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Nuclear weapons at a glance: North Korea

Summary

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Summary

Despite having conducted several nuclear tests, and demonstrated its missile capabilities, North Korea is not officially recognised by the international community as a nuclear weapons state.

It is, however, acknowledged as nuclear capable and since 2011 North Korea's nuclear programme has accelerated. In summary:

- Since 2006 North Korea has conducted six nuclear tests, the most recent in September 2017.
- Opinions are divided on the size of its stockpile. SIPRI's most recent estimate places North Korea's nuclear warheads between 40 and 50. It continues to produce fissile material for weapons purposes.
- In July 2017 North Korea successfully tested, for the first time, an Intercontinental Ballistic Missile (ICBM) technically capable of striking the United States. Despite the imposition of UN Security Council resolutions prohibiting the development and testing of ballistic missiles/ ICBM, North Korea has continued its ICBM programme. In early 2022 North Korea abandoned its self-declared moratorium on nuclear and ICBM testing and conducted an ICBM test in March 2022.
- North Korea is thought to have achieved miniaturisation of a nuclear warhead, a technological threshold in the attainment of a credible ICBM nuclear capability.
- North Korea's nuclear doctrine appears to be shifting from one based solely on deterrence, to a posture that embraces the concept of pre-emptive first strikes.

Since September 2021 North Korea has been conducting an accelerated campaign of missile testing. At the time of writing, North Korea has conducted 16 missile tests in the last four months alone, in contravention of UN Security Council resolutions. There are also indications that North Korea may be preparing to conduct a seventh nuclear test.

This paper is intended as an introduction to North Korea's nuclear weapons policies and programmes. It is part of a series of country profiles which are available on the House of Commons Library website.

1 Nuclear Status

North Korea's nuclear programme began in the 1950's, largely with the assistance of the Soviet Union.[1]

Despite having conducted six nuclear tests, and demonstrated its missile capabilities, North Korea is not officially recognised by the international community as a nuclear weapons state.[2] It is, however, acknowledged as nuclear capable.

Since 2011, North Korea's nuclear programme has accelerated under Chairman Kim Jong-un, in defiance of UN Security Council resolutions, UN sanctions and diplomatic efforts to agree denuclearisation.

The self-declared status of North Korea as a "nuclear state" was underscored in 2012 when this phrase was added to the preamble of the country's Constitution.[3]

1 The Nuclear Threat Initiative provides a detailed history of North Korea's nuclear development. In a January 2016 blog, Dr David Lowry also describes how the UK inadvertently assisted North Korea, whose nuclear reactors are based on British designs.

2 Under the Nuclear Non-Proliferation Treaty (NPT) a nuclear weapon state is defined as one that manufactured and exploded a nuclear weapon, or other nuclear explosive device, prior to 1 January 1967. The five permanent members of the UN Security Council (the P5) are the only NPT recognised nuclear powers. Israel, India and Pakistan are considered de facto nuclear weapon states.

3 A. Mansourov, "Kim Jong Un's nuclear doctrine and strategy: what everybody needs to know", Nautilus Institute, 16 December 2014

2 Nuclear doctrine

Given the opaque nature of the North Korean regime, piecing together its "nuclear doctrine" is not straight-forward.

Deterrence and, ultimately, regime survival have long been the assumed rationale behind North Korea's nuclear weapons programme. Indeed, at a meeting of the Central Committee of the Workers' Party of Korea in January 2020, Kim Jong un referred to the possession of nuclear weapons as a "great event" in defending and guaranteeing North Korea's "sovereignty and right to existence".[4]

At a military parade in April 2022, however, Kim Jong un made a speech in which he appeared to declare a shift in nuclear doctrine:

> The fundamental mission of our nuclear forces is to deter a war, but our nukes can never be confined to the single mission of war deterrent even at a time when a situation we are not desirous of at all is created on this land.
> If any forces try to violate the fundamental interests of our state, our nuclear forces will have to decisively accomplish its unexpected second mission.
> The nuclear forces of our Republic should be fully prepared to fulfil their responsible mission and put their unique deterrent in motion at any time.[5]

In a press statement a few weeks earlier, Kim's sister Kim Yo Jong had made similar assertions, suggesting that "one's nuclear combat force is mobilized to take initiative at the outset of war, completely dampen the enemy's war spirits, prevent protracted hostilities, and preserve one's own military muscle".[6]

Both sets of remarks suggest a move away from purely deterrence to a willingness to conduct pre-emptive first strikes against an adversary.

4 "Report on 5th Plenary Meeting of 7th CC, WPK", *KCNA Watch,* 1 January 2020

5 Voice of Korea, Speech made by President of State Affairs Kim Jong un at military parade for celebrating 90th anniversary of KPRA, 25 April 2022

6 38 North, "Yoon's key North Korea challenges", 5 May 2022

3 Nuclear arms control agreements

3.1 Nuclear Non-Proliferation Treaty (NPT)

North Korea acceded to the NPT in 1985 but withdrew from it in 2003.

There is still some debate about its status under the treaty, however. Several countries argue that the correct withdrawal procedures were not followed,[7] that North Korea is still bound by the provisions of the NPT and, therefore, needs to be brought back into compliance.[8]

3.2 Comprehensive Test Ban Treaty (CTBT)

North Korea is not a signatory to the CTBT and has repeatedly violated the international norm against nuclear testing.

Under Article XIV of the CTBT, North Korea is a designated Annex 2 state, whose signature and ratification is required before the treaty can enter force.

In April 2018 Kim Jong-un announced a moratorium on intercontinental ballistic missile and nuclear tests, saying the country no longer needed such tests. However, less than two years later he renounced that moratorium amid renewed tensions with the US (see below).

3.3 Denuclearisation talks

In 1992 North and South Korea signed the 'Joint Declaration on the Denuclearization of the Korean Peninsula', in which both sides agreed not to manufacture, test, deploy or use nuclear weapons. North Korea formally withdrew from the Declaration in 2013.[9]

7 In announcing its intention to withdraw from the NPT in 2003, North Korea backdated its mandatory three-month withdrawal notification to1993, when it first threatened to withdraw from the treaty.

8 The British Government in its document *The Road to 2010*, for example, discussed North Korea obligations as a State Party to the NPT, while the Final Report of the Preparatory Committee for the 2010 Review Conference acknowledged the uncertainty over North Korea's status (p.48).

9 "Nuclear disarmament: North Korea", Nuclear Threat Initiative, 23 September 2015

Six-party talks

Between 2003 and 2009 North Korea took part in the Six-Party Talks with South Korea, China, Russia, Japan and the United States. The aim of the talks was to find a way forward in dismantling North Korea's nuclear weapons programme. In 2005 a Joint Statement on agreed steps toward denuclearisation of the Korean Peninsula was achieved. However, that agreement proved to be short lived as relations between the US and North Korea quickly deteriorated. North Korea conducted its first nuclear test shortly after.

The resumption of talks in 2007 achieved little and talks were eventually suspended in 2009.[10]

UN Security Council resolutions and sanctions

Under UN Security Council resolutions North Korea is prohibited from nuclear and ballistic missile testing.

North Korea is subject to a UN arms embargo and sanctions for multiple breaches of a series of Security Council resolutions (UNSCR)in connection with its nuclear weapons programme.[11] The United Nations monitors implementation of North Korean sanctions through the 1718 Committee, established in 2006[12] and a Panel of Experts established in 2009.[13] The Panel produces regular reports to the Security Council on the status of the sanctions and enforcement. Whether sanctions are working, or whether North Korea has, to a large extent, evaded them is a matter of some debate.[14]

At the end of April 2017, the UN Security Council issued a statement condemning North Korea's latest missile tests, calling its actions "highly destabilizing" and a "flagrant and provocative defiance of the Security Council". It also accused North Korea of "greatly increasing tensions in the region and beyond". The statement demanded no further nuclear tests by North Korea and suggested that further "significant measures", including sanctions, could be imposed.

Indeed, in June and August 2017 the UNSCR adopted further resolutions (2356 and 2371) extending the scope of sanctions and reaffirming its position that North Korea "must abandon all nuclear weapons and existing nuclear programmes in a complete, verifiable and irreversible manner, and immediately cease all related activities".

10 In 2012 North Korea and the US also reached agreement on freezing the North Korean nuclear programme in exchange for US food aid. That agreement also fell apart within months after North Korea, in defiance of UN security council resolutions, launched a rocket using ballistic missile technologies to place an earth observation satellite in orbit.

11 United Nations Security Council resolutions: 1695 (2006), 1718 (2006), 1874 (2009), 2087 (2013), 2094 (2013), 2270 (2016), 2321 (2016), 2356 (2017), 2371 (2017), 2375 (2017), 2397 (2017).

12 UNSCR 1718 (2006)

13 UNSCR 1874 (2009)

14 This is examined in greater detail in Library briefing CBP8793, North Korea: January 2020 update. RUSI's Project Sandstone also examines North Korea's illicit shipping networks.

After North Korea conducted a sixth nuclear test in early September 2017, and a further intercontinental ballistic missile (ICBM) test in November 2017, the UNSCR adopted a further two resolutions (2375 and 2397) tightening the sanctions regime.[15]

US-North Korea summit talks (2018-2019)

Whereas 2017 was a year of rapidly rising tensions between the US and North Korea, there was a sudden improvement in relations in early 2018, with both sides talking up the prospects for peace. In April 2018 Kim Jong-un announced a moratorium on intercontinental ballistic missile and nuclear tests, saying the country no longer needed such tests.

In June 2018 the first US-North Korea summit was held in Singapore. Several confidence-building actions followed the Singapore summit. North Korea stopped testing nuclear weapons and put some facilities and equipment out of use; the US and South Korea suspended their military exercises.

The second US-North Korea summit took place in Vietnam in February 2019. There was considerable optimism ahead of the Vietnam summit that further progress towards peace could be made. However, the summit broke up early without any agreement.

The set-back in Vietnam confirmed that the two sides continue to have very different ideas about what denuclearisation should mean and how it should happen. The US wants total denuclearisation by North Korea after which everything else will follow. Specifically, security guarantees through a peace treaty that ends the Korean War and the complete lifting of sanctions.

In contrast, North Korea calls for the denuclearisation of the Korean peninsula, which potentially brings into play the US "security umbrella" which has protected South Korea. Its approach remains a gradualist one based on reciprocal actions, with some sanctions relief upfront. This has been described as "something for something".

Despite the rhetoric of the Trump administration, nothing concrete was achieved from the US-North Korea denuclearisation talks.

The two leaders did meet again at the end of June 2019 in the Demilitarised Zone that divides the two Koreas. South Korean President Moon also attended. Donald Trump symbolically stepped into North Korea during the meeting. This raised hopes that the two sides might find a way forward through negotiations after all. But despite continuing contacts by high-ranking officials, nothing concrete materialised.

Since then, relations have taken a downturn. In late 2019 Kim Jong-un announced that the US had until the end of the year to adopt a more flexible

[15] The principal sanctions established by each UNSCR are summarised by the Arms Control Association.

negotiating position and make concrete proposals to revive dialogue. He said that, in their absence, North Korea would give the world a "Christmas gift".

Although that "gift" failed to materialise, at a meeting of the Central Committee of the Korean Workers Party in December 2019, Kim made several speeches calling for "positive and offensive measures" to safeguard the country's "sovereignty and security". He also announced that North Korea was abandoning its moratorium on nuclear and intercontinental ballistic missile testing and said that regime would be unveiling a new "strategic weapon" soon.[16] In January 2020 a North Korean official stated that the 2018 moratorium had been designed as a confidence building measure with the US but as Washington "remains unchanged in its ambition to block the development of North Korea, it has no reason to be unilaterally bound by its past commitment".[17] Despite this change of stance, however, no further tests were conducted.

Prospect of future talks?

The current conflict in Ukraine has presented North Korea with a window of opportunity to continue developing its deterrent capabilities, relatively unimpeded by the US or the United Nations.

The North Korean regime has long stated that it has no further interest in resuming talks with the US until Washington adopts a different approach to the relaxation of sanctions.

The North Korean regime has continued this approach under President Biden and in recent months has increased the pressure with a new, sustained, missile testing programme (see below). In January 2022 the regime confirmed North Korea's intention to lift the self-imposed moratorium on nuclear and ICBM tests, despite having already threatened to do so in December 2019. Kim Jong un accused the US of "hostile acts" against North Korea and said that US policy was "jeopardising North Korea's right to self-defence" which "can no longer be tolerated".[18]

Several analysts have suggested that, while benefitting from advancements to its missile and overall deterrent capabilities, the extent of the missile testing programme would indicate that North Korea is seeking to "normalise" ballistic missile testing ahead of any future dialogue on denuclearisation and sanctions concessions. North Korea has used its missile testing programme in the past to put pressure on the US to engage in diplomatic dialogue, thereby allowing North Korea to negotiate from a position of strength and push for the removal of international sanctions in exchange for movement on their nuclear programme.

As such, they argue that North Korea is likely to "ratchet up the pressure" on the US and the new South Korean President, Yoon Suk Yeol, over the next few months by conducting more missile tests, and possibly even a nuclear test

16 The Lowy Institute, "North Korea's ambiguous New Year message", 8 January 2020

17 "North Korea Denuclearization Digest", *Arms Control Today*, January 2020

18 Jane's Defence Weekly, "Pyongyang indicates intention to lift suspension on nuclear and ICBM tests", 20 January 2022

(see below).[19] Analysts at the Center for Strategic and International Studies predict that North Koreas is "likely to continue to avoid negotiations for the rest of 2022, if not longer, as it works toward achieving the technical benchmarks that Kim detailed in the Eighth Party Congress".[20]

While the current conflict in Ukraine has not motivated North Korea's recent testing campaign, it is also widely acknowledged to have presented a "window of opportunity" for North Korea to continue developing its deterrent capabilities relatively unimpeded while the US' foreign policy focus lies elsewhere and any censure at the UN seems unlikely.[21]

In response to the recent round of testing, the US has imposed additional bilateral sanctions on North Korea, enhanced the readiness of ballistic missile defences in the region and strengthened its intelligence, surveillance and reconnaissance activities. The US administration has, however, stated its continued willingness to pursue "serious and sustained dialogue…without preconditions" and called on North Korea to "halt its destabilizing actions and instead choose engagement". Complete denuclearisation of the Korean Peninsula remains the ultimate goal.[22]

Calls for action by the UN have also been made, and the UN Security Council met in emergency session at the end of March 2022 to discuss North Korea's first ICBM test launch in five years (see below). The UN Security Council met again on 11 May. While the US, supported by the UK,[23] is pushing for further UN sanctions to be adopted, Russia and China have indicated their opposition to such action.[24]

Impact of a new hard-line South Korean President?

The recent election of a new hard-line President in South Korea, Yoon Suk Yeol, is expected to change the dynamic of relations on the Korean Peninsula. During his election campaign President Yoon promised to strengthen South Korea's defence against North Korea's rapidly developing nuclear forces and suggested that South Korea would consider pre-emptive strikes on North Korean missile capabilities, which prompted criticism and threats of pre-emptive action of its from the Kim regime.[25]

In his inauguration speech on 10 May President Yoon did call for denuclearisation of the Korean Peninsula in exchange for a plan to strengthen

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19 Jane's Intelligence Weekly, "North Korean missile launches likely aimed at securing economic concessions", 31 March 2022

20 Center for strategic and International Studies, "The burgeoning North Korean missile threat", 29 April 2022

21 Jane's Intelligence Review, "South Korea's new government likely to take tougher stance against North Korea", 9 May 2022

22 US Department of State, Briefing with Special Representative for the DPRK on recent developments in the DPRK and US efforts to advance denuclearization on the Korean Peninsula, 6 April 2022

23 Foreign, Commonwealth and Development Office, Press release, 11 May 2022

24 The Washington Post, "US clashes with China and Russia over North Korea sanctions", 11 May 2022

25 Yonhap News Agency, "Yoon's spokesperson defends S. Korea's right to launch pre-emptive strike", 5 April 2022

North Korea's economy.[26] However, few observers expect North Korea to accept his offer and there are fears of escalation, miscalculation and an arms race developing on the Peninsula. The adoption of a more hard-line approach to North Korea is also likely to revitalise debate in South Korea over possession of its own nuclear capability, or at the very least the reintroduction of US tactical nuclear weapons in the country.[27]

[26] The Korea Herald, "Full text of President Yoon Suk-yeol's inauguration speech", 10 May 2022

[27] The US withdrew its tactical nuclear weapons from South Korea in 1991.

4 Nuclear capabilities

"North Korea's ambitions extend beyond fielding a primitive existential deterrent".

Center for Strategic and International Studies, April 2022

At the Eighth Party Congress of the Worker's Party of Korea in January 2021, Kim Jong-un pledged to continue developing advanced weapons, including nuclear weapons. Among the regime's nuclear priorities are the development of a nuclear-powered ballistic missile submarine, solid-fuelled ICBM, multiple warhead ICBM, tactical nuclear weapons and a nuclear tipped hypersonic glide vehicle (HGV).

The development of such capabilities would enhance the responsiveness and survivability of North Korea's nuclear force, supporting the view that North Korea's nuclear posture is moving away from one premised on deterrence and survival of the regime, to one that is more offensive and pre-emptory in nature.

Many of the new systems under development were subsequently displayed at a military parade to mark the 90th anniversary of the Korean People's Army in April 2022, the fourth such event in two years. In a speech to the parade, Kim Jong-un called for the continued enhancement of the country's nuclear forces, in terms of both quantity and scale.[28]

That parade coincided with an intensive campaign of missile testing that North Korea has been conducting over the last six months, and allegations that the country is preparing to conduct its seventh nuclear test.

4.1 Nuclear testing programme

North Korea has conducted six underground nuclear weapons tests, four of which have been authorised under current leader Kim Jong-un: 2006, 2009, 2013, January 2016, September 2016, and on 2 September 2017.

North Korea's nuclear weapons tests in 2006 and 2009 are believed to have involved the use of plutonium and produced estimated yields of one kiloton and approximately four kilotons respectively.

The 2013 test is estimated to have produced a yield of approximately 10 kilotons. There had been speculation that the device may have involved the use of HEU, but this could not be independently verified.

[28] Jane's Defence Weekly, "North Korea's Kim calls for military modernisation", 29 April 2022

The North Korean regime has issued statements suggesting that the January 2016 test involved its first thermonuclear/hydrogen bomb.[29] But many experts were doubtful, arguing that the yield produced – estimated at 6-8 kilotons – was far too small for such a bomb. But some argued that the test may have been of a "boosted fission device" using hydrogen isotopes to improve the fission reaction. If true, in future North Korea might require less fissile material for each weapon, which would make it easier to develop smaller, miniaturised warheads for its intercontinental ballistic missile programme.[30]

Assessments of the September 2016 test suggested that the device had an approximate yield of 20 kilotons. North Korean state media suggested that it had demonstrated significant advances in "standardisation" which many experts interpreted as technological advancements in miniaturisation. However, those claims could not be independently verified and experts remained sceptical of North Korea's claims.

Initial assessments of the last test on 2 September 2017 suggested that the nuclear device was potentially a thermonuclear/hydrogen bomb with a yield of approximately 100 kilotons, North Korea's most powerful nuclear explosion yet. Some analysts have since revised that estimate to up to 250 kilotons.[31]

Preparations for a seventh nuclear test?

On 28 April 2022 the Center for Strategic and International Studies published a report in which it alleged that preparations for a seventh North Korean nuclear weapons test were well underway.[32]

The report suggested that recent satellite imagery has shown "continued activity" at the Punggye-ri nuclear test facility, including the construction of new buildings, and an increase in equipment and supplies immediately outside one of the test facility's tunnels that had previously been rendered unusable following US-North Korean talks in 2018 (see above). A project to restore the testing tunnel is thought to be underway and its use for a potential nuclear test is considered possible within the next four months.[33] In a press briefing on 6 May 2022, the US State Department shared this assessment, saying that North Korea could be ready to conduct a nuclear test "as early as this month".[34]

It has been suggested that North Korea could be preparing to test a tactical nuclear weapon, as opposed a larger strategic nuclear warhead. The

29 "North Korea claims hydrogen bomb test", *Arms Control Today*, January/February 2016

30 The amount of fissile material in a warhead can be reduced, and their yield increased, by using tritium to boost the fission process. "North Korea's nuclear threat: how to halt its slow but steady advance", Arms Control Association Threat Assessment Brief, 19 February 2016

31 As reported in *The Washington Post*, 14 September 2017

32 Center for Strategic and International Studies, "Punggye-ri update: Construction and volleyball", 28 April 2022

33 Center for Strategic and International Studies, "Punggye-ri update: Construction and volleyball", 28 April 2022

34 US Department of State, Department Press Briefing, 6 May 2022

development of tactical nuclear weapons was identified as a priority by the regime in January 2021 (see below). According to Jane's analysts:

> There will be limited fallout from testing a tactical nuclear weapon which would make it easier for North Korea to manage the environmental effects of such a test and ensure that radiation does not spill over the Chinese border.
>
> At the same time, the shock value that such a test would generate would serve North Korean propaganda purposes equally well.[35]

The conduct of a nuclear test within this timeframe would fit with recent statements from Kim Jong-un on the need to enhance North Korea's nuclear capabilities and the spate of recent missile tests being conducted by the regime (see below for more detail).

It would also coincide with the inauguration of South Korea's new President, Yoon Suk Yeol (see above) and the forthcoming summit between President Biden and President Yoon on 21 May in Seoul.

However, the country is now facing an imminent public health crisis following a large scale Covid-19 outbreak.[36] Lockdown measures have been imposed but there are concerns for North Korea's population of 25 million people who are unvaccinated and only have access to basic healthcare.[37] Whether the regime will press ahead with a nuclear test in such circumstances is unclear. Many observers have pointed, however, to the continued testing of North Korea's missile capabilities despite the Covid-19 outbreak, suggesting that "North Korea would likely continue to build its arsenal with weapons tests to boost public morale and strengthen loyalty for the Kim leadership".[38]

4.2 Nuclear stockpile

Estimates of the number of nuclear weapons North Korea possesses are dependent upon fissile material production, but also on the design of any nuclear weapon. Higher yield thermonuclear weapons, for example, require more fissile material than a lower yield single-stage fission weapon design.[39] Based on its testing programme to date, analysts concur that it is unclear which North Korea is prioritising.[40]

35 Jane's Intelligence Review, North Korea: CBRN Quarterly Update, April 2022

36 The regime had until now claimed to have had no covid cases after it closed its borders in January 2020

37 North Korea has previously refused assistance from the international community, including vaccines that were offered through the covax scheme.

38 South China Morning Post, "Amid first Covid outbreak, North Korea fires ballistic missiles in warning ahead of Joe Biden's visit to Asia", 13 May 2022

39 According to the IPFM, a first-generation warhead would require 15-18kg of HEU or 5-6kg of plutonium. A second generation boosted warhead would require 12kg of HEU or 4-5kg of plutonium.

40 Kristensen and Korda, Nuclear Notebook: North Korean nuclear weapons, 2021

As such, the exact size of North Korea's nuclear stockpile is unclear. For a long time 8-10 plutonium-based nuclear weapons had been a common estimate, with some analysts suggesting that North Korea may be in possession of a small number of Highly Enriched Uranium (HEU)-based weapons.[41]

In July 2017, however, the US Defence Intelligence Agency was reported by *The Washington Post* to have significantly raised its official estimate of the number of nuclear warheads that North Korea possesses, to 60.[42] That figure was questioned by a number of independent experts who continued to suggest that North Korea's stockpile remained much lower. Siegfried Hecker, Director Emeritus of the Los Alamos National Laboratory and one of the last known officials to have inspected North Korea's nuclear facilities in 2010, argued that the size of North Korea's stockpile was no more than 20-25 warheads; while warning of the potential risks of overselling the North Korean threat.[43] Jonathan Pollack of the Brookings Institution also argued that "there's a troubled history with such intelligence shifts in the past. That should inject caution, if not outright scepticism, in evaluating these new assessments".[44]

Indeed, at the time, many prominent commentators such as the Stockholm International Peace Research Institute (SIPRI) retained a much more conservative estimate of 10-20 warheads in the North Korean stockpile.[45]

Recent assessments

Fissile material production

North Korea continues to produce fissile material.

In September 2020 the IAEA had reported that despite ongoing maintenance activities there appeared to have been no signs of plutonium production at the Yongbyon nuclear complex since the end of 2018 and that a new Experimental Light Water Reactor under construction had not yet commenced operation. Such observations led many analysts to conclude, at the time, that North Korea's plutonium production could be stalled.

In August 2021, however, the IAEA reported signs "consistent with the operation of the reactor", indicating that plutonium production had restarted.[46] In April 2022 Jane's Intelligence Review also noted that construction activities around the new Experimental Light Water Reactor appeared complete and that "should the ELWR [experimental light water

41 "Recalibrating US policy towards North Korea", Arms Control Association, February 2017
42 "North Korea now making missile-ready nuclear weapons, US analysts say", *The Washington Post,* August 2017
43 "North Korea now making missile-ready nuclear weapons, US analysts say", *The Washington Post,* August 2017
44 "What do intelligence leaks about North Korea tell us?", Brookings Institution, 9 August 2017
45 SIPRI Yearbook 2017
46 IAEA, Application of safeguard's in the Democratic People's Republic of Korea (PDF), August 2021

reactor] become operational then it would significantly increase Pyongyang's plutonium production capability".[47]

Uranium enrichment activities are also considered by the IAEA to be ongoing.[48]

North Korea has a single, declared, uranium enrichment facility at Yongbyon which has continued to operate. There are concerns, however, that North Korea is also operating a number of covert uranium enrichment plants. As Kristensen and Korda note, "it is much more difficult to assess… because the footprint for these facilities is significantly smaller and harder to detect".[49] Analysts consider that at least one additional centrifuge facility exists outside of the Yongbyon complex.[50]

The International Panel on Fissile Materials (IPFM) estimates the country to have at least 0.04 tons of plutonium and potentially 0.7 tons of highly enriched uranium (HEU) stockpiled for weapons purposes, although it says that "there is as yet no firm evidence that North Korea has produced HEU".[51] On current rates of HEU production, analysts consider that North Korea "might be capable of adding sufficient fissile material for a few to half a dozen nuclear warheads per year".[52]

Stockpile size

In their 2021 Nuclear Notebook, Hans Kristensen and Matt Korda "cautiously" estimated that North Korea may have produced enough fissile material to build between 40 and 50 warheads, most of which would be single-stage fission weapons.[53] However, all authors acknowledged that there was some uncertainty as to how many nuclear weapons had been fully assembled.[54]

Has miniaturisation been achieved?

Achieving miniaturisation of a nuclear warhead so that it is capable of being deployed on a ballistic missile is considered a key threshold in becoming a viable nuclear weapons state.

47 Jane's Intelligence Review, North Korea: CBRN Quarterly Update, April 2022

48 International Atomic Energy Agency, Application of safeguards in the Democratic People's Republic of Korea (PDF), 27 August 2021. The IAEA has not conducted on-site inspections of North Korea's nuclear facilities since 2009. The organisation continues to monitor North Korea's nuclear activities, however, with the use of tools such as satellite imagery.

49 Kristensen and Korda, Nuclear Notebook: North Korean nuclear weapons, 2021

50 SIPRI Yearbook 2020, p.379

51 International Panel on Fissile Materials, Fissile material stocks and North Korea profile

52 Kristensen and Korda, Nuclear Notebook: North Korean nuclear weapons, 2021

53 Kristensen and Korda, Nuclear Notebook: North Korean nuclear weapons, 2021

54 SIPRI Yearbook 2020 and Kristensen and Korda, Nuclear Notebook: North Korean nuclear weapons, 2021

In its September 2016 nuclear test, the regime claimed that it had made advances in miniaturisation, although this was greeted, at the time, with some scepticism.

In August 2017 the US Defence Intelligence Agency was reported to have concluded that North Korea had successfully produced a miniaturised nuclear warhead capable of being fitted on a ballistic missile.[55] Since 2016 this is a view that has been shared by Japan's Ministry of Defence in its annual Defense White Paper. The 2020 White Paper confirms that:

> given the technological maturity obtained through a series of nuclear tests, North Korea is assessed to have already miniaturized nuclear weapons to fit ballistic missile warheads.[56]

In an August 2020 report, the UN Panel of Experts concluded that North Korea had "probably" achieved miniaturisation of its nuclear warheads.[57]

Tactical nuclear warheads?

At the Eighth Party Congress of the WPK in January 2021, commitments were made to not only "push ahead the production of super-sized nuclear warheads" but to also focus on making "nuclear weapons smaller and lighter for more tactical uses". The development of tactical nuclear weapons was considered necessary by the regime to "thoroughly contain, control and handle on our own initiative various military threats on the Korean peninsula, which are inevitably accompanied [by] the nuclear threat".[58]

There have been suggestions that preparations for a possible forthcoming nuclear test (see above) could be for a smaller tactical nuclear warhead.

A spate of recent testing of North Korea's latest short-range ballistic missile capabilities (see below) would also support a move in this direction.

55 "North Korea now making missile-ready nuclear weapons, US analysts say", *The Washington Post,* August 2017

56 Defense of Japan 2020, p.90

57 "North Korea 'probably' has mini nuclear weapons: UN report", *Deutsche Welle,* 4 August 2020

58 The National Committee on North Korea, On Report made by Supreme Leader Kim Jong un at Eighth Party Congress of WPK, January 2021

4.3 Ballistic missile programme

"There is considerable uncertainty about which of North Korea's missiles have been fielded with an active operational nuclear capability".

Hans Kristensen and Matt Korda, Nuclear Notebook, 2021

North Korea has a long-standing ballistic missile programme which, in concert with the nuclear testing programme, has been accelerated significantly since 2011 under leader Kim Jong-un.

Substantial achievements have been made in advancing North Korea's ballistic missile capabilities beyond its operational inventory of regionally focused short-to-medium range missiles (Scud, Hwasong-5 and 6, KN-02, KN-25, Nodong and Pukguksong-2 missiles),[59] which collectively bring all of South Korea, and most of Japan, in range. Over the last few years, North Korea has achieved progressively longer ranges and increasingly sophisticated delivery capabilities. It is unclear, however, which missile systems have achieved full operational capability, and which are intended to be nuclear capable.

In September 2021 North Korea began a missile testing campaign, the pace of which Jane's analysts have called "unprecedented".[60] At the time of writing, in just over four months North Korea has conducted 15 missile tests, including of its ICBM capability.

Short and medium-range ballistic missiles

North Korea already possesses a significant arsenal of short and medium-range ballistic missiles.

At the time of writing, North Korea has conducted 16 missile tests since the start of 2022.

In the last few years North Korea has been augmenting that capability with the development of newer, more sophisticated missile systems. In 2019 North Korea tested the new solid-fuelled KN-23 SRBM. Road mobile, with a range of 690km, the system has been noted for its similarities to the Russia Iskander-M, leading many to question whether North Korea has received foreign assistance for its SRBM development programme.[61] It is unclear whether the KN-23 has entered service. A modified version of the KN-23 was reportedly test fired in September 2021 and again in April 2022.[62] The former test launch was carried out by a newly formed railway-borne missile regiment,[63] while the latter was attended by Kim Jong un. His presence at the April 2022 test has led many to conclude that the KN-23 is of sufficient strategic importance that it is likely to have a nuclear role.[64]

59 A detailed list of North Korean missile capabilities and ranges has been compiled by the CSIS Missile Defense Project.

60 Jane's Defence Weekly, "North Korea parades latest missile systems", 27 April 2022

61 CSIS Missile Defense Project, North Korea: KN-23 (accessed 10 May 2022)

62 Jane's Defence Weekly, "Escalatory responses : The accelerating arms race on the Korean Peninsula", 17 December 2021 and Jane's Defence Weekly, "North Korea parades latest missile systems", 27 April 2022

63 Jane's Defence Weekly, "Escalatory responses : The accelerating arms race on the Korean Peninsula", 17 December 2021

64 Jane's Defence Weekly, "North Korea tests new nuclear-capable short-range missile", 18 April 2022

North Korea also tested its new solid-fuelled KN-24 SRBM for the first time in 2019. With a range of 410km, in flight manoeuvrability, and enhanced accuracy, North Korean state media has referred to the missile as a "tactical guided weapon". The KN-24 remains under development and was tested most recently in January 2022 as part of a new concerted missile testing programme.[65] In a briefing in April 2022, the US Congressional research Service described the missile as posing "significant threat to South Korea and US assets on the Peninsula" and acknowledged its potential as a dual-capable system.[66]

Intermediate-range ballistic missiles

In April 2016 North Korea began testing its road-mobile Musudan (Hwasong-10) intermediate-range missile for the first time, which has a range of up to 4,000km. Following a series of test failures, the status of the development programme is currently unknown. There have been suggestions that it may have since been replaced by the Hwasong-12.

In May 2017 the regime tested a new intermediate-range missile with a range of 4,500km: the Hwasong-12. Fired at a lofted trajectory it reached approximately 2,000km, far greater than that achieved in previous missile tests. Had it been fired on a standard trajectory experts concluded that it would have achieved a range of at least 4,000km. Achieving such an altitude would also have allowed the regime to test the ability of the missile to exit, and re-enter the atmosphere, which is crucial to developing an ICBM capability.[67]

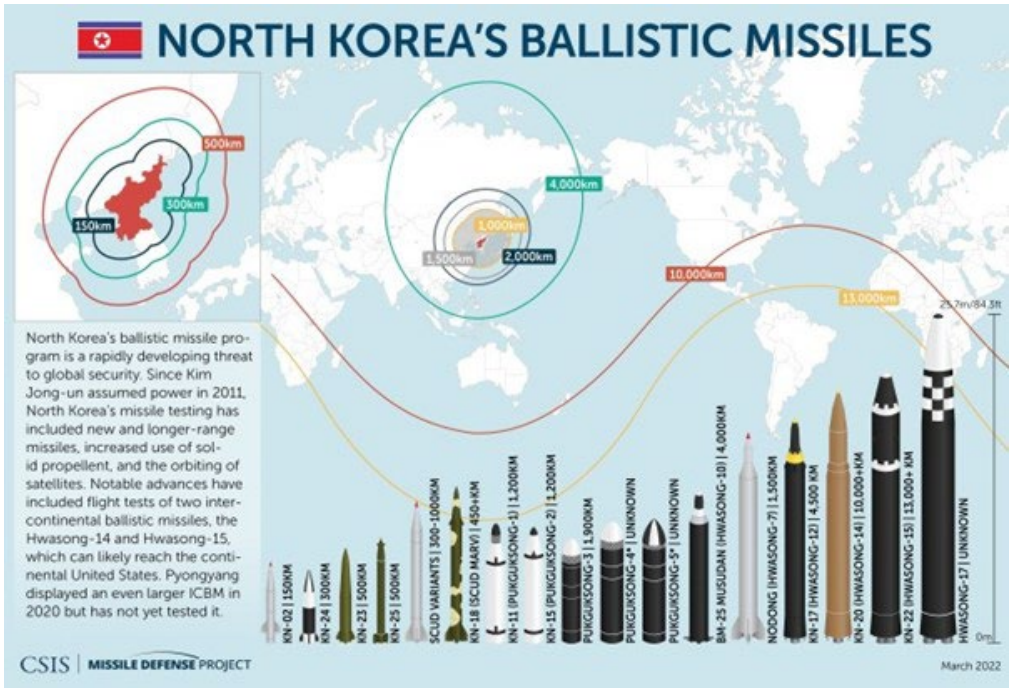
The missile was tested again at the end of August and again in mid-September 2017, both times on a standard trajectory overflying Japan, before landing in the Pacific Ocean. The second test flight reached a range of 3,700km, the furthest a North Korean ballistic missile had ever flown, at the time. Such range would put the US military base of Guam in the Pacific well within range.

While short of the range that would designate the Hwasong-12 as an ICBM its successful testing in 2017 was widely viewed by experts as a key stepping-stone in North Korea's ICBM development programme. It is not yet clear if the Hwasong-12 has been operationally deployed. A further test launch of the missile was conducted in January 2022.

65 CSIS Missile Defense Project, North Korea: KN-24 (accessed 10 May 2022)

66 US Congressional Research Service, North Korea's nuclear weapons and missile programs, updated 8 April 2022

67 For an ICBM to be credible the warhead must be able to survive atmospheric re-entry from space.



Source: Missile Defense Project, Center for Strategic and International Studies, last updated 24 March 2022

Since September 2021 the North Korean regime has been accelerating its missile development and testing programme.

ICBM development programme

Development of a reliable ICBM capability, which would provide the ability to strike the continental United States, has been the primary focus of North Korea's ballistic missile programme.

Achieving a viable ICBM capability had been believed to be several years away. In February 2017 Jeffrey Lewis of the Center for Nonproliferation Studies suggested that North Korea may attain a missile capable of targeting the US mainland by 2022. Other analysts had predicted a much longer timeframe.[68]

However, on two separate occasions in July 2017[69] North Korea took its first steps to achieving a viable ICBM capability after successfully testing its Hwasong-14 ICBM.[70] Both were conducted at a lofted trajectory, although experts concluded that on a standard trajectory they would have achieved ranges of 6,700km and 10,400km respectively, putting Hawaii, Alaska and subsequently the majority of the US mainland in range. At 8,657km from Pyongyang, London would also be in range of the Hwasong-14. However, some concluded that the second test had only been partially successful

68 See "Recalibrating US policy towards North Korea", *Arms Control Association*, February 2017

69 4 and 28 July

70 The relationship between the Hwasong-14 and two ICBM (the KN-08 and KN-14) which North Korea has displayed at military parades since 2012 but never tested, is unclear.

because the missile's re-entry vehicle had "disintegrated prematurely". Michael Elleman of the International Institute for Strategic Studies, said:

> A reasonable conclusion based on the video evidence is that the Hwasong-14's re-entry vehicle did not survive during its second test. If this assessment accurately reflects reality, North Korea's engineers have yet to master re-entry technologies and more work remains before [North Korean leader] Kim Jong Un has an ICBM capable of striking the American mainland.[71]

Such significant advances in its ballistic missile programme in a relatively short space of time led many to conclude that achieving a reliable ICBM capability could be possible within the next two years (by 2019), particularly if miniaturisation of its nuclear warheads had also been achieved. It also led a number of commentators to question whether North Korea had attained illicit missile technologies and knowledge from overseas.[72] Opinion continues to be divided on whether this is indeed the case, with a number of analysts highlighting the synergies with North Korea's TaepoDong 2 space launch vehicle programme which has successfully launched crude satellites into orbit.

In November 2017 North Korea conducted a further ICBM test. Designated the Hwasong-15, the missile was described as a heavier ICBM capable of "attacking the whole mainland of the US", thereby indicating greater range (13,000 km) than the Hwasong-14. The missile is also thought capable of carrying decoys or countermeasures to address US missile defence.[73] A number of commentators again expressed doubts about the technological ability of the warhead to survive atmospheric re-entry. Such doubts led then US Secretary of Defense, Jim Mattis, to comment that the Hwasong-15 "has not yet shown to be a capable threat against us right now".[74]

Experts widely agreed that North Korea had yet to prove the performance and reliability of both of its ICBM, in particular the survivability of a re-entry vehicle or terminal stage guidance and warhead activation. Yet, as an article in *The Washington Post* in October 2020 pointed out:

> While North Korea has refrained from carrying out provocative tests of its most advanced weapons systems, it never stopped working on them.[75]

Indeed, at a military parade in October 2020, the North Korean regime unveiled its long-awaited new "strategic weapon". Referred to as the Hwasong-16, it is a road-mobile, liquid-fuelled ICBM that is significantly larger than previous ICBM.

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71 "Video Shows Possible Failure of North Korean ICBM Test", IISS Commentary, 31 July 2017

72 See for example Michael Elleman, "The secret to North Korea's ICBN success", IISS Voices, 14 August 2017 and *The Diplomat*, 16 August 2017

73 US missile defence efforts in the last few years have been focused largely on the threat posed by North Korea.

74 "North Korea tests new long-range missile", *Arms Control Today,* January 2018

75 "As Kim wooed Trump with 'love letters', he kept building his nuclear capability, intelligence shows", *The Washington Post,* 1 October 2020

The motivation behind developing a much larger ICBM than North Korea currently possesses is unclear, [76] although the political message it sends, both domestically and on the international stage, cannot be underestimated. Its larger size may enable the delivery of a greater payload to the same range as the Hwasong-15, possibly involving multiple independently targetable re-entry vehicles (MIRV).[77] Or it could allow for the additional deployment of countermeasures in order to overcome US missile defence systems. Showcasing the world's largest mobile ICBM, albeit one that hasn't been flight tested, also demonstrates prestige, technological ability and a determination to keep the nuclear option open. As Michael Elleman has observed, however, "these advanced capabilities would require a sophisticated testing campaign that would take several years to complete.[78]

A resumption of ICBM testing

In March 2022, and for the first time since lifting the self-imposed moratorium on ICBM and nuclear testing,[79] North Korea flight tested what it claimed was a newer ICBM variant – the Hwasong-17.

The first test of an ICBM in five years, and in contravention of UN Security Council resolutions, the missile is reported to have travelled over 1,000km, at an altitude of more than 6,200km before landing in the East Sea. This is the furthest a North Korean ICBM has travelled under test conditions.

However, North Korea's claims that it had successfully tested a Hwasong-17 have subsequently been disputed by the US and South Korean governments. They assert that the missile in question was in fact the Hwasong-15, which was the subject of North Korea's last ICBM test in 2017. [80]

Experts have also questioned North Korea's claims.[81] It has been suggested that North Korea could be attempting to cover up the launch of a suspected Hwasong-17 ICBM on 16 March, which ended in failure after the missile exploded just minutes after take-off and was witnessed by multiple people after the debris fell on Pyongyang. [82]

The US Government has also accused North Korea of conducing two tests in early March that involved parts of a new ICBM system, and not for the

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76 Countries with ICBM largely seek to make road-mobile ICBM smaller so they can be more mobile and are easier to conceal.

77 North Korea is yet to demonstrate a MIRV capability, which is technologically demanding.

78 Michael Elleman, "Does size matter? North Korea's newest ICBM", 38 North, 21 October 2020

79 Kim Jong un has stated on two separate occasions, in December 2019 and January 2022, that North Korea would lift its testing moratorium.

80 The Washington Post, "North Korea's latest missile test may not have been what it claimed", 28 March 2022

81 See for example Center for Strategic and International Studies, The North Korean Missile Threat: Expert Roundtable, 31 March 2022 and Arms Control Today, "Doubts raised about North Korean missile test", April 2022

82 The Washington Post, "North Korea's latest missile test may not have been what it claimed", 28 March 2022 and NK News, "North Korean projectile debris fell near Pyongyang after test failure", 16 March 2022

development of a new satellite-based reconnaissance system as the North Korean regime claimed.[83]

Regardless of the veracity of North Korea's claims as to the variant recently tested, the successful test flight demonstrates that North Korea's ICBM development programme is advancing. In response to the test, the G7 member states and the EU issued a joint statement in which they "strongly condemn[ed] the continued testing of ballistic missiles" and expressed regret that North Korea had abandoned its self-declared moratorium on ICBM testing. They called on North Korea to comply with its legal obligations under UN Security Council resolutions and accept "repeated offers of dialogue put forward by all parties concerned, including the United States, the Republic of Korea and Japan".[84]

Hypersonic glide vehicles (HGV)

The commitment in January 2021 to developing advanced nuclear weapons included reference to developing "hypersonic gliding flight warheads in a short period".[85] Hypersonic weapons, of which a hypersonic glide vehicle (HGV) is one type, can travel at speeds of at least Mach 5, are highly manoeuvrable and can potentially evade radar and missile defence systems.[86] Such capability would improve North Korea's nuclear strike capability.

In September 2021 the North Korean regime subsequently claimed to have tested a new hypersonic missile, designated the Hwasong-8.[87]

The South Korean Government said that given then detected speed and features of the missile, which was determined to be a HGV, it appeared to be "at an early stage of development that would require considerable time for actual deployment".[88] The US State Department condemned the test, reiterating that North Korea was in violation of multiple UN Security Council resolutions and threatened North Korea's neighbours and the international community.[89]

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83 US Department of Defense, Statement by Pentagon Press Secretary John Kirby on recent DPRK missile tests, 10 March 2022 and Jane's Intelligence Review, North Korea: CBRN quarterly update, April 2022

84 Foreign, Commonwealth and Development Office, Press release, 25 March 2022

85 The National Committee on North Korea, On Report made by Supreme Leader Kim Jong un at Eighth Party Congress of WPK, January 2021

86 HGV's differ from hypersonic cruise missiles in that they are launched by a rocket from which the glide vehicle then separates and travels at speed towards its target. HGV's can be conventionally or nuclear armed. Ballistic missiles can also travel at Mach speed but have a set trajectory and limited manoeuvrability.

87 KCNA Watch, "Hypersonic missile newly developed by Academy of Defence Science test-fired", 29 September 2021

88 Jane's Defence Weekly, "North Korea claims to have tested newly developed hypersonic missile", 29 September 2021

89 US Department of State, Press briefing, 28 September 2021

Further hypersonic tests were conducted in January 2022,[90] and at the April 2022 military parade, North Korea displayed the Hwasong-8.

Submarine-launched ballistic missiles (SLBM)

North Korea has also continued to pursue development of a submarine - launched nuclear capability. Such technological advancement would provide North Korea with a credible nuclear second-strike capability and enhance survivability of the deterrent.

In May 2015, North Korea announced that it had successfully flight-tested a submarine-launched ballistic missile, although analysts widely agreed that the missile was launched from a submerged barge rather than a submarine. There were further SLBM tests in November 2015 and throughout 2016, with varying degrees of success. In August 2016, testing was undertaken, for the first time, from a Gorae-class ballistic missile submarine. Experts believed at the time, however, that the country was still a long way from having a meaningful submarine-based nuclear weapons capability.[91]

In 2019 North Korea announced that it had conducted the first flight test of a new SLBM, designated the Pukguksong-3, with an estimated range of 1,900 kilometres.

New variants of the Pukguksong SLBM have since been unveiled. At a military parade in October 2020 the Pukguksong-4 was put on display, closely followed by the Pukguksong-5 at a parade in January 2021. How these latest variants differ in design and performance from the Pukguksong-3 is unclear, although a greater range and payload capacity are considered the most likely.[92] Neither missile has, however, been test fired.

In October 2021 North Korea conducted its first SLBM test in two years. Neither the Pukguksong-4 or 5 SLBM, the missile was, according to Pyongyang, the test of "a new type of SLBM".[93] Further analysis suggested that the SLBM was in fact a navalised version of the ground-launched short-range KN-23 ballistic missile.[94]

On May 2022 it is suspected of conducting another SLBM test. The missile is reported to have flown approximately 600 kilometres before landing in the East Sea, just outside of Japan's Exclusive Economic Zone.[95] It is unclear at present whether the test was a second test launch of the navalised KN-23, or a new variant of the Pukguksong, referred to by some analysts as the

90 Jane's Defence Weekly, "North Korea launches missiles in response to US sanctions", 14 January 2022

91 "North Korea's nuclear threat: how to halt its slow but steady advance", Arms Control Association Threat Assessment Brief, 19 February 2016

92 "What North Korea's latest missile parade tells us, and what it doesn't", *IISS Blog,* 12 October 2020

93 Arms Control Today, "North Korea tests SLBM", November 2021

94 Jane's Defence Weekly, "Escalatory responses: The accelerating arms race on the Korean Peninsula", 17 December 2021

95 Jane's Defence Weekly, "North Korea fires suspected SLBM", 9 May 2022

Pukguksng-6, which was unveiled at a military parade at the end of April 2022.[96]

A new ballistic missile submarine?

North Korea has one Gorae-class ballistic missile submarine, which it has been using as an experimental testbed for its SLBM development programme.

A new nuclear-powered ballistic missile submarine is, however, reportedly under development. In January 2021, Kim Jong-un said that the new submarine would be capable of launching a strategic nuclear weapon and would be "of great importance in raising the country's long-range nuclear strike capability".[97]

The status of that programme is currently unknown. Several analysts have made the point that a credible submarine capability is an important determinant when assessing the overall effectiveness and threat level posed by North Korea's SLBM programme. Following the SLBM test in October 2021, Adam Mount of the Federation of American Scientists observed that "SLBMs are only as good as the vessel that carry them" and that the "weak link in their [North Korea's] submarine missile programme is the submarines" and that it posed "an enormous technical challenge for the North Koreans".[98]

Box 1: Suggested reading

- World Nuclear Forces (PDF), SIPRI Yearbook 2021
- Hans Kristensen and Matt Korda, Nuclear Notebook: North Korean Nuclear Capabilities, 2021

96 North Korea News, "North Korea shows off apparent new solid fuel missile", 26 April 2022

97 Jane's Defence Weekly, "North Korea fires suspected SLBM", 9 May 2022 and Eighth Party Congress of WPK, January 2021

98 CNN, "North Korea says its latest ballistic missile test was launched from a submarine", 20 October 2021

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