

North Korean nuclear weapons primer

A look at the North Korean nuclear missile program and current capabilities

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Introduction to the North Korean missile program



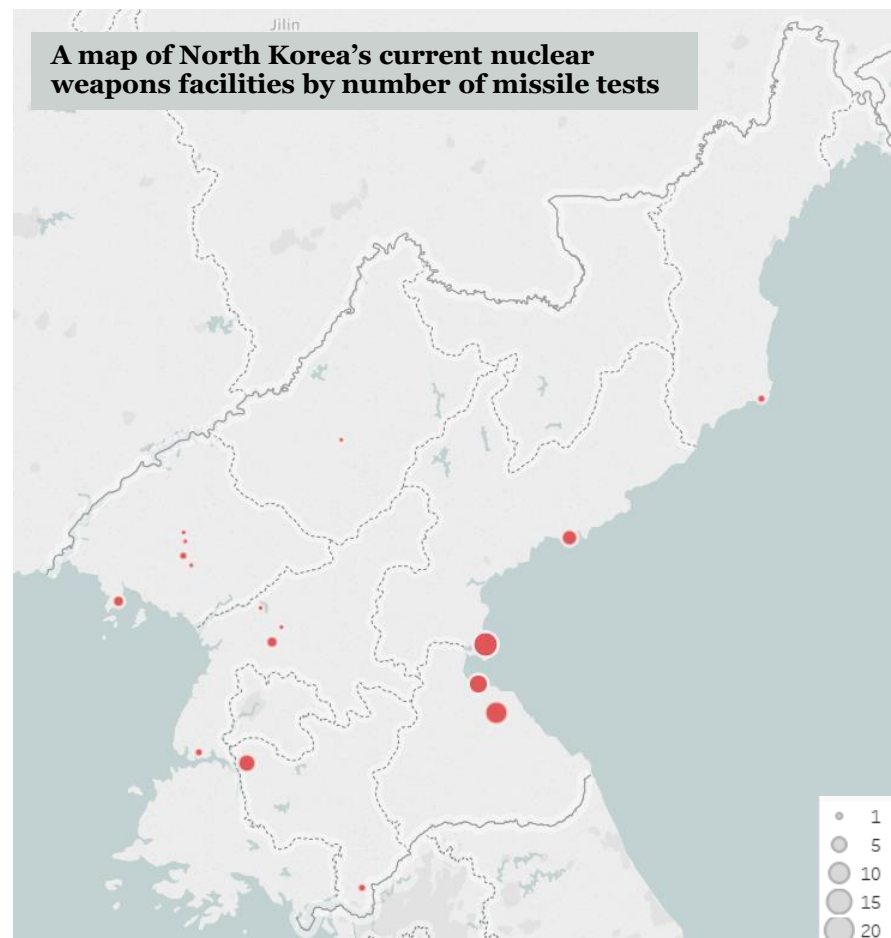
North Korea is one of nine countries that possess nuclear weapons. The other eight are China, France, India, Israel, Pakistan, Russia, the United Kingdom, and the United States



In January of 2003, Pyongyang withdrew from the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). It is the only country with nuclear weapons capabilities that does not observe the ban on nuclear weapons tests

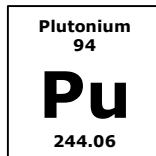
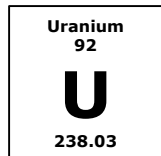


US intelligence assessed that the DPRK has successfully produced a miniaturized nuclear warhead to fit inside missiles. Some analysts are skeptical of North Korea's warhead re-entry capabilities. Experts speculate that North Korea could deploy the ICBM Hwasong-14 in 2018



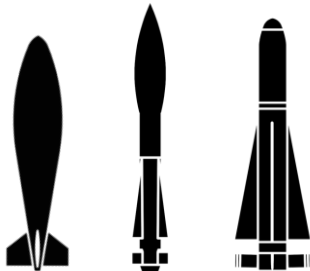
Sources: James Martin Center for Nonproliferation Studies, North Korea Missile Test Database, 2017; Kim Tong-Hyung, "Analysts doubts North Korea's ICBM re-entry capability" Associated Press, August 1, 2017; Nuclear Threat initiative, "Nuclear 101 Module" 2017; "What we know about North Korea's missile Programme" BBC News, August, 10 2017;

How did North Korea acquire nuclear ICBM capabilities?

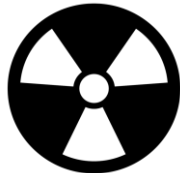


Steps to acquire nuclear weapons

Acquire fissile material: In the most significant hurdle to obtaining nuclear weapons, a country must enrich uranium, produce plutonium, or procure this material illicitly through theft or purchase.



Fabricate nuclear fuel and weapons: After acquiring materials, countries must have individuals with expertise in chemistry, electronics, explosives, metallurgy and physics to fabricate a nuclear weapon. This process involves converting the enriched element into fuel rods and assemblies for nuclear reactors and designing a weapon to deliver the nuclear fuel. Basic design concepts for weapons fabrication are available on public domain. Both weapons components and manufacturing techniques can be obtained legitimately.



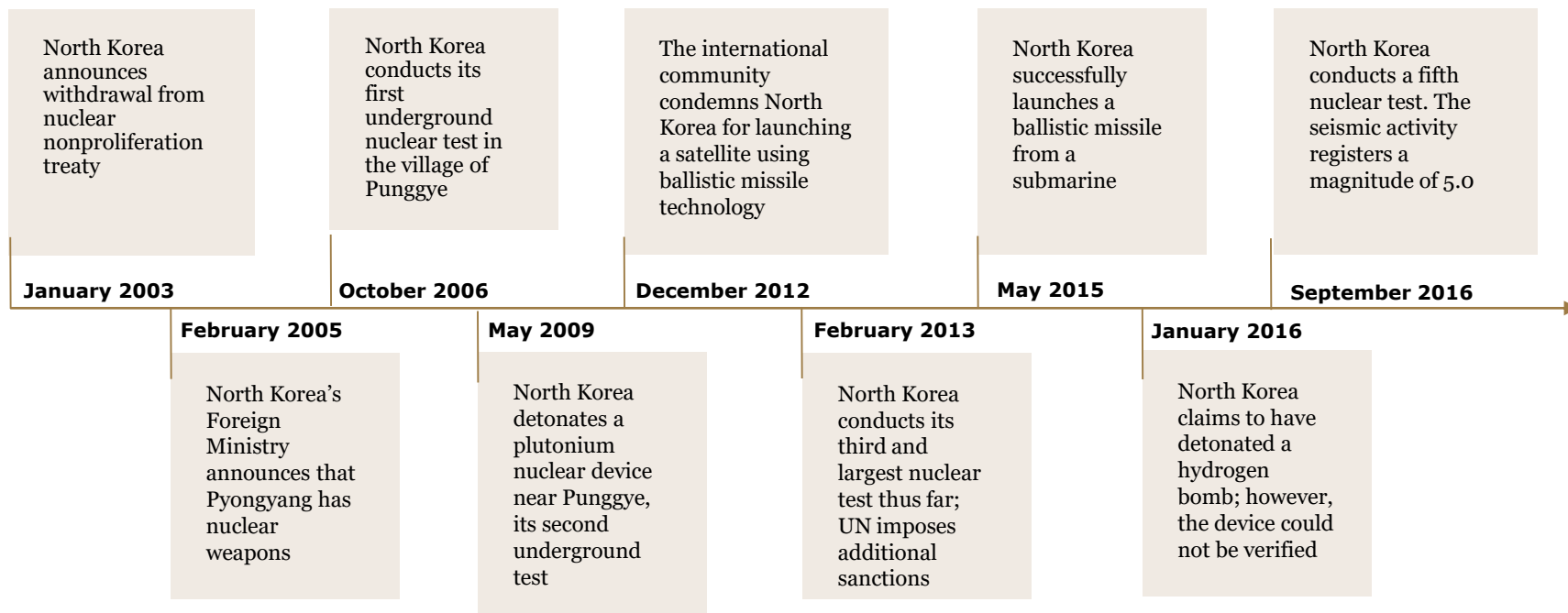
Test weapons: Once a nuclear weapon has been assembled, it must be tested to validate functionality. Some weapons need not be tested with their nuclear components unless the country desires light-weight or thermonuclear weapons, also known as hydrogen bombs. Conducting a clandestine nuclear weapons test is very difficult.



Deliver nuclear weapons: Multiple delivery systems including missiles, drones, and combat aircraft can deliver nuclear weapons. Ballistic missiles are most preferred because of their range, delivery speed, payload capabilities, and ability to penetrate an adversary's missile defenses. Long-range systems, however, require miniaturization to fit a nuclear weapon on the missile and do need to be tested. Long-range nuclear missiles must have atmospheric re-entry capabilities to survive extreme heat and pressure and hit the intended target.

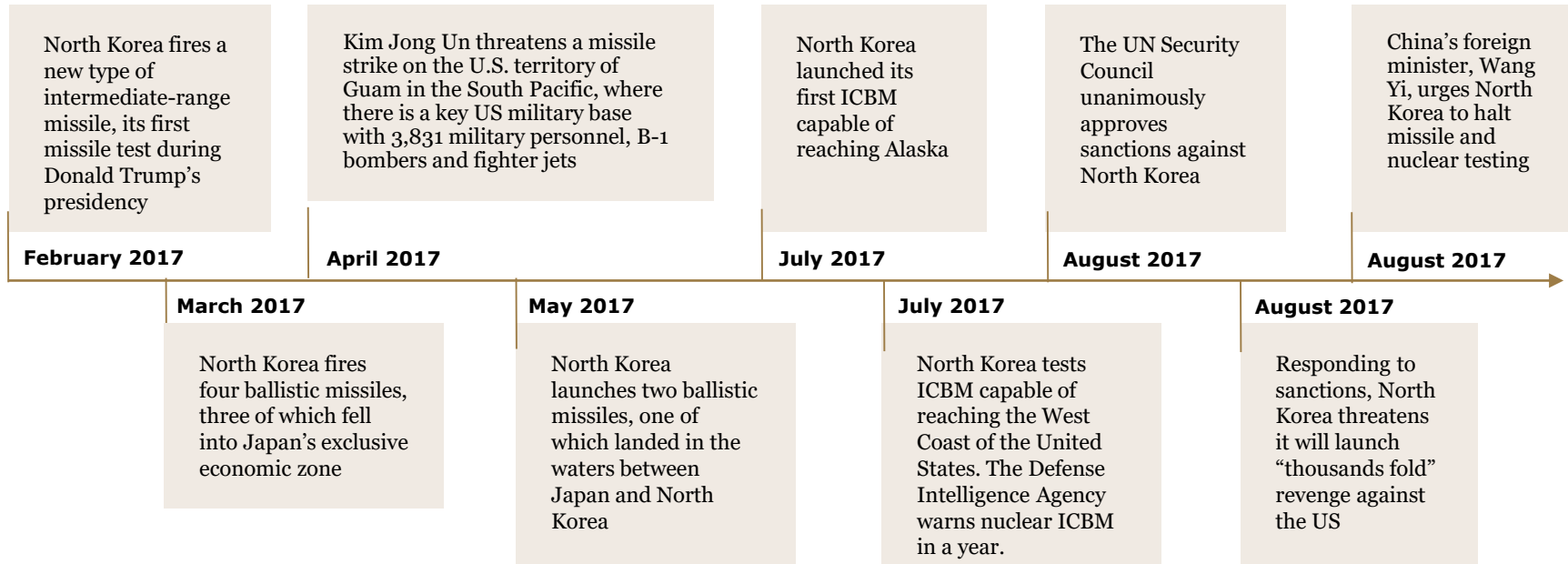
Sources: Kim Tong-Hyung, "Analysts doubts North Korea's ICBM re-entry capability" Associated Press, August 1, 2017; Nuclear Threat initiative, "Nuclear 101 Module" 2017; "What we know about North Korea's missile Programme" BBC News, August, 10 2017; Jessica Durando, "North Korea, U.S. timeline: 13 days of increasing tension" USA Today, August 8, 2017.

Timeline of the North Korean missile program



Sources: New York Times, Jan 6, 2016; The Guardian, "Timeline: North Korea's Nuclear weapons development," Jan 6, 2016; Arms Control Association, "Chronology of US-North Korean Nuclear and Missile Diplomacy," Updated March 2017; Sam Kim, "A Timeline of North Korea's Missile Launches and Nuclear Detonations," Bloomberg, March 5, 2017; Nuclear Threat initiative, "Nuclear 101 Module" 2017; "What we know about North Korea's missile Programme" BBC News, August, 10 2017.

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A timeline of the most recent escalations

- Aug 11, 2017 ○ **Trump declares army prepared to respond:** President Trump tweets that military solutions are “locked and loaded” in case of North Korean attack
- Aug 21, 2017 ○ **Ulchi Freedom Guardian exercises:** The US and South Korea begin joint summer military exercises with 17,500 American troops. Mostly computer simulations, they continue until August 31
- Aug 26, 2017 ○ **DPRK launches more missiles:** North Korea launches three short-range missiles into the sea between Japan and the Korean Peninsula
- Sept 3, 2017 ○ **North Korea tests a hydrogen bomb:** In its sixth nuclear test recorded to date, the DPRK claims to have successfully tested a hydrogen bomb
- Sept 15, 2017 ○ **North Korean missile flies over Japan’s Hokkaido Island:** The Hwasong-12 passes over Japan into the Pacific, causing Japan to issue cell phone alerts of a potential missile strike. At 2,300 miles, this is the longest missile flight
- Nov 29, 2017 ○ **North Korea breaks two-month lull in missile launches:** Two weeks after Trump’s visit to Asia and one week after the administration designated North Korea as a state sponsor of terrorism, Pyongyang launches the Hwasong-15, an ICBM the furthest reach of any missile launched by the country to date

The DPRK issues stamps to commemorate the successful Hwasong-14 ICBM launch



Credit: KCNA/Reuters

Sources: Sam Kim, “A Timeline of North Korea’s Missile Launches and Nuclear Detonations,” Bloomberg, April 15, 2017; Chloe Sang-Hun, “North Korea Fires Medium-Range Ballistic Missile,” New York Times, May 21, 2017; Jessica Durando, “North Korea, U.S. timeline: 13 days of increasing tension” USA Today, August 8, 2017; Neil Conner, “North Korea releases special stamps to mark test launch of missiles” The Telegraph, August 8, 2017; Jeremy Lin, Sarah Frostenson, Tyler Fisher, & Jon McClure, “Anatomy of a crisis: The North Korea threat,” Politico, August 12, 2017; Anna Fifield, “North Korea launches three missiles into sea, heightening tensions,” Washington Post, August 26, 2017; Anna Fifield, In the latest test, North Korea detonates its most powerful nuclear device yet,” September 3, 2017; Mark Landler, Choe Sang-Hun, Helene Cooper, “North Korea Fires a Ballistic Missile, in a Further Challenge to Trump,” New York Times; Associated Press, “A Look at This Year’s North Korean Nuclear and Missile Tests,” Time, November 28, 2017.

DPRK breaks two-month lull in missile testing with ICBM launch

North Korea fired a missile at dawn (local time) on Wednesday, November 28, in the first missile test since September 15

The launch



- The “Hwasong-15” missile was launched from Pyongsong in North Korea’s South Pyongan province according to South Korea’s Joint Chiefs of Staff
- Initial DoD reports assessed the missile was an intercontinental ballistic missile (ICBM) capable of reaching Washington, D.C. with a flattened trajectory, but that this launch was not a threat to the US or its territories
- Secretary of Defense James Mattis reported that this missile reached a higher altitude than the previous tests. The South Korean news agency, Yonhap, reported the missile reached an altitude of 2,800 miles, and the Pentagon estimated the missile travelled a distance of 620 miles before it landed in the Sea of Japan
- Dr. David Wright, a scientist at the Union of Concerned Scientist, explained the ICBM may have been fitted with a mock payload that weighed a negligible amount, and the distance the ICBM could travel would decrease with the weight of a nuclear warhead



The response



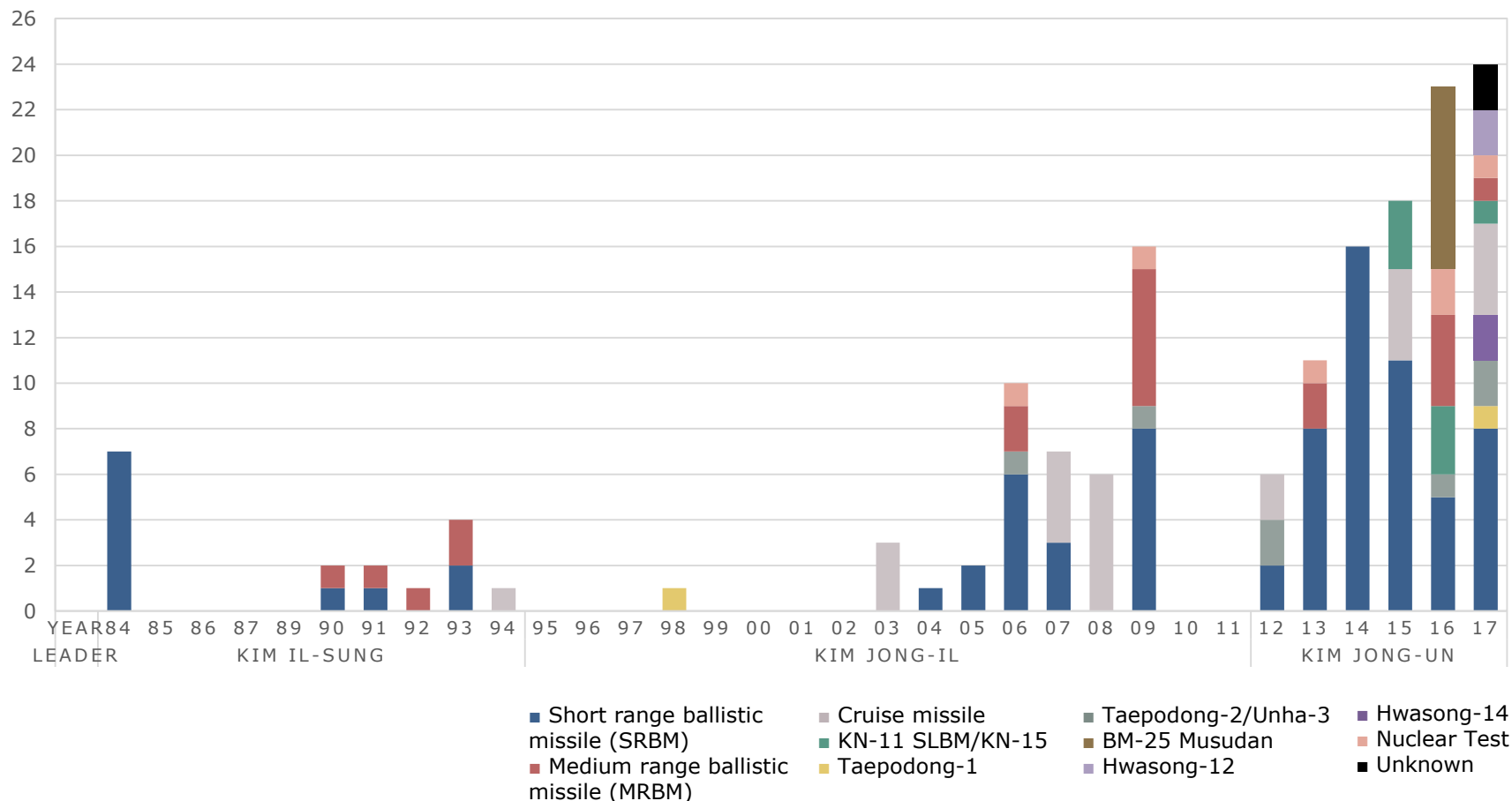
- South Korea responded by firing pinpoint missiles from a land-based battery, a Navy destroyer and an F-16 fighter jet to show its pre-emptive capabilities
- Trump responded to the launch saying, “Nothing changed,” and “We will take care of it.” Trump spoke with Japanese Prime Minister Shinzo Abe, and both leaders agreed on the need to strengthen deterrence capabilities and for China to maintain a stronger stance in countering Kim Jong Un
- Secretary of State Rex Tillerson said, “Diplomatic options remain viable and open, for now,” and called on the international community to take economic and diplomatic steps to deter North Korea from continuing their nuclear weapons program
- The UN Security Council scheduled an emergency meeting for the afternoon of November 29 in response to the missile launch



Sources: Katie Bo Williams, “North Korea fires ballistic missile,” The Hill, November 28, 2017; Jordan Fabian, “Trump: ‘We will handle’ North Korea missile launch,” The Hill, November 28, 2017; Josh Delk, “Mattis: North Korea missile launch was highest ever,” The Hill, November 28, 2017; Brett Samuels, “Tillerson on North Korea missile launch: Diplomatic options viable ‘for now,’” The Hill, November 28, 2017; Mark Landler, Choe Sang-Hun, Helene Cooper, “North Korea Fires a Ballistic Missile, in a Further Challenge to Trump,” New York Times, November 28, 2017; Reuters Staff, “Trump, Japan’s Abe agree to boost deterrence against North Korea: Japan government,” Reuters, November 28, 2017.

North Korean missile launches since 1984

Data accounts for full flight tests only, and does not include partial tests of missile subsystems, tests of air defense systems, or short range rockets and artillery firing



Sources: CSIS Missile Defense Project "Missile Threat" 2017; Kelsey Davenport, "Chronology of US – North Korean Nuclear Missile Diplomacy, Arms Control Association, September 3, 2017

US uses cyberweapons to counter North Korean nuclear threat

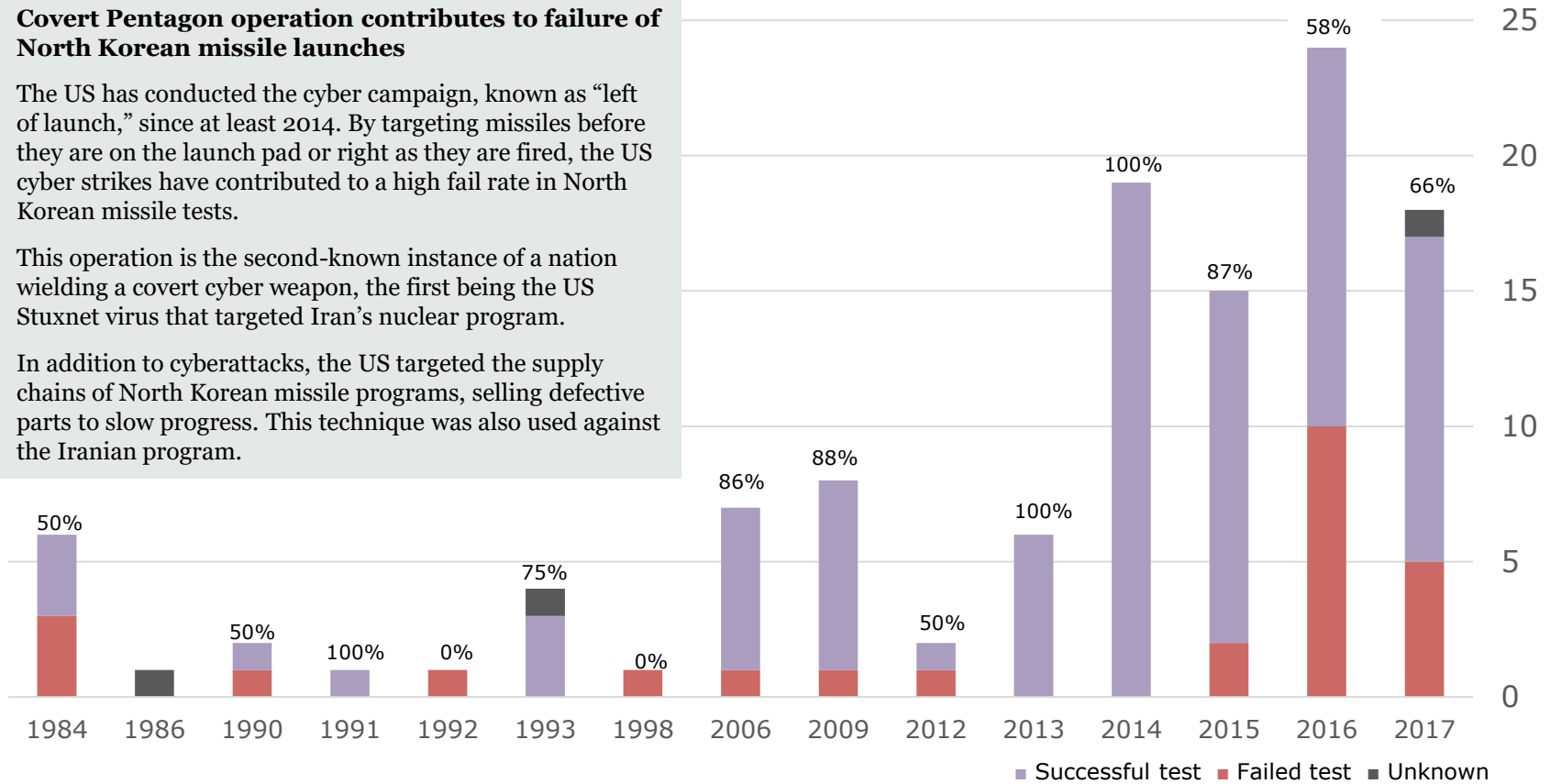
Success and failure of launches by year from 1894 – August 2017

Covert Pentagon operation contributes to failure of North Korean missile launches

The US has conducted the cyber campaign, known as “left of launch,” since at least 2014. By targeting missiles before they are on the launch pad or right as they are fired, the US cyber strikes have contributed to a high fail rate in North Korean missile tests.

This operation is the second-known instance of a nation wielding a covert cyber weapon, the first being the US Stuxnet virus that targeted Iran’s nuclear program.

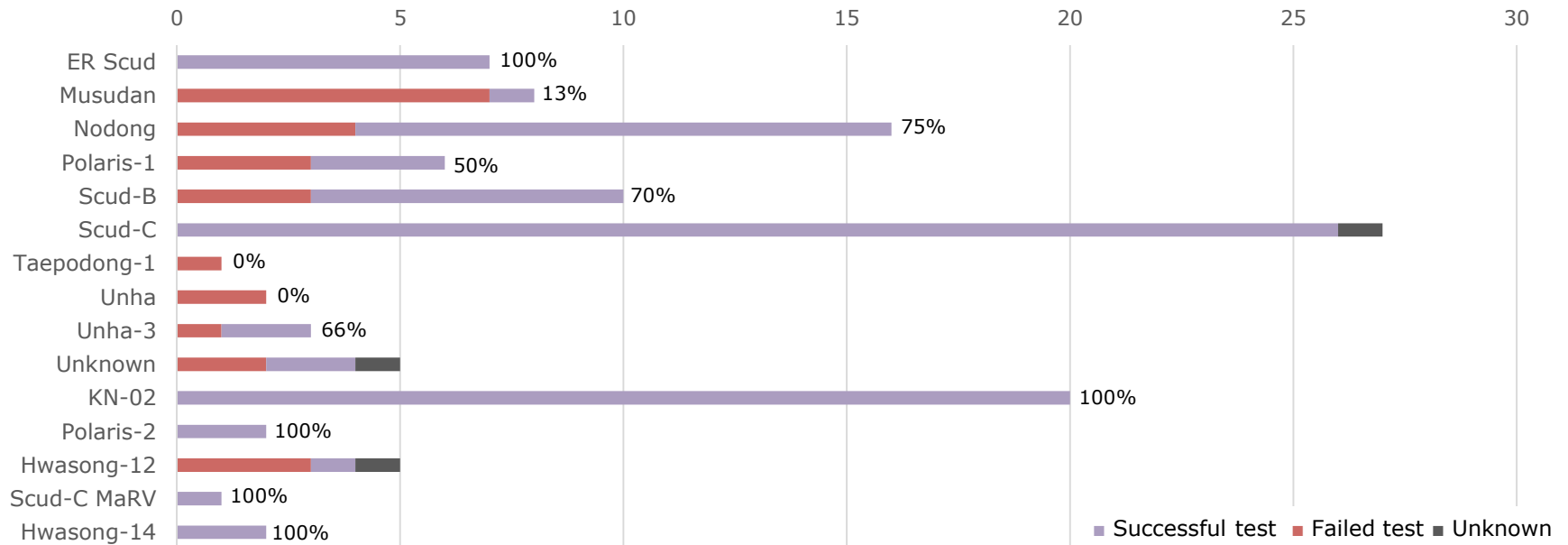
In addition to cyberattacks, the US targeted the supply chains of North Korean missile programs, selling defective parts to slow progress. This technique was also used against the Iranian program.



Sources: National Journal Research, 2017; David E. Sanger and William J. Broad, “Trump Inherits a Secret Cyberwar Against North Korean Missiles” New York Times, March 4, 2017; James Martin Center for Nonproliferation Studies, North Korea Missile Test Database, 2017.

The secret to North Korean success

Success and failure of launches by missile from 1984 – August 2017



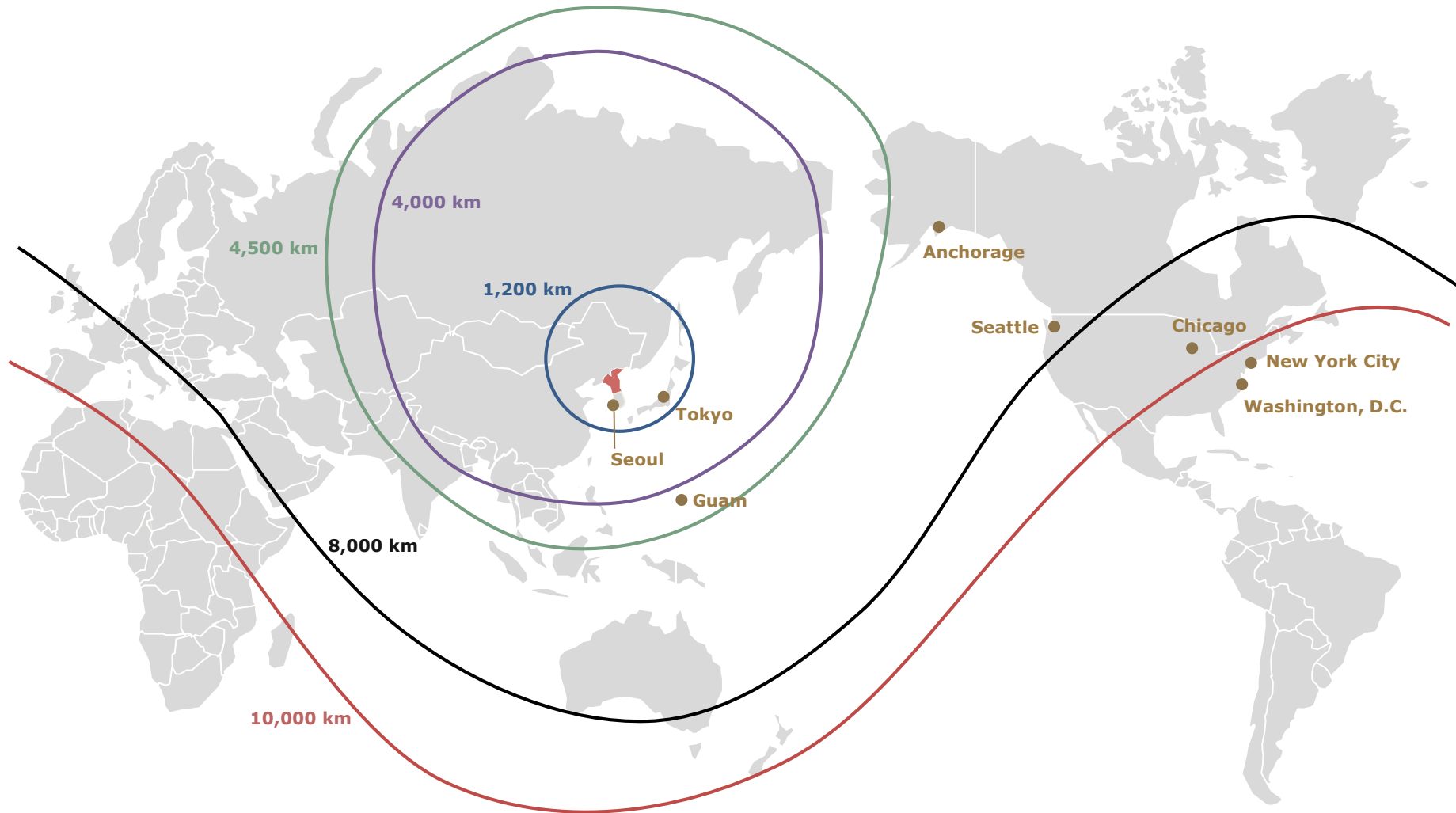
Evidence that North Korea procured missile engines from illicit channels in Russia and Ukraine

Michael Elleman, senior fellow at the International Institute for Strategic Studies, remarks that no other country has made the transition from medium-range ballistic missile (MRBM) to an ICBM so quickly. The Hwasong-12 and -14 use a high-performance liquid-propellant engine (LPE) based on the Soviet RD-250 engines, originally designed by Glushko enterprise.

There are hundreds of these engines, which are small enough to be flown or transported by train, stored in decommissioned rocket facilities on the borderlands of Russia and Ukraine. Following difficult financial times in Ukraine, North Korean operatives may have used arms dealers and criminal networks to procure the engines.

Sources James Martin Center for Nonproliferation Studies, North Korea Missile Test Database, 2017; Michael Elleman, "The secret to North Korea's ICBM success," IISS, August 14, 2017; William Broad & David Singer, "North Korea's Missile Success is linked to Ukrainian Plant, Investigators Say," New York Times, August 14, 2017.

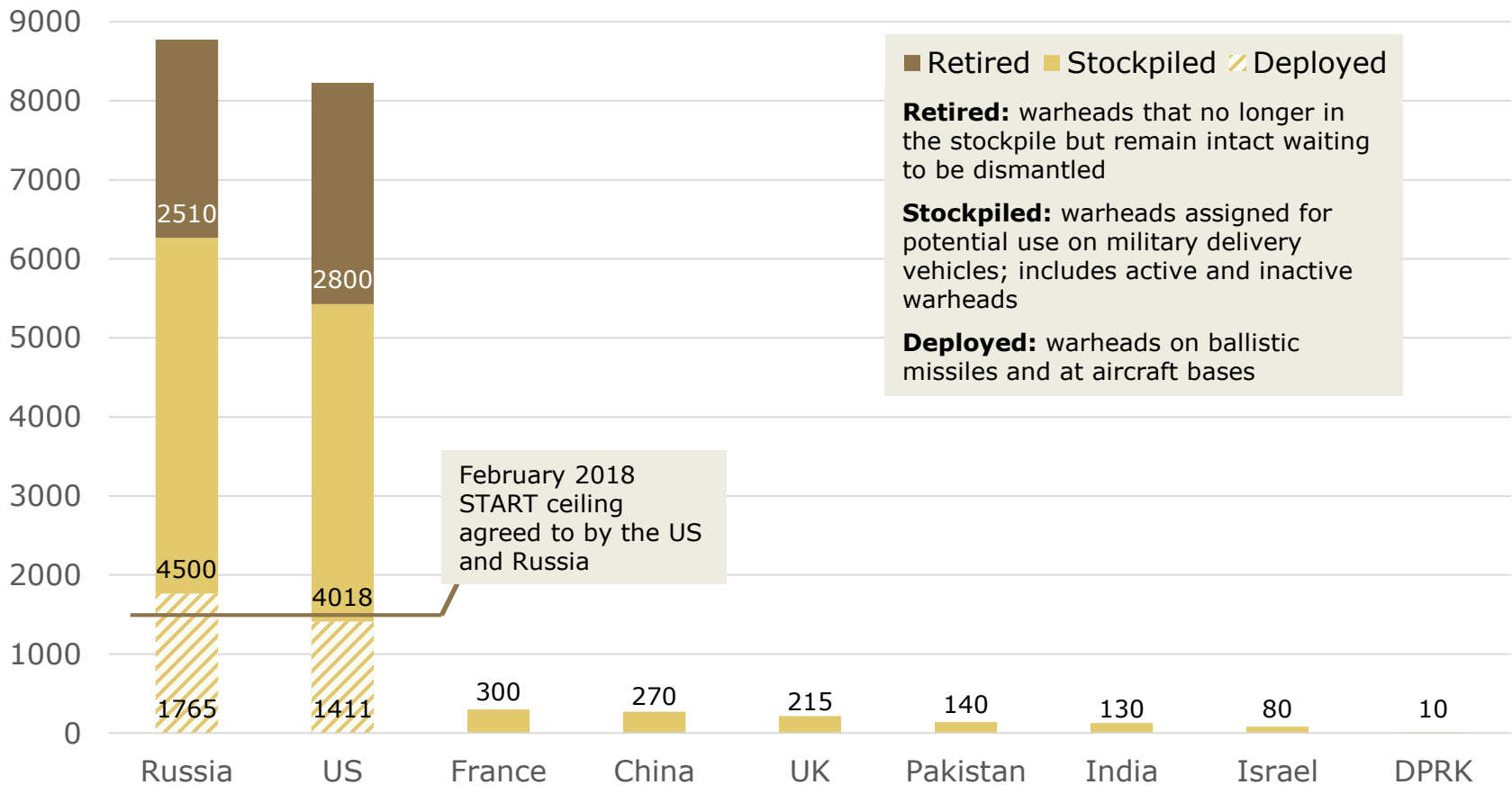
North Korean missile ranges



Sources: Kim Tong-Hyung, "Analysts doubts North Korea's ICBM re-entry capability" Associated Press, August 1, 2017; Nuclear Threat initiative, "Nuclear 101 Module" 2017; "What we know about North Korea's missile Programme" BBC News, August, 10 2017; Jessica Durando, "North Korea, U.S. tieline: 13 days of increasing tension" USA Today, August 8, 2017.

Estimated nuclear warhead inventories

More than 90% of the world's estimated 15,000 nuclear warheads belong to Russia and the US



Sources: Kelsey Davenport & Kingston Reif, "Nuclear Weapons: Who Has What at a Glance," Arms Control Association, July 5, 2017

Potential actions for the US, North Korea and other nations



Direct targeting of nuclear facilities

- A preemptive nuclear strike by the US is unlikely because of the damage that would result
- The US may choose to target nuclear reactors, missile facilities and launch pads for ICBMs in North Korea using stealth aircraft
- The US would try to limit the damage caused by North Korean retaliation with the Terminal High Altitude Area Defense (THAAD) system while vacating troops stationed at US military bases in South Korea



UN Security Council

- The UN Security Council is weighing non-military options to deter North Korea from further weapons development including banning textile exports, the national airline, and supplies of oil to the government
- The Council could also consider prohibiting North Koreans from working abroad and imposing asset freezes and travel restrictions on high-level officials
- The Chinese ambassador to the United Nations underlined the need for dialogue to prevent war on the peninsula

Experts in the field indicate conflict on the Korean peninsula could involve more than nuclear weapons

- Intelligence agencies estimate North Korea has the largest chemical weapons arsenal on the planet, with 2,500 to 5,000 tons of toxic agents
- President Trump has weighed preemptive military action as a potential option against North Korea, but this may incite the DPRK to use its chemical weapons arsenal against South Korea
- Some of North Korea's long-range artillery pieces are trained on Seoul and loaded with chemical munitions, says the Pentagon and South Korean intelligence
- The THAAD system in South Korea will defend against some missiles launched against it, but the system cannot protect from conventional, chemical tipped shells or rockets

Sources: Brendan Bordelon, "North Korea's Chemical Arsenal Complicates US Options," National Journal, August 16, 2017; Alex Lockie "Trump says the military is 'locked and loaded' to strike North Korea – here's how it would go down," Business Insider, August 11, 2017; Christine Kim, "South Korea seeks bigger warheads, North Korean ICBM reportedly on the move," September 2, 2017; Rebecca Savransky, "Chinese Ambassador: China 'will never allow chaos and war' on the Korean Peninsula," September 4, 2017.