on a 24 m extending boom reputedly enabled more accurate targeting of low-altitude planes. This generation of Buk missile systems was stalled due to poor economic conditions after the fall of the Soviet Union. The system was presented as a static display at the 2007 MAKS Airshow. In October 2007, Russian General Nikolai Frolov, commander of the Russian Ground Forces air defense, declared that the army would receive the brand-new Buk-M3 to replace the Buk-M1. He stipulated that the M3 would feature advanced electronic components and enter into service in 2009. The upgraded Buk-M3 TELAR will have a seven rollers tracked chassis and 6 missiles in launch tubes. Inside the TELAR of a Buk-M1 SAM system A standard Buk battalion consists of a command vehicle, target acquisition radar (TAR) vehicle, six transporter erector launcher and radar (TELAR) vehicles and three transporter erector launcher (TEL) vehicles. A Buk missile battery consists of two TELAR and one TEL vehicle. Inside the TEL of a Buk-M1-2 SAM system The Buk-M1-2 TELAR uses the GM-569 chassis designed and produced by JSC MMZ (Mytishchi). The TELAR superstructure is a turret containing the fire control radar at the front and a launcher with four ready-to-fire missiles on top. Each TELAR is operated by a crew of four and is equipped with chemical, biological, radiological, and nuclear ( ) protection. It can guide up to three missiles against a single target. While the early Buk had a day radar tracking system 9Sh38 (similar to that used on Kub, Tor and Osa missile system), its current design can be fitted with a combined optical tracking system with a thermal camera and a laser rangefinder for passive tracking of the target. The 9K37 system can also use the same 1S91 Straight Flush 25 kW G/H band continuous wave radar as the 3M9 "Kub" system. The 9S35 radar of the original Buk TELAR uses a mechanical scan of a antenna reflector, where the Buk-M2 TELAR design used a PESA, for tracking and missile guidance. A Buk-M1-2 SAM system 9S18M1-1 Tube Arm target acquisition radar (TAR) on 2005 MAKS Airshow The 9K37 uses the 9S18 "Tube Arm" or 9S18M1 (which carries the NATO reporting name "Snow ") (Russian: 9C18 " "; dome) target acquisition radar in combination with the 9S35 or 9S35M1 (NATO: "Fire ") H/I band tracking and engagement radar which is mounted on each TELAR. The 9S18M1 target acquisition radar

has a maximum detection range of 85 km (53 mi) and can detect an aircraft flying at 100 m (330 ft) from 35 km (22 mi) away and even lower flying targets at ranges of around 10 20 km (6.2 12.4 mi). of the upgraded TELAR of a Buk-M2E The TEL reload vehicle for the Buk battery resembles the TELAR, but instead of a radar they have a crane for the loading of missiles. They are capable of launching missiles directly but require the cooperation of a 9S35-equipped TELAR for missile guidance. A reload vehicle can transfer its missiles to a TELAR in around 13 minutes and can reload itself from stores in around 15 minutes. Also, the Buk-M2 featured a new vehicle like TELAR but with radar atop of a telescopic lift and without missiles, called a target acquisition radar (TAR) 9S36. This vehicle could be used together with two TELs 9A316 to attack up to four targets, missile guidance in forested or hilly regions. The mobile simulator SAM Buk-M2E was shown at MAKS-2013. A self-propelled fire simulator installation JMA 9A317ET SAM "Buk-M2E", based on the mobile, is designed for training and evaluating the combat crew in the war environment to detect, capture, lock on to ("maintain") and defeat targets. A computer information system fully records all actions of the crew to a "black box" to allow objective assessment of the consistency of the crew's actions and results. All vehicles of the Buk-M1 (Buk-M1-2) missile system use an Argon-15A computer, as does the Zaslon radar (the first Soviet-made airborne digital computer, designed in 1972 by the Soviet Research Institute of Engineering (NI , currently NII Argon). It is produced at a in u plant originally named "50 Years of the USSR". The vehicles of Buk-M2 (Buk-M2E) missile system use a slightly upgraded version of Argon-A15K. This processor is also used in such military systems as anti-submarine defence Korshun and Sova, airborne radars for MiG-31 and MiG-33, mobile tactical missile systems Tochka, Oka and Volga. ,[when?] Argons are upgraded with the Baget series of processors by NIIP. Basic missile system specifications Target acquisition (by TAR 9S18M1, 9S18M1-1) Range: 140 kilometres (87 miles) Altitude: 60 25,000 metres (200 82,020 ft) Firing groups in one battalion: up to 6 (with one command post) Firing groups operating in a sector 90 in azimuth, 0 7 and 7 14 in elevation 45 in azimuth, 14 52 in elevation Radar mast lifting height (for TAR 9S36): 21 metres (69 ft) Reloading of 4 missiles by TEL from itself: around 15 minutes readiness time: no more than 5 minutes Kill probability (by one missile): 90 95% Target engagement zone Aircraft Altitude: 15 25,000 metres (49 82,021 ft) Range: 3 42 kilometres (2 26 miles) Tactical ballistic missiles Altitude: 2 16 kilometres (6,600 52,500 feet) Range: 3 20 kilometres (1.9 12.4 miles) Sea targets: up to 25 kilometres (16 miles) Land targets: up to 15 kilometres (9.3 miles) The system is estimated to have a 70% to 93% probability of destroying a targeted aircraft per missile launched (over 85% of Tomahawks in Syria). In 1992, the system was demonstrated to be capable of intercepting Scud missiles and large rocket artillery. The Buk is a mobile, radar-guided surface-to-air missile (SAM) missile system with all four main components acquisition and targeting radars, a command element, missile launchers, and a logistics element mounted on tracked vehicles. This allows the system to move with other military forces and relocate to make it a more difficult target to find than a fixed SAM system. The acquisition radar component (several variants have differing capabilities) allows the system to identify, track and target selected targets. The command component is intended to discern "friendly" military aircraft from foes (IFF), prioritise multiple targets, and pass radar targeting information to the missile launchers. The missile launcher component can carry a variety of missiles (as listed below) and may be able to engage more than one target simultaneously. The logistics component carries additional (reload) missiles and provides other supplies and parts for the system and the operators. In general, the system identifies potential targets (radar), selects a particular target (command), fires a missile (launcher) at the target, and resupplies the system (logistics). The missiles require a radar lock to initially steer the missile to the target until the missile's onboard radar system takes over to provide final course corrections. A proximity fuse aboard the missile determines when it will detonate, creating an expanding fragmentation pattern of missile components and warhead to intercept and destroy the target. A proximity fuse improves the "probability of kill" given the missile and target closure rates, which can be more than 3,000 km/h (1,900 mph) (or more than 900 m/s (3,000 ft/s)). Alternatively, the command component may be able to remotely detonate the missile, or the onboard contact fuse will cause the warhead to detonate. The most capable radar, assuming it has a line of sight (no terrain between the radar and the target), can track targets (depending on size) as low as 30 m (98 ft) and as far as 140 km (87 mi). The most capable missile can hit targets as far as 50 km

(31 mi) and more than 24,000 m (79,000 ft) in altitude. Since the introduction of the Buk in the 1970s, the capabilities of its system components have evolved, which has led to different nomenclature and nicknames for the components' variants. The Buk has also been adapted for use on naval vessels. Integration with higher level command posts The basic command post of the Buk missile system is 9 510 (9K317 Buk-M2), 9S470M1-2 (9K37M1-2 Buk-M1-2) and 9S470 (Buk-M1) vehicles, organising the Buk system into a battery. It is capable of linking with various higher level command posts (HL). As an option, with the use of HLCP, the Buk missile system may be controlled by an upper level command post system 9S52 Polyana-D4, integrating it with S-300V/S-300VM into an air defence brigade. Also, it may be controlled by an upper level command post system 73N6ME "Baikal-1ME" together with 1 4 units of PPRU-M1 (PPRU-M1-2), integrating it with SA-19 "Grison" (2K22 Tunguska) (6 24 units total) into an air defence brigade, as well as SA-10/20 and SA-5 Gammon and SA-2 Guideline and SA-3 Goa and Air Force. With the use of the mobile command center Ranzhir or Ranzhir-M (GRAU designations 9S737, 9S737) the Buk missile system allows creation of mixed groups of air defense forces, including Tor, Tunguska, Strela-10, and Igla. "Senezh" is another optional command post for a free mixing of any systems. In addition to mixing their potential, each of the air defense system with the aid of Senezh can become part of another air defence system (missile's / radar's / targeting information). The system works automatically. But for the full realisation of all functions, a Senezh-control system need various other monitoring systems for air defence and air force. Otherwise a Senezh system will work as a command centre, but not within a free association. 3S90 "Uragan" / M-22, or for export "Shtil" 9M317M surface-to-air-missiles of 3S90M vertical launching system (VLS) cells at the Russian frigate Admiral Essen. 3S90E "Shtil" (export variant of M-22 Uragan) single-arm launcher version on INS Talwar (F40). VLS launched "Shtil" version also available. The 3S90 "Uragan" (Russian: ; hurricane) is the naval variant of the 9K37 "Buk" and has the NATO reporting name "Gadfly" and US designation SA-N-7, it also carries the designation M-22. The export version of this system is known as "Shtil" (Russian: ; still). The 9 38 missiles from the 9K37 "Buk" are also used on the 3S90 "Uragan". The launch system is different with missiles being loaded vertically onto a single arm trainable launcher, this launcher is replenished from an under-deck magazine with a 24-round capacity, loading takes 12 seconds to accomplish. The Uragan uses the MR-750 Top Steer D/E band as a target acquisition radar (naval analogue of the 9S18 or 9S18M1) which has a maximum detection range of 300 km (190 mi) depending on the variant. The radar performing the role of the 9S35 the 3R90 Front H/I band tracking and engagement radar with a maximum range of 30 km (19 mi).The 'E' version = extended has a range of 50 to 70 km. The Uragan underwent trials from 1974 aboard the Project 61 destroyer Provorny, prior to being introduced aboard the Project 956 Sovremenny class, with the first of class commissioned in 1980. The Uragan was officially adopted for service in 1983. The modernised version of the 3S90 is the 9K37M1-2 (or 9K317E) "Ezh", which carries the NATO reporting name "Grizzly" or SA-N-12 and the export designation "Shtil". It uses the new 9M317 missile. In 1997, India signed a contract for the three Project 1135.6 frigates with "Shtil". Later, when the decision was made to modernise it with a new package of hardware & missiles, the name changed to "Shtil-1". 3S90M, or for export "Shtil-1" 3S90M SA missile system VLS version (graphic) In 2004, the first demonstration module of the new 9M317M (export 9M317ME) missile was presented by Scientific and Production Plant for the upgraded 3S90M / "Shtil-1" naval missile system (jointly with 'Altair'), designed primary for use on warships. It has 2 styles of launchers, a single-rail launcher and vertical launch system. For single-rail launcher, each launcher consists of 24 missiles and a maximum of 4 launchers can be used together, while for vertical launch system, each launcher consists of 12 missiles and a maximum of 12 launchers can be used together. Old systems Uragan, Ezh and Shtil could be upgraded to Shtil-1 by replacing the launcher module inside the ship. It has a range of 32 km for rail launcher 50 km for VLS launcher. The reaction time is 10 19 seconds for single-rail launcher and 5 10 seconds for vertical launch system, and there are various differences in missile characteristics for both launcher styles. The interval between starts is less 2 seconds. To protect against boats, helicopters, aircraft, anti-ship missiles. The first Shtil-1 systems were installed into ships exported to India and , specifically Talwar-class frigates and Type 052B destroyers. It is also in service of the Russian Navy, specifically Admiral Grigorovich-class frigates. Operational history Russian Armed Forces use a Buk-M1 to engage air targets near southern

during the Russo-Ukrainian war the War in Abkhazia (1992 1993), Abkhaz separatist forces had the support of Russian forces in their combat against the Georgian government. On 10 January 1993, an Abkhaz Aero L-39 was shot down by a Russian Buk during a friendly-fire incident. The pilot, Oleg , who was commander of the Abkhaz separatist air force, was killed during the incident. Abkhaz authorities claimed that a Buk air defense system was used to shoot down four Georgian drones at the beginning of May 2008. Initial reports on Georgian Buk missile system success claimed that the system was responsible for shooting down four Russian aircraft three Sukhoi Su-25 close air support aircraft and a Tupolev Tu-22M strategic bomber in the 2008 South Ossetia war. U.S. officials have said Georgian Buk-1M was certainly the cause of the Tu-22M's loss and contributed to the losses of the three Su-25s. According to some analysts, the loss of four aircraft was surprising and a heavy toll for Russia given the small size of Georgia's military. Some have also pointed out that Russian electronic countermeasures systems were apparently unable to jam and suppress enemy SAMs in the conflict and that Russia was, surprisingly, unable to come up with effective countermeasures against missile systems it had designed. Georgia bought these missile systems from Ukraine; there was an inquiry to determine if the purchase was illegal. According to Moscow Brief six and not four aircraft (Georgia maintains the higher numbers), were shot down, but Russia claims that the three Su-25s were shot down by friendly fire, while highlighting a serious issue in the coordination of Russian Air Force and its ground forces during that war. Russo-Ukrainian War The system was used to shoot down the Boeing 777-200ER Malaysia Airlines Flight 17 from 20km away, on 17 July 2014, in eastern Ukraine, killing 298 people.: 142 147 Evidence included missile fragments found on site including pieces of warhead stuck in the wreckage as well as non-explosive parts of the missile with serial number remnants. Missile fragments were recovered from the bodies of the flight crew. On 7 August 2014, pro-Russian separatist forces shot down a Ukrainian Air Force Mikoyan MiG-29 with a Buk surface-to-air missile near the town of Yenakievo. The pilot managed to eject. On 14 April 2018, American, British, and French forces launched a barrage of 105 air-to-surface and cruise missiles targeting eight sites in Syria. The Russian Ministry of said that twenty-nine Buk-M2E missiles launched in response destroyed twenty-four incoming missiles. The SOHR, which is cited by many independent media organisations, reported that the Syrian Air Force intercepted and shot down at least 65 missiles. The American of said that no missiles were shot down. On 19 July 2021, according to Vadim Kulit, deputy chief of the Russian for Reconciliation of the Opposing Parties in Syria, four Israeli Air Force F-16 fighters entered Syria's airspace via the US-controlled al-Tanf zone and fired eight guided missiles at an area southeast of Aleppo. He said that seven missiles were shot down by the Russian-made Pantsyr-S and Buk-M2 systems of the Syrian Air Forces. Buk-M2E reportedly continued interceptions through the beginning of September. Russo-Ukrainian war (2022 present) A Ukrainian Buk-M1 TELAR adapted for the use of Sea Sparrow missiles Ukraine's Soviet-era Buk and S-300 missile systems have proven effective at medium and long ranges, forcing Russian jets to fly lower and bringing them into the range of MANPADS and short-range missile systems. Ukraine is adapting some of its Buk missile systems/launchers to accept Sea Sparrow missiles. Previously the Polish company Wojskowe Zak ady Uzbrojenia S.A. offered to integrate the Sea Sparrow missile into Kub launchers for export customers, demonstrating the feasibility of integrating NATO standard missiles with Soviet platforms. Both the Buk missile 9M38 and Sea Sparrow are semi-active radar guidance missiles. However, the Sea Sparrow missile is shorter in range than the 9M38 missile. There is a surplus number of these missiles in the US stockpiles. The RIM-162 variant of the Sea Sparrow missile is still in production. A Ukrainian commander of a Buk battery has told the BBC that while his system is "target number one" for the Russians, the shortage of spare parts is more critical than missiles, even though his vehicle carried only two missiles instead of four. On 27 February 2022, a Ukrainian TB2 Bayraktar drone destroyed a TELAR missile and radar transporter and another TEL launcher of a Russian Buk-M1-2 SAM system near Malin, northwest of Kyiv. On 23 February 2024, the General Staff of the Ukrainian Armed Forces announced that two Russian Buk-M3 air defense missile systems were destroyed. On 11 May 2024, a Russian drone destroyed a Ukrainian Buk-M1 missile system. The Buk-M1 system appears to have been fitted with US-made RIM-7 Sea Sparrow missiles, instead of the original 9M38 missiles. On 11 June 2024 a Switchblade, believed to be a model -600 or improved model, struck a Russian Buk missile launcher in Sarabash (formerly Komunarivka), .

The drone had to travel more than 30 kilometres (19 mi). On 30 2024, The Unmanned Systems Forces claimed to have destroyed a Russian "Buk-M1-2", in Zaporizhzhia. On 7 April 2025, Ukrainian drones, from the Unmanned Systems Forces of the Armed Forces of Ukraine destroyed 3 Buk missile launchers in Kursk over 12 hours, a Buk-M2 and two Buk-M3s. On 7 October 2025, Ukrainian forces landed a drone on a Buk-M2 or Buk-M3 and the drone travelled with the missile system for some fifteen kilometres before the crew noticed it. They filmed it with their phones and one of the crew tried to disarm with a stick before the crew scattered and the drone exploded. Follow up strikes hit other vehicles nearby. On 10 October 2025, Russia claimed to have shot down the first two Flamingo (missile)s, one using a Buk missile launcher. Pictures were supplied, the missile was claimed to have been travelling at 100 metres and a speed of "roughly 600 kilometers per hour." 2026 United States intervention in Venezuela On 3 January 2026, a footage showed a destroyed Venezuelan Buk-M2E in Generalissimo Francisco de Miranda Air Base in after United States strikes emerged. 9 38 of 9M38M1, 9M317 and 9M317ME surface-to-air missiles of the Buk missile systemTypeSurface-to-air missilePlace of originSoviet UnionProduction historyVariants9 38, 9 38M1, 9M317Specifications (9 38, 9M317)Mass690 kg (1,520 lb), 715 kg (1,576 lb)Length5,550 millimetres (18 ft 3 in) mm (15+3 4 in); wingspan 860 mm (2 ft 10 in)WarheadFrag-HEWarhead weight70 kg (150 lb) proximity fusePropellantSolid propellant rocketOperationalrange30 kilometres (19 mi)Flight altitude14,000 metres (46,000 ft)Maximum speedMach 3GuidancesystemSemi-active radar System composition 9 38 and 9 38M1 missile The 9M38 uses a single-stage X-winged design without any detachable parts; its exterior design is similar to the American Tartar and Standard surface-to-air missile series. The design had to conform to strict naval dimension limitations, allowing the missile to be adapted for the M-22 SAM system in the Soviet Navy. Each missile is 5,550 mm (219 in) long, weighs 690 kg (1,520 lb) and carries a relatively large 70 kg (150 lb) warhead which is triggered by a radar proximity fuze. In the forward compartment of the missile, a semi-active homing radar head (9E50, Russian: 9 50, 9 50 1), autopilot equipment, power source and warhead are located. The homing method chosen was proportional navigation. Some elements of the missile were compatible with the Kub's 3M9; for example, its forward compartment diameter 330 millimetres (13 in), which was less than the rear compartment diameter. 9M38M1 contains about 8000 shrapnel elements in the warhead, of which every fourth is in the shape of a butterfly. 9M317 surface-to-air missile on the Buk-M2 quadruple launcher. Early Buk M1 missile in display. The 9M38 surface-to-air missile uses a two-mode solid-fuel rocket engine with total burn time of about 15 seconds; the combustion chamber is reinforced by metal. For the purpose of reducing the centring dispersion while in flight, the combustion chamber is located close to the centre of the missile and includes a longer gas pipe. The 9M38 is capable of readiness without inspection for at least 10 years of service. The missile is delivered to the army in the 9Ya266 (9 266) transport container. The 9M317 missile was developed as a common missile for the Russian Ground Force's Air Forces (PVO) (using Buk-M1-2) as well as for ship-based PVO of the Russian Navy (Ezh). Its exterior design bears a resemblance to the Vympel R-37 air-to-air missile. The unified multi-functional 9M317 (export designation 9M317E) can be used to engage aerodynamic, ballistic, above-water and radio contrast targets from both land and sea. Examples of targets include tactical ballistic missiles, strategic cruise missiles, anti-ship missiles, tactical, strategic and army aircraft and helicopters. It was designed by OJSC Scientific Production Plant ( ). The maximum engageable target speed was Mach 3.49 and it can tolerate an acceleration overload of 24G. It was first used with Buk-M1-2 system of the land forces and the Shtil-1 system of the naval forces. In comparison with 9M38M1, the 9M317 has a larger defeat area, which is up to 45 km of range and 25 km of altitude and of lateral parameter, and a larger target classification. Externally the 9M317 differs from the 9M38M1 by a smaller wing chord. It uses the inertial correction control system with semi-active radar homing, using the proportional navigation (PN) targeting method. The semi-active missile homing radar head (used in 9E420, Russian: 9 420) as well as 9E50M1 for the 9M38M1 missile (9E50 for 9M38) and 1SB4 for Kub missile (Russian: 1 4) was designed by MNII Agat (Zhukovskiy) and manufactured by MMZ at Ioshkar-Ola. The 9M317 missile uses active homing when approaching the target. 9M317M and 9M317A missiles , several modernised versions are ordered, including the 9M317M / 9M317ME, and active radar homing (ARH) missile 9M317A / 9M317MAE. The lead developer, NIIP, reported the testing of the 9M317A missile within Buk-M1-2A "OKR

Vskhod" (Sprout in English) in 2005. The range is reported as being up to 50 km (31 mi), maximum altitude around 25 km (82,000 ft) and maximum target speed around Mach 4. The weight of the missile has increased slightly to 720 kg (1,590 lb). The missile's Vskhod development program for the Buk-M1-2A was completed in 2011. This missile could increase the survival capability and firing performance of the Buk-M1-2A using its ability to hit targets over the horizon. In 2011, NPP completed preliminary trials of the new autonomous target missile system OKR Pensne (pince-nez in English) developed from earlier missiles. The weight of the missile is 581 kg, including the 62 kg blast fragmentation warhead initiated by a dual-mode radar proximity fuze. of the hull are 5.18 m length; 0.36 m maximum diameter. Range is 2.5 32 km in a 3S90M / "Shtil-1" naval missile system. Altitude of targets from 15 m up to 15 km (and from 10 m to 10 km against other missiles). 9M317ME missiles can be fired at 2-second intervals, while its reaction (readiness) time is up to 10 s. The missile was designed to be single-staged, inertial guidance, radio control mid-course update and terminal semi-active radar homing. The tail surfaces have a span of 0.82 m when deployed after the missile leaves the launch container by a spring mechanism. Four gas-control vanes operating in the motor efflux turn the missile towards the required direction of flight. After the turnover manoeuvre, they are no longer used and subsequent flight controlled via moving tail surfaces. A dual-mode solid-propellant rocket motor provides the missile with a maximum speed of Mach 4.5. The 9M318 is a medium-range surface-to-air missile developed in Belarus for the Buk-MB2 and Buk-MB3K air defense systems. The missile was initially developed around 2010 by the design bureau OKB TSP in Minsk. It was first displayed publicly at the MILEX defense exhibition in Minsk in 2019. The missile has a reported maximum range of about 70 kilometres and can engage targets flying at altitudes between 15 metres and 25 kilometres. The 9M318 was designed to decrease Belarus dependence on Russian missile sources and is produced by the privately run National Bureau of the Republic of Belarus from local materials. The missile has been under testing since 2020; the complex, which includes it, was demonstrated on A -2022 in Baku. It was intended to be able to operate in a heavy ECM environment and perform anti-ballistic missile functions. It can also engage tactical ballistic missiles and surface targets with ranges from 1 km to 60 km, with active jamming. The missile weighs 815 kilograms, it can travel at speeds up to 1350 m/s, and utilises an active radar homing seeker to achieve up to 10 cm accuracy. Missile (GRAU designation) 3M9 9 38 9 389 38M1 9 389 38M19M317 9M317 9M317M 9M317ME System (GRAU and NATO designation) 2K12 "Kub" (SA-6) 9K37 "Buk" (SA-11) 9K37M "Buk-M1" (SA-11) 9K37M1-2 "Buk-M1-2" (SA-17) 9K317E "Buk-M2E" (SA-17) 9K37M Buk-M3 (SA-27)/ Shtil-1 SA-N-12 9K37M Buk M3 or Shtil 1 SA-N-12 (export version) Introduced 1967 adopted by 1980 is used from 1978 1983 is used from 1979 1998 development is completed 1988, produced from 2007 2016 1983 / first seen in 2004 Missiles per TEL 3 4 4 4 4 12 12/24/36 Missiles per TELAR 3 4 4 4 4 6 Missile weight 599 kg (1321 lb) 690 kg (1521 lb) 690 kg (1521 lb) 9 38M1: 690 kg (1521 lb);9M317: 710 720 kg (1565 1587 lb) 710 720 kg (1565 1587 lb) 581 kg 581 kg Range 6(8) 22 km (2 15 miles) 3,5 25 (30) km (3 19 miles) 3,3 35 km (2 22 miles) 9 38M1: 3 42 km (2 26 miles);9M317: 3 50 km (2 31 miles) 3 50(M2), 45(M2E) km (2 31(29) miles) 2.5 70 km (1.6 43.5 mi) (M-22=25 km)/3,5-32 up to 50 km (taking into account the use against large targets (ships)) Range of altitude 100 7000 m 25 18000 (20000) m (100 46,000 ft) 15 22000 m (100 72,000 ft) 15 25000 m (100 82,000 ft) 15 of M2E 10 of M2 25000 m (to-82,000 ft) 0.015 35 km (49 114,829 ft) (M-22=10)5 15000 m Missile speed (Mach) 2.8 3 3 3 4 4.6 4.5 (for M-22 average speed of 1000 m/s) Maximum target speed (Mach) 2 800 m/s 4 4 to meet (M2E aerodynamic up to 1100 m/s, of ballistic 1200 m/s), pursuing 300 400 m/s 3,000 m/s (11,000 km/h (6,800 mph); Mach 8.8 830 m/s/? Maximum manoeuvrability (G) (for missiles). 19/? 19 20 24 For missiles (24). For target (10). 24 up to 19/? Simultaneous fire 1 2 (Kub-M4/Buk-1) (2) max 6 18 (2) 18 22 6 old/12 update 1997 24 36 2 12 (For Shtil-1 directs to 3 missiles simultaneously at each target) Original design tree 9K37-1 'Buk-1' First Buk missile system variant accepted into service, incorporating a 9A38 TELAR within a 2K12M3 Kub-M3 battery. 9K37 'Buk'- The completed Buk missile system with all new system components, back-compatible with 2K12 Kub. 9K37M1 'Buk-M1' An improved variant of the original 9K37 which entered into service with the then Soviet armed forces. 9K37M1-2 'Buk-M1-2' ('Gang' for export markets) An improved variant of the 9K37M1 'Buk-M1' which entered into service with the Russian armed forces. 9K317 'Ural' initial design of Buk-M2 which entered into service

with the Russian armed forces Backside of the 9A317 TELAR of Buk-M2E (export version) at the 2007 MAKS Airshow Wheeled MZKT-6922 TELAR of Buk-M2EK SAM system at Kapustin Yar, 2011 9K317E 'Buk-M2E' revised design for export markets 9K37M1-2A 'Buk-M1-2A' redesign of Buk-M1-2 for the use of 9M317A missile 'Buk-M2EK' A wheeled variant of Buk-M2 on MZKT-6922 chassis exported to Venezuela and Syria. 9K317M 'Buk-M3' A SAM battalion has 36 target channels in total. Naval version design tree 3S90/M-22 Uragan (SA-N-7 "Gadfly") Naval version of the 9K37 Buk missile system with 9M38/9M38M1 missile. 3S90 Ezh (SA-N-7B/SA-N-12 'Grizzly') Naval version of the 9K37M1-2 with 9M317 missile. 3S90 Shtil (SA-N-7C 'Gollum') Naval export version of the 9K37M1-2 with 9M317E missile. 3S90E.1 "Shtil-1" (SA-N-12 'Grizzly') Naval export version with 9M317ME missile. 3S90M Smerch (SA-N-12 'Grizzly') naval version with 9M317M missile. Wheeled MZKT-69225 TELAR of Buk-MB3K SAM system at Milex military exhibition, 2021 Belarus In May on the MILEX-2005 exposition in Minsk, Belarus presented their own digital upgrade package for early models of 9K37 Buk, called Buk-MB. On 26 June 2013 an exported version of Buk-MB was displayed on a military parade in Baku. It included the new 80K6M Ukrainian-build radar on an MZKT chassis (instead the old 9S18M1) and the new Russian-build missile 9M317 (as in Buk-M2). Buk-MB has been sold to Azerbaijan. HQ-16A The HQ-16 is a medium range semi-active radar homing surface-to-air missile developed by the People's Republic of . of the HQ-16 began in 2005 as a joint development with Russian company Almaz-Antey, based on the older Buk-M1 and Buk-M2 surface-to-air missile systems. (GRAU and NATO designation) 9K37 "Buk" (SA-11) 9K37-1 "Buk-1" (SA-11) 9K37M1 "Buk-M1" (SA-11) 9K37M1-2 "Buk-M1-2" (SA-17) 9K317E "Buk-M2E" post 9S470 N/A 9S470M1 9S470M1-2 9S510 Surveillance radar (SURN, SOTs, or TAR) 9S18 Kupol 1S91M3 9S18M1 Kupol-M1 9S18 1-1 9S112, 9S36 TELAR 9 310, 9 38 9A38 9A310M1 9A310M1-2 9A317 TEL 9 39 2P25M3 9A39M1 9A39M1, 9A39M1-2 9A316 TEL 9A316 TELAR 9A317 Upper level CP (PBU of the zrbr zenith-rocket brigade) from the structure of ASU Polyana-D4 4 zrdn (zenith-rocket division) CP 9S470 SOTs 9S18 Kupol range up to 120 km (45 km at a height 30 meters). 3 zrbat (zenith-rocket battery) 2 TELAR 9 310 1 TEL 9 39 Technical service division ommunication service platoon 2K12M4 Kub-M4 (9K37-1 Buk-1) 1 SURN 1S91M3 (from the structure of 2K12M3 Kub-M3) 4 TEL 2P25M3 (from the structure of 2K12M3 Kub-M3) 1 TELAR 9A38 (from the structure of 9K37 Buk) 9K37M1 Buk-M1 (Ganges) Technical service division 9V95M1E mobile automatized control and test station vehicle based on a ZIL-131 with a trailer 9V883, 9V884, 9V894 repair and technical service vehicles based on Ural-43203-1012 9V881E technical service workshop based on Ural-43203-1012 9T229 transporter vehicle for 8 missiles or 6 containers with missiles based on a KrAZ-255 9T31M auto crane MTO-ATG-M1 technical service workshop based on ZIL-131 Preparing to fight (inversely) 5 min. Translation in battle mode, not for the first time in battle (after moving to another place) no more than 20 seconds. the exercise, " 92" (1992) SAM family of "Buk" conducted successful firing at targets on the basis of ballistic missile R-17 Elbrus, and on the basis of MLRS rockets "Smerch" (caliber 0.3 meters). 9K37M1-2 Buk-M1-2 (Ural) A command post vehicle 9S470M1-2 may take control over 4 batteries, each has 1 TELAR 9A310M1-2 with 1 TEL 9A39M1/9A39M1-2 or 2 batteries, each has 1 target acquisition radar 9S18 1-1 and 2 TELs 9A39M1 Additionally, the TELAR 9A310M1-2 may take control over the Kub vehicles just the TEL 2P25 or the self-propelled unit of reconnaissance and guidance 1S91 with a TEL 2P25. In this configuration complex can simultaneously fire two goals instead of one. Probability of hitting of one rocket is: Statically flying aircraft, 0.7 0.9; Manoeuvring aircraft with overdrive to 7 8 G, 0.5 0.7; Tactical ballistic missiles, 0.5 0.7; Anti-radar missiles, 0.6 0.8; missiles, 0.6 0.8. The composition: command post 9S470M1-2 6 self-propelled fire units 9A310M1-2 can perform all combat functions, including identification of the state of the owner of the object detected. 3 launchers (can fire, transporting and loading of other launchers) installation 9A39M1, target detection station 9S18M1, machine of maintenance 9V881M1-2 with caravan ZIP 9T456, workshop of maintenance SPA-M1, machine of repair and maintenance. The maximum range of fire against ballistic missiles is 20 km, and the maximum target speed is 1200 m/s. Its capacity of protecting against ballistic missiles is comparable with that of the Patriot PAC-2. However, the engagement ceiling is lower. Preparing to fight (inversely) 5 min. Translation in battle mode, not for the first time in battle (after moving to another place) no more than 20 seconds. The range for engaging

targets on land is 15 km, 25 km on the water. The capture distance of targets with RCS = 5 m2 40 km. It automatically provides a high resistance to interference and work in several different combat modes, detection range of the locator of early detection 160 km. Technical service division Technical service vehicle MTO 9V881M1-2 with a trailer ZIP 9T456 Technical service workshop MTO AGZ-M1 Technical service and maintenance vehicles MRTO: MRTO-1 9V883M1, MRTO-2 9V884M1, MRTO-3 9V894M1 Transport vehicle (TM) 9T243 with a technological equipment set KTO 9T3184 Automated control and test mobile station AKIPS 9V95M1 Workshop vehicle for the missile maintenance 9T458 Unified compressor station UKS-400V Mobile power plant PES-100-T/400-AKP1 There was an experimental 9 320 TEL (with 8 missiles). Some works were performed to use a wheeled vehicles for Buk-M2-1 on a KrAZ-260 chassis, but they were not completed. in 1988. Accepted for service in 2008. The structure of the Buk-M2 Fighting means Anti-aircraft missiles: 9 317 Self-propelled firing installation: 9 317 and 9 318 (towed), has everything for self-War, reaction time 5 sec, range to 20 km (radar cross-section of 1 2 m2; height 3 km), 18 20 km (RCS 1 2 m2, height 10 15 m), range of work in the system 5 to + 85 degrees for missile guidance (to search for up to 70 if alone) Installation of charging 9 317 and 9 318 or shooting teams 9 510: 9 316 and 9 320; Management tools post 9 510, reaction time 2 seconds. Radar of targets detection (all directions 360) 9 18 1 3, range to 160 km (1 2 m2) Radar of illumination and guidance of missiles or radar of targets detection of range 60 9 36. 9S36-1 (if derrick is raised as much as possible) range to 120 km (radar cross-section of 1 2 m2, height 3 km), 30 35 km (RCS 1 2 m2, height 10 15 m) Translation in battle mode for the first time in battle-not more than 5 minutes, but 10 15 minutes when using derrick in which the radar of 9S36-1. Translation in battle mode, not for the first time in battle (after moving to another place) no more than 20 seconds. The probability of hitting targets one missile is: (data from the developer and several other sources) Aircraft of tactical aviation, 0.9 0.95 Tactical ballistic missiles, 0.6 0.7 maximum speed of ballistic targets 1200 m/s. missiles, 0.7 0.8 Hovering helicopters, 0.3 0.4 Helicopter, 0.7 0.8 Anti-radiation missile, 0.5 0.7. The minimum rs to 0.05 square meters. -and-night passive optical system for target detection, thermal imager with minimal radiation (9 317 and 9 318). The system operates in a mountainous area without glare. The normal range of a ballistic missile to intercept with the use of Buk is up to 200 km. 9A316M launcher of the Buk-M3 surface-to-air missile system The 9K317M 'Buk-M3' is the latest production version, based on new hardware. It has 36 target channels and features advanced electronic components. Specifications include a maximum target speed of 3,000 m/s (11,000 km/h; 6,700 mph; Mach 8.8), an altitude range of 0.015 35 km (49 114,829 ft) and a distance range of 2.5 70 km (1.6 43.5 mi). Extensive trials began in 2015, with the first deliveries planned for 2016. (2 in 2016). The probability of hitting a target with one missile is: aircraft 0.95; tactical ballistic missile 0.7; cruise missile 0.8. It offers increased efficiency against electronic countermeasures and manoeuvring targets. They are more compact, increasing the TELAR's carrying capacity to six missiles. The missile's new HE-fragmentation warhead can more easily penetrate armor. The complex is highly mobile and designed against air, ground and sea targets (e.g. destroyers). The missile reaches a speed of 1,550 m/s (5,600 km/h; 3,500 mph; Mach 4.6), and manoeuvres by air rudders and reactive rudders. The interval between shots is one second in any direction. Targeting is by commands or active homing, or in combination. Thermal radar[clarification needed] works on any target at any time in any weather. Russian sources claim the system can destroy the MGM-140 ATA , though as of 2016 this has never been actually attempted. Radar, guidance and target detection operates at a range of 60 9S36. A target at an altitude of 7 10 m can be detected at a distance of up to 35 km, targets like the AGM-158A "JASSM" at an altitude of 20 m, and RCS over 0.1 m2 at a distance of 17 18 km. The radar sees targets at an altitude of 5 meters and in practical shooting, the system demonstrated its ability to destroy anti-ship missiles flying at that altitude. In June 2016 Almaz-Antey announced successful trials of the anti-aircraft complex. Firing at Kapustin Yar in the Astrakhan region was carried out at a ballistic target, which was made by the missile-target. The first brigade set of the "Buk-M3" was delivered in 2016. It is in active service. A missile uses active guidance, the system has radio and thermal guidance (any weather, day / night), the missile uses guidance 1) on commands, 2) only active homing, 3) mixed.[clarification needed] The missile uses a directional explosion, minimum target height 5 meters. In April 2018, Rosoboronexport announced that it would be promoting the Buk-M3 "Viking" version for export. The system can be integrated with the

launchers of the Antey 2500 complex, increasing its range from 65 to 130 km. The "Viking" is reported to be able to operate both autonomously and in cooperation with other air defence systems, using their radar data for targeting, and have a gap of 20 seconds between stopping and launching missiles. The probability of intercept is reported to be close to 100%. The complex is also reported to be effective against tactical ballistic missiles. Map with Buk operators Former Buk-M1-2 of Armenian Army 9K37 Buk in Azerbaijan service Ukrainian 9K37 Buk SAMS during the Kyiv Independence Parade (2008) Potential operators Argentina: Russia offered the Buk-M2E to the Argentine Air Force. Before 1990, 9K37M1E "Ganga" launchers were supposed to enter the armies of the Warsaw Pact, but did not enter their armaments because they ceased to exist. 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Suwaki Gap

URL: https://en.wikipedia.org/wiki/Suwa%C5%82ki_Gap

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54 12 N 23 24 E / 54.2 N 23.4 EThe Suwa ki Gap, also known as the Suwa ki corridor[a][b] ([su vawk i]), is a sparsely populated area around the border between Lithuania and Poland, and centres on the shortest path between Belarus and the Russian exclave of Kaliningrad Oblast on the Polish side of the border. Named after the Polish town of Suwa ki, this choke point has become of great strategic and military importance since Poland and the Baltic states joined the North Atlantic Treaty Organization (NATO). -up at the Suwa ki Gap Map of Europe: Lithuania Poland border The border between Poland and Lithuania in the area of the Suwa ki Gap was formed after the Suwa ki Agreement of 1920, but it carried little importance in the interwar period as at the time, the Polish lands stretched farther northeast. the War, Lithuania was part of the Soviet Union and communist Poland was a member of the Soviet-led Warsaw Pact alliance. The dissolution of the Soviet Union and the Warsaw Pact hardened borders that cut through the shortest land route between Kaliningrad (Russian territory isolated from the mainland) and Belarus, Russia's ally. As the Baltic states and Poland eventually joined NATO, this narrow border stretch between Poland and Lithuania became a vulnerability for the military bloc because, if a hypothetical military conflict were to erupt between Russia and Belarus on one side and NATO on the other, capturing the 65 km (40 mi)-long strip of land between Russia's Kaliningrad Oblast and Belarus would likely jeopardise NATO's attempts to defend the Baltic states, because it would cut off the only land route there. NATO's fears about the Suwa ki Gap intensified after 2014, when Russia annexed and launched the war in , and further increased after Russia started a full-scale invasion of Ukraine in February 2022. These worries prompted the alliance to increase its military presence in the area, and an arms race was triggered by these events. Both Russia and the European Union countries also saw great interest in civilian uses of the gap. In the 1990s and early 2000s, Russia attempted to negotiate an extraterritorial corridor to connect its exclave of Kaliningrad Oblast with Grodno in Belarus. Poland, Lithuania and the EU did not consent. Movement of goods through the gap was disrupted in summer 2022, during the Russian invasion of Ukraine, as Lithuania and the European Union introduced transit restrictions on Russian vehicles as part of their sanctions. The Via Baltica road, a vital sea and road link connecting Finland and the Baltic states with the rest of the European Union, passes through the area. The expressway connection from the Polish side, the new S61 expressway, while the A5 highway in Lithuania is being upgraded to a divided highway. The Rail Baltica route near the Suwa ki Gap is under construction. The Suwa ki Gap is a sparsely populated region in the north-eastern corner of Poland, in Podlaskie Voivodeship. This hilly area, one of the coldest in Poland, is located on the western margins of the East European Plain. It is crossed by numerous river valleys and deep lakes (such as Ha cza and Wigry), and its vast swathes are covered by thick forests (including the August w Primeval Forest) and marshes, such as those in the Biebrza National Park. To its west lies another lake district known as Masuria. The area is relatively poorly developed - there is little industry besides forestry-related facilities, the road network is sparse and the nearest large airport is located several hundred kilometres away; only two major roads (with at least one lane in each direction) and one rail line link Poland with Lithuania. The area is home to some ethnic minorities, particularly Ukrainians, Lithuanians (close to the border with Lithuania) and Russians, but the Russians are not very numerous on the Polish side. Poland and Lithuania both gained independence in the aftermath of World War I and started to fight in order to establish control over as much terrain as they could militarily hold. While Lithuania claimed the majority-Polish Suwa ki and Vilnius, it ultimately failed to control both. Suwa ki was agreed to be part of Poland as a result of the Suwa ki Agreement, while Vilnius was captured by Poland in a false flag operation known as eligowski's mutiny. In the interwar period, the Suwa ki region was a protrusion of Poland into surrounding Lithuania and East Prussia (part of Germany), rather than a gap, and was of little strategic importance. The Russia Lithuania Poland tripoint near Vi tytis, photographed from the Polish side, marks the northwestern end of the Suwa ki Gap. Russia is to the left and Lithuania is to the right Following World War II, the vicinity of K nigsberg, renamed Kaliningrad shortly after the war, was incorporated as part of the Russian SFSR, part of the Soviet Union, and became a closed area for most of the Soviet era. Lithuania became a Union republic within the USSR, while Poland came under the Soviet sphere of influence and joined the Warsaw Pact. Until the dissolution of the Soviet Union, Poland's only eastern and northern neighbour was the USSR, thus, as in the interwar period, the region mattered little in military terms. This changed after 1991, when Kaliningrad Oblast became a

semi-exclave of Russia, sandwiched between Poland and Lithuania, both of which are neighbours with Belarus. Neither borders the "mainland" part of Russia. Kaliningrad Oblast's neighbours both entered the European Union and the North Atlantic Treaty Organization (NATO). At the same time, only 65 km (40 mi) of Polish territory separates two areas of the rival Security Treaty Organisation ( ) and the Union State, both of which include Russia and Belarus. The former Estonian President Toomas Hendrik Ilves claims to have come up with the name "Suwa ki Gap" before his meeting with Ursula von der Leyen, then serving as the defence minister of Germany, in April 2015 to highlight the vulnerability of the area for the Baltic states. The first time a special corridor between Kaliningrad and Belarus (planned to go via Poland) was discussed during a 1990 meeting between Yuri Shemonov, a senior official in Kaliningrad Oblast, and Nikolai Ryzhkov and Mikhail Gorbachev, Premier and President of the Soviet Union, respectively. While Ryzhkov was supportive of the idea, Gorbachev vetoed the proposal, urging the other two men to "stop spreading panic". After the Soviet Union fell apart, Kaliningrad was cut off from Russia, thus the Russians sought to secure a land transit route from the exclave to mainland Russia through Belarus. After some initial preparations, including signing a treaty which obliged Poland and Russia to open a border crossing near Go dap, the Russian government announced their intention to build a special "communication corridor" between the checkpoint and Grodno in Belarus, justifying the decision by the region's close economic ties with the country. Russia, which communicated the idea to the Polish side in 1994, additionally sought to bypass Lithuania, with which it had strained diplomatic relations. Initially, the idea sparked little interest, but extensive discussions came in 1996, when Boris Yeltsin, President of Russia, declared he would negotiate with the Polish side to seek permission to build a motorway, citing high transit costs via Lithuania. Top Polish government officials rejected the proposal. Among the main reasons was the fact that among Poles, the proposal sounded too much like the German request for an extraterritorial link through the Polish just prior to its 1939 invasion of Poland, and was thus seen as unacceptable. This feeling was amplified by the persistent usage of the word "corridor" among Russian officials. Aleksander Kwa niewski, then-president of Poland, sounded concerns about the environmental impact of the investment, while some politicians from the then-ruling coalition (SLD-PSL) argued that the corridor would cause a deterioration of diplomatic relations between Poland and Lithuania. There have been reports that Suwa ki Voivodeship, the then local authority for the area in Poland, started talks about the corridor to alleviate its economic problems and even signed an agreement with Grodno Region authorities to promote its construction via a border crossing in Lipszczany, but lukowski, then-voivode of Suwa ki who was seen by the media as supportive of the idea, denied having ever endorsed the proposal, and no proof for that (such as plans or cost estimates) was found in an internal party investigation. When G , the Polish agency responsible for the maintenance of main roads, updated its plans for the expressway network in 1996, the proposed link was nowhere to be found. The topic returned in 2001 2002 when Poland and Lithuania were negotiating accession to the European Union. Russian citizens in Kaliningrad were facing the prospect of having to use passports and apply for visas to cross the border of the new EU member states, which sparked outrage in the Russian press. Therefore, Russia suggested that the European grant a right to a 12-hour free transit for the citizens of the oblast through special corridors in Poland and Lithuania, but this proposal was rejected. Another proposal, with sealed trains, also failed to gain traction; it was ultimately agreed to introduce special permits for Russian citizens travelling to/from Kaliningrad Oblast for transit through Lithuania (but not Poland), known as Facilitated Rail Transit (FRTD) and a Facilitated Transit (FTD) for rail and road trips, respectively. Kaliningrad Oblast has since been generally supplied by freight trains transiting through Lithuania. However, on 17 June 2022, in retaliation for Russia's invasion of Ukraine, Lithuania started blocking supplies of sanctioned items to the enclave via road or rail, citing EU's sanction guidance. That guidance was then clarified in a way that exempted rail traffic from the restrictions so long as the volume of deliveries remained within prior consumption volumes, but then iauli bankas, the bank servicing the transit payments, announced it would refuse to accept ruble payments from 15 August and any payments from Russian entities from 1 September. Transit remains possible via payments to other banks but, in September 2022, was expected to become more burdensome as payments for each freight service will be processed separately to comply with Lithuanian anti-fraud regulator's guidance. Another possibility remains for ships to go from St. Petersburg to

Kaliningrad, but this route may be unavailable in winter because the more northerly port may freeze. EU economic infrastructure The Suwa ki Gap hosts several critical corridors because it is the only land route between the Baltic states and the rest of the European Union and NATO. A strategic communication artery, known in the international E-road network as E67 or as Via Baltica (expressway S61 on the Polish side and A5 highway on the Lithuanian part), passes through the Suwa ki Gap. It is part of the North Sea-Baltic (previously the Baltic-Adriatic), one of the core routes of the Trans-European Transport Network (TEN-T) that connects Finland and the Baltic states with the rest of Europe. As of June 2025, the Polish expressway is completed; the only segment not fully open yet is the bypass of om a, expected to be unveiled in September 2025. On the Lithuanian side, most of the A5 highway is upgraded to a dual highway with grade-separated junctions. The last section of the motorway, that close to the border is slated to be completed by late 2025. The Rail Baltica project, currently under construction, will improve the existing connection between the Baltic states and the rest of the European Union by creating a new, unified standard-gauge trunk line running across the Baltic states from Kaunas to Tallinn and eventually underneath the Gulf of Finland to Helsinki. The existing rail connection is only a single-track, non-electrified line that can only go to Kaunas without changing track gauges. This is because Baltic state railways still use the wider Russian gauge, while the vast majority of Polish rolling stock is adapted to the standard gauge common in Western Europe. The Polish sections are expected to be ready by 2028, but as of February 2024 construction work in Poland is already delayed by 3 years and there is no guaranteed funding for the section between E k and the Polish-Lithuanian border. The Gas Interconnection Poland Lithuania, which opened on 1 May 2022, is the only terrestrial link between the Baltic and Finnish natural gas pipeline system and the rest of the European Union. Its strategic importance was the reason it was recognized as a Project of Interest by the EU. The LitPol Link is the route for the only land-based high voltage line between Poland and Lithuania, which was opened in late 2015. Another high-voltage line to Lithuania is yet in the planning stages, as the sea-based Harmony Link (through Klaip da) was found to be economically unfeasible. The Suwa ki Gap is an important constraint on civilian airspace since the 2022 Russian invasion of Ukraine began. Because of sanctions against Russia and Belarus (in the latter case imposed after Roman Protasevich's airplane was hijacked by the government while over its airspace), aviation from these countries may not fly through the European Union, including to Kaliningrad. However, Russia also banned EU carriers over its territory, and EU airlines were urged not to fly over Belarus. Thus the only feasible way for civilian planes to fly from the Baltic states or Finland southwards is through the Suwa ki Gap, or over the Baltic Sea. infrastructure crossing the Suwa ki Gap The E67 route, gradually upgraded to expressway standards Progress on expressway S61 in Poland, leading to the Suwa ki Gap, as of April 2024. Green: open. Red: under construction The planned Rail Baltica route LitPol Link, the high-voltage electricity line connecting Poland and Lithuania Military considerations Frontlines on 18 February 1915, during the Second Battle of the Masurian Lakes, waged in the Suwa ki Gap area NATO armoured vehicles seen going through the former Budzisko-Kalvarija border crossing into Lithuania as part of Operation Ride, 2015 Long before the Suwa ki Gap became of concern to NATO, several army battles or operations occurred on the terrain. For example, during Napoleon's war in Russia, part of his army, which crossed into the country from the of Warsaw, used the Suwa ki Gap as a launching pad for the invasion and, by the beginning of 1813, when the remnants of his army retreated, it crossed the gap from Kaunas towards Warsaw. Both battles of the Masurian Lakes during World War I passed or were directly waged on the territory. the invasion of Poland, which started World War II, most of the action skirted the area, while in 1944, the Red Army simply advanced into East Prussia and no major battle occurred in the area. Poland and Lithuania joined the North Atlantic Treaty Organization in 1999 and 2004, respectively. On the one hand, this meant that the Kaliningrad exclave was surrounded by NATO states, but on the other, this created a choke point for the military alliance as all troops supplied by land must pass through the Suwa ki Gap. In the event of its capture, the Baltic states would be surrounded by Russia, Russian-controlled territories, and Belarus, a Russian ally. Even if Belarus or Russia are not physically present in the corridor, it is narrow enough for the short-range rockets stationed in either country to target any military supplies coming through the corridor, while alternative routes of delivery, i.e. by sea or air, are also threatened by the anti-air and anti-ship missiles stationed in Kaliningrad Oblast.

to its strategic importance for NATO and the Baltic states, it has been described as one of NATO's hot spots, its "Achilles' heel" and dubbed the modern version of the Fulda Gap. Initially, this vulnerability was of relatively little concern as, throughout most of the 1990s, Russia was stuck in a deep depression, which necessitated large-scale cuts to the country's military budget. Even though the army was of significant size, it was poorly equipped and had low military capabilities. Russia NATO relations were more cordial then, as Russia was not openly hostile to NATO, which was affirmed while signing the 1997 Founding Act, and it was thought that Russia would eventually become a pacifist democracy, decreasing its military and nuclear presence.[c] NATO's commitment not to build any permanent bases beyond the Oder river therefore seemed reasonable. Tanks crossing a water obstacle on the Hozha training ground, Grodno Oblast, Belarus, 30 km (19 mi) from the Suwa ki gap, during the 2020 Slavic Brotherhood exercisesA German Army soldier directs a tank out of water. This activity was part of the 2017 Iron Wolf exercises in Lithuania Escalation of tensions The qualitative and quantitative improvement in armaments started with the rule of Vladimir Putin. Short-range (>500 km [310 mi]) Iskander-M missiles, capable of carrying thermonuclear warheads, were installed in 2018. Additional installations were deployed in the late 2010s, including more area denial weapons, such as K-300P Bastion-P and P-800 Oniks anti-ship missiles and S-400 anti-air missiles. In general, the importance of the corridor among the Western nations is said to have been initially underestimated due to the fact that Western countries sought to normalise relations with Russia. Most of NATO's activities therefore concentrated on drills and exercises rather than deterrence. The shift in policy occurred gradually after Russia's aggression in Ukraine, which started in 2014. After the 2014 Wales summit and then the 2016 Warsaw summit, NATO members agreed on more military presence in the eastern member states of the Alliance, which came to fruition as the NATO Enhanced Forward Presence. In 2018, the Polish side proposed to station a permanent armoured division in the Bydgoszcz-Toru area (dubbed "Fort Trump") with up to US$2 billion in financial support, but NATO did not agree to it as it was afraid it would potentially run afoul of the 1997 Founding Act, which, among other things, constrains NATO's ability to build permanent bases next to the Suwa ki Gap. While the permanent military base ultimately did not appear, the military situation around the region has been steadily escalating, and deterrence tactics seem only to have increased the concentration of firepower on both sides. Several military drills, including Zapad 2017, Zapad 2021 and the Union Resolve 2022 exercises in Belarus and Kaliningrad Oblast and others that were unexpected, and NATO's 2017 Iron Wolf exercises in Lithuania as well as some of the annual Operation Saber Strike operations, occurred in areas close to the Suwa ki Gap. Around 20,000 soldiers riding 3,500 military vehicles participated in the 24 NATO drill in Northern Poland. The Russian forces did not leave Belarus after the 2022 exercises and invaded Ukraine from the north in February and March that year. As the war on NATO's eastern border unraveled, NATO dispatched more troops to its eastern flank, though its representatives said it would not establish permanent presence on its eastern borders. The situation around the area further intensified following Lithuania's declaration on banning the transit of sanctioned goods through its territory. As the security situation rapidly worsened on the east, the Lithuanian and Icelandic ministers of foreign affairs said that Russia had effectively repudiated the 1997 agreement, which was also indirectly suggested by Mircea Geoan , NATO's Secretary General. However, by the end of 2023, several assessments found that the threat has become much smaller after the invasion began. They suggested that Russian troops getting bogged down in eastern and southern Ukraine, accession of Sweden and Finland to NATO and a change in the alliance's tactics that saw more troops deployed on NATO's borders meant that Russia was much less likely to start another war. standing of forces NATO and its member states As of spring 2022, units closest to the Suwa ki Gap that belong to NATO or to its member states included: 900 German soldiers together with , Norwegian and troops, totalling about 1,600 personnel, alongside the Mechanised Infantry Brigade Iron Wolf, dispatched in a NATO multinational division in Rukla on the Lithuanian side, 140 km (87 mi) from the border. The brigade is armed with Leopard 2 tanks, Marder infantry fighting vehicles, and PzH-2000 self-propelled howitzers. In June 2023, Minister Boris Pistorius announced that the Germans would increase their presence to 4,000 troops, but the whole brigade is only expected to come in 2027. A million project is going to expand the premises of the military base. A subunit of the Iron Wolf brigade, the Grand Birut Mechanized Uhlan Battalion, is stationed in Alytus, 60 km (37 mi) from the Polish-

Lithuanian border. Additionally, the military base in R dninkai Training Area, which is 35 km (22 mi) south of Vilnius and about 125 km (78 mi) from the Suwa ki Gap, was ordered to be reactivated as a matter of urgency after the Seimas passed a bill to that effect. The base was reopened in June 2022 and is capable of holding 3,000 soldiers. An American battalion-sized group, 800 people, from the 185th Infantry Regiment, as of mid-2022, together with the Polish 15th Mechanised Brigade, as well as 400 British Royal and some Romanian and troops. These troops are stationed near the Polish towns of Orzysz and Bemowo Piskie, about the same distance from the border as Rukla. The forces are armed with American M1 Abrams and Polish modified T-72 tanks, Stryker, M3 Bradley and Polish BWP-1 infantry fighting vehicles, M-92 rockets and Romanian air defence systems. Brigades in both countries operate on a rotational basis. The Polish and Lithuanian host brigades signed an agreement for mutual cooperation in 2020, but, unlike with the operations with foreign forces, these are not subordinate to NATO command; The 14th Anti-Tank Artillery Regiment, under Polish command, garrisoned in Suwa ki and armed with Israeli Spike-LR missiles. The regiment was briefly degraded to a squadron as its equipment was outdated. Some other forces in the area under Polish command include an artillery regiment in W gorzewo, a mechanised brigade in Gi ycko and an anti-air unit in Go dap. Up to 40,000 troops within NATO Response Force, activated on 25 February 2022 following Russia's invasion in Ukraine, which are available on short notice. In June 2022, Jens Stoltenberg, Secretary General of NATO, pledged more weapons and troops to the Baltic States, seeking to augment NATO's presence to a brigade in each of the Baltic states and Poland (3,000-5,000 troops in each country), while the NATO Response Force will be increased to 300,000 troops. Kaliningrad Oblast is a very heavily militarized area subordinate to the command of the Western Military . Until the 2022 Russian invasion of Ukraine, the Western MD hosted the best equipment and army forces at Russian disposal. In 1997 2010, the whole oblast was organised as a special region under a unified command of all forces dispatched there. Kaliningrad is the headquarters of the Baltic Fleet and the headquarters of the 11th Army (Russian Navy), which has ample air defence capabilities and whose divisions have undergone extensive modernisation in the late 2010s. According to Konrad Muzyka, who authored a detailed study on the district's forces, the units stationed in Kaliningrad permit medium-intensity combat in the area without support from the Russian mainland. The town of Gusev, in the eastern part of the oblast, just 50 km (31 mi) from the Vi tytis tripoint, hosts the 79th Motor Rifle Brigade (BMP-2s and 2S19 Msta self-propelled howitzers) and the 11th Tank Regiment (90 tanks, of which most are T-72B1s at least 23 are the more recent T-72B3s). Missile units are stationed on the air base (Iskander missile launchers), while the majority of air defence units (Smerch and BM-27 Uragan multiple rocket launchers) are located in the vicinity of Kaliningrad. Kaliningrad also hosts capabilities to conduct electronic warfare, in which the Russian forces have both inherited much experience from the Soviet times and earned it during hybrid warfare operations such as in . Russia has not officially confirmed whether it has nuclear warheads in the exclave, but Iskander missiles are known to be capable of carrying such weapons. In 2018, the Federation of American Scientists published photos showing a weapons storage facility northwest of Kaliningrad being upgraded in a way that enables nuclear weapons storage. In addition to that, Arvydas Anu auskas, the Lithuanian minister of defence, claimed that Russia already has these in the exclave. Belarus's military command, while formally independent as a military command of a sovereign state, has organisationally aligned itself with the Russian command and is in many respects wholly or substantially dependent on Russian defence institutions and contractors, while persistent underinvestment in its own military and deepening ties with its eastern neighbour left the military with low offensive capabilities, with the only feasible role being that of support of the main Russian forces. For instance, the countries share the air defence system, including its command. There are relatively few units on the Belarusian side - the headquarters of the Western Operational (one of the two in Belarus) as well as the 6th Mechanised Brigade is in Grodno (S-300 anti-air missiles), while air operations may be conducted from the military air base in Lida. They have received some Russian reinforcements ahead of Zapad-2021 exercises, including more S-300 missiles in Grodno, and in early 2022, when S-400 missiles were installed in Gomel Region. In May 2022, Alexander Lukashenko announced that he had bought Iskanders and S-400 missiles from the Russians. There is broad consensus among Western military think tanks that any hypothetical attack on NATO would involve an attempt to capture the Suwa ki Gap

and therefore to surround the Baltic states. The reasons for the hypothetical attack are seen not to be primarily the occupation of the three former Soviet republics by Russia but to sow distrust in NATO's capabilities, to discredit the military alliance and to assert Russia's position as one of the major military powers. A possible scenario for such a move was voiced by Igor Korotchenko [ru], a retired Russian colonel and state TV pundit, who suggested that the Russians could take over the Suwa ki Gap as well as the Swedish island of Gotland while jamming NATO's radio signals, in order to establish effective military control over all possible supply routes to the Baltic states. Another summary was presented by Franz-Stefan Gady of the International Institute for Strategic Studies, where he suggested that Russia would capture the Suwa ki Gap and then force NATO to back down using the threat of deploying nuclear weapons. being shorter, the Polish side of the Suwa ki Gap is unlikely to be used as the area of main concentration of these forces, according to these experts. A 2019 Russian paper indicated that the potential attack cutting off the Baltic states from NATO could be held north of the Suwa ki Gap, in south-western Lithuania, due to better efficiencies for the Russian forces; the same route was assumed in Zapad 2017 and Zapad 2021 military exercises. This is also an area of attack deemed more favourable by the for European Policy Analysis ( ) and the Swedish Research Agency (FOI) papers, as the terrain is flatter and less forested and thus easier for heavier troops. Faustyna Klocek was one of the few proposing that the attack would lie over Polish territory. Some analysts suggest another theory, namely that the importance of the Suwa ki Gap is overblown. 's Michael Kofman compared the Suwa ki Gap's to a "MacGuffin" (by itself unimportant but what he argues could be part of a frontline stretching for hundreds of kilometres) and arguing that previous analyses, which were necessarily limited, relied on a simplified view of the Russian military and did not sufficiently analyse its doctrine as a whole. Franz-Stefan Gady, on the other hand, opined that if Russia's goal were to present a fait accompli situation, it would be easier for Russia to capture any Baltic state rather than specifically the Suwa ki Gap because the Russians would have to defend it against Poles and possibly Germans instead of the small armies of the Baltic states. Alexander Lanoszka of House says that Russia has no interest in closing the gap, as the transit agreements are already good enough and invading NATO would create as many problems for Russia as NATO would have. Fredrik Westerlund (FOI) had a similar point of view. the migrant crisis on the eastern border of NATO and EU, there were concerns voiced by NATO and Ukrainian intelligence officials that Belarus would send migrants to the Suwa ki Gap in order to destabilise the area, which in turn would give a pretext for Russia to introduce "peacekeeping" troops. The Polish government's fear that Russia could potentially open up a migrant route via Kaliningrad Oblast culminated in a decision to build a fence on the border with the exclave, similar to the one Poland erected on the Belarusian border the previous year. To some extent, these fears were justified after the Wagner Group aborted the rebellion in Russia and was thus exiled to Belarus. The mercenaries started training Belarusian soldiers in close proximity to the Polish border near the vulnerable area, which prompted the Polish Armed Forces to close some of the border crossings and send 10,000 reinforcement troops. Some of the initial assessments were grim about the prospect of the Baltic states. In 2016, the RAND ran simulations that suggested that with the NATO forces available at the time and despite less military presence in the area than in the Soviet times, an unexpected attack would have Russian troops enter or approach Riga and Tallinn in 36 60 hours from the moment of the invasion. The think tank attributed the swift advance to the tactical advantage in the region, easier logistics for Russian troops, better maneuverability and an advantage in heavy equipment on Russia's side. In general, the Russian Armed Forces, according to NATO's expectations, will try to overwhelm the Baltic states, cut off its only land route to the rest of NATO and force a fait accompli situation before the Alliance's reinforcements are able to come by land (air reinforcements are much more expensive and are vulnerable to surface-to-air strikes), only to face a dilemma between surrendering the area to the invader and directly confronting Russian troops, potentially escalating the war to a nuclear conflict. Ben Hodges, a retired US Army general who served as a high-ranking NATO commander and who co-authored a paper published by the on the defence of the Suwa ki Gap, said in 2018 that the Suwa ki Gap was an area where "many (of) NATO's [...] weaknesses converge[d]". Following major setbacks in the Russian invasion of Ukraine, Hodges revised his opinion towards a more positive tone, saying that NATO was much better prepared and could hold control over the area in case of an attack, particularly

since Sweden and Finland would, in his opinion, likely help NATO despite at the time not being members of the alliance. An Estonian MP estimated that Finland's membership in NATO, for which the accession protocol was signed in 2022, would make the security situation of the Baltic states more tenable thanks to an alternative corridor lying through the waters of the Gulf of Finland, which could be enforced using the relatively robust Finnish Navy. It was also suggested that Swedish accession to NATO would finally grant NATO some strategic depth in the area and otherwise facilitate the defence of the Baltic states. There appears to be strong support for Russia's invasion of the area among the Russians. A March 2022 survey by a Ukrainian pollster, which was concealing its identity while soliciting answers and which was asking questions using the Russian government-preferred rhetoric, reported that a large majority of Russians could support an invasion of another country should the "special military operation", as Russia officially calls the invasion of Ukraine, succeed, and that the most support for that invasion (three-quarters of those who did not abstain from an answer, and almost half of all respondents) would be against Poland, followed by the Baltic states. While the Suwa ki Gap is a choke point, military analysts suggest that the fact that the region has abundant thick forests, streams and lakes means that the landscape facilitates defence against an invading force. Additionally, the soil in the area makes it very hard to operate under rainy conditions as off-road areas or roads without a hard surface become impassable mud. The for European Policy Analysis paper points out that the hilly and more forested terrain of the Polish part of the Suwa ki Gap favours actions on the defensive side, such as ambushes and holding entrenched positions; at the same time, low density of roads that are largely not designed for carrying heavy cargo means that the few that remain available for the military may be easily blocked. The natural defences largely eliminate the need for additional military fortifications, and some of them, such as the one in Baka arzewo, have been converted to private museums. On the other hand, this also means that once Russia is in possession of the corridor, which could happen if NATO reinforcements arrive late, it will be very hard to eject the Russians from the area. These reports say that the conditions are unfavourable for heavy equipment, particularly in bad weather, though John R. of the Strategic Studies Institute argued the terrain was generally fine for a tank offensive. The current Polish military doctrine under Mariusz B aszczak, the Minister of National (MoD), is to concentrate the units close to the Russian and Belarusian borders in order to wage a defensive campaign in a similar way to the one Poland was conducting in September 1939. There were two war games made to verify the scenario. In the first one, made in 2019, the US Marine War modelled a hypothetical scenario of World War III. The other one, codenamed Zima-20, was conducted by the Polish War Studies Academy on MoD's request in 2020. Most of its assumptions remain confidential, but it is known that they include units with yet-to-be-delivered upgraded equipment that try to endure 22 days of defence against an invading force and, similarly to the American model, the military activities start in the Suwa ki Gap and Poland tries to defend Eastern Poland at all cost. Both results were catastrophic: in the American simulation, Polish units would incur about 60,000 casualties in the first day of war, and NATO and Russia would fare a battle that would prove very bloody to both sides, losing about half of the participating forces within 72 hours. Zima-20's results, which are interpreted with some dose of caution, showed that by day 4 of the invasion, the Russians already advanced to the Vistula river and fighting in Warsaw was underway, while by day 5, the Polish ports were rendered unusable for reinforcements or occupied, the Navy and the Air Force were obliterated despite NATO's assistance, while the Polish units dispatched close to the border could lose as much as 60-80% of personnel and materiel.[d] Very few locals are expected to endorse an invasion, in contrast to what happened in in 2014, as the influence of the Russians in the area is not significant; that said, Michalski's survey found that the region's local population is inadequately prepared for a hypothetical military conflict and that the area has next to no civilians immediately ready to engage in combat. Regional tensions are such that some tourists are afraid to go there, though Andrzej S k and retired . Kazimierz Kuczy ski say that such fears are likely unfounded as Russia's resources are being expended in Ukraine. Additionally, the Russians may want to use the historic tensions between Poland and Lithuania to set them against each other. NATO's military doctrine assumes that its member states would have to hold the invasion for as long as NATO needs to send reinforcements to the attacked states, and in the meantime, NATO would operate on the terrain using tripwire forces dispatched in the area. There is no consensus about the right kind of forces and their mode

of deployment near the Suwa ki Gap that would best fit the doctrine, though the predominant thought goes that at least some forces or money to improve infrastructure should be sent to Poland. Among the analysts that took into account the Suwa ki Gap vulnerability in their reports or opinion pieces, the majority argued that some form of permanent U.S. military presence in Poland should exist, and most of the reports agreed that the NATO (or American) units should be as mobile as practically possible. The Warsaw Institute argued that while it would be costly to maintain, the military base proposed by Poland in 2018 would be an effective deterrent for Russia and would ensure quick dispatches of U.S. forces to the Suwa ki Gap if needed. Hunzeker and Lanoszka say that fears over the bottleneck are exaggerated, as are fears over Russian war against NATO, and they conclude that nothing should constrain the Alliance from attacking Kaliningrad Oblast or Belarus if the latter engages in the conflict, too. They advocate for a permanent presence of U.S. military but with units dispersed all over Poland instead of one big military base, and crafted in a way that avoids as much Russian rebuke as possible. Lanoszka separately suggests troops dispatched to Russian-minority areas in Estonia and Latvia instead, as he believes Russia is more likely to make a limited incursion on these areas. Another report, by the Strategic Studies Institute (SSI), also suggested a permanent presence of one brigade of NATO troops in each of the Baltic states. Hodges et al., writing for , in principle supported an increased permanent presence of U.S. forces (including a divisional headquarters) but also said that NATO forces must be more mobile so that Russian troops have no chance to avoid the tripwire units. The report also recommended that more effort should be put into improving transport capabilities and reducing red tape between NATO's member states, noting that defending the Suwa ki Gap is a much different challenge from that of the War-era Fulda Gap. John R. of the SSI echoed paper's arguments and argued that since Russia deployed a large contingent of Russian troops together with modern arms in Belarus just prior to the beginning of the full-scale Russian invasion of Ukraine, NATO should disregard the 1997 Founding Act and start a dramatic increase of armaments and troop numbers near the Suwa ki Gap and in the Baltic states. Some experts argued the opposite, i.e. that increased NATO presence may be detrimental for NATO. Nikolai Sokov of the James Martin for Nonproliferation Studies, writing for the conservative outlet The National Interest, criticised the recommendations for ramping up military presence, arguing that Russia and NATO should learn to live with their own vulnerabilities in order to prevent an arms race. Some people, including Trenin of Moscow , said this had already been happening due to NATO's increased presence in the area. James J. of the Atlantic similarly argued that the West should not escalate by sending more troops to the immediate vicinity of the Suwa ki Gap, but instead rely on efficient logistics in case of war. Viljar Veebel and Zdzis aw liwa, on the other hand, proposed that NATO should either deploy as many troops as it can while not paying attention to Russia's complaints about that or attempt to convince them (by escalating elsewhere, for example) not to reinforce their troops near the Suwa ki Gap using means other than deterrence. Russia NATO relations Salient (military) Suwa ki Region Orenburg corridor Siliguri Other NATO vulnerabilities: Foc ani Gate GIUK gap Fulda Gap ^ The term "Suwa ki corridor" (korytarz suwalski) may refer both to the Suwa ki Gap and the road link between Kaliningrad Oblast and (Russian ally) Belarus that was proposed by Russians in the 1990s ^ Also known in other languages as: Polish: przesmyk suwalski or korytarz suwalski; Lithuanian: Suvalk koridorius or Suvalk tarpas; Belarusian: , romanized: suvalski kalidor and Russian: , romanized: suvalkskij koridor ^ The Founding Act is not a ratified treaty and therefore is not legally binding. ^ The government officials initially did not comment on the revelations of the secret war game, though B aszczak later denied that the exercises were unsuccessful and said that the Polish Armed Forces were capable of withholding a potential offensive. ^ Zubek, Adam (14 August 2011). "Suwalski biegun zimna. tam?" [Pole in Suwa ki. Why there?]. 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Field Artillery Branch (United States)

URL: https://en.wikipedia.org/wiki/Field_Artillery_Branch_(United_States)

Date: 05/02/2026 | Words: 7,418

From Wikipedia, the free encyclopedia This article needs to be updated. The reason given is: The ERCA (Extended Range Artillery) program was canceled in 2024, but the article still mentions it as a current program. Almost every section related to the ERCA needs to be updated.. Please help update this article to reflect recent events or newly available information. (April 2025) Field ArtilleryField Artillery branch insignia, featuring two crossed field gunsActiveNovember 17, 1775; 250 years ago United StatesBranch United States ArmyType armsHome stationFort Sill, Oklahoma, United StatesNicknamesKing of BattleGod of WarRed LegPatronSaint Barbara Scarlet The Field Artillery Branch of the United States Army is part the "Maneuver, Fires and Effects" (MFE) classification, in accordance with current organizational doctrine. Historical background The U.S. Army Field Artillery branch traces its origins to 17 November 1775 when the , unanimously elected Henry Knox " of the Regiment of Artillery". The regiment formally entered service on 1 January 1776. the 19th century a total of seven Artillery regiments were formed which contained a mixture of "heavy" artillery companies and "light" artillery batteries. The light artillery batteries took the role of field artillery although they did not use that designation. The seven artillery regiments were designated as regiments of artillery and were not distinguished as being either "coast" or "field" artillery as was the practice in the 20th century. In the reorganization of the Army by an act of passed on 2 February 1901, the seven Artillery regiments were reorganized as the Artillery . The was also split into 195 battery-sized units (called companies at the time) of Field Artillery and Artillery. In 1907, the Artillery was reorganized into the Field Artillery and the Artillery . Although presently Field Artillery and Air Artillery are separate branches, both inherit the traditions of the Artillery branch. In 1907, the Field Artillery companies of the Artillery were organized into six Field Artillery regiments. In 1916, as the United States was preparing for its eventual entry into World War I, these six regiments were supplemented by 15 more Field Artillery regiments. World War I numerous other Field Artillery Regiments were organized in the National Guard and National Army, which were mobilized to supplement the Regular Army. In 1924 the Army organized the Artillery into regiments. The first seven regiments retained the lineage of the seven Artillery regiments which existed in the 19th century. The Artillery was disbanded in 1950 and its units were consolidated with the Field Artillery in the Artillery branch. In 1968 the Artillery branch divided into Field Artillery and Air Artillery branches with the newly formed 1st through 7th Air Artillery regiments retaining the lineage of the seven 19th century artillery regiments. Although the oldest Artillery regiments in the Army are in the Air Artillery branch, this is not necessarily the case for individual units below the regimental level. For example, the 1st Battalion of the 5th Field Artillery traces its lineage to the Alexander Hamilton Battery, formed in 1776, which is the oldest Artillery unit in the active United States Army and is the only Regular Army unit which can trace its lineage to the American Revolution. The oldest Field Artillery unit in the U.S. Army is the 1st Battalion, 101st Field Artillery, Massachusetts Army National Guard, which traces its origins to 1636. Originally an Infantry unit, it was reorganized as an Artillery unit in 1916. The mission of the Field Artillery is to destroy, defeat, or disrupt the enemy with integrated fires to enable maneuver commanders to dominate in unified land operations. The Field Artillery is one of the Army's combat arms, traditionally one of the three major branches (with Infantry and Armor). It refers to those units that use artillery weapons systems to deliver surface-to-surface long range indirect fire. Indirect fire means that the projectile does not follow the line of sight to the target. Mortars are not field artillery weapons; they are organic to infantry units and are manned by infantry personnel (US Army MOS 11C or USMC 0341). The term field artillery is distinguished from the Air Artillery, and historically, from the U.S. Army Artillery (with the function of coastal defense artillery), a branch which existed from 1901 to 1950. In 1950, the two branches were unified and called simply Artillery, until Air Artillery was made into a separate branch in 1968. The insignia of the Field Artillery branch is a pair of crossed field guns (19th-century-style cannon) in gold, and dates back to 1834. The home of the Field Artillery and the Field Artillery School are at Fort Sill, Oklahoma. Harry S. Truman in 1918, the only "redleg" to become president Field artillery is called the "King of Battle". in the 20th century saw artillery become exponentially more effective as indirect fire methods were introduced immediately prior to World War I. World War I and World War II, field artillery was the single highest casualty-producing weapons system on any battlefield. Soldiers from artillery units have often been used as infantry during both the Iraq War and the War in Afghanistan.

While field artillery units have often performed admirably as infantry and accomplished infantry missions, such use has led to the atrophy of essential field artillery specific skills and tasks. Members of the Field Artillery are referred to as "redlegs" because during the Mexican American War, both Ringgold's Battery and 's Battery were issued uniforms distinguished by scarlet stripes down the legs of their uniform pants, a practice continued through the War and on dress uniforms even after WWI. Scarlet was established as the Artillery Branch color along with crossed cannon branch insignia in the Regulations of 1833. Branch colors are found on the shoulder straps of officers ranking colonel and below wearing the blue dress uniform and on the branch of service scarves authorized for wear with a variety of uniforms. of Field Artillery From 1903 to 1908, one of Artillery oversaw both field artillery and coast artillery. The of Artillery from this time were: Brigadier General Wallace F. Randolph, 1903 1904 Brigadier General John Patten Story, 1904 1905 Brigadier General Samuel M. Mills, 1905 1906 Brigadier General Arthur Murray, 1906 1908 (became the first of Artillery) After 1908, one general served as of Artillery which had a corps structure, while the Field Artillery had a regimental structure and had no chief or corps designation. This disorganized Field Artillery occasioned a boardroom bloodletting in 1917 after the entry of the US into the First World War in April 1917 proved that the Quartermaster General of the United States Army Henry Granville Sharpe was unfit for this purpose. In the aftermath of bloody Tuesday Brigadier general William J. Snow was appointed to the unofficial post of of Field Artillery in February 1918. He continued in that post after it was codified into law in 1920. He served until retiring in 1927, and oversaw the artillery branch's postwar reorganization, including the beginning of testing and experimentation to determine how to transition from horse drawn equipment to mechanized, and modernize processes for directing and controlling indirect fire to improve speed and accuracy. After 1920, the of Artillery was joined by the of Field Artillery. From 1920 to 1942, the Field Artillery corps was led by a branch chief who held the rank of major general. This was in keeping with the Army's other major branches, including infantry, cavalry, and coast artillery. Each chief was responsible for planning and overseeing execution of training, equipping, and manning within his branch. The branch chief positions were eliminated in 1942, and their functions consolidated under the commander of the Army Ground Forces as a way to end inter-branch rivalries and enable synchronized and coordinated activities as part of World War II's combined arms doctrine. The of Field Artillery from this time were: Major General William J. Snow, 1920 1927 Major General Fred T. Austin, 1927 1930 Major General Harry G. Bishop, 1930 1934 Major General Upton Birnie Jr., 1934 1938 Major General Robert M. , 1938 1942 The professional journal of the Field Artillery is published at Fort Sill. Known as the Field Artillery Journal in 1911, it went through many name changes through Field Artillery in 1987. The journal merged with Air Artillery in 2007 to become Fires. weapon systems The U.S. Army employs five types of field artillery weapon systems: M119A3 105 mm light towed howitzer M777A2 155 mm medium towed howitzer M109A7 Paladin 155 mm self-propelled howitzer M142 High Mobility Rocket Artillery System (HIMARS), a wheeled launcher capable of firing 227 mm rockets or Army Tactical Missile System (ATA) missiles M270A1 Multiple Launch Rocket System (MLRS), a self-propelled launcher capable of firing 227 mm rockets or Army Tactical Missile System (ATA) missiles Long Range Precision Fires Long Range Precision Fires (LRPF) was a priority of the U.S. Army Futures (AFC), disbanded in October 2025. The aim was to modernize a suite of capabilities of the artillery.[a] LRPF appears to be a project of an AFC cross-functional team ( ), a requirements definition process for new capabilities, such as targeting the new one-thousand-mile (1,600 km) missiles, "streamlining the sensor-shooter link at every echelon" (Promotable) John Rafferty, for a Strategic Long Range (SLRC) for a hypersonic projectile (program cancelled in May 2022), a target capability for the Field Artillery (its howitzers) and Air Artillery (a 500 km missile), and a test case for the acquisition process of the U.S. Army such as the Long-Range Hypersonic Weapon (LRHW), a standoff weapon to be fielded by FY2023. The LRHW has been named Eagle by the US Army. Future weapon systems Long Range Precision Fires (LRPF) Multi-domain operations (MDO) span multiple domains: cislunar space, land, air, maritime, cyber, and populations. According to AFC, the mission of the Long Range Precision Fires (LRPF) is to "deliver cutting-edge surface-to-surface (SSM) fires systems that will significantly increase range and effects over currently fielded US and adversary systems." AFC's five major programs for LRPF are: The Extended Range Artillery (ERCA) program which develops a system

capable of firing accurately at targets beyond 70 km as opposed to the M109A7's 30 km current range[b] The Precision Strike Missile (PrSM) which is a precision-strike guided SSM fired from the M270A1 MLRS and M142 HIMARS doubling the present rate-of-fire with two missiles per launch pod[c] The Strategic Long-Range (SLRC) program, which would have developed a system that could have fired a hypersonic projectile up to 1,000 miles (1,600 km) against air defense, artillery, missile systems, and command and control targets was terminated 23 May 2022. The -Hypersonic Glide Body (C-HGB) is a collaborative program between the Army, Navy, Air Force, and Missile Agency (MDA) which is planned to become the base of the Long-Range Hypersonic Weapon (LRHW) program A ground-launchable BGM-109 Tomahawk, as well as the SM-6 to fill the gap in the Army's mid-range missile capabilities. Based on Futures 's development between July 2018 and 2020, by 2023 the earliest versions of these weapons will be fielded:Long-Range Hypersonic Weapon training with all-up-round in its canister, 7 Oct 2021 The kill chains will take less than 1 minute, from detection of the target, to execution of the fires command; these operations will have the capability to precisely strike "command centers, air defenses, missile batteries, and logistics centers" nearly simultaneously.[d] The speed of battle damage assessment will depend on the travel time of the munition. This capability depends on the ability of a specialized , Assured precision navigation and timing (APNT) to provide detail. Long Range Precision Fires (LRPF): Howitzer artillery ranges have doubled, in excess of 60 km (37 mi), with accuracy within 1 meter of the aimpoint, currently with sufficient accuracy to intercept cruise missiles, as of September 2020, reaching the 43-mile (69 km) range as of 2020. Precision Strike Missiles (PrSMs) can reach in excess of 150 miles (240 km), with current 2020 tests[c] Mid-range capability (MRC) fires[e] can reach in excess of 500 to 1,000 miles (800 1,610 km), using mature Navy missiles Long-Range Hypersonic Weapons (LRHWs) are to have a range greater than 1,725 miles (2,776 km). The current M109A6 "Paladin" howitzer range is doubled in the M109A7 variant.: minute 3:07 An operational test of components of the Long range cannon was scheduled for 2020. The LRC is complementary to Extended range cannon artillery (ERCA), the M1299 Extended Range Artillery howitzer. Baseline ERCA is to enter service in 2023. Investigations for ERCA in 2025: rocket-boosted artillery shells: Tests of the Multiple launch rocket system (MLRS) XM30 rocket shell have demonstrated a near-doubling of the range of the munition, using the Tail controlled guided multiple launch rocket system, or TC-G. The TRA capability manager (TCM) Field Artillery Brigade - has been named a command position.[f] An autoloader for ERCA's 95-pound shells is under development at Picatinny Arsenal, to support a sustained firing rate of 10 rounds a minute A robotic vehicle for carrying the shells is a separate effort at Futures 's Army Applications Lab. The Precision Strike Missile (PrSM) is intended to replace the Army Tactical Missile System (MGM-140 ATA) in 2023. PrSM flight testing is delayed beyond 2 August 2019, the anticipated date for the expiration of the Intermediate-range Nuclear Forces Treaty, which set 499 kilometer limits on intermediate-range missiles. (Sanger and Edward Wong projected that the earliest test of a longer range missile could be a ground-launched version of a Tomahawk cruise missile, followed by a test of a mobile ground launched IRBM with a range of 1,800 2,500 miles (2,900 4,000 km) before year-end 2019.) The 2020 National Authorization Act (N) was approved on 9 2019, which allowed the Pentagon to continue testing such missiles in FY2020. The Lockheed PrSM prototype had its first launch on 10 2019 at White Sands Missile Range, in a 150-mile (240 km) test, and an overhead detonation; the Raytheon PrSM prototype was delayed from its planned November launch, and Raytheon has now withdrawn from the PrSM risk reduction phase. The PrSM's range and accuracy, the interfaces to HIMARS launcher, and test software, met expectations. PrSM passed Milestone B on 1 October 2021. Baseline PrSM is to enter service in 2023; an upgraded version of PrSM, with multi-mode seekers will then be sought.[c] For targets beyond the PrSM's range, the Army's R will seek a mid-range missile prototype by 2023, with a reach from 1,000 to 2,000 miles (1,600 3,200 km). Loren Thompson points out that a spectrum of medium-range to long-range weapons will be available to the service by 2023; R 's prototype Mid-Range (MRC) battery will field mature Navy missiles, likely for the Indo-Pacific theater in FY2023. is developing OpFires, an intermediate-range hypersonic weapon which is shorter-range than the Army's LRHW. is seeking a role in the armory for OpFires' throttle-able rocket motor, post-2023. announced in July 2022 it successfully tested its OpFires hypersonic weapon at White Sands Missile Range (WSMR) for the first time. The

OpFires launch was from a Marine logistics truck. OpFires will "rapidly and precisely engage critical, time-sensitive targets while penetrating modern enemy air defenses", potentially to be launched from a High Mobility Artillery Rocket System (HIMARS) launcher. These weapons will likely require planning for new Army (or Joint) formations. The Long range hypersonic weapons (LRHWs) will use precision targeting data against anti-access area denial (A2AD) radars and other critical infrastructure of near-peer competitors by 2023. LRHW does depend on stable funding. Advanced Field Artillery Tactical System (AFATDS) 7.0 is the vehicle for a Multi-domain task force's artillery battery very similar to a THAAD battery: beginning in 2020, these batteries will train for a hypersonic glide vehicle which is common to the Joint forces. The Long range hypersonic weapon (LRHW) glide vehicle is to be launched from transporter erector launchers. Tests of the hypersonic glide body (C-HGB) to be used by the Army and Navy were meeting expectations in 2020. In August 2020 the director of Assured precision navigation and timing (APNT) announced tests which integrate the entire fires kill chain, from initial detection to final destruction. William B. Nelson announced the flow of satellite data from the European theater (Germany), and AI processing of AFATDS targeting data to the fires units. In September 2020 an AI kill chain was formulated in seconds; a hypervelocity (speeds up to Mach 5) munition, launched from a descendant of the Paladin, intercepted a cruise missile surrogate. Three flight tests of LRHW were scheduled in 2021; that plan was changed to one test in late 2021, followed by a multi-missile test in 2022. The LRHW has been named ' Eagle' The first LRHW battery will start to receive its first operational rounds in early FY2023; all eight rounds for this battery will have been delivered by FY2023. By then, the PEO Missiles and Space will have picked up the LRHW program, for batteries two and three in FY'25 and FY'27, respectively. Battery one will first train, and then participate in the LRHW flight test launches in FY'22 and FY'23. In 1789 after the Revolution there was only one battalion of four companies of artillery. In 1794 a " of Artillerists and Engineers" was organized, which included the four companies of artillery then in service and had sixteen companies in four battalions. In 1802 there was a reduction of the army. The Artillery were separated from the Engineers and the former formed into one regiment of 20 companies. In 1808 a regiment of ten companies called the "Regiment of Light Artillery" was formed. In 1812 two more regiments were added. In 1821 four regiments were created from existing units on the following lines. 1st Regiment of Artillery, 2 March 1821, listed by artillery battery: A B C D E F G H I K- added 1832 L- added 1847 M- added 1847 N- added 1899 O- added 1899 2nd Regiment of Artillery, 2 March 1821 Battery A, 2nd U.S. Artillery 3rd Regiment of Artillery, 2 March 1821 4th Regiment of Artillery, 2 March 1821 4th U.S. Artillery, Battery H 4th U.S. Artillery, Battery I 4th U.S. Artillery, Battery M 5th Regiment of Artillery, 4 May 1861 5th U.S. Artillery, Battery H 6th Regiment of Artillery, 8 March 1898 7th Regiment of Artillery, 8 March 1898 (98 Batteries) In 1901 the regimental organization of the US Army artillery was abolished, more companies were added, and given numerical designations. 126 companies of heavy (coast) artillery 30 companies of light (field) artillery In 1907 the Artillery was established as a separate branch, and the Field Artillery re-established regiments officially, although provisional regiments had existed since 1905. 1st Field Artillery Regiment With 2 battalions each with 3 batteries 2nd Field Artillery Regiment 3rd Field Artillery Regiment 4th Field Artillery Regiment 5th Field Artillery Regiment 6th Field Artillery Regiment In 1916 enacted the National Act and 15 more regiments were authorized. 7th Field Artillery Regiment 8th Field Artillery Regiment 9th Field Artillery Regiment 10th Field Artillery Regiment 11th Field Artillery Regiment 12th Field Artillery Regiment 13th Field Artillery Regiment 14th Field Artillery Regiment 15th Field Artillery Regiment 16th Field Artillery Regiment 17th Field Artillery Regiment 18th Field Artillery Regiment 19th Field Artillery Regiment 20th Field Artillery Regiment 21st Field Artillery Regiment In 1917, following the American entry into World War I, regimental numbers from 1-100 were reserved for the Regular Army, from 101-300 for the National Guard, and 301 and above for the National Army. Under this system, the 1st-21st and 76th-83rd Field Artillery Regiments were organized in the Regular Army, the 101st-151st Regiments in the National Guard, and the 25th-75th, 84th, 85th, and 301st-351st in the National Army. Field artillery brigades, numbered 1st-24th, 51st-67th, and 151st-172nd, were also organized, with each brigade typically commanding three regiments; each division had one of these artillery brigades. A 1918 expansion added the 22d Field Artillery Regiment through the 39th Field Artillery Regiment with some exceptions, notably

Philippine Scouts units. The Artillery constantly reorganized the numbered companies until 1924, but during World War I created 61 artillery regiments from the numbered companies, for service (or potential service) with the American Expeditionary Forces (AEF); the 30th through 45th Artillery Brigades were also created to command groups of these regiments. These regiments operated almost all US-manned heavy and railway artillery on the Western Front, and were designated, for example, 51st Artillery (Artillery ( )). Most of these were disbanded immediately after the war. The Artillery also acquired the antiaircraft mission during the war, which was formalized a few years later. In 1924 the Artillery adopted a regimental system, and numbered companies were returned to letter designations. (In order to promote esprit-de-corps, the first 7 regiments were linked to the original 7 regiments of artillery). 1943 most antiaircraft units lost their Artillery designations, and the regiments were broken up into battalions. However, the antiaircraft branch remained nominally part of the Artillery . In late 1944 the Artillery harbor defense regiments were inactivated or reorganized as battalions, which themselves were mostly disbanded in April 1945, with personnel transferred to the local Harbor . 977 Artillery and antiaircraft battalions were created before the branch's demise in 1950. In 1943 an Army reorganization eliminated the regimental structure in all branches except infantry and created numerous serially numbered field artillery battalions by breaking up the existing regiments. Also during World War II, new designations were applied to some units, the "Armored Field Artillery Battalion" for self-propelled units and the "Parachute (or Glider) Field Artillery Battalion" for airborne units. "Field Artillery Groups" were also created during the war as an alternative to the regimental concept. The Army Anti-Aircraft (ARAA) was created in July 1950, and renamed to become US Army Air (USARA) in 1957. A new system, the U.S. Army Arms Regimental System ( ), was adopted in 1957 to replace the old regimental system. used the Army's traditional regiments as parent organizations for historical purposes, but the primary building blocks are divisions, and brigades became battalions. Each battalion carries an association with a parent regiment, even though the regimental organization no longer exists. In some brigades several numbered battalions carrying the same regimental association may still serve together, and tend to consider themselves part of the traditional regiment when in fact they are independent battalions serving a brigade, rather than a regimental, headquarters. From c. 1959 through 1971 antiaircraft units and field artillery units were combined with common parent regiments for lineage purposes, for example the "1st Artillery". In 1968 the Air Artillery Branch (United States Army) was split from the artillery, with the Regular Army air defense and field artillery regiments separating on 1 September 1971. The was replaced by the U.S. Army Regimental System (USARS) in 1981. US Artillery Structure 1989. On 1 October 2005, the word "regiment" was formally appended to the name of all active and inactive and USARS regiments. So, for example, the 1st officially became titled the 1st Regiment. the War the Field Artillery was responsible for all mobile ballistic missile weapons systems, including the Lance and Pershing II ballistic missiles. List of prominent Redlegs The nickname Redlegs refers to soldiers and former soldiers in the US Army Artillery. The nickname hearkens back to when artillerymen wore distinctive red stripes on their uniform trousers. Ken Berry, Actor, , and , started his army service in Artillery, until winning a talent contest and transferring into special services. Matt Bevin, 62nd governor of Kentucky Tommy Franks, 7th of United States (2000 2003) Berry Gordy, founder of Motown Record . Alexander Hamilton, Founding Father of the United States and first Secretary of the Treasury. Edwin Meese, 75th United States Attorney General Jack N. Merritt, U.S. Military Representative to NATO, 1985 1987, National Security Raymond T. Odierno, 38th of Staff of the United States Army Roy Earl Parrish, West Virginia state senator (1915 1918) J.H. Binford Peay III, 24th Vice of Staff of the Army, 5th of United States , and 14th Superintendent of the Virginia Military Institute Rangel, Member of U.S. House of Representatives (1971 2017) Joe R. Reeder, Undersecretary of the Army, 1993 1997 J. Reimer, 33rd of Staff of the United States Army Samuel Ringgold, hero of the Battle of Palo Alto James N. Robertson, Member of the Pennsylvania House of Representatives (1949 1952), Brigadier general in the Pennsylvania National Guard Randolph Scott, film actor and 2nd Lieutenant of Artillery, 1917 1919 John Shalikashvili, Supreme Allied Europe, 1992 1993, 13th of the Joint of Staff Maxwell D. Taylor, 20th of Staff of the United States Army, 5th of the Joint of Staff, and Ambassador to South Vietnam George H. Thomas, major general in the War and famous as the "Rock of " Harry S. Truman, 33rd president of the United States John William Vessey Jr,

10th of the Joint of Staff E. Vuono, 31st of Staff of the United States Army Allen West, retired U.S. Army lieutenant colonel and member of U.S. House of Representatives (2011 2013) William Westmoreland, 25th of Staff of the United States Army and 2nd of Military Assistance , Vietnam Field artillery in the American War List of artillery List of field artillery regiments of the United States List of United States War Forms lists US Army ordnance publications c. 1895 1920, links online versions, including many field artillery weapons Siege artillery in the American War United States Army branch insignia US Field artillery team U.S. Horse Artillery Brigade ^ The proponent for the Field Artillery Branch is defined in Regulation AR 5-22, and acts in concert with Army Staff. In Force modernization, of Staff G-8 and G-3/5/7 sit on the Army Requirements Oversight (AROC), to advise the of Staff of the Army ( ).: diagram on p.559 The commander, AFC is responsible for Force design. The Army's Force management model begins with a projection of the Future operating environment, in terms of resources: political, military, economic, social, information, infrastructure, physical environment, and the time available to bring the army to bear on the situation. The AROC serves as a discussion forum of these factors. The relevant strategy is provided by the Army's leadership. A analysis models the factors necessary to change the force into a relevant Future force. A J process identifies the gaps in capability between and Future force. A Force design to meet the materiel gaps is underway. An organization with the desired capabilities (manpower, materiel, training) is brought to bear on each gap. AR 5-22 lists the Force modernization proponent for each Army branch, which can be a or Branch proponent leader. Staff uses a Synchronization meeting: minute 8:29 before seeking approval HTAR Force Management 3-2b: "Managing change in any large, complex organization requires the synchronization of many interrelated processes".: p2-27 A budget request is submitted to . The resources are "dictated by ". Approved requests then await resource deliveries which then become available to the combatant commanders. ^ In late FY2023 18 ERCA prototypes will undergo a one-year operational assessment at Fort Bliss. ^ Jump up to: a b c Munitions such as PrSM will need to fire and then move, at targets on the move. ^ "[HIMARS] is used to destroy critical communications nodes, command posts, airfields, and important logistics facilities". Mick Ryerson (Major General, Australian Army, retired) ^ Mid-range capability (MRC) missile, was later renamed Strategic Mid-Range Fires (SMRF). ^ "That's pretty important because that gives him ( ) the authority to do what needs to be done across the Army with the myriad responsibilities that he has," Shoffner said." becomes a direct report to the TRA commander Tribune staff (22 August 2019) named division artillery director ^ "DA PAM 670-1" . army.mil. United States of . 11 October 2017. ^ Smith, Bolling W.; Gaines, William C. " Artillery Organization: A Brief Overview" . Study Group. ^ "1st Battalion, 5th Field Artillery Regiment (Alexander Hamilton Battery)". Lineage And Honors Information. US Army of Military History. 4 May 2009. ^ Breau, Jordan (18 March 2010). "Oldest Field Artillery Battalion Takes at Phoenix". News. ^ McKenney, Janice E. (2010). US Army of Military History ( ) Publication 60 11, Army Lineage Series, Field Artillery, Part 2. 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pp20-21) AROC is a forum for requirements decisions (RDF); 4-1 p.24) CG,AFC is responsible for force design; 6-4 p39) figure 6-1 staffing and review process; figures for more staffing and review processes follow. ^ Jump up to: a b c James Kennedy (2019) Force Management Model - ^ Research, , and Acquisition AR 71 9 (2009) Warfighting Aug 15, 2019 update ^ James Kennedy, (Jun 2022) AY22 Force Integration Weekly meetings on , , , or . 50:31 ^ Lee, (23 March 2022). "The US Military's Force Management Tug-of-War". ^ Judson, Jen (8 November 2022). "Lockheed talks results of US Army's long-range munition shoot-off". ^ Freedberg, Sydney Jr. (11 September 2018). "Aiming The Army's Thousand-Mile Missiles". ^ , Matthew (14 September 2018). "The Army is developing a new strategic cannon to devastate targets over 1,000 miles away". ^ "The Army's dream of artillery that fires 1,000 miles is officially a dud". 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"Army's Newest Long-Range Fires System Isn't New, But It Will Be Effective". ^ Theresa Hitchens "ABMS Proves AI For C2", breakingdefense.com, 3 September 2020 ^ Tim Lister and Oren Liebermann, (14 Jul 2022) Ukraine's new US rockets are causing fresh problems for Russia ^ Todd South (20 Aug 2020) Army missile defenders defeat cruise and ballistic missiles nearly simultaneously The test created terabytes of data to be queried. ^ Sydney J. Freedberg Jr. (22 Mar 2021) Army Missiles, Missile Race Budget To 2023 ^ Office of the of Public Affairs (10.16.2019) 2019 AUSA Warriors - TacticalSpace: Future Force Space Assured Positioning, Navigation and Timing Tactical Space: SDA is structuring a multi-layer satellite system: Backbone layer for data transport downward to the long-range precision fires layer for missiles' trajectories, whether friendly or threat Tracking layer for hypersonic glide vehicles which represent threats to the multi-layer satellite system Space situational awareness for cis-lunar trajectories, NavWar ^ Jump up to: a b Sydney J. Freedberg Jr. (5 August 2020) Army Tests New All Kill : From Space To AI Initially, satellites feed data to TITAN. Prometheus, which is AI software, combs through the data for potential threats and targets. SHOT, which is also software, tracks each target on a custody list, correlating each target's current location, signature, and threat assessment, with a list of candidate fires countermeasures, ranked by capability, range to the target, kill radius, etc. "SHOT then computes the optimal match of weapons to targets", and passes the list to AFATDS. Human commanders choose whether to fire, or not, from the list of fires assets (Nelson notes that ERCA and Grey Eagle drones are to be added to the list of fires assets currently M777 howitzers and MLRS 270 rocket launchers in the upcoming tests, August 2020). satellites perform Battle damage assessment, to update the list of threats and targets. ^ Jump up to: a b Sydney J. Freedberg Jr. (14 August 2020) Army Intel Feed The Kill ? Quickly pooling data will take AI and cloud "Project " ^ O'Neill, APNT Public Affairs (23 August 2019) APNT Hosts First Annual Assessment Exercise ^ Jump up to: a b c Todd South (11 Mar 2020) The Army is 'making artillery great again' Press conference. ^ Ben Wolfgang (22 2020) Army's long-range cannon hits target 43 miles away ^ Jump up to: a b c Sydney J. Freedberg Jr. (10 2019) Hit: Army Test-Fires Lockheed Precision Strike Missile EX Schultz (10 . 2019) Lockheed Martin missile test goes off well ^ Todd South (20 Sep 2022) Army missile teams will add robots and multi-payload rockets Hunter Blackwell, Aviation and Missile

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be last hope for fixing spending. ^ Sydney J. Freedberg Jr. (20 September 2019) ' Budget Gridlock Threatens Army Hypersonics G8 is posing a heuristic to get beyond delay in N (national defense authorization act) for 2020 (get Army funding by calendar year-end) Jacob Pramuk (27 Sep 2019) Trump signs spending bill to avoid another government shutdown CR funds the government until 21 Nov 2019 ^ Jump up to: a b Sydney J. Freedberg Jr. (28 Feb 2020) Army Ramps Up Funding For Laser Shield, Hypersonic Sword In FY2021 HELs funding is up 209 percent; LRHW funding is up 86 percent. R spending is $1 billion in 2021. ^ (3 March 2020) Army to fire two hypersonic test shots this year, Mc says ^ Jump up to: a b Sean Kimmons, Army News Service "Joint hypersonic weapon tests to start next year". www.army.mil. 8 October 2019. Retrieved 15 2021. ^ Nancy Jones-Bonbrest, Army Rapid and Technologies Office (R) (12 February 2020) Virtual Reality helps Soldiers shape Army hypersonic weapon prototype LRHW ^ Nathan Strout (29 Apr 2022) Army Futures learning from Russia's invasion of Ukraine Satellite "sensors also need to be better integrated with Army systems, to the point that satellite data can be downlinked directly to the battlefield". Willie Nelson, Asst Sec Army ^ Sydney J. Freedberg Jr. (26 January 2018) $86,000 + 5,600 MPH = Hyper Velocity Missile ^ Sydney J. Freedberg Jr. (10 September 2020) Target Gone In 20 Seconds: Army Sensor-Shooter Test ^ Matthew (5 Aug 2020) Army to Speed Up Testing of Planned Hypersonic Missile ^ Nancy Jones-Bonbrest, Army Rapid and Technologies Office (16 February 2021) Speeding ahead: Hypersonics team stays on track to deliver despite pandemic ^ Theresa Hitchens "' ' Of 2023 Fielding Goal, Army Hypersonic Weapon ' Eagle'", breakingdefense.com, 11 August 2021 ^ Jump up to: a b c Andrew Eversden (15 Oct 2021) First Live Hypersonic Missile Rounds To Be to Army Unit Next Year ^ Sydney J. Freedberg Jr. (November 22, 2019) SecArmy's Multi- Kill : Space- -AI Army Multi- Operations , 2018 slide from TRA pamphlet 525-3-1 (2018). ^ Patrick Tucker (21 Oct 2022) The Military's Network Warfare Experiment Scaled Up This Year ^ army.mil Archived 22 2016 at the Wayback Machine McKenney, Janice E. The Organizational History of Field Artillery, 1775 2003 (Pub 60-16). Army Lineage Series. Washington: of Military History, 2007: 100 101. ^ Rinaldi, pp. 124 150 ^ Rinaldi, pp. 157 165 ^ Berhow, pp. 423 500 ^ Stanton, pp. 434 510 ^ Stanton, pp. 339 424 ^ http://digitaledition.qwinc.com/publication/?i=161091 last visited 13 September 2013 ^ "Ohio and West Virginia Appointments at Fort Benjamin Harrison Training " . Official Bulletin. Vol. 1, no. 78. on Public Information. 10 August 1917. p. 14. Berhow, Mark A., ed. (2004). American Seacoast , A Reference Guide (Second ed.). Press. ISBN 0-9748167-0-1. Ewing, (1975). Field Artillery, 1954 1973. of the Army. Hazlett, James C., Edwin Olmstead, and M. Hume Parks. Field Artillery Weapons of the American War, rev. ed., Urbana: University of Illinois Press, 1983. ISBN 0-252-07210-3. Heitman, Francis B. (1903). Historical Register and of the United States Army, 1789 1903, Vol. 1. Washington, DC: Government Printing Office. McKenney, Janice E. (2010). US Army of Military History ( ) Publication 60 11, Army Lineage Series, Field Artillery, Parts 1 & 2. Washington, DC: US Army of Military History. Rinaldi, Richard A. (2004). The U. S. Army in World War I: Orders of Battle. General LLC. ISBN 0-9720296-4-8. Ripley, Warren. Artillery and Ammunition of the War. 4th ed. , SC: The Battery Press, 1984. O 12668104. Stanton, Shelby L. (1991). World War II Order of Battle. Galahad Books. ISBN 0-88365-775-9. Williford, Glen M. (2016). American Breechloading Mobile Artillery, 1875 1953. Atglen, Pennsylvania: Schiffer Publishing. ISBN 978-0-7643-5049-8. United States Army in the World War 1917-1919: Reports of the -in- , Staff Sections and Services . Vol. 15. Washington, D.C.: of Military History United States Army. 1991. http://historicalresources.net/ResearchTools/M728.pdf Archived 4 August 2012 at the Wayback Machine (Page 8) Official US Army lineage site for current field artillery units Archived 22 May 2011 at the Wayback Machine "Memorial, William J. Snow 1890". westpointaog.org/. West Point, NY: West Point Association of Graduates. 1947. Ike Skelton Arms Research Library Archived 22 July 2011 at the Wayback Machine The Organizational History of Field Artillery from 1775 to 2003 Archived 22 2016 at the Wayback Machine Weapons of the Field Artillery (1965) is available for free viewing and download at the Internet Archive Morris Swett at the Field Artillery School at Fort Sill

Haplogroup A (mtDNA)

URL: https://en.wikipedia.org/wiki/Haplogroup_A_(mtDNA)

Date: 05/02/2026 | Words: 6,327

From Wikipedia, the free encyclopedia This article is about the human mt haplogroup. For the unrelated human Y- haplogroup, see Haplogroup A (Y-). Haplogroup APossible time of origin40,000 10,000 YBP40,500 (95% CI 37,900 43,200) ybp age18,600 (95% CI 14,200 23,900) ybp24,209 (SD 4,906) ybpPossible place of originEast AsiaAncestorN , A4, A5, A7, A8 mutations152, 235, 523-524d, 663, 1736, 4248, 4824, 8794, 16290, 16319 In human mitochondrial genetics, Haplogroup A is a human mitochondrial (mt) haplogroup. mt -based chart of possible large human migrations. Haplogroup A is believed to have arisen in Asia some 30,000 50,000 years BC. Its ancestral haplogroup was Haplogroup N. However, the extant diversity of mitochondrial genomes that belong to Haplogroup A is low relative to the degree of divergence from its nearest outgroups in haplogroup N, which suggests that extant members of Haplogroup A might be descended from a population that has emerged from a bottleneck approximately 20,000 years ago. Its highest frequencies are among Native Americans, its largest overall population is in East Asia, and its greatest variety (which suggests its origin point) is in East Asia. Thus, it might have originated in and spread from the Far East. Its subclade A2 shares a T16362C mutation with subclades A1 (found in Japan, Tashkurgan, Veliky Novgorod, Mongols, and Altaians), A6 (found in Tibet and in the Yangtze River basin), A12'23 (found in Siberia and among Uralic and Turkic peoples), A13'14 (found in southern Siberia, Xinjiang, Ladakh, , Yunnan, Thailand, and Vietnam), A15 (found in , Naxi, Uyghur, Japan, and among the Sherpa of Tibet and Nepal), A16 (found in Uyghur, Buryat, Turkey), A17 (found in , Miao, Yi, Tibet, Ladakh, Kyrgyz, Thailand, and Vietnam), A18 (found in), A19 (found in), A20 (found among Han and in Japan), A21 (found in Tibet and in Jammu and Kashmir), A22 (found in), A24 (found in Beijing and West Bohemia), A25 (found in Japan and Yakutia), and A26 (found in). A2 is found in Kamchatka and is also one of five mt haplogroups found in the indigenous peoples of the Americas, the others being B, C, D, and X. Haplogroup A2 is the most common haplogroup among the Inuit, Na- , and many Amerind ethnic groups of North and America. Lineages belonging to haplogroup A2 also comprise the majority of the mt pool of the Inuit and their neighbors, the , in northeasternmost Siberia. Other branches of haplogroup A are less frequent but widespread among other populations of Asia. Haplogroup A5 is rather limited to populations from Korea and Japan southward, though it has been detected as singletons in a pair of large samples of Khamnigans (1/99 = 1.0%) and Buryats (1/295 = 0.3%) from the Buryat Republic. In Asia, A(xA2) is especially frequent in Tibeto-Burman-speaking populations of Southwest , such as Tibetans (6/65 = 9.2%, 25/216 = 11.6%, 11/73 = 15.1%). Approximately 7% to 15% of Koreans belong to haplogroup A. Approximately 5% to 12% of the Japanese belong to haplogroup A (including A4, A5, and A(xA4, A5)). Approximately 4% to 13% of Mongols belong to haplogroup A, almost all of whom are contained within the A4 subclade (2/47 = 4.3% Mongolians from Ulan Bator in haplogroup A4, 4/48 = 8.3% Mongols from New Barag Left Banner in haplogroup A(xA5), 6/47 = 12.8% Mongolians from Ulan Bator in haplogroup A4). Approximately 3% to 9% of people belong to haplogroup A. Haplogroup A also has been found in Vietnamese (2/42 = 4.8%, including one A4 and one A5(xA5a)). Approximately 4% (3/71) of Tatars from Aznakayevo, 3% (4/126) of Tatars from Buinsk, and 2% of Turkish people belong to haplogroup A. Haplogroup A4 has been found in 2.4% (2/82) of a sample of Persians from eastern Iran and in 2.3% (1/44) of a sample of Tajiks from Tajikistan. Haplogroup A is not found among Austronesians. In Nepalese population except Sherpa, haplogroup A was mirrored by its clades, A27, A14 and A17, of which A27 was the most abundant clade in Newar (3.99%). Newly defined clade A27 only discerned so far in Newar and Nepali-mix coalesce at ~ 8.4 Kya suggesting their ancient origin and potentially in situ differentiation in Nepal. This phylogenetic tree of haplogroup A subclades is based on the paper by Mannis van Oven and Manfred Kayser Updated comprehensive phylogenetic tree of global human mitochondrial variation and subsequent published research. A A(xA5, A8, A10) (Han from Wuhan), Buryat (Inner Mongolia) A+T152C!+T16362C Uyghur, Korea, Japan, Vietnam (Hmong from Lao Province, Kinh from Hanoi, C Lao) A1 [TMRCA 12,800 (95% CI 6,500 22,700) ybp] A1* Japan, Korea A1a [TMRCA 7,500 (95% CI 4,500 11,800) ybp] A1a* Japan (Aichi), Sarikoli (Tashkurgan), USA, England A1a1 [TMRCA 5,000 (95% CI 2,200 9,800) ybp] A1a1* Buryat, Altai Kizhi A1a1a Buryat, Mongol (Inner Mongolia) [TMRCA 1,050 (95% CI 75 5,500) ybp] A1a2 Russia (Bashkortostan, Velikij Novgorod), Iran (Turkmen) [TMRCA 1,950 (95% CI 100 10,500) ybp] A1a3 Greece (Ioannina), United States (West Virginia) [TMRCA 1,150 (95% CI 75 6,000) ybp] A2 Ache, Waiwai, Zoro, Surui, Waiapi,

Poturujara, Kayapo, Katuena, Guarani, Arsario, , , ancient , USA (Pennsylvania,), Mexico (Zapotec), , Republic, , Venezuela, Ecuador, Peru, Argentina [TMRCA 10,600 (95% CI 9,600 11,700) ybp] A2a Eskimo (Greenland,), A2a1 Inuit ( ), Selkup A2a2 Eskimo ( ), A2a3 Eskimo (Greenland, ,), A2a4 USA (New Mexico, Arizona), Mexico ( ) A2a5 Apache, USA (, Arizona, New Mexico, Texas), (, Shuswap) A2b A2b1 , Koryak, Eskimo (, , Greenland) A2c A2d USA (Mexican, Hispanic) A2d1 USA (Mexican) A2d1a USA (Hispanic) A2d2 USA (Hispanic) A2e'ao A2e A2ao A2ao1 A2f A2f1 Newfoundland A2f1a , USA (Native American) A2f2 USA (Mexican, Hispanic), Mexico A2f3 USA (Mexican, Hispanic) A2g USA (Mexican, Hispanic), Mexico, Iberian Peninsula A2g1 USA (Mexican, Hispanic), Latin America A2h (of Amazonas, Arhuaco), Yanomama, Kogui A2h1 USA (Mexican, Hispanic), Mexico, Latin America A2i USA (Hispanic, etc.), (Ojibwa, Prince Edward Island, Pabos in Quebec) A2j USA (Hispanic) A2j1 USA (Hispanic) A2k USA (Puerto Rico) A2k1 Ecuador, Wayuu, Mexico A2k1a Venezuela, (Pasto of Putumayo), USA (Hispanic) A2l'm'n'o'ai'aj A2l A2m A2n A2o A2ai A2aj A2p'am A2p A2p1 A2p2 A2am USA (Puerto Rico, Hispanic), Venezuela. One ancient found in ao, in a ( ) site dating 1160-1500 CE. A2q A2q1 A2r USA (Hispanic, Mexican), A2r1 Mexico, USA (Mexican) A2s A2t USA (Mexican) A2u A2u1 A2u2 A2v A2v1 USA (Mexican, Hispanic), Mexico (La Mixteca) A2v1a Guatemala, USA (Mexican) A2v1b Mexico A2v1i USA, Mexico (Mexican, Hispanic) A2w (Kogi, Guambiano of Putumayo), Arsario, USA (Mexican, Hispanic) A2w1 Mexico, Islands, Guatemala (La Tinta), Panama (Guaymi), A2x A2y A2z USA (Hispanic, Puerto Rico) A2aa A2ab - Brazil (PE, MT), Paraguay, Argentina A2ac A2ac1 A2ad A2ad1 A2ad2 A2ae A2af A2af1 A2af1a A2af1a1 A2af1a2 A2af1b A2af1b1 A2af1b1a A2af1b1b A2af1b2 A2af2 A2ag A2ah A2ak A2al A2an A2ap A2aq A6 [TMRCA 12,000 (95% CI 8,600 16,100) ybp] A6* , Korea A6a [TMRCA 9,600 (95% CI 5,500 15,500) ybp] A6a* Han (Wuhan, etc.) A6a1 Tujia A6b Tibet [TMRCA 5,000 (95% CI 2,700 8,300) ybp] A6b* Tibet (, Ladakh) A6b1 Tibet (Sherpa) A6c Tibet (Lhoba, Monpa) A12'23 Austria, Romania, Poland, Russia, possibly found among Udmurts and Komis A12 Republic, Germany [TMRCA 11,800 (95% CI 6,500 19,700) ybp] A12a Ireland, UK, New Zealand, USA, Nenets, Selkup [TMRCA 4,700 (95% CI 2,700 7,600) ybp] A12a* Mansi, Yakut (Vilyuy River basin), Kyrgyz (Kyrgyzstan) A12a1 Kyordyughen Site (Ymyiakhtakh , Yakutia), Hungary ( ) [TMRCA 2,800 (95% CI 1,450 4,900) ybp] A12a2 Evenk (Krasnoyarsk Krai, Stony Tunguska River basin) [TMRCA 1,250 (95% CI 100 6,600) ybp] A12b Buryat, Karos-Eperjessz g (Hungarian conqueror period) [TMRCA 3,000 (95% CI 425 10,700) ybp] A23 Mongol (Inner Mongolia), Buryat, Ket, Qashqai (Iran), ancient Scythian ( ) [TMRCA 6,200 (95% CI 3,300 10,600) ybp] A13'14 Russia (Buryat, Khamnigan), (Shiyan, Tu, Uyghur, etc.), Ladakh, Thailand, Vietnam (Mang), Korea, Japan, Paraguay (Alto Parana), Ireland A13 A13a Thailand (Khon Mueang from Rai Province and Lampang Province), A13b A13b1 Uyghur, Taiwan A13b2 (Lahu, etc.), Thailand (Red Lahu from Mae Hong Son Province), Vietnam (Ph L) A13b2a (Naxi), Thailand (Lisu from Mae Hong Son Province) A14 Russia (Altai Kizhi, etc.), Kyrgyz (Artux), Uyghur, , Han ( ), Taiwan, Thailand (Lawa from Mai Province, Mon from Lopburi Province), Vietnam (Pa Then) A15 Uyghur A15a (Han in Beijing, Lanzhou, etc.), Tibet (Tingri), Uyghur, Japan A15b , Japan (Ehime) A15c A15c1 Naxi, Tibet (Sherpa), Nepal (Sherpa) A16 Buryat, Uyghur, Turk A17 (Han from Beijing, Lanzhou, etc.), Miao, Yi, Tibet (Lhoba, Monpa, Tingri), Ladakh, Kyrgyz (Tashkurgan), Thailand (Lawa from Mai Province and Mae Hong Son Province, Blang from Rai Province, Mon from Ratchaburi Province), Vietnam (Ph L , H Nh) A18 Japan, (Han from Fujian, Han from Beijing, Han from Lanzhou), Romania A19 (Han from Beijing, etc.) A20 Japan, Han ( ) A21 Tibet (Sherpa, , etc.), Jammu and Kashmir A22 , Han ( ) A24 (Han in Beijing), Turkey, Republic (West Bohemia) A25 Japan ( ), , Yakut (Vilyuy River basin) A26 A3 Japan (Tokyo, etc.), Korea, USA [TMRCA 6,800 (95% CI 3,200 12,600) ybp] A3a Japan (Aichi, etc.) [TMRCA 4,300 (95% CI 1,400 9,800) ybp] A7 [TMRCA 8,800 (95% CI 5,400 13,500) ybp] A7* A7a Tibet [TMRCA 7,000 (95% CI 3,900 11,700) ybp] A7a* Lhoba A7a1 Lhoba A7a2 Lhoba, Monpa A7b Japan (Tokyo, etc.) [TMRCA 6,300 (95% CI 2,100 14,700) ybp] A9 A11 Nepal, Korea, Russia [TMRCA 14,500 (95% CI 9,700 20,800) ybp] A11a Tibet (Lhasa, Nyingchi, Tingri, Sherpa, Lhoba, etc.), Ladakh A11b Tibet (Tingri, , etc.), Naxi, Han (Yunnan) A5 (incl. Hong Kong), Japan [TMRCA 16,200 (95% CI 11,100 22,800) ybp] A5a Japan (Tokyo, Aichi, etc.), Korea, [TMRCA 5,500 (95% CI 3,800 7,600) ybp] A5a1 Korea A5a1a Japan (Tokyo, etc.), Korea A5a1a1 Japan (Tokyo, , Aichi, etc.), Korea A5a1a1a Japan

(Tokyo, etc.) A5a1a1b Japan (Tokyo, , etc.), Korea A5a1a2 Japan, Korea A5a1a2a Japan (Aichi) A5a1b Japan (Tokyo, Aichi) A5a2 Japan (Tokyo, Aichi, etc.) A5a3 A5a3* Korea, USA (African American) A5a3a A5a3a* Japan (Tokyo) A5a3a1 Japan (Tokyo, Aichi, etc.) A5a4 Japan A5a5 Japan, South Korea (Seoul), Uyghur A5b (Tujia, Hui, etc.) [TMRCA 12,800 ybp (95% CI 8,400 18,800) ybp] A5b1 (Han from Beijing, etc.), Japan, Korea, Uyghur, Thailand, Vietnam (Tay), Singapore [TMRCA 8,600 (95% CI 6,600 11,100) ybp] A5b1* Uyghur A5b1a Japan (Tokyo, etc.), Korea [TMRCA 6,700 (95% CI 3,700 11,300) ybp] A5b1b (Han from Fujian, Miao, etc.), Uyghur, Korea [TMRCA 7,300 (95% CI 5,600 9,400) ybp] A5b1b* Han A5b1b1 A5b1b1* Miao A5b1b1a A5b1b1b A5b1b2 Uyghur A5b1c Han ( ) [TMRCA 7,600 (95% CI 3,100 15,500) ybp] A5b1c1 Taiwan (Hakka, Bunun, Paiwan) [TMRCA 5,400 (95% CI 1,800 12,600) ybp] A5b1d [TMRCA 7,300 (95% CI 3,700 13,000) ybp] A5b1d* A5b1d1 Siamese (Thailand), Tay (Vietnam) A5b2 (Tujia, etc.) A5c Japan (Aichi, etc.), Korea, Khamnigan, Buryat, Barghut [TMRCA 8,200 (95% CI 4,800 13,000) ybp] A5c1 Japan (Tokyo, , Aichi, etc.) A8 Uyghur [TMRCA 14,000 (95% CI 9,500 19,800) ybp] A8a Okunev culture, Ket, Selkup, Pakistan, Poland, Italy [TMRCA 11,000 (95% CI 8,000 14,800) ybp] A8a* Han (Guizhou), Korean A8a1 Hungary, Albania [TMRCA 5,500 (95% CI 3,000 9,200) ybp] A8a1* Uyghur, Poland (Podhale), USA (Louisiana) A8a1a Yakut, Uyghur, Buryat A8a2 A8a2a Kets (Kellog, etc.), Tofalar (Alygdzher) [TMRCA 2,200 (95% CI 125 12,000) ybp] A8a2b Tuvan (Bay-Tal), Poland A8b Koryak [TMRCA 1,050 (95% CI 75 5,600) ybp] A10 (Uyghur), Afghanistan (Hazara, Uzbek), Russia (Mansi, Volga Tatars, etc.), France, , New York [TMRCA 9,200 (95% CI 4,900 15,600) ybp] Table of Frequencies of Mt Haplogroup A Population Frequency Source Subtypes T ch ( ) 1 42 Tlingit 1 2 Acoma Pueblo 1 1 Esselen 1 1 A01 Haida 0.966 29 Eskimo (Greenland) 0.961 385 Volodko 2008 A2b=196, A2a=174 Eskimo ( ) 0.900 50 Volodko 2008 A2a=36, A2b=9 Eskimo ( ) 0.875 96 Volodko 2008 A2b=68, A2a=16 Mixtec 0.828 29 Siberian Eskimo 0.772 79 A2=61 (41/46 , 17/25 Sireniki, 3/8 Naukan) Eskimo (Naukan) 0.744 39 Volodko 2008 A2b=16, A2a=13 (Anadyr,) 0.733 15 A2=11 Eskimo (Sireniki) 0.703 37 Volodko 2008 A2a=16, A2b=10 0.682 66 A2=45 / 0.667 27 Mixe 0.625 16 Apache 0.621 29 Nahua (, Mexico) 0.613 31 A=19 Nahua/ (Mexico) 0.531 32 Siouan 0.529 34 0.524 21 A02, A03, A04, A05, A07, A09, A10, A12 Maya (Mexico) 0.519 27 Navajo 0.517 58 Nuxalk (Bella) 0.5 36 Salinan 0.5 6 A01, A06, A13 Ojibwe ( )/Kickapoo 0.484 62 Salinan/ 0.455 11 Nuu- -Nulth 0.4 15 Kiowa 0.4 5 /Seminole 0.389 18 Aleut (Aleutian Islands) 0.344 163 Volodko 2008 A2a=56 Zapotec 0.333 15 Pawnee 0.333 3 /Arapaho 0.308 26 Nu (Gongshan, Yunnan) 0.300 30 A=9 Lisu (Gongshan, Yunnan) 0.297 37 A=11 Mi'kmaq (Newfoundland)/Narragansett 0.286 7 (Markovo,) 0.250 32 Volodko 2008 A2a=6, A2b=2 Tibetan (, Yunnan) 0.250 24 A=6 Yi (Hezhang , Guizhou) 0.250 20 A=5 Ohlone ( ) 0.25 8 A01 Tibetan (Nagchu, Tibet) 0.229 35 A=8 Tibetan (Qinghai) 0.214 56 A=12 Tibetan (Shannan, Tibet) 0.211 19 A=4 Yi (Xishuangbanna, Yunnan) 0.188 16 A=3 Tibetan (, Tibet) 0.172 29 A1=5 Zuni 0.182 22 Korean (Arun Banner) 0.146 48 A5=4, A(xA5)=3 Tujia (Western Hunan) 0.141 64 A=9 Pumi (Ninglang, Yunnan) 0.139 36 A=5 Tujia (Yanhe , Guizhou) 0.138 29 A=4 Tibetans 0.136 432 A6=9, A11a=15, A15c1a=14, Tibetan (Lhasa, Tibet) 0.136 44 A1=6 Mongolian (Ulan Bator) 0.128 47 A4(xA2)=6 Hani (Xishuangbanna, Yunnan) 0.121 33 A=4 Japanese (Miyazaki) 0.120 100 A4=4, A5=4, A(xA4,A5)=4 Gelao (, Guizhou) 0.118 102 A=12 Penutian ( ) 0.118 17 Tibetan (Zhongdian, Yunnan) 0.114 35 A=4 Tubalar (Turochak &) 0.111 72 A(xA2)=8 Havasupai/Hualapai/ Yavapai/Mojave 0.111 18 Tibetan (Shannan, Tibet) 0.109 55 A1=6 Tibetan (Shigatse, Tibet) 0.103 29 A1=3 Mongolian (S khbaatar Province) 0.102 246 A=14, A5c=1, A8a=1, A12=8, A14=1 Yi (Shuangbai, Yunnan) 0.100 40 A=4 Manchurian 0.100 40 A(xA4,A5)=3, A4=1 Han (Shaanxi) 0.099 562 A=9, A1=5, A5a=1, A5b=3, A5c=1, A6=3, A8a=2, A11=2, A12=1, A14=7, A15a=9, A15b=1, A15c=2, A17=4, A18=2, A19=1, A20=1, A21=1, A22=1 Korean (northern) 0.098 51 A4=4, A5(xA5a)=1 Yi (Luxi, Yunnan) 0.097 31 A=3 Han ( ) 0.096 73 Zheng 2011 A=7 Han (Jilin) 0.094 381 A=11, A1=1, A3=1, A5a1a2=1, A5b=2, A8a=1, A11=3, A12=1, A14=1, A15=7, A17=4, A18=2, A19=1 Japanese 0.090 211 A5=11, A(xA5)=8 Naxi (Lijiang, Yunnan) 0.089 45 A=4 Korean (South Korea) 0.089 203 A=18 (Shenyang, Liaoning) 0.088 160 A=14 Hmong (Jishou, Hunan) 0.087 103 A(xA6)=7, A6=2 Han (Liaoning) 0.087 646 A=56 Japanese (T hoku) 0.086 336 A=29 Mongolian (Province) 0.084 370 A=17, A1a=6, A5a=4, A13=1, A14=1, A16=1, A25=1 Evenk (Siberia) 0.084 130 A2a=2, A4=7, A4b=2 Mongol (New Barag Left Banner) 0.083 48 A(xA5)=4 Tibetans 0.083 145 A11=4, A14=3, A15=2, A21=3 Korean

(South Korea) 0.081 185 A4=6, A5(xA5a)=5, A(xA4,A5)=3, A5a=1 0.077 13 Korean (South Korea) 0.077 261 A=20 Mongolian (Khentii Province) 0.076 132 A=8, A12=2 Han (Beijing Normal University) 0.074 121 Zheng 2011 A=9 Pai Yuman 0.074 27 A=2 Tibetan (Nyingchi, Tibet) 0.074 54 A1=4 Han (Southwest , pool of 44 Sichuan, 34 , 33 Yunnan, and 26 Guizhou) 0.073 137 A=10 Han (Hunan and Fujian) 0.073 55 Zheng 2011 A=4 Telengit 0.073 55 A=4 Korean (Seoul National University Hospital) 0.073 633 Fuku 2007 A=46 Japanese people 0.071 672 A1a=1, A3a=1, A5a1=28, A5a2=3, A5a3=2, A5a4=1, A5a-a*=5, A5b1a1a=1, A5c(xA5c1)=4, A7a=1, A25b=1 Buryat 0.071 126 A(xA5)=9 Han (southern) 0.069 390 A=27 Korean (South Korea) 0.068 103 A5=4, A4(xA2)=3 Japanese (Tokyo) 0.068 118 Zheng 2011 A=8 Okinawa 0.067 326 A=22 Japanese (northern Ky sh) 0.066 256 A=17 Mongolian (Mongolia) 0.064 2420 A=75, A1a=15, A5a=4, A5c=1, A7=2, A8a1=14, A11(xA11a1)=6, A12a=14, A13=3, A14=4, A15(xA15a)=7, A16=2, A23=4, A24=2, A25=2, Itelmen 0.064 47 A(xA2)=3 Japanese (Gifu) 0.063 1617 Fuku 2007 A=102 Yokuts 0.063 16 A08 Zhuang(Napo , Guangxi) 0.062 130 A=8 Barghut (Hulun Buir) 0.060 149 A4=8, A8=1 Japanese (Hokkaid) 0.060 217 Asari 2007 A=13 Bai (, Yunnan) 0.059 68 A=4 Ket 0.059 34 A8a2 Evenk (Siberia) 0.056 71 A(xA2)=4 Telenghit (Altai Republic) 0.056 71 A4(xA2)=4 Jino (Xishuangbanna, Yunnan) 0.056 18 A=1 Bai (Xishuangbanna, Yunnan) 0.053 19 A=1 Koryak 0.052 155 A2=4, A(xA2)=4 Mongolian (Khovd Province) 0.051 429 A(xA1a, A14, A15, A23, A24)=12, A11a1=3, A8a1=7 Buryat (Buryatia) 0.051 295 A4(xA2)=13, A5=1, A8=1 Khamnigan (Buryatia) 0.051 99 A4(xA2)=4, A5=1 Tibetan (, Yunnan) 0.050 40 A=2 Han (Beijing) 0.050 40 A4=1, A(xA4,A5)=1 Japanese (T kai) 0.050 282 A=14 (Xishuangbanna, Yunnan) 0.049 41 A=2 Vietnamese 0.048 42 A4=1, A5(xA5a)=1 Yakama 0.048 42 A=2 people (Hulunbuir) 0.048 209 A=2, A1a=2, A5c=1, A8a=1, A14=4 Han (Kunming, Yunnan) 0.047 43 A=2 Jetisu Kazakhstan 0.045 200 A=4, A12=2, A14=1, A5=2 (Anabarsky, Volochanka, Ust-Avam, &) 0.045 154 A10=3, A8=2, A4(xA4b)=2 Oroqen (Oroqen Autonomous Banner) 0.045 44 A(xA5)=2 Va (Simao, Yunnan) 0.045 22 A=1 Evenk (New Barag Left Banner) 0.043 47 A(xA5)=2 Mongolian (Ulan Bator) 0.043 47 A4=2 Tatar (Aznakayevo) 0.042 71 Malyarchuk 2010 A(xA8b)=2, A8b=1 Altai-kizhi 0.042 48 A=2 Guoshan Yao (Jianghua, Hunan) 0.042 24 A(xA6)=1 Evenk (Krasnoyarsk) 0.041 73 A4(xA2)=3 Evenk (Ust-Maysky, Oleneksky, Zhigansky) 0.040 125 A4(xA4b)=3, A4b=2 Ainu 0.039 51 Sato 2009 A=2 Kalmyk (Kalmykia) 0.036 110 A4(xA2)=3, A8=1 Han (Taiwanese) 0.036 111 A4e1=2, A5b=2 Yakut (Vilyuy River basin) 0.036 111 A4(xA4b)=2, A4b=1, A8=1 Han (Taiwan) 0.036 1117 A=40 (Tianzhu , Guizhou) 0.036 28 A=1 Shor 0.036 28 A=1 Khakassian (Khakassia) 0.035 57 A4(xA2)=2 Altay Kizhi 0.033 90 A4(xA2)=3 Taiwanese (Taipei, Taiwan) 0.033 91 A=3 Wuzhou Yao (Fuchuan, Guangxi) 0.032 31 A(xA6)=1 Tatar (Buinsk) 0.032 126 Malyarchuk 2010 A8b=4 Pan Yao (Tianlin, Guangxi) 0.031 32 A6=1 Kazakh (Kosh-Agach) 0.031 98 A4=3 Mansi 0.031 98 A(xA2)=3 Altai-kizhi (Altai Republic) 0.029 276 A=8 Bapai Yao (Liannan, Guangdong) 0.029 35 A6=1 Guangdong 0.026 546 A=14 Kim Mun (Malipo, Yunnan) 0.025 40 A6=1 Persian (eastern Iran) 0.024 82 A4(xA2)=2 Tu Yao (Hezhou, Guangxi) 0.024 41 A6=1 Yakut (vicinity of Yakutsk) 0.024 164 A4b=2, A4(xA4b)=1, A8=1 Lowland Yao (Fuchuan, Guangxi) 0.024 42 A(xA6)=1 Tajik (Tajikistan) 0.023 44 A4(xA2)=1 (Evenk Autonomous Banner) 0.022 45 A(xA5)=1 Evenk (Buryatia) 0.022 45 A4(xA2)=1 Tuvan 0.021 95 A(xA2)=2 Aini (Xishuangbanna, Yunnan) 0.020 50 A=1 Kumandin (Turochak) 0.019 52 A=1 Guangxi 0.017 1111 A=19 Yakut 0.017 117 A(xA5)=2 Vietnamese people (Kinh) 0.013 399 A=1, A11=1, A15(xA15b)=2, A5b1b=1 Shor (Kemerovo) 0.012 82 A4(xA2)=1 Tuvinian (Tuva) 0.010 105 A4(xA2)=1 Khanty 0.009 106 A=1 Vietnam 0.008 392 A=3 Southeast Yunnan 0.006 158 A=1 Li (Hainan) 0.003 346 A=1 Kiliwa 0.000 7 Seri 0.000 8 Paiute/Shoshone 0 9 Yao (Mengla, Yunnan) 0.000 10 Xiban Yao (Fangcheng, Guangxi) 0.000 11 Kiliwa/Paipai 0 11 Uto-Aztecan ( ) 0 14 Lahu (Xishuangbanna, Yunnan) 0.000 15 Kumeyaay 0 16 Yukaghir (Upper Kolyma) 0.000 18 Volodko 2008 Huatou Yao (Fangcheng, Guangxi) 0.000 19 Filipino (Palawan) 0.000 20 (Xishuangbanna, Yunnan) 0.000 21 Yukaghir (Verkhnekolymsky & Nizhnekolymsky) 0.000 22 River Yuman 0.000 22 Yuman 0.000 23 Quechan/ 0 23 Hindu (, Nepal) 0.000 24 Nganasan 0.000 24 Tibetan (Nyingchi, Tibet) 0.000 24 Buryat (Kushun, Nizhneudinsk, Irkutsk) 0.000 25 Bunu (& Tianlin, Guangxi) 0.000 25 Kurd (northwestern Iran) 0.000 25 Lanten Yao (Tianlin, Guangxi) 0.000 26 Iu Mien (Mengla, Yunnan) 0.000 27 Washo 0 28 Andhra Pradesh (tribal) 0.000 29 Batek (Malaysia) 0.000 29 (Hainan) 0.000 30 Tujia (Yongshun, Hunan) 0.000 30 Batak (Palawan) 0.000 31 Gelao (, Guizhou) 0.000 31 Lingao (Hainan)

0.000 31 Lahu (Simao, Yunnan) 0.000 32 Mendriq (Malaysia) 0.000 32 Mien (Shangsi, Guangxi) 0.000 32 Negidal 0.000 33 Teleut 0.000 33 Temuan (Malaysia) 0.000 33 Lahu (Lancang, Yunnan) 0.000 35 Aleut (Islands) 0.000 36 Volodko 2008 Va (Ximeng & Gengma, Yunnan) 0.000 36 Yakut (Yakutia) 0.000 36 Jemez/Taos/San Ildefonso Pueblo 0 36 Taono O'odham 0.000 37 Hmong (Wenshan, Yunnan) 0.000 39 Nganasan 0.000 39 Volodko 2008 Thai 0.000 40 Tharu (Morang, Nepal) 0.000 40 Ambon 0.000 43 Lombok (Mataram) 0.000 44 Alor 0.000 45 Tofalar 0.000 46 Udegey 0.000 46 Hindu (New , India) 0.000 48 Sumba (Waingapu) 0.000 50 Jahai (Malaysia) 0.000 51 Senoi (Malaysia) 0.000 52 Teleut (Kemerovo) 0.000 53 Nivkh (northern Sakhalin) 0.000 56 Filipino 0.000 61 Semelai (Malaysia) 0.000 61 Mansi 0.000 63 Filipino 0.000 64 Filipino (Mindanao) 0.000 70 Tubalar (Turochak) 0.000 71 Bali 0.000 82 Yukaghir (Lower Kolyma-Indigirka) 0.000 82 Volodko 2008 Ulchi 0.000 87 (Turochak) 0.000 91 N. Paiute/ Shoshoni 0.000 94 Northern Paiute 0.000 98 Even (Eveno-Bytantaysky & Momsky) 0.000 105 Even (Siberia) 0.000 122 Tharu (, Nepal) 0.000 133 Yakut (northern Yakutia) 0.000 148 (B nh Thu n, Vietnam) 0.000 168 Filipino (Luzon) 0.000 177 Sumatra 0.000 180 Sulawesi 0.000 237 Taiwan aborigine 0.000 640 The mummy "Juanita" of Peru, also called the "Ice Maiden", has been shown to belong to mitochondrial haplogroup A. In his popular book The Seven of Eve, Bryan Sykes named the originator of this mt haplogroup Aiyana. Eva Longoria, an American actress of Mexican descent, belongs to Haplogroup A2. Michelle Rodriguez, an American actress with a mother, is likewise in A2. Genealogical test Genetic genealogy Human mitochondrial genetics Population genetics Indigenous Amerindian genetics Phylogenetic tree of human mitochondrial (mt) haplogroups Mitochondrial Eve (L) L0 L1 6 L1 L2 L3 L4 L5 L6 M N CZ D E G Q O A S R I W X Y C Z B F R0 pre-JT P U HV JT K H V J T ^ Jump up to: a b c d e f g h i j k l m n o p q r s t u v w x y z aa ab ac ad ae af ag ah ai aj ak al am an ao ap aq ar as at au av aw ax ay "YFull MTree 1.01.5539". Retrieved 2019-04-14. ^ Behar DM, van Oven M, Rosset S, Metspalu M, EL, Silva NM, Kivisild T, Torroni A, Villems R (April 2012). "A " " reassessment of the human mitochondrial tree from its root". Am J Hum Genet. 90 (4): 675 84. doi:10.1016/j.ajhg.2012.03.002. PMC 3322232. PMID 22482806. ^ Jump up to: a b van Oven, Mannis; Manfred Kayser (13 Oct 2008). "Updated comprehensive phylogenetic tree of global human mitochondrial variation". Human Mutation. 30 (2): E386 E394. doi:10.1002/humu.20921. PMID 18853457. S2 27566749. ^ Jump up to: a b Fagundes, Nelson J.R.; Kanitz, Ricardo; Eckert, Roberta; Valls, Ana C.S.; Bogo, Mauricio R.; Salzano, Francisco M.; Smith, Glenn; Silva, Wilson A.; Zago, Marco A.; Ribeiro-dos-Santos, Andrea K.; Santos, Sidney E.B.; Petzl-Erler, Maria Luiza; Bonatto, Sandro L. (2008). "Mitochondrial Population Genomics Supports a Single Pre- Origin with a Route for the Peopling of the Americas" . American Journal of Human Genetics. 82 (3): 583 592. doi:10.1016/j.ajhg.2007.11.013. PMC 2427228. PMID 18313026. Retrieved 2009-11-19. ^ Jump up to: a b c d Tanaka, Masashi; et al. (2004). "Mitochondrial Genome Variation in Eastern Asia and the Peopling of Japan". Genome Research. 14 (10A): 1832 50. doi:10.1101/ gr.2286304. PMC 524407. PMID 15466285. ^ Jump up to: a b c d e f g h i j k l m n o p q r s t u v w x y z M, Malyarchuk B, Grzybowski T, G, I, Perkova M, C, Luzina F, Lee HK, Vanecek T, Villems R, Zakharov I (November 2007). "Phylogeographic analysis of mitochondrial in northern Asian populations". Am J Hum Genet. 81 (5): 1025 41. doi:10.1086/522933. PMC 2265662. PMID 17924343. ^ Volodko, Natalia V.; Starikovskaya, Elena B.; Mazunin, Ilya O.; Eltsov, Nikolai P.; Naidenko, Polina V.; Wallace, C.; Sukernik, Rem I. (9 May 2008). "Mitochondrial Genome in Arctic Siberians, with Particular Reference to the Evolutionary History of Beringia and Pleistocenic Peopling of the Americas". The American Journal of Human Genetics. 82 (5): 1084 1100. doi:10.1016/j.ajhg.2008.03.019. PMC 2427195. PMID 18452887. ^ Jump up to: a b c Pimenoff VN, D, Palo JU, Vershubsky G, Kozlov A, Sajantila A (October 2008). "Northwest Siberian Khanty and Mansi in the junction of West and East Eurasian gene pools as revealed by uniparental markers". Eur J Hum Genet. 16 (10): 1254 64. doi:10.1038/ejhg.2008.101. PMID 18506205. ^ Fuku, Noriyuki; Park, Kyong Soo; Yamada, Yoshiji; Nishigaki, Yutaka; , Young Min; Matsuo, Hitoshi; Segawa, Tomonori; Watanabe, Sachiro; Kato, Kimihiko; Yokoi, Kiyoshi; Nozawa, Yoshinori; Lee, Hong Kyu; Tanaka, Masashi (March 2007). "Mitochondrial Haplogroup N9a Resistance against Type 2 in Asians". The American Journal of Human Genetics. 80 (3): 407 415. doi:10.1086/512202. PMC 1821119. PMID 17273962. ^ Jump up to: a b Ji F, Sharpley MS, O, Alves LS, Qian P, Wang Y, D, Lvova M, Xu J, Yao W, Simon M, Platt J, Xu S, Angelin A, A, Huang T, Wang PH,

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