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The Korean *Civil*-Military Balance

(3rd Major Revision: May 24, 2018)

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CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES | BURKE CHAIR IN STRATEGY

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Introduction

It is all too easy for Americans in particular to focus on the North Korean nuclear and missile threats, rather than the overall military balance in the Koreas and the impact that any kind of war fighting can have on the civil population of South Korea and the other states in North east Asia. The nuclear balance is an all too critical aspect of the security of the region, but it is only part of the story and military capability do not address the potential impact and cost of any given form of conflict.

The Burke Chair is now issuing a revised comparison of the civil and military balance between the two Koreas, and that shows the strength of the U.S. forces now in Korea, Japan, and the Pacific. **The Civil Side of the Balance**

The civil part of this assessment highlights the extreme differences between the high level of civil development in South Korea and the limited development of North Korea's economy, governance, and civil society. It highlights the very different kinds of vulnerability on each side, and raises serious question about the North Korea's ability to support and sustain the highest level of overall militarization of any nation in the world if current CIA and other estimate of the size o and character of its economy and budget are correct.

Geography ***(pages 11-18)***

The data on geography highlight the fact that both Korea's are highly mountainous, have limited arable land, and often have cities in areas than are somewhat contained by either terrain or the sea. The fact that North Korea separates South Korea from the rest of mainland Asia effectively makes it an island from a strategic viewpoint, as well as makes access to Japan and Japanese support critical in wartime. It also makes continued access to maritime and air traffic critical to the operation of its large, modern economy.

Terrain and access to air and seaports also has a major impact on tactical military operations bit involves a level of detail which is beyond the scope of this report.

Governance ***(pages 19-27)***

North Korea and South Korea have fundamentally different political systems -- an authoritarian dictatorship controlling a large command economy and a functioning democracy dependent on capitalism and its private sector. This gives the leader of North Korea an advantage in terms of allocate resources to security and taking risks, but has severely limit North Korea's development and overall economic growth and strength.

Many aspects of the World Bank's governance ratings for North Korea --voice and accountability, government effectiveness, regulatory quality, rule of law and control of corruption -- are so low that they raise serious questions about how well North Korean governance could survive sustained attack and support sustained, large-scale military operations.

People and Society ***(pages 28-38)***

North Korea's limited development has affected life spans and every aspect of public health. Its high level of militarization also requires so many men that it consumes a large percentage of its population and potential labor force, adding to its development problems while the outdated structure of its economy makes it over-dependent on agricultural labor.

At the same time, South Korea is highly urbanized and very vulnerable to attacks on its major cities -- especially in the greater Seoul area which has nearly half its population. Its higher living standards also make it much more dependent on the continuity of economic operations and various services. North Korean vulnerability is different. it has a much more dispersed general population with lower expectations, but it is critically dependent on every aspect of an economy with limited redundancy and on the operations of its one major semi-modern city-- Pyongyang.

Economy ***(pages 39-52)***

CIA estimates that North Korea has an extraordinarily small GDP for a state with such large military forces: Some $40 billion in 2015 in purchasing power parity (PPP) terms, and $28 billion in 2013 in official exchange rate terms -- by far the most relevant measure of economic strength in terms of the size of a modern economy. Its per capita income for a population of 25.2 million was only $1,700 in 2015.

In contrast, the CIA estimates that South Korea had a GDP of $2,027 billion in 2017 in purchasing power parity (PPP) terms (over 50 times the most recent figure reported for North Korea), and $1,530 billion in official exchange rate terms (55 times that of North Korea). It also estimates that South Korea has a GDP per capita of $39,400 in 2017, for a population of 51.2 million. This is 23 times the most recent figure the CIA reports for North Korea.

There are no credible current unclassified estimates of North Korean military spending. The estimates that are available are badly dated, and do not track with any other major sources of economic data. The CIA estimate of the total North Korean budget seems to fall significantly below the probable real world level of military and security spending. At the same time, an estimate of a North Korean state budget of an authoritarian command economy whose expenditures are only 0.011% of South Korea’s budget raises major credibility problems.

These gaps are so great that they also raise serious question about North Korea's ability to fund future military modernization and its sustainment capability. At the same time the illustrate the vulnerabilities created by South Korea's dependence on a far more sophisticated and modern economy and higher expectations.

Energy ***(pages 53-60)***

South Korea's modern economy makes it a massive importer of oil and gas, and has led it to develop a major nuclear power industry. Its refineries, energy transit and processing facilities make it a target rich energy environment but also give it considerable energy storage capacity and reserves as well as redundancy. North Korea's energy production is far lower than South Korea's. It makes only limited use of gas, and it is far more dependent on coal. An EIA study indicated that North Korea had reserves of about 600 million metric tons of coal in 2014, according to BP Plc, compared to recoverable reserves of 251 billion tons for the U.S. and 244 billion for China.

As for petroleum, China supplied North Korea with 10,000 barrels a day of crude oil before sanctions according to the EIA. This is only equivalent to less than one percent of daily consumption in the U.S. North Korea built a coal gasification plant in 2006 as part of its upgrade of the Namhung Youth Chemical Complex, but it is unclear it can turn to coal gasification or liquids on large commercial scale.

South Korea has about 10 times the installed electric generation capability of North Korea. Electrification is also very different. The CIA estimates that in 2013 some 18.4 million North Koreans were without electricity: 18,400,000: 30% of the total population, 41% for urban areas and 13% rural areas: 13%. It estimates that 100% of South Koreans have electricity.

Communication ***(pages 61-65)***

South Korea permits access to all modern forms of communication on a market basis. North Korea sharply restricts access to communications and media – including satellite receivers, use of radios, cellphones, internet access, and access to all forms of news media. North Korea has no independent media; radios and TVs are pre-tuned to government stations; 4 government-owned TV stations; the Korean Workers' Party owns and operates the Korean Central Broadcasting Station, and the state-run Voice of Korea operates an external broadcast service; the government prohibits listening to and jams foreign broadcasts.

South Korea has 24 times more fixed phone lines, and 18 times more cell phones than North Korea. South Korea has 44.153 million Internet users and this covers 89.9% of the population (July 2016 est.), making it the 17th largest user in the world. Internet distribution in North Korea is limited to a small number of state sanctioned users.

South Korea, however, is far more dependent on modern communications for all aspects of its economy and social structure, but has far larger and more survivable systems.

Transportation ***(pages 66-73)***

South Korea has a far more modern and survivable transport system. It has a modern civil air transportation system with competing airlines and extensive international connections. North Korea has negligible civil air traffic by comparison.

South Korea has a modern pipeline system. North Korea has one short pipeline. North Korea is more reliant on rail transport: 7,435 kilometers versus 3,874 kilometers for the South. South Korea, however, has a modern road system with 91,195 km of paved roads, including 4,193 km of expressways. North Korea has only 724 kilometers of paved road. South Korea has well over seven times as many ships in its merchant marine and 3 major container ports and 6 LNG terminals while North Korea has none.

The Military Side of the Balance

The military portion of the analysis provides data on both the size and location of U.S. forces in Korea and Asia, and the conventional Korean military balance. It draws on recent and past reporting by the Department of Defenses -- as well as reporting from other sources and NGOs.

The quantitative comparisons illustrate the fact that North Korea has parity or superiority in numbers, but the various narratives highlight North Korea's major qualitative weaknesses. It also addresses key aspects of the asymmetric balance, the potential impact of nuclear warfighting on South Korea, and the uncertainties surrounding the missile balance, North Korea's holdings of chemical weapons, and the risks posed by North Korea's possible development or possession of biological weapons.

U.S. Military Forces ***(pages 84-105)***

The United States does not normally deploy large combat forces in South Korea, but has a major presence in the region, can rapidly project air power including stealth and precision strike capability, cruise missiles, missile defenses, and seapower. It can build up a major land presence as well if it has strategic warning. Its series of regular exercises with Korean forces also allows it to cooperate effective with South Korean forces and maintain the situational awareness and interoperability that is critical to actual military operations.

North Korea's steadily expanding missile ranges do, however, allow it to strike at U.S. targets well beyond the Korean Peninsula, and a fully credible nuclear threat to U.S. bases and civil targets in the U.S. will affect the future levels of deterrence unless the U.S. offers some matching form of extended deterrence or South Korea acquires nuclear weapons.

Conventional Military Balance ***(pages 82-92)***

North Korea has massive conventional forces of a country its size and with its comparatively small and poorly developed economy. It has a nearly 2:1 lead in manpower, and a major lead in main battle tanks, artillery, and combat ships. North Korea

also however, is sharply inferior in weapons quality, key aspects of sustainability, and advanced C^4I, IS&R and battle management systems.

North Korea could almost certainly use conventional forces to inflict major damage on the south. at the same time, North Korea's its less developed and less redundant target base gives it a different kind of vulnerability. It would take only a comparatively limited number of precision air strikes to cripple key aspects of the North Korea economy and/or military point targets.

South Korea also has an advantage in surface-to-air missiles with some point defense capability against missiles, and the U.S. is introducing theater missile defense systems. It would take substantially more such system, however, and something approaching Israel's layered missile, rocket, and artillery defenses to give South Korea major protection against North Korean attacks.

As a result, the he South's qualitative advantages seem great enough to offset North Korean numbers and allow it to win any major conventional conflict with U.S. support. Key wild cards would be the specific scenario involved, the level of North Korean surprise if any, the potential role of China, a shift to some form of asymmetric or unconventional warfare that would favor the North, and escalation to nuclear weapons.

Asymmetric Balance ***(pages 106-124)***

Both sides have large, well trained, and capable special and unconventional forces. However, North Korea's status as a largely closed society with a single major leader or decision-maker willing to risk significant parts of the civil population gives it a major potential advantage in conducting asymmetric warfare.

North Korea has a long history of exploiting low level asymmetric threats and incidents, and has deployed two major asymmetric threats to South Korea: A series of tunnels across the DMZ and a major sheltered missile-rocket-artillery threat just north of the DMZ that can pose a major threat to Seoul.

Such threats do need to be kept in careful proportion. Moving mechanized forces through closed tunnels without exposed major ventilation systems is difficult, as is moving infantry troops. Some of the higher estimates of South Korean civilian casualties in the greater Seoul area seem to be based on highly unrealistic rates of fire, exposed vulnerability, unrealistic range estimates, and survival in the face of modern precision counterstrikes. North Korea's most valuable key targets are within the range of U.S. and South Korean precision strike systems, and while these are no designed to produce mass casualties they could have a major impact on North Korea's economy, governance, and ability to conduct and sustain military operations.

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Missile Forces ***(pages 125-144)***

North Korea has a major lead in conventionally armed ballistic missiles for short, medium, and long range combat -- a threat compounded by its potential use of nuclear and chemical weapons, and possibly biological weapons. Almost all of North Korea's current ballistic missiles, however, lack sufficient precision to for it to use conventionally armed warheads effectively against critical military, governance, and infrastructure point targets. They are more suited for use as terror weapons against civil area targets.

South Korea is, however, beginning to acquire its own ballistic and cruise missile forces, and both sides are acquiring cruise missiles and UCAVs with precision strike capability. This can radically change the missile capabilities on both sides in the near future.

Nuclear Forces ***(pages 145-163)***

North Korea now has a monopoly on nuclear weapons although the U.S. has deployed nuclear weapons in South Korea in the past and South Korea has the technology base to produce nuclear weapons and has examined this option.

Both North and South Korea are “one bomb” countries to some extent. A nuclear strike on either Seoul or Pyongyang would cripple key aspects of each regime and economy. The U.S. and South Korean can conduct devastating precision conventional and stealth attacks, but the political and strategic impact of a nuclear strike would be far greater.

South Korea faces special problems because it is highly urbanized and its major cities have a very dense population. Its mixed terrain and many high rise and solidly built buildings would affect this vulnerability, however, and most damage models assume a flat plain. South Korea's recovery capability to deal with a major strike on Seoul is unclear. The capital has very high percentage of it population, core leaders, and critical elements of economy.

South Korea also has limited dispersal capability around cities to absorb population fleeing strikes, and high vulnerability to interruption of imports. It has limited ability to sustain the resulting refugee or IDP populations, and provide medical and other services. North Korean “offset” targeting and choice of height of burst could radically increase fallout effects.

As a result, steadily rising North Korean yields, range, and accuracy could pose a growing threat, and even the most effective missile and air defenses cannot guarantee security. North Korean nuclear-armed missiles could can threaten Japan and U.S. bases in the region, as well as targets in the U.S. Possible counters are U.S. extended deterrence, South Korea going nuclear, or North Korean freeze/dismantling of effort.

The Chemical and Biological Dimension ***(pages 164-176)***

There is no chemical or biological balance. U.S. and South Korea can develop chemical and biological defenses but their arms control agreements prevent them from, acquiring a matching offensive threat.

The data on North Korea's ability to pose chemical and biological threats range from highly probable inventory of chemical weapons to a potential capability to develop and deploy biological weapons that are so lethal that their use could inflict the equivalent of a nuclear attack.

Most sources agree that the North Korean chemical threat is all too real, but many sources seem to exaggerate the range of deployed weapons, their numbers, and their lethality. Real world chemical weapons are more terror weapons that weapon of mass destruction. Terror, however, can be enough. Simply testing or disbursing chemical rounds can have a powerful effect.

There is no evidence that North Korea has deployed biological weapons or that permits any assessment of its lethality. It is clear, however, that the biological option could give North Korea a credible alternative to sustaining its nuclear program with much depending on North Korea's level of efforts or claims. One key issue that affects any use of biological threats, deterrence. and war fighting is any side's ability to determine real world effects without significant large-scale human testing.

Other Burke Chair Reports on the Korean Balance

This report is designed to highlight key quantitative and geographic comparisons, and not to provide a full analysis of each area that is covered. It builds on prior studies of the military balance and testimony to Congress to examine both the civil and military balances in the Koreas, and the cost of a range of different forms of war fighting. These earlier reports include:

Anthony H. Cordesman and Charles Ayers, *The Military Balance in the Koreas and Northeast Asia*, January 31, 2017, https://www.csis.org/analysis/web-book-military-balance-koreas-and-northeast-asia.

Anthony H. Cordesman, *More Than a Nuclear Threat: North Korea's Chemical, Biological, and Conventional Weapons*, March 22, 2018, *https://docs.house.gov/Committee/Calendar/ByEvent.aspx?EventID=106780, and https://www.csis.org/analysis/more-nuclear-threat-north-koreas-chemical-biological-and-conventional-weapons-0.*

Anthony H. Cordesman, South Korea's Civilian Vulnerabilities in War, March 22, 2018, https://www.csis.org/analysis/more-nuclear-threat-north-koreas-chemical-biological-and-conventional-weapons-0

DEFENDING AGAINST A "WILD CARD" REGIME

Key Issues

- Impact on region with 40%+ of U.S. Imports
- Nuclear and missile negotiations
- U.S. military options: Preventive, preemptive
- Irregular/asymmetric threats and conflicts
- Possible forms of escalation to conventional war
  - Artillery threat near DMZ
  - Tunnels
- Costs and risks of war to Korean civilians
- Expansion of conflict:
  - Japan
  - China
  - Russia
- Missile wars
- Use of weapons of mass destruction.

GEOGRAPHY

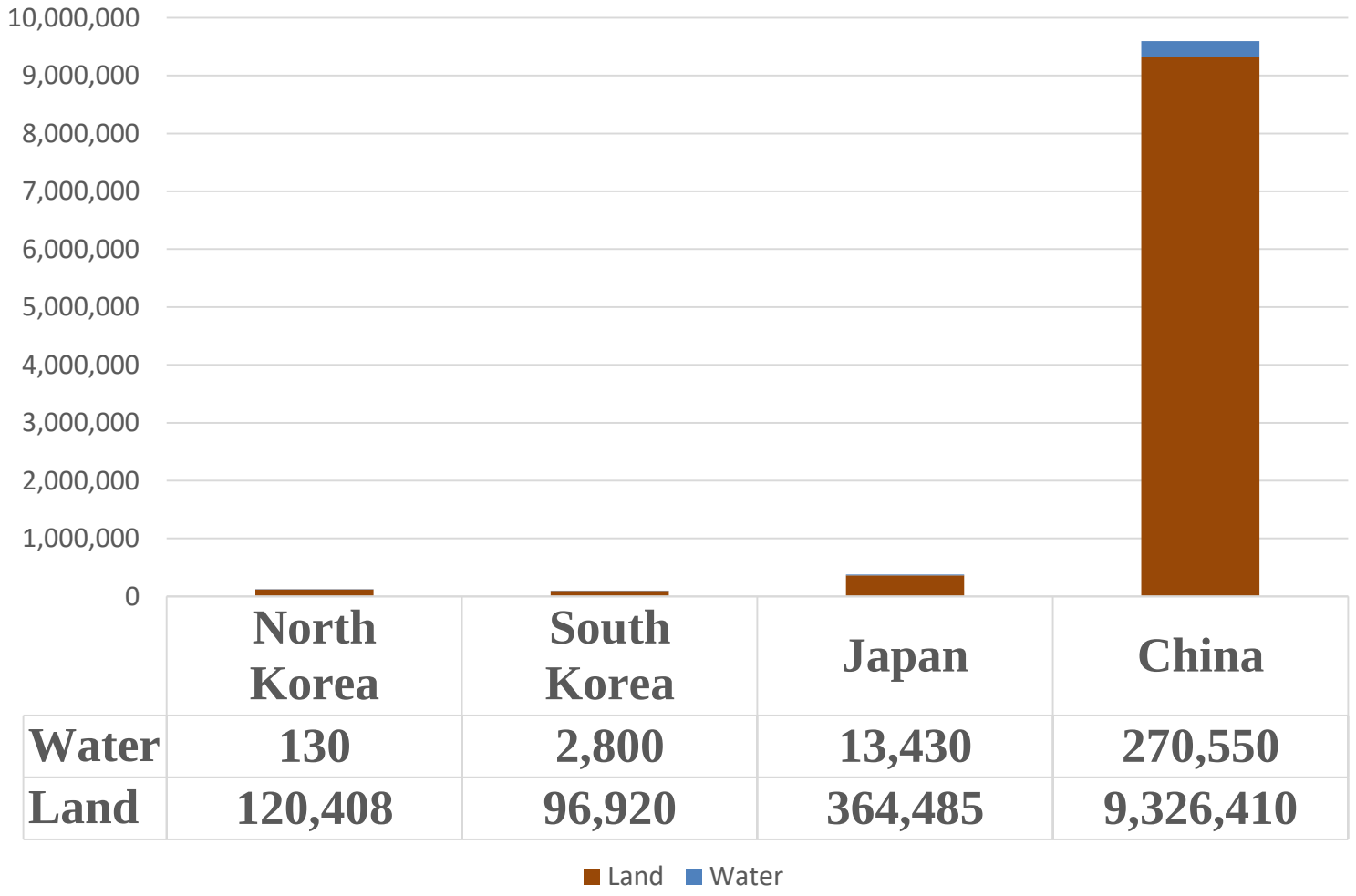
North versus South

- The geography of the Korean Peninsula is highly mountainous and presents major terrain problems for military operations, as well as only limited arable land.
- North Korea has common borders with China and Russia as well as South Korea. China 1,352 km, South Korea 237 km, Russia 18 km. It also claims a military boundary line 50 nm in the Sea of Japan and a 200 nm exclusive economic zone limit in the Yellow Sea where all foreign vessels and aircraft without permission are banned.
- North Korean territorial issues include dispute with China over the sovereignty of certain islands in Yalu and Tumen Rivers; Military Demarcation Line within the 4-km-wide and Demilitarized Zone has separated North from South Korea since 1953; periodic incidents in the Yellow Sea with South Korea which claims the Northern Limiting Line as a maritime boundary; North Korea supports South Korea in rejecting Japan's claim to Liancourt Rocks (Tok-do/Take-shima)
- South Korea is effectively isolated from any transit through North Korea or land ties to Asia. It effectively is an island. It claims 12 nm maritime zone; between 3 nm and 12 nm in the Korea Strait, a 24 km contiguous zone, and a 200 nm exclusive economic zone.
- South Korea territorial issues include Military Demarcation Line within the 4-km-wide Demilitarized Zone has separated North from South Korea since 1953; periodic incidents with North Korea in the Yellow Sea over the Northern Limit Line, which South Korea claims as a maritime boundary; South Korea and Japan claim Liancourt Rocks (Tok-do/Take-shima), occupied by South Korea since 1954

Topography and Borders of Korea

- 70% mountains
- Limited arable plains between mountain ranges
- 17% - 22% arable land in North, 15%-18% in South

Area Comparison, by Country (sq. km)



	North Korea	South Korea	Japan	China
Water	130	2,800	13,430	270,550
Land	120,408	96,920	364,485	9,326,410

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2147.html#kn

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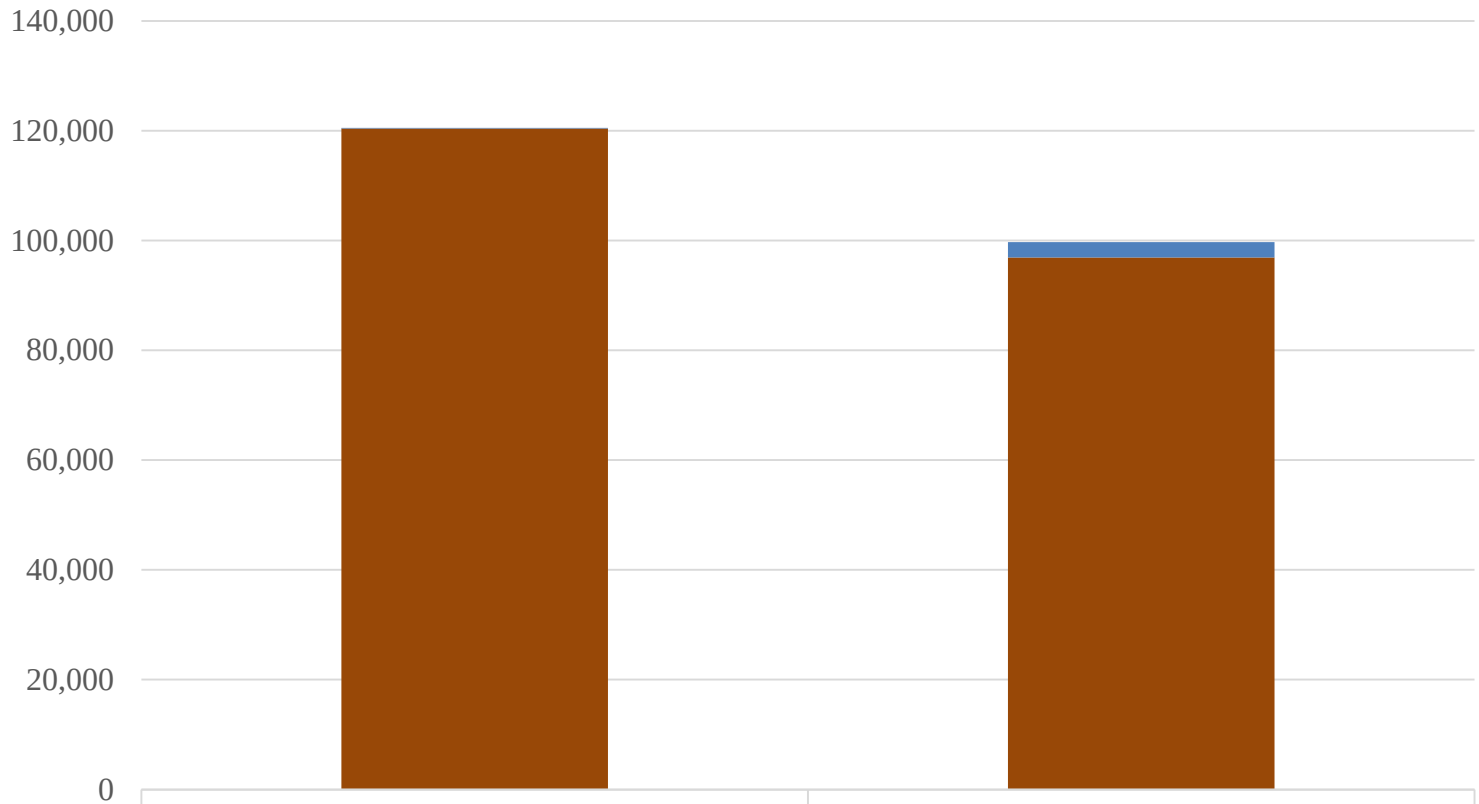
Area Comparison, by Country (sq. km)
North Korea & South Korea



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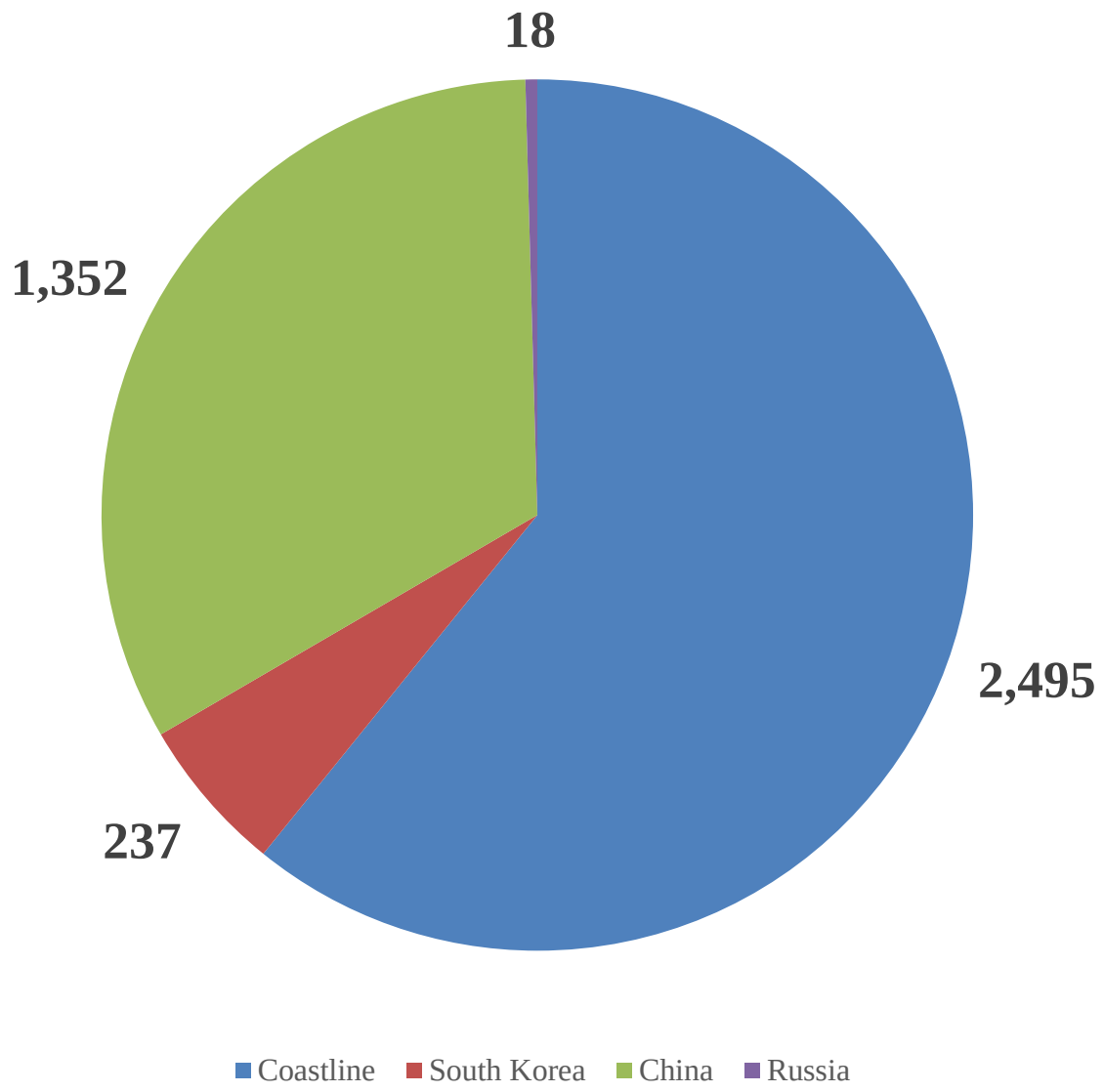
CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2147.html#kn

Land Boundaries: North Korea (km)



CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2096.html#ks

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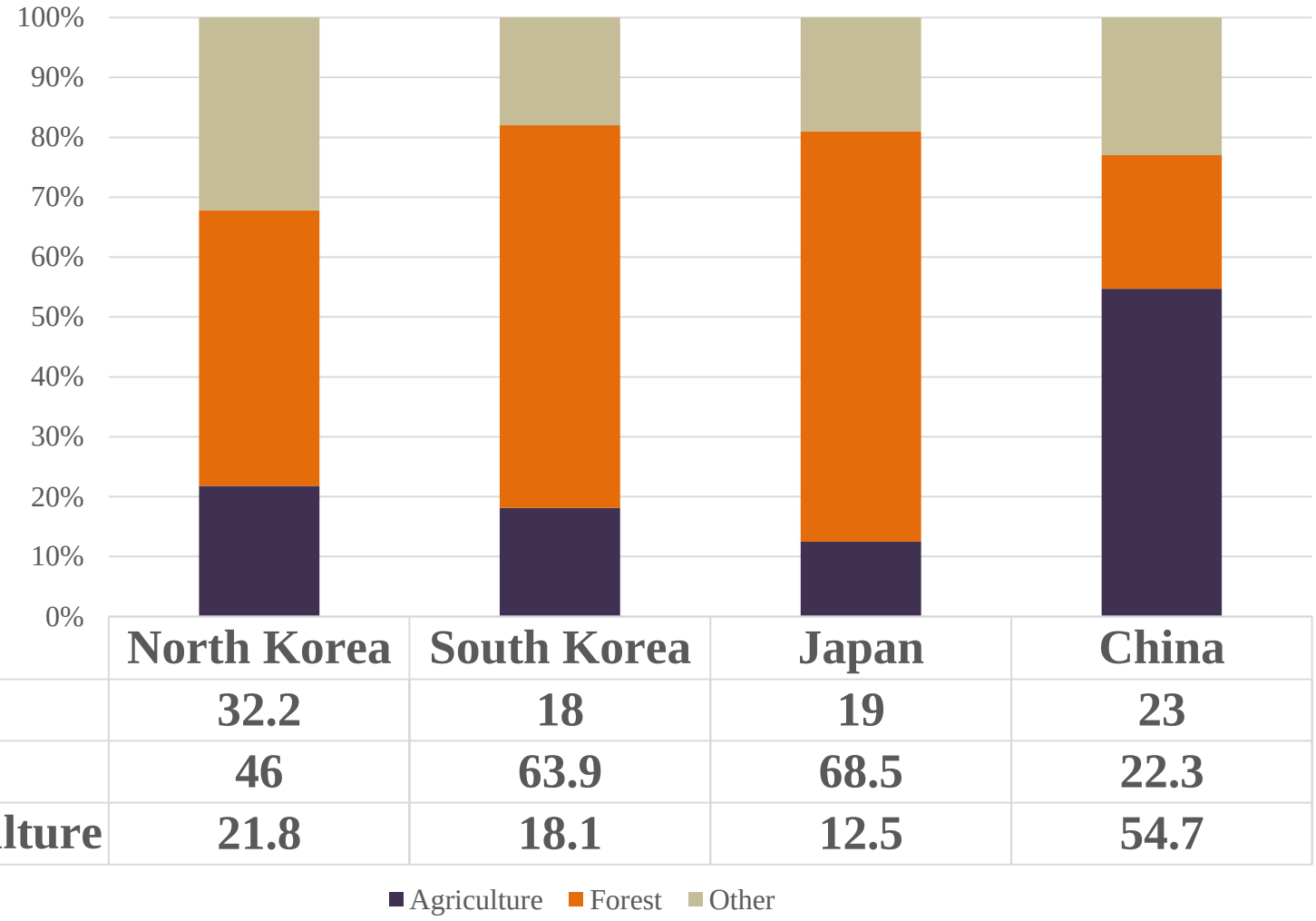
Natural Resources

North Korea	coal, iron ore, limestone, magnesite, graphite, copper, zinc, lead, precious metals, hydropower
South Korea	coal, tungsten, graphite, molybdenum, lead, hydropower potential
Japan	fish (*negligible energy & mineral resources*)
China	coal, iron ore, petroleum, natural gas, mercury, tin, tungsten, antimony, manganese, molybdenum, vanadium, magnetite, aluminum, lead, zinc, rare earth elements, uranium, hydropower potential (world's largest), arable land

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2111.html#ch

Land Use



	North Korea	South Korea	Japan	China
Other	32.2	18	19	23
Forest	46	63.9	68.5	22.3
Agriculture	21.8	18.1	12.5	54.7

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2097.html#kn

GOVERNANCE

North versus South

- North Korea is the world's only successful modern hereditary dictatorship, and has pursued the much same mix of challenges and threats to its southern neighbor for three generations. South Korea has gradually become a working democracy.
- The governance of North Korea is structured to preserve the rule of its leader, and support what is currently the highest degree of militarization in the world in both the percentage of its population under arms and the size of its forces relative to its economy. It is largely isolated from the global economy.
- The World Bank governance ratings indicate that North Korea is one of the least effective governments in the world. Its corruption ratings for both North and South Korea, however, seem to understate the current level of problems.
- The low current World Bank governance ratings ratings for North Korean political stability and the absence of violence seem to understate Kim Jong Un's success in using force to establish full control over the North Korean governance, and ability to continues North Korea's long history of challenging and provoking outside states to achieve its own goals and objectives.
- South Korea's governance is structured to support a modern trading state, and moderate military efforts as a percentage of its population and burden on its economy.
- North Korea's authoritarian character has helped sharply limit its economic modernization and development. Its GDP is extremely low for an Asian state, and its population far more rural and distributed among relatively small industrial facilities.

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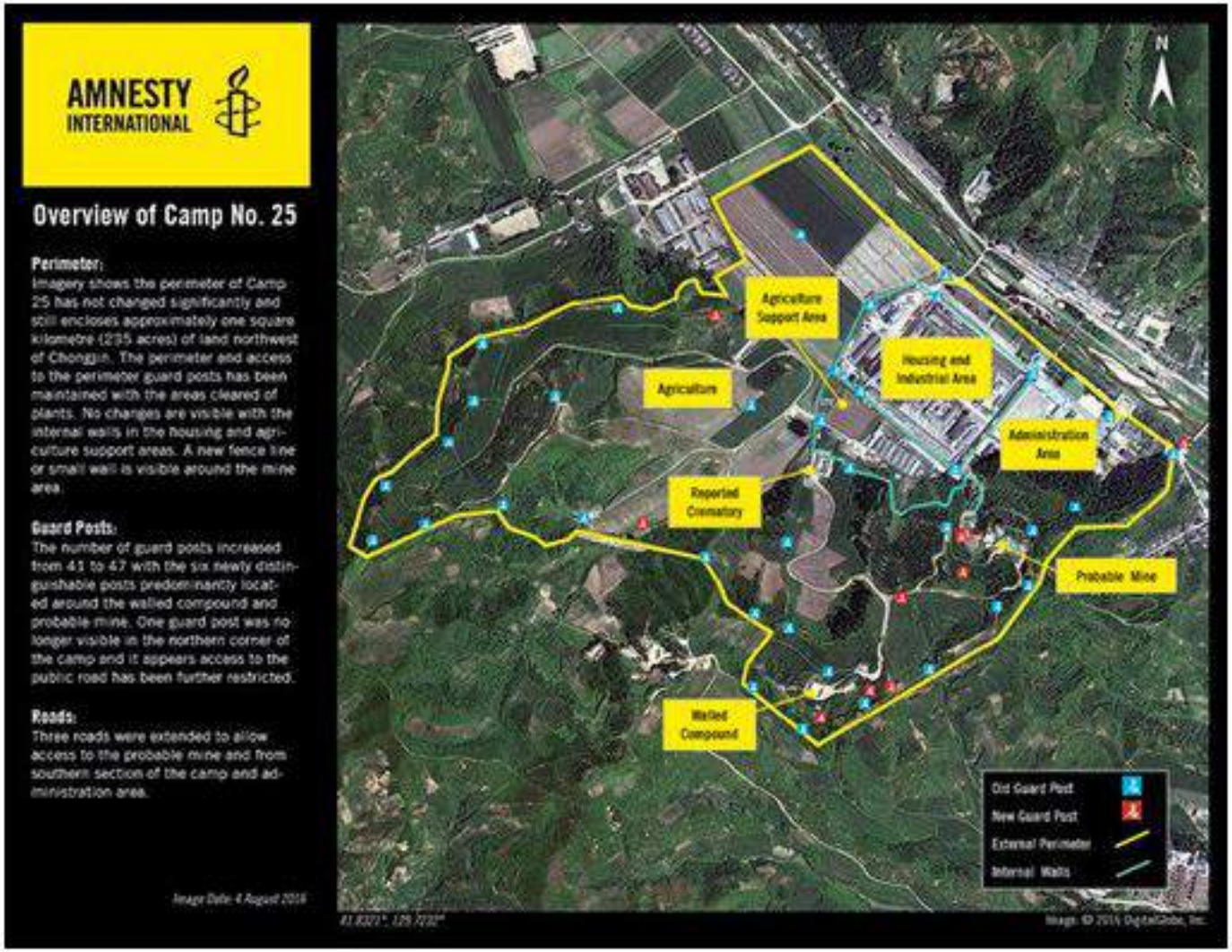
Three Generations of Rational Marxist Hereditary God Emperors

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

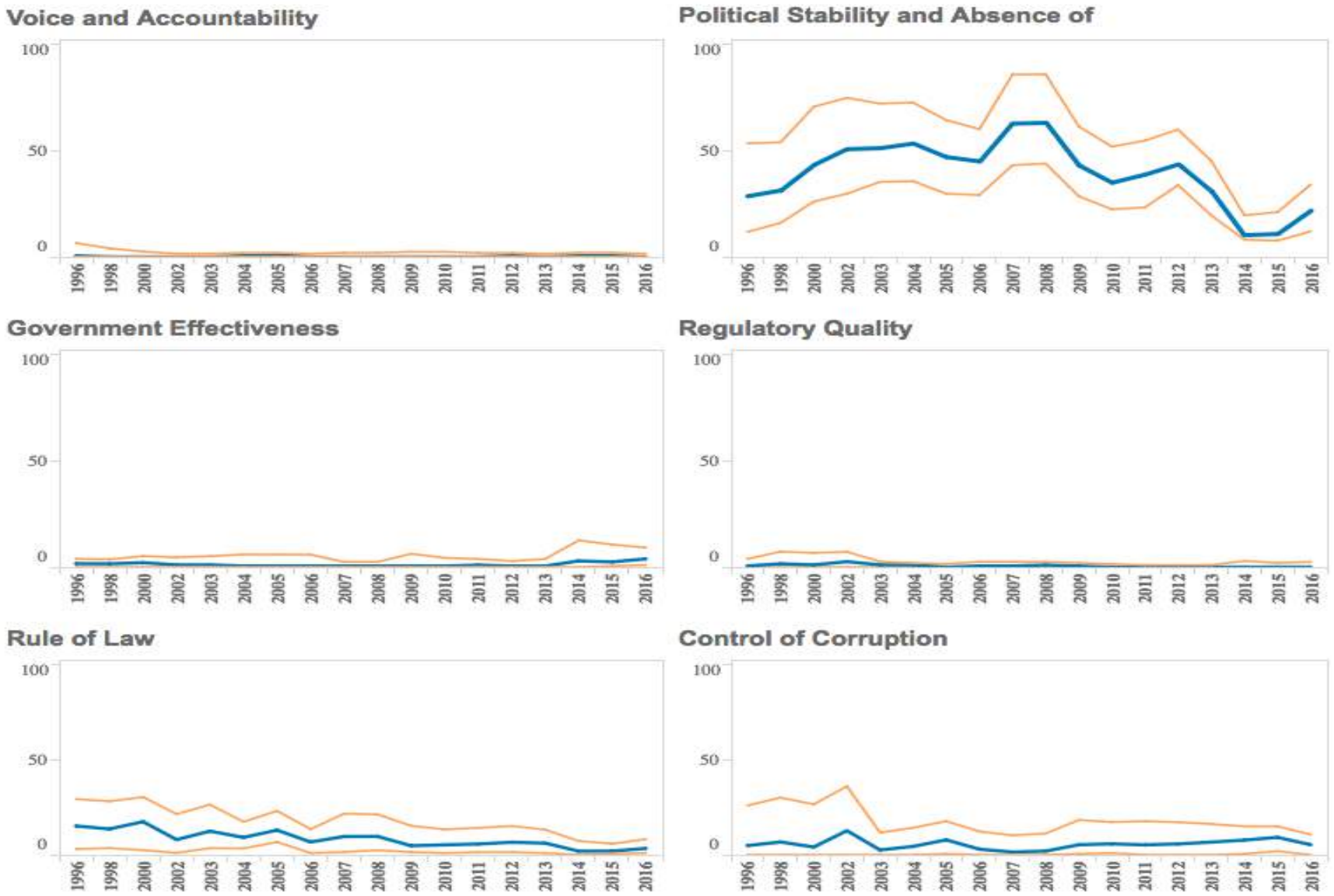
Rule by Repression: North Korean Prison Camp



(Amnesty International)

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

North Korea: Competing to be the World's Worst



Kaufmann and Mastruzzi, *Worldwide Governance Indicators, North Korea*, World Bank, http://info.worldbank.org/governance/WGI/#reports.

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North Korea: NGO Rankings

Economy [edit]

Further information: Economy of North Korea

Economy rankings

Organization	Survey	Year	Place	Out of	Value	Ref
The Heritage Foundation/*The Wall Street Journal*	Index of Economic Freedom	2016	178	178	Overall score: 2.6 (Repressed)	[1]

Politics, law and military [edit]

Further information: Politics of North Korea, Law of North Korea, and Military of North Korea

Political, law and military rankings

Organization	Survey	Year	Place	Out of	Value	Ref
Transparency International	Corruption Perceptions Index	2016	174 ▼	176	Score: 12 (Highly corrupt)	[2][3]
The Economist Intelligence Unit	Democracy Index	2015	167	167	Overall score: 1.08 (Authoritarian)	[4]
Institute for Economics and Peace	Global Peace Index	2016	150 ▲	163	GPI score: 2.944	[5][6]
	Global Terrorism Index	2014	124	162	No impact of terrorism in 2014	[7]
Reporters Without Borders	Press Freedom Index	2017	180 ▼	180	Score: 84.98 (Very serious situation)	[8][9]
Freedom House	Freedom in the World	2017	193 ▼	195	Score: 3 (Not free)	[10][11][12]
	Freedom of the Press	2017	198 ▲	199	Score: 98 (Not free)	[13][14]

Science and technology [edit]

Science and technology rankings

Organization	Survey	Year	Place	Out of	Value	Ref
United Nations Public Administration Network	E-Government Development Index	2014	149	193	EGDI: 0.2753	[15]
	E-Participation Index	2014	186	193	EPART: 0.0196	[15]
	E-Government Development Index	2016	153	193	Index: 0.2801	[16]

Society and quality of life [edit]

Social and quality of life rankings

Organization	Survey	Year	Place	Out of	Value	Ref
Walk Free Foundation	Global Slavery Index	2016	1 ▲	167	4.373% of the population in modern slavery	[17][18]
United Nations Development Program	Human Development Index	1995	75 —	174	HDI value: 0.766 (Medium human development)	[19][20]
Fund for Peace	Fragile States Index	2016	30 ▼	178	Total: 93.9 (Alert)	[21][22][23]
Bertelsmann Stiftung	Bertelsmann Stiftung's Transformation Index	2015	126	129	Average value: 2.14	[24]
Foundation for the Advancement of Liberty	World Index of Moral Freedom	2016	127	160	Index: 34.50 (Low Moral Freedom)	[25]
International Food Policy Research Institute	Global Hunger Index	2016	21 ▲	118	Score: 28.6 (Serious)	[26][27]
Open Doors	World Watch List (most persecuted Christians)	2017	1 —	50	Score: 92/100 (Extreme persecution)	[28][29]

Wikipedia, https://en.wikipedia.org/wiki/International_rankings_of_North_Korea

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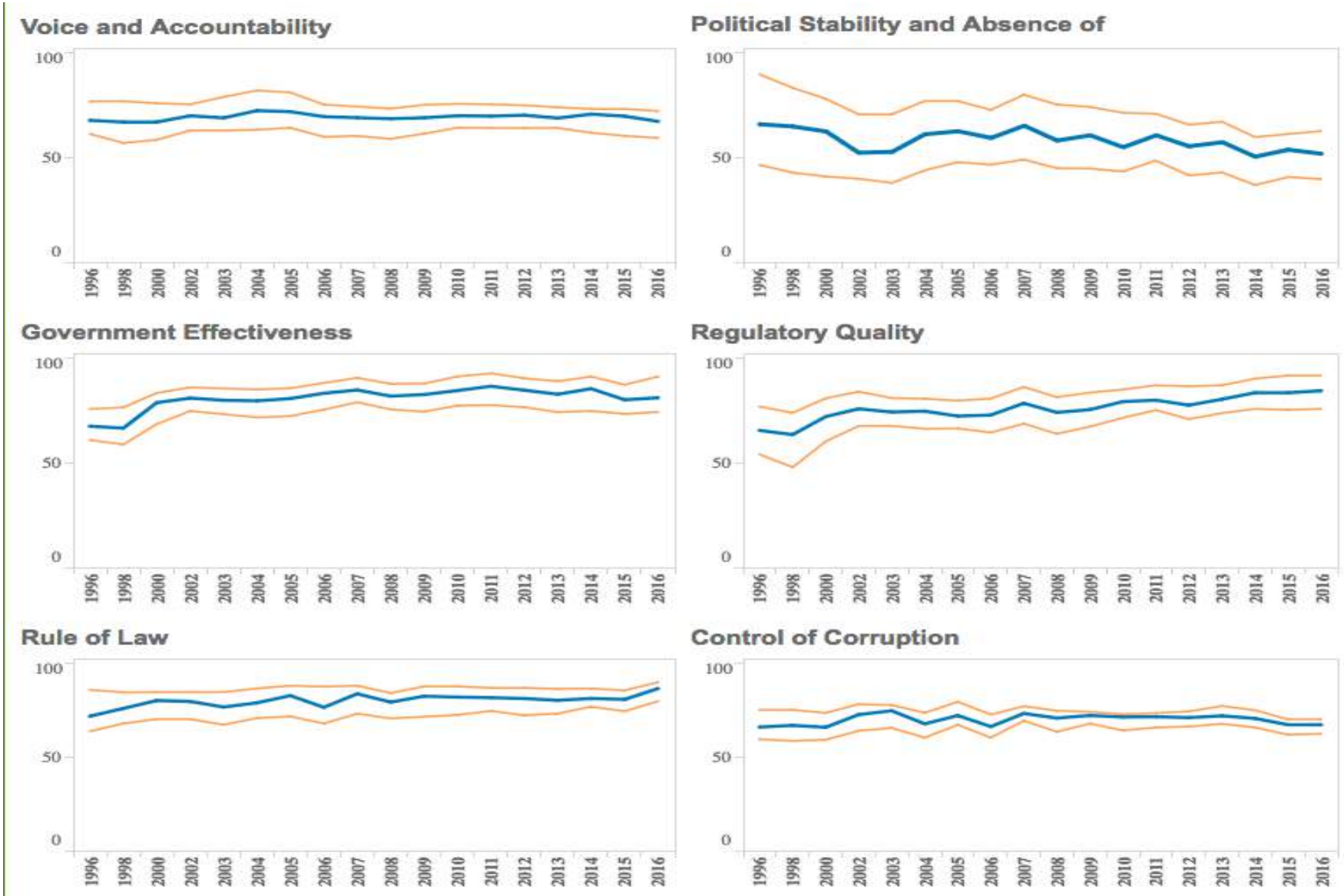
South Korea: Good to High Scores



Kaufmann and Mastruzzi, *Worldwide Governance Indicators, North Korea*, World Bank, http://info.worldbank.org/governance/WGI/#reports.

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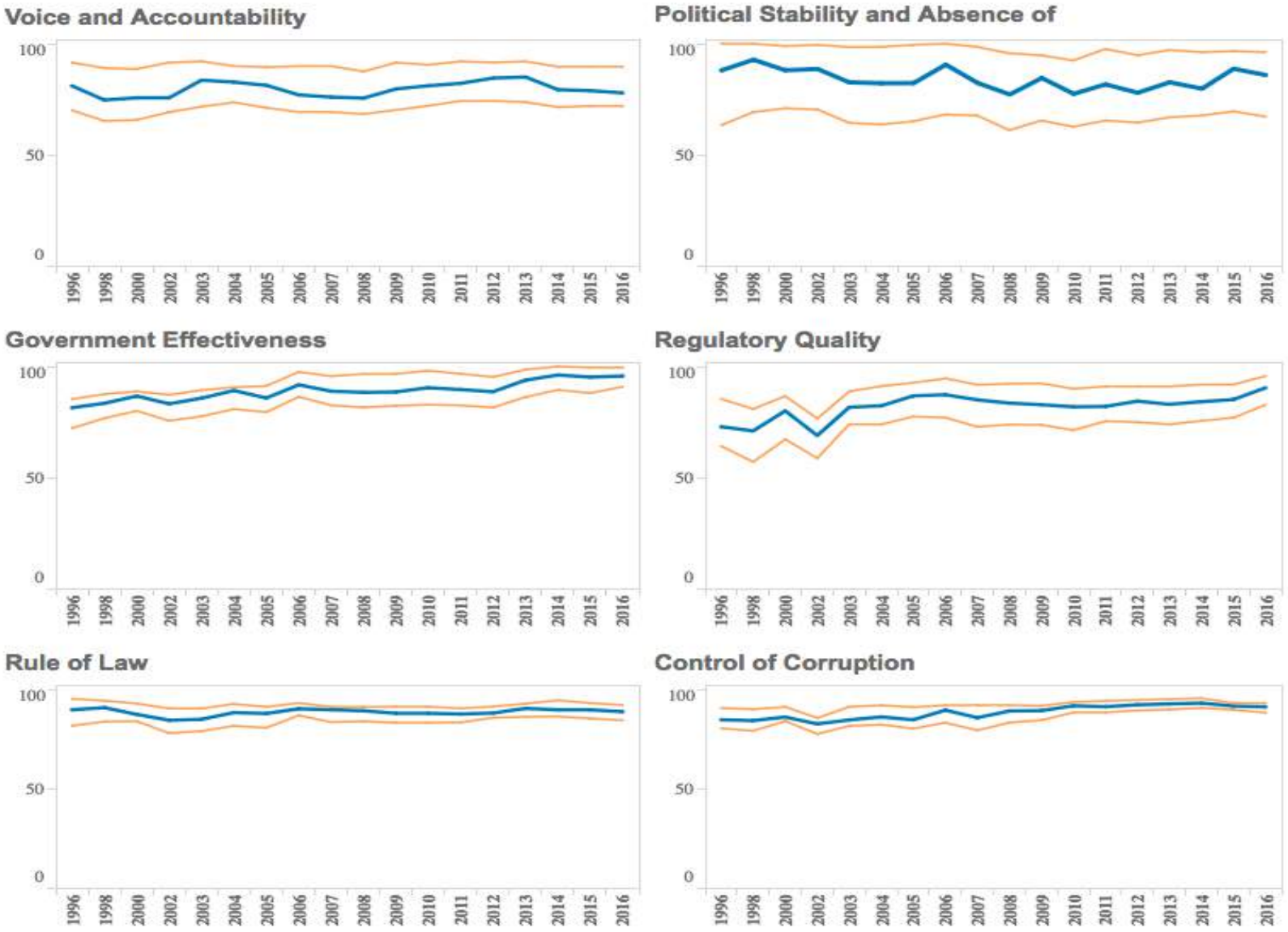
Japan: High Scores



The inner, thicker blue line shows the selected country's percentile rank on each of the six aggregate governance indicators.
The outer, thinner red lines show the indicate margins of error.

Kaufmann and Mastruzzi, *Worldwide Governance Indicators, North Korea*, World Bank, http://info.worldbank.org/governance/WGI/#reports.

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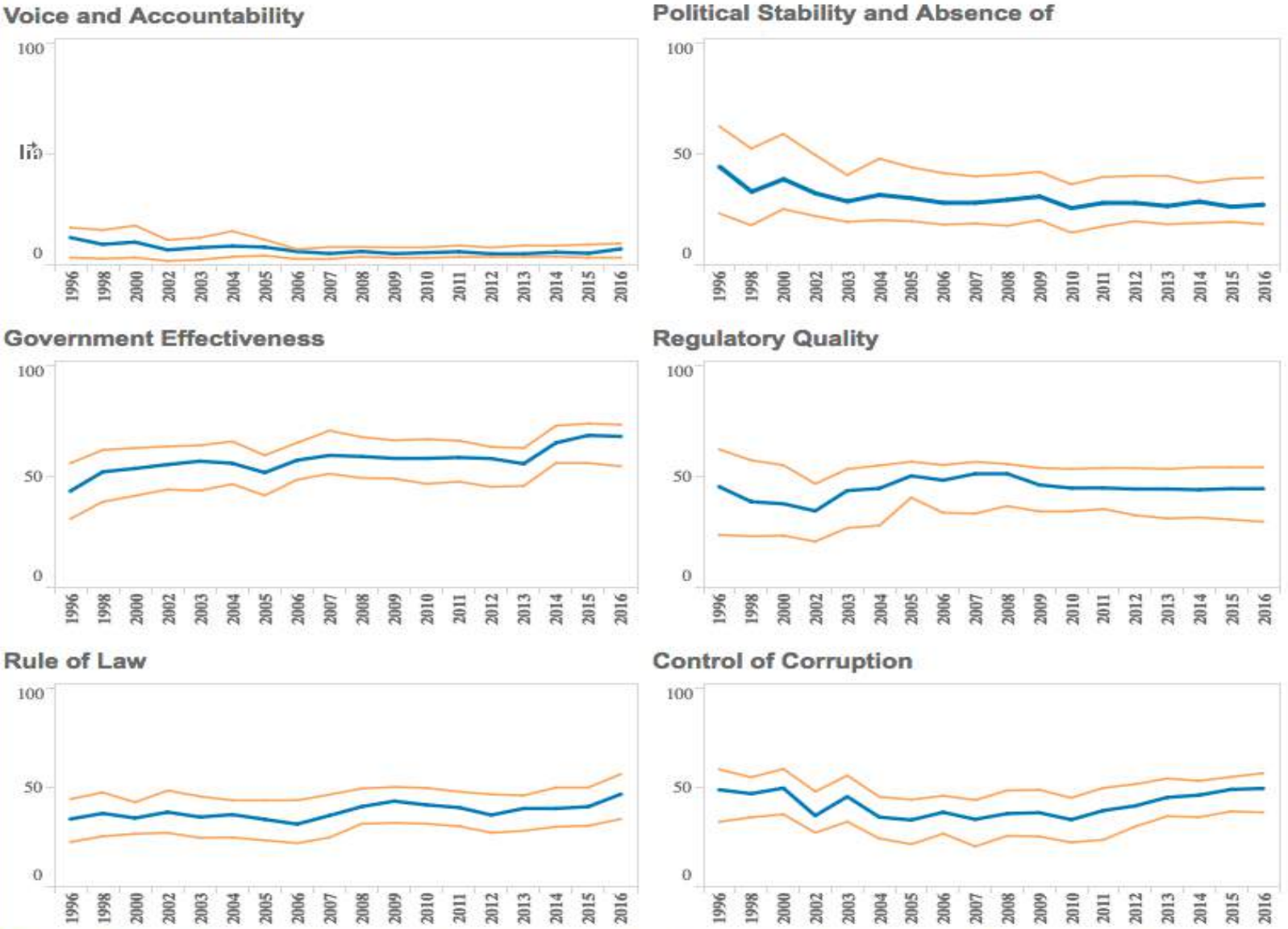
China: Low to Good Scores



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PEOPLE & SOCIETY

North versus South

- Urbanization creates a vulnerable target mix in both countries, and the major city in each country is a major target and critical to its economy and governance. The Pyongyang area is North Korea's only major modern city, and CIA estimates indicate its population was 2.9 million in 2015, and around 3.1 million in 2017.
- South Korea has roughly twice the population of North Korea and some of the most densely populated cities in the world. In 2015, SEOUL (capital) has 9.774 million; Busan (Pusan) 3.216 million; Incheon (Inch'on) 2.685 million; Daegu (Taegu) 2.244 million; Daejon (Taejon) 1.564 million; Gwangju (Kwangju) 1.536 million. The greater Seoul area has a population of nearly 25 million – half the total population.
- North Korea has 1,389,000 active military and paramilitary. This is nearly 6% of the total population and more than 11% of all males – a major burden on the labor force. South Korea has 634,000 military and paramilitary, only a little more than 1% of the total population and 2% of males.
- South Korea has notably better living conditions, a longer life expectancy, and higher medical standards. This gives it a larger percentage of older citizens. Some 36% of North Koreas population is 0-24 years; the percentage for South Korea is 26%.
- North Korea has a labor force that the CIA estimates at 14 million and one that reflects a badly dated economy: 25.4% agriculture, 41% industry, and 33.5% services. The figure for South Korea is 27.5million and reflects a far more modern economy: 4.9% agriculture, 24.1% industry, and 71% services.

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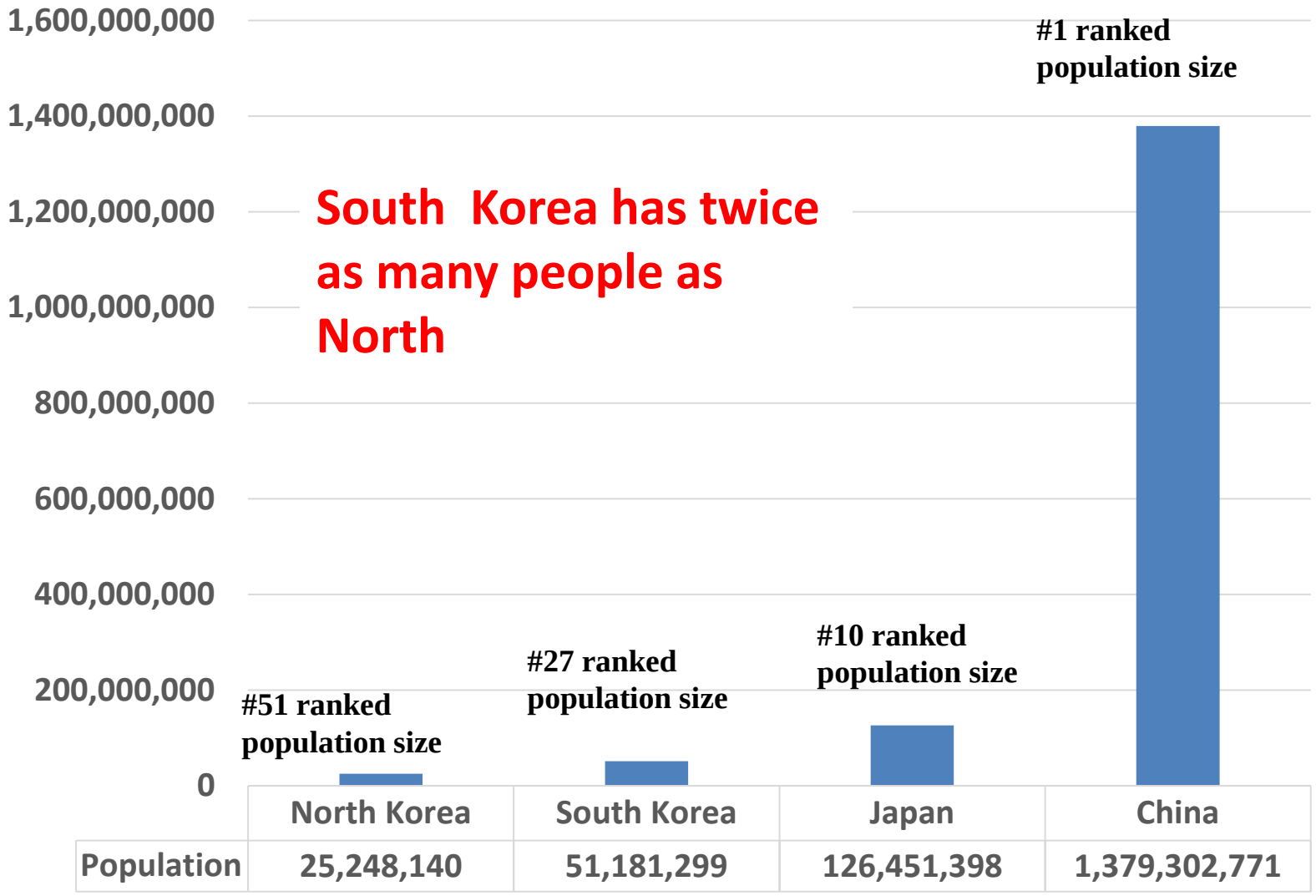
Population, by Country (2017) & Ranking



	North Korea	South Korea	Japan	China
Population	25,248,140	51,181,299	126,451,398	1,379,302,771

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2119rank.html#ch

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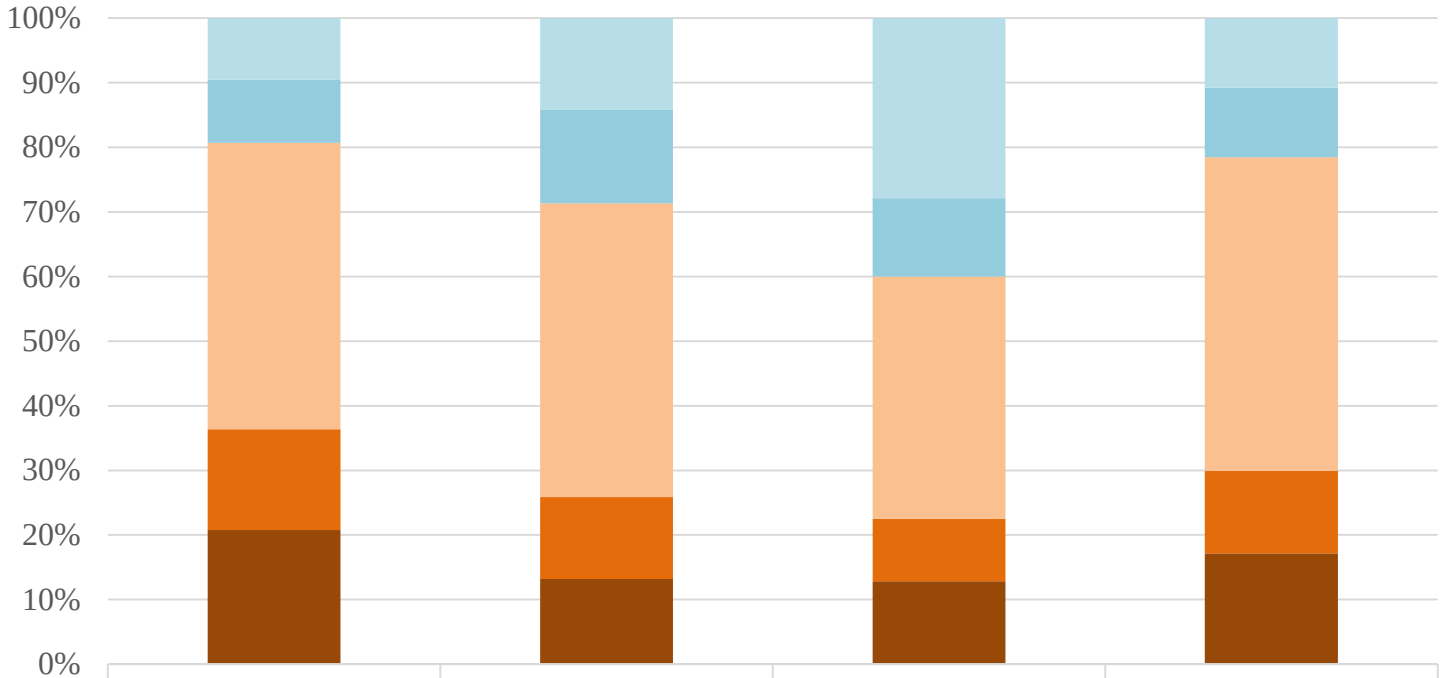
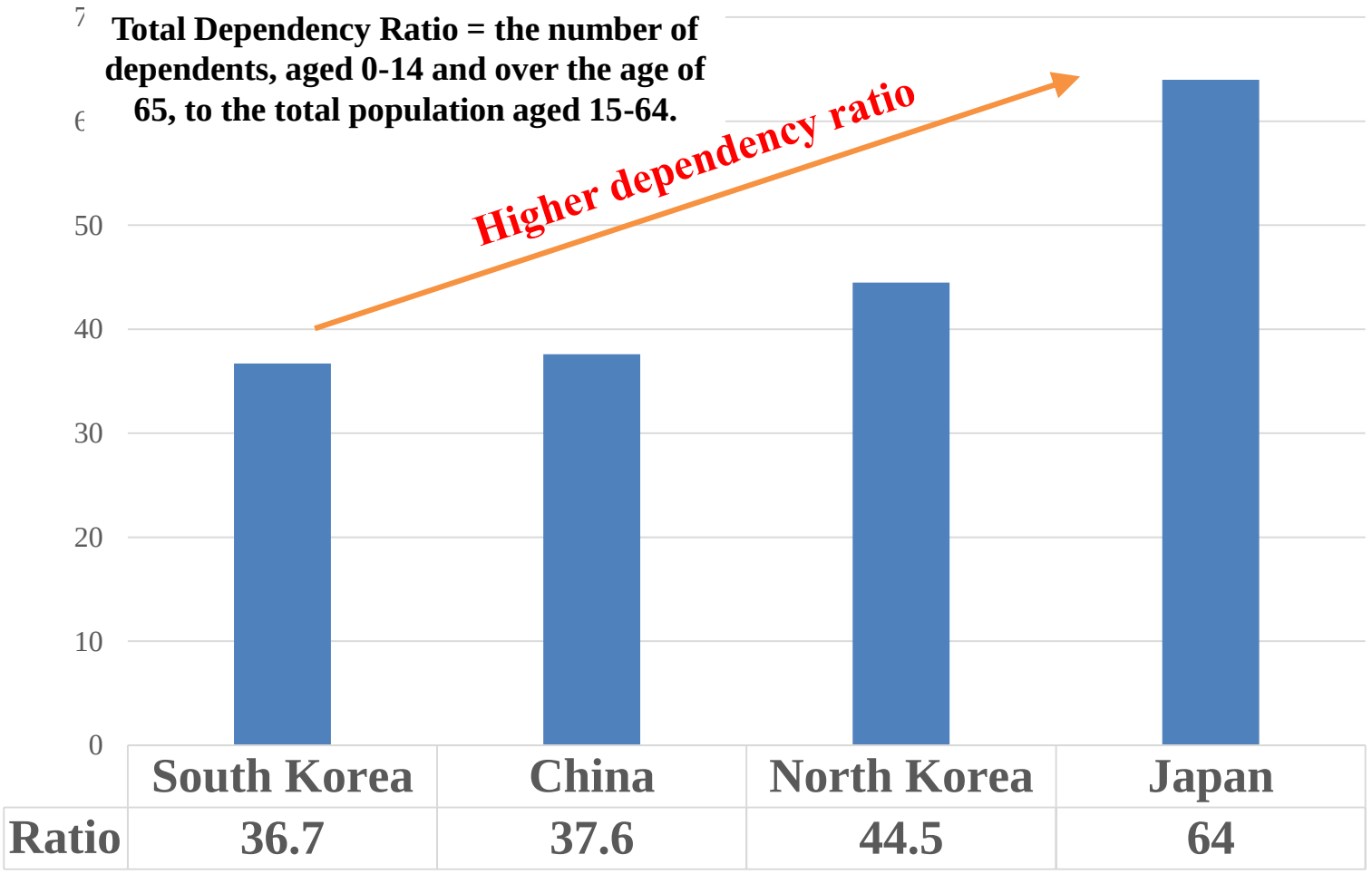
Age Structure, by Country, 2017



	North Korea	South Korea	Japan	China
65+	9.56	14.2	27.87	10.81
55-64	9.77	14.49	12.15	10.75
25-54	44.28	45.52	37.5	48.51
15-24	15.59	12.66	9.64	12.78
0-14	20.78	13.21	12.84	17.15

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2010.html#ch

Total Dependency Ratio, by Country, 2017



	South Korea	China	North Korea	Japan
Ratio	36.7	37.6	44.5	64

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2261.html#kn

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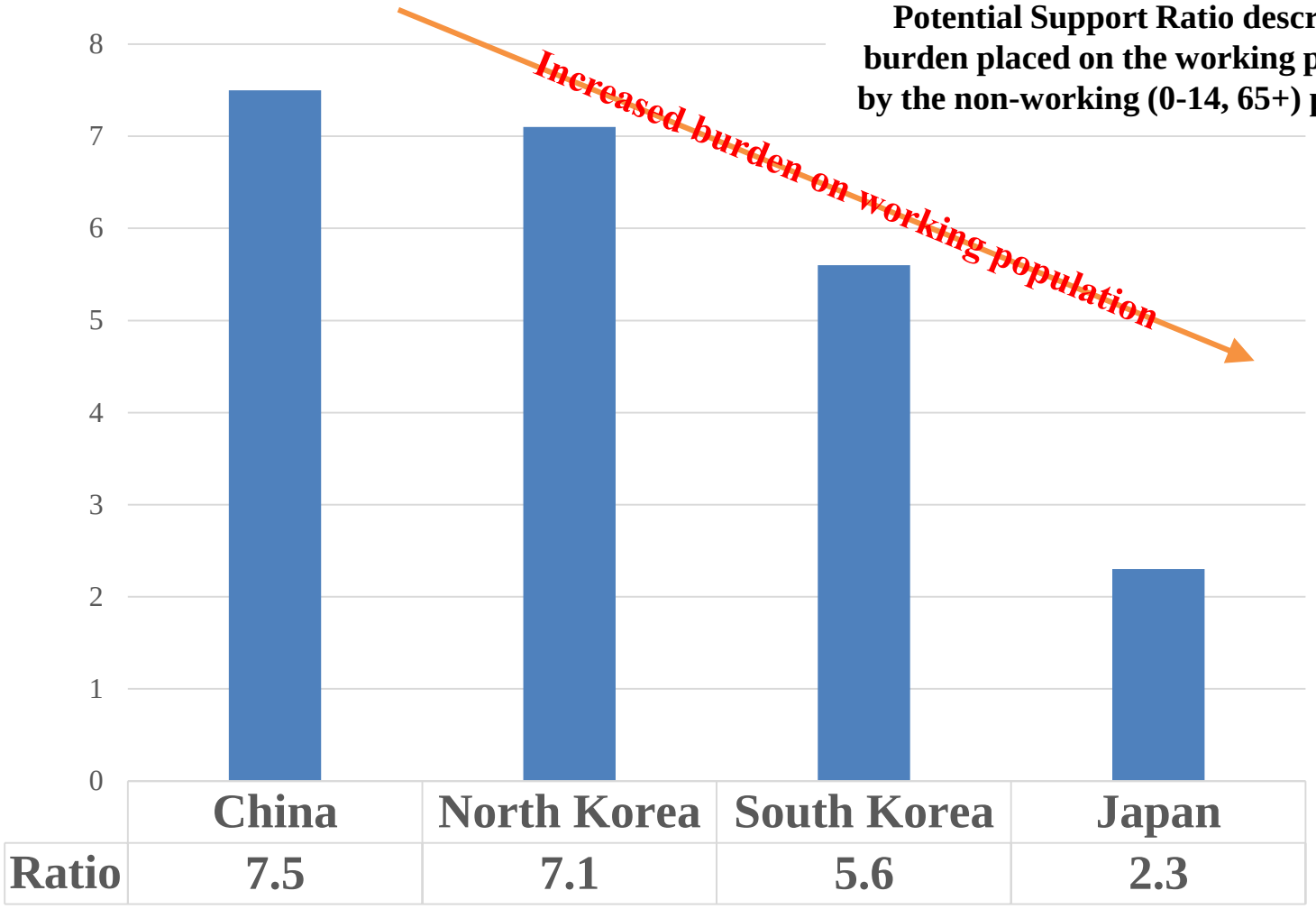
Potential Support Ratio, by Country, 2017



	China	North Korea	South Korea	Japan
Ratio	7.5	7.1	5.6	2.3

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2261.html#kn

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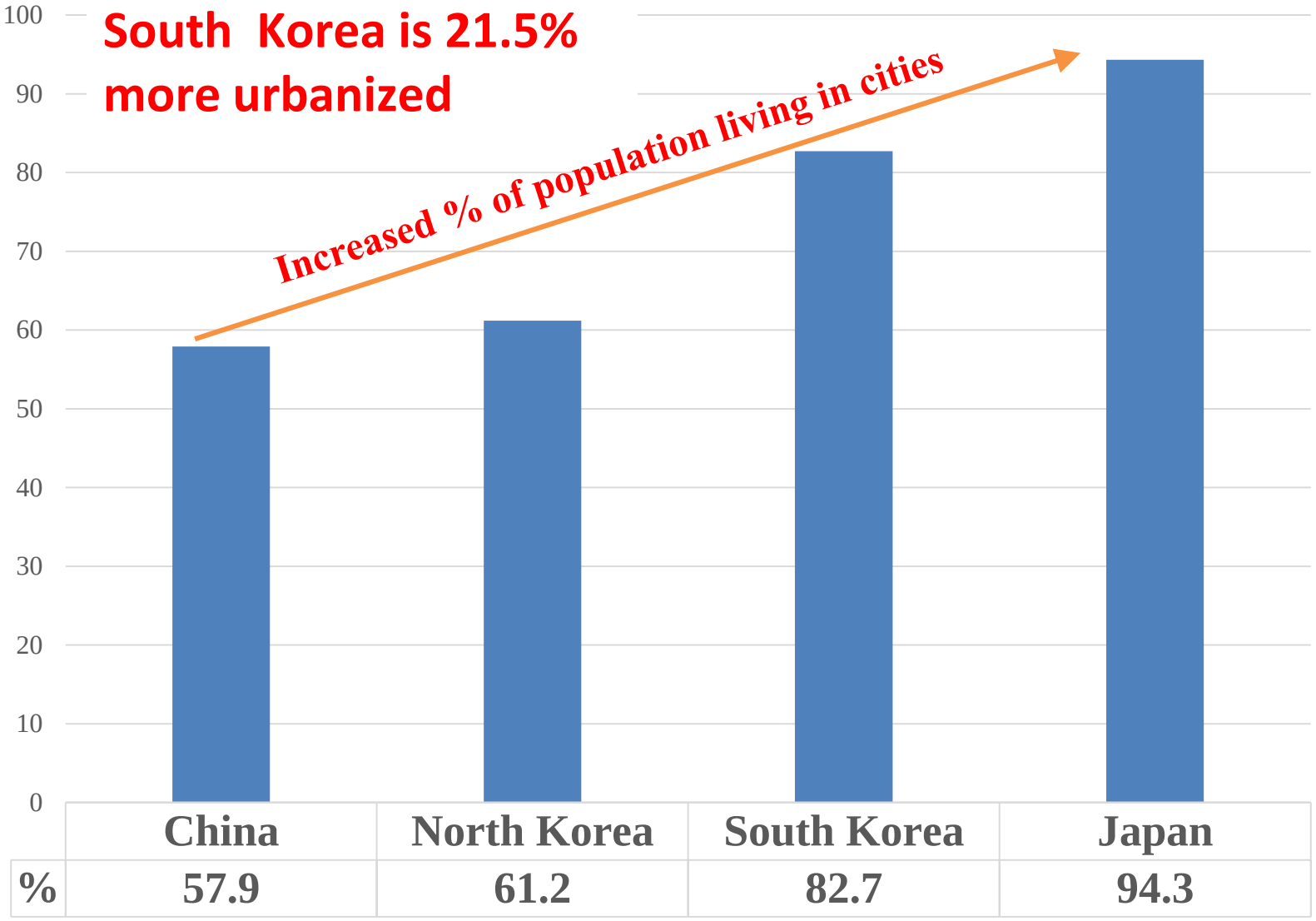
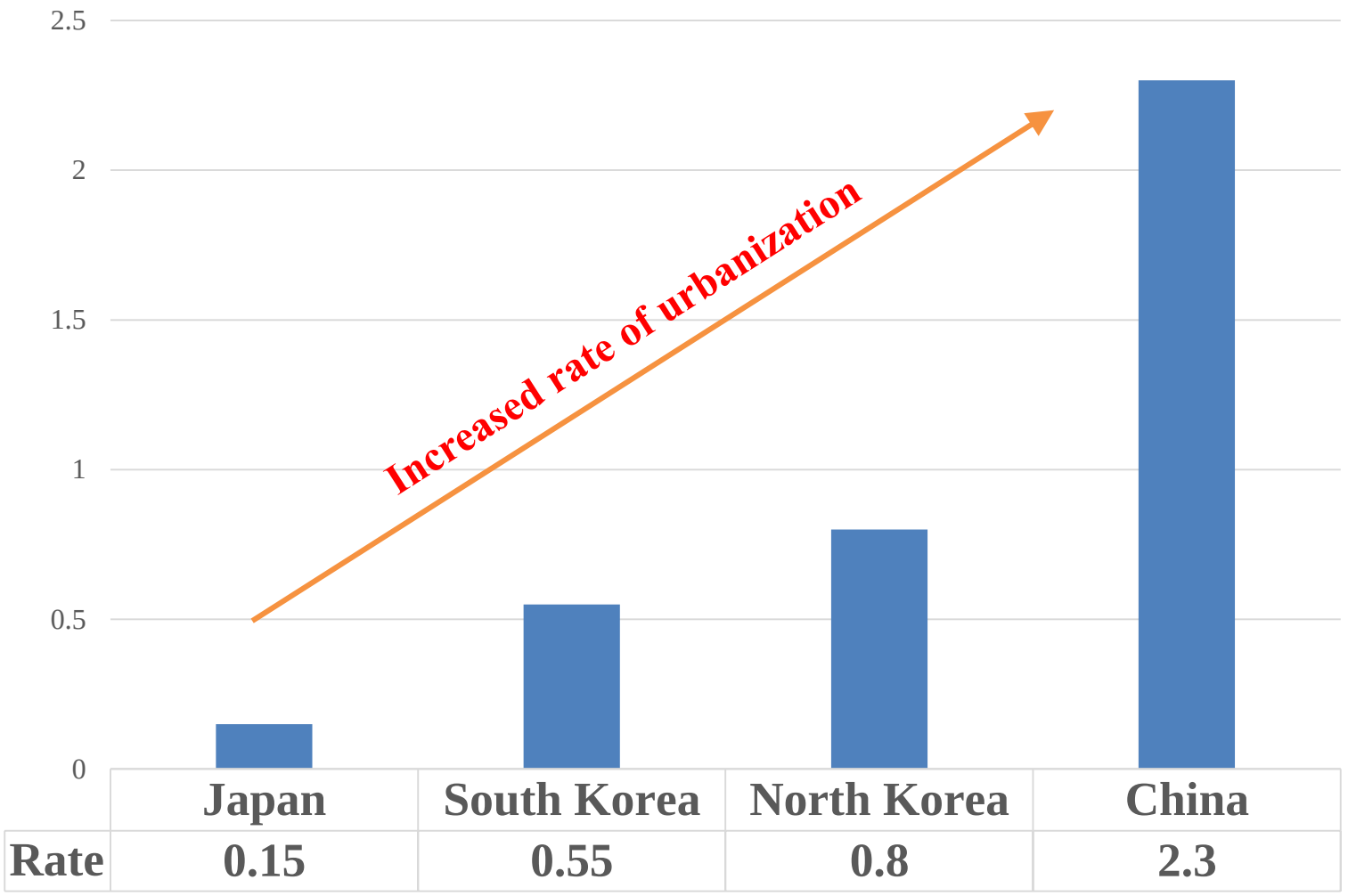
Urbanization, by Country, 2017



	China	North Korea	South Korea	Japan
%	57.9	61.2	82.7	94.3

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2212.html#kn

Rate of Urbanization, by Country, 2017 (%)



	Japan	South Korea	North Korea	China
Rate	0.15	0.55	0.8	2.3

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2212.html#kn

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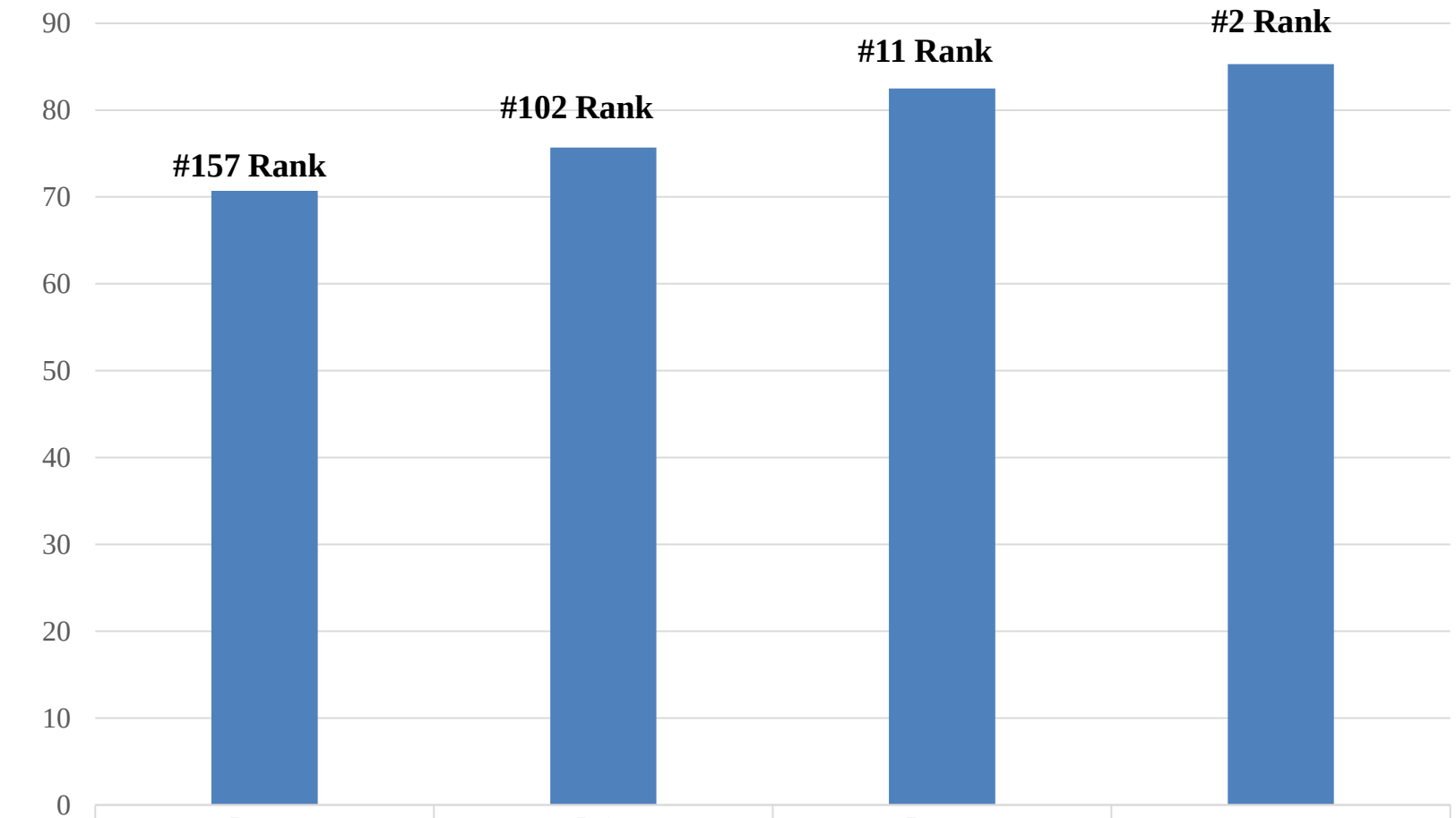
Life Expectancy & Ranking, by Country, 2017



	North Korea	China	South Korea	Japan
Age	70.7	75.7	82.5	85.3

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2102rank.html#kn

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Uncertain Medical Statistics: North vs. South Korea - I

STAT	North Korea	South Korea
Infant mortality rate	**24.84** Ranked 82nd. **3 times more** than South Korea	**7.18** Ranked 143th.
Infant mortality rate > Total	**27.11 deaths/1,000 live births** Ranked 74th. **7 times more** than South Korea	**4.16 deaths/1,000 live births** Ranked 192nd.
Life expectancy at birth > Total population	**68.89 years** Ranked 145th.	**79.05 years** Ranked 40th. **15% more** than North Korea
Physicians > Per 1,000 people	**3.29 per 1,000 people** Ranked 18th. **2 times more** than South Korea	**1.6 per 1,000 people** Ranked 40th.
Per capita total expenditure on health in international dollars	**57** Ranked 158th.	**982** Ranked 35th. **17 times more** than North Korea

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Uncertain Medical Statistics: North vs. South Korea - II

STAT	North Korea	South Korea
Intestinal diseases death rate	**4.21%** Ranked 94th. **61% more** than South Korea	**2.62%** Ranked 100th.
Incidence of tuberculosis > Per 100,000 people	**177.78 per 100,000 people** Ranked 55th. **84% more** than South Korea	**96.41 per 100,000 people** Ranked 81st.
% of population using improved drinking water sources > Rural	**100** Ranked 1st. **41% more** than South Korea	**71** Ranked 76th.
% of population using adequate sanitation facilities > Rural	**100** Ranked 1st. **25 times more** than South Korea	**4** Ranked 138th.
Deaths > Urban deaths of infant boys	**1,898** Ranked 4th. **3 times more** than South Korea	**656** Ranked 6th.
Deaths > Urban deaths of infant girls per million people	**67.73** Ranked 5th. **7 times more** than South Korea	**10.08** Ranked 23th.

For 2015. Source: Nationmaster, "Country vs country: North Korea and South Korea compared: Health stats," http://www.nationmaster.com/country-info/compare/North-Korea/South-Korea/Health.

ECONOMY

North versus South

- CIA estimates that North Korea has an extraordinarily small GDP for a state with such large military forces: Some $40 billion in 2015 in purchasing power parity (PPP) terms, and $28 billion in 2013 in official exchange rate terms -- by far the most relevant measure of economic strength in terms of the size of a modern economy. Its per capita income for a population of 25.2 million was only $1,700 in 2015.
- In contrast, the CIA estimates that South Korea had a GDP of $2,027 billion in 2017 in purchasing power parity (PPP) terms (over 50 times the most recent figure reported for North Korea), and $1,530 billion in official exchange rate terms (55 times that of North Korea). It also estimates that South Korea has a GDP per capita of $39,400 in 2017, for a population of 51.2 million. This is 23 times the most recent figure the CIA reports for North Korea.
- There is no way to put North Korea's military spending in perspective relative to the size of its economy or the level of spending in South Korea. There are no reliable estimates of North Korean military spending. The International Institute for Strategic Studies (IISS) and the Stockholm International Peace Research Institute (SIPRI)-- the usual sources for comparable data -- do not report any figures for North Korea.
- South Korea does report its spending publically, however, and the IISS reports a figure of $35.7 billion in 2017. This is only 2.3% of South Korea's GDP, but its roughly equal to North Korea's entire GDP in PPP terms by CIA estimates, and much larger than North Korea's GDP using the more relevant official exchange rate metric.

South Korean Estimate of Key Korean Economic Indicators in 2014 and 2016

Category	South Korea		North Korea		Comparison (South Korea/North Korea)	
	2014	2015	2014	2015	2014	2015
Nominal GNI (trillion won)	1,490.8	1,565.8	34.2	34.5	43.7	45.4
Per-capita GNI (ten thousand won)	2,956	3,094	139	139	21.3	22.3
Economic Growth Rate (%)	3.3	2.6	1.0	-1.1	-	-
Trade Volume (USD 100 million)	10,981.8	9,632.6	76.1	62.5	144.3	154.1
Population (thousand)	50,424	50,617	24,662	24,779	2.0	2.0

• Source: The Bank of Korea

• GNI (Gross National Income): Since 1993, major countries and international organizations such as the UN and IMF have replaced GNP with GNI (GNI≒GNP)

South Korean Ministry of Defense, White Paper 2016, 2017, Appendix, http://www.mod.go.jp/e/publ/w_paper/2017.html, p. 269

Relative Vulnerability

- Key questions arise as to relative vulnerability – not only in economics but every aspect of development, continuity of civilian life, and infrastructure.
- South Korea is far more developed, has far less ability to support its total population outside secure urban areas, and far higher living standards to preserve.
- At the same time, North Korea has a far more marginal economy, infrastructure, and mix of services both in terms of numbers of targets, redundancy, and total target base.
- North Korea's economy and structure of governance is centered around one moderate sized city -- Pyongyang – which is only 160 kilometers from the DMZ and 195 kilometers from the center of Seoul – minor distances in terms of air and missile strikes.
- As later charts show, similar issues affect key transportation nodes, ports, power grids, and national infrastructure.

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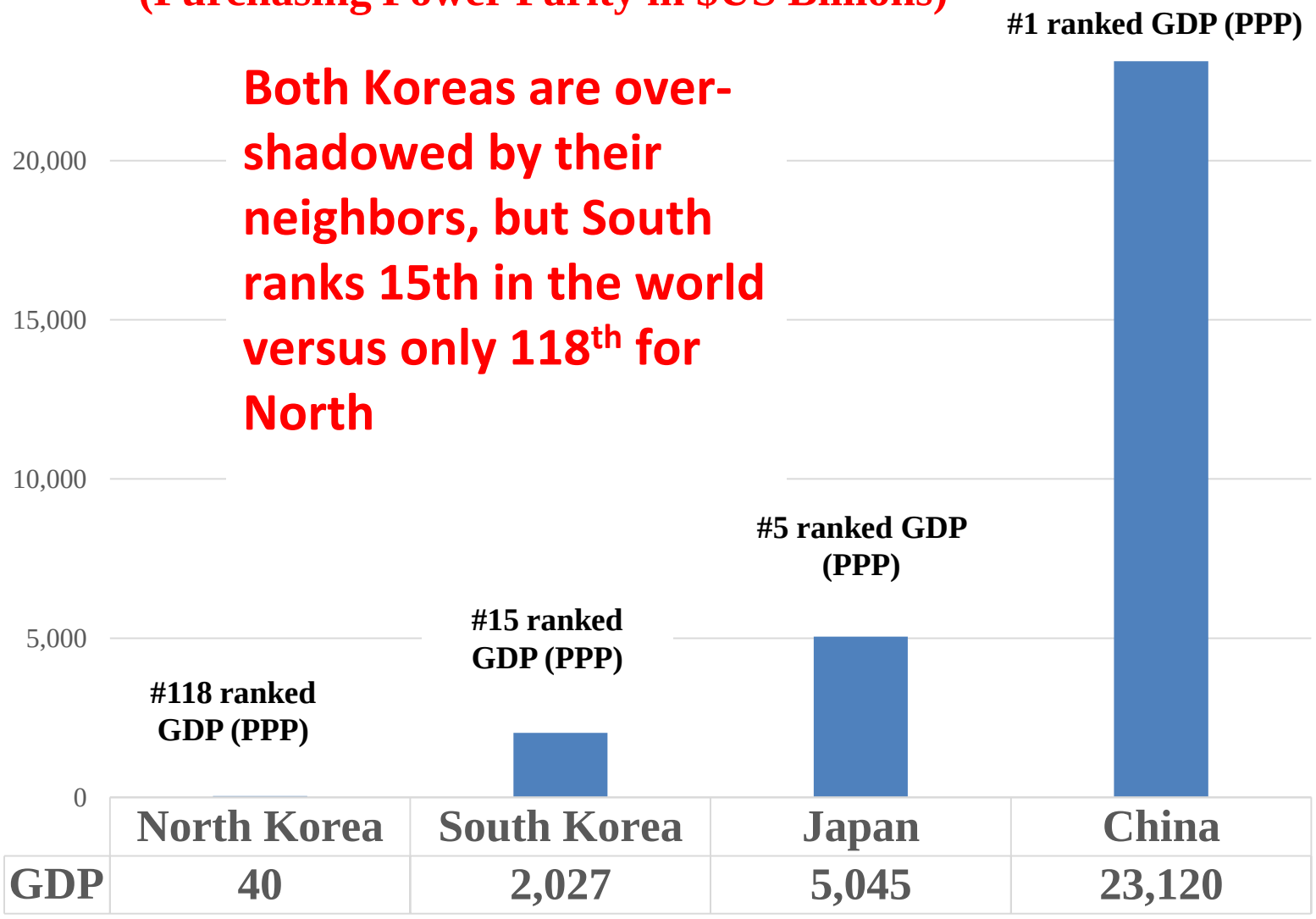
GDP in 2017

(Purchasing Power Parity in $US Billions)

Both Koreas are over-shadowed by their neighbors, but South ranks 15th in the world versus only 118th for North



	North Korea	South Korea	Japan	China
GDP	40	2,027	5,045	23,120

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2001.html#ja

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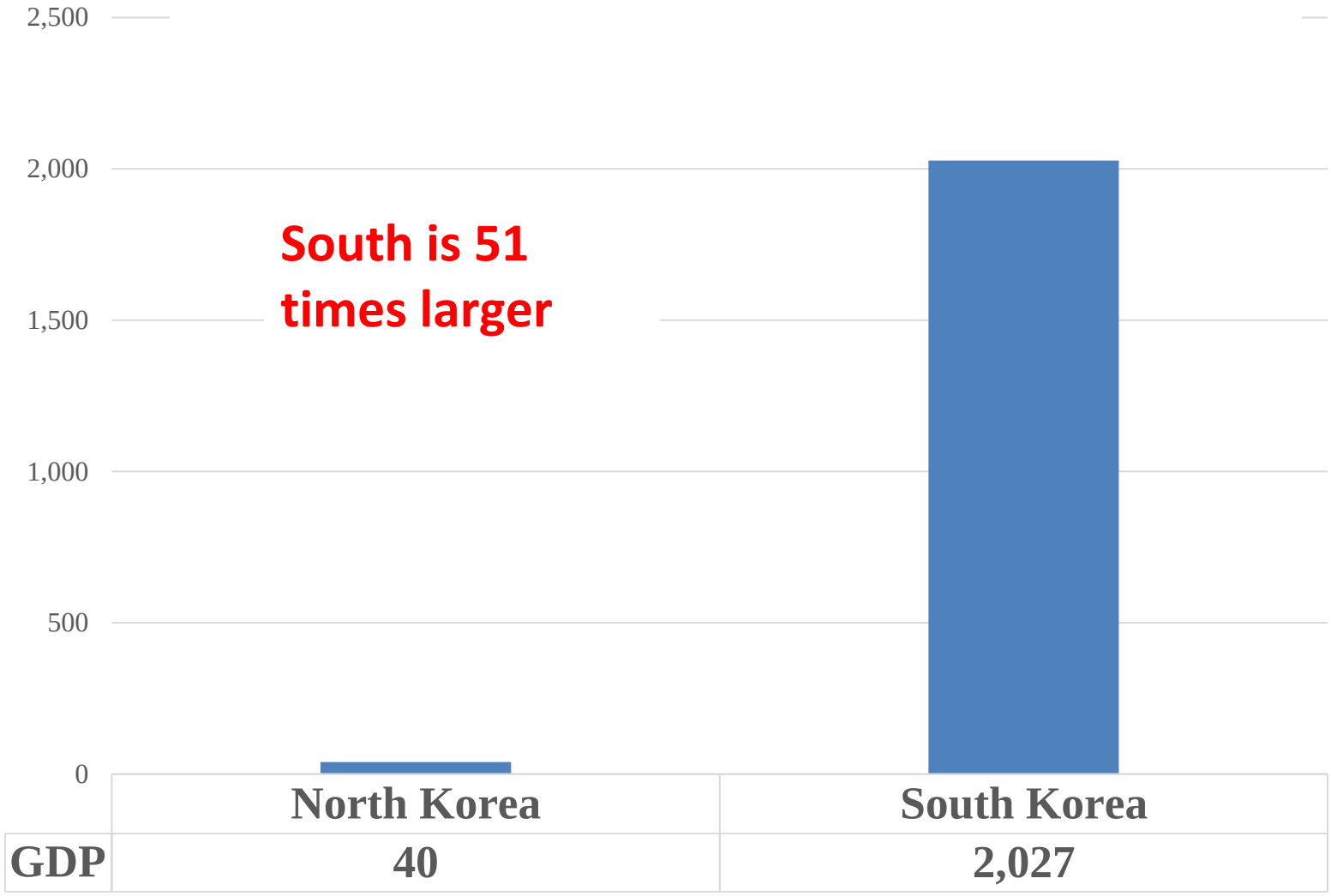
GDP North Korea & South Korea, 2017

(Purchasing Power Parity in $US Billions)



CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2001.html#ja

Comparative Wealth: 1950-2010

South goes from equality through 1975 to 17 times larger in 2010

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

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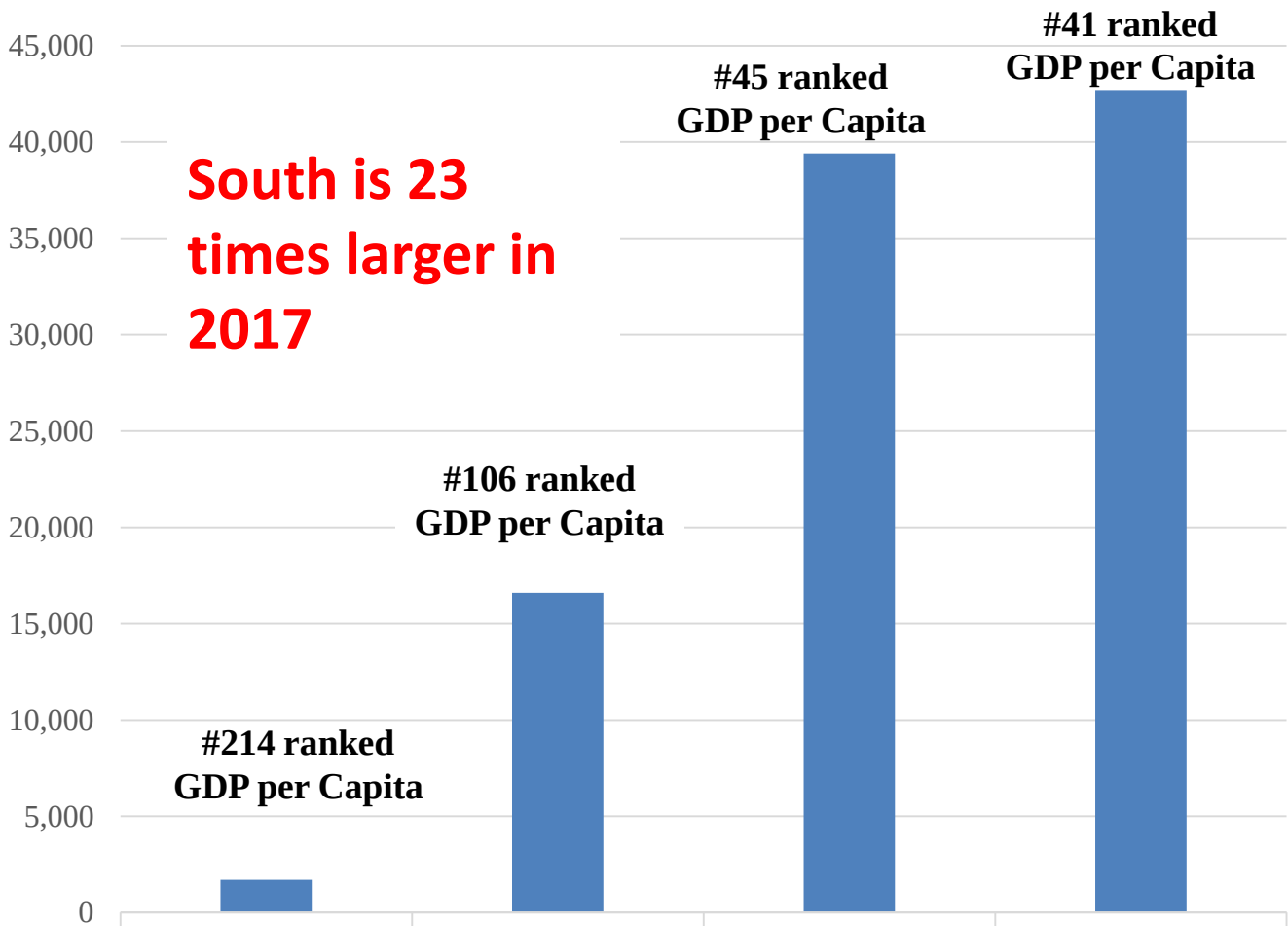
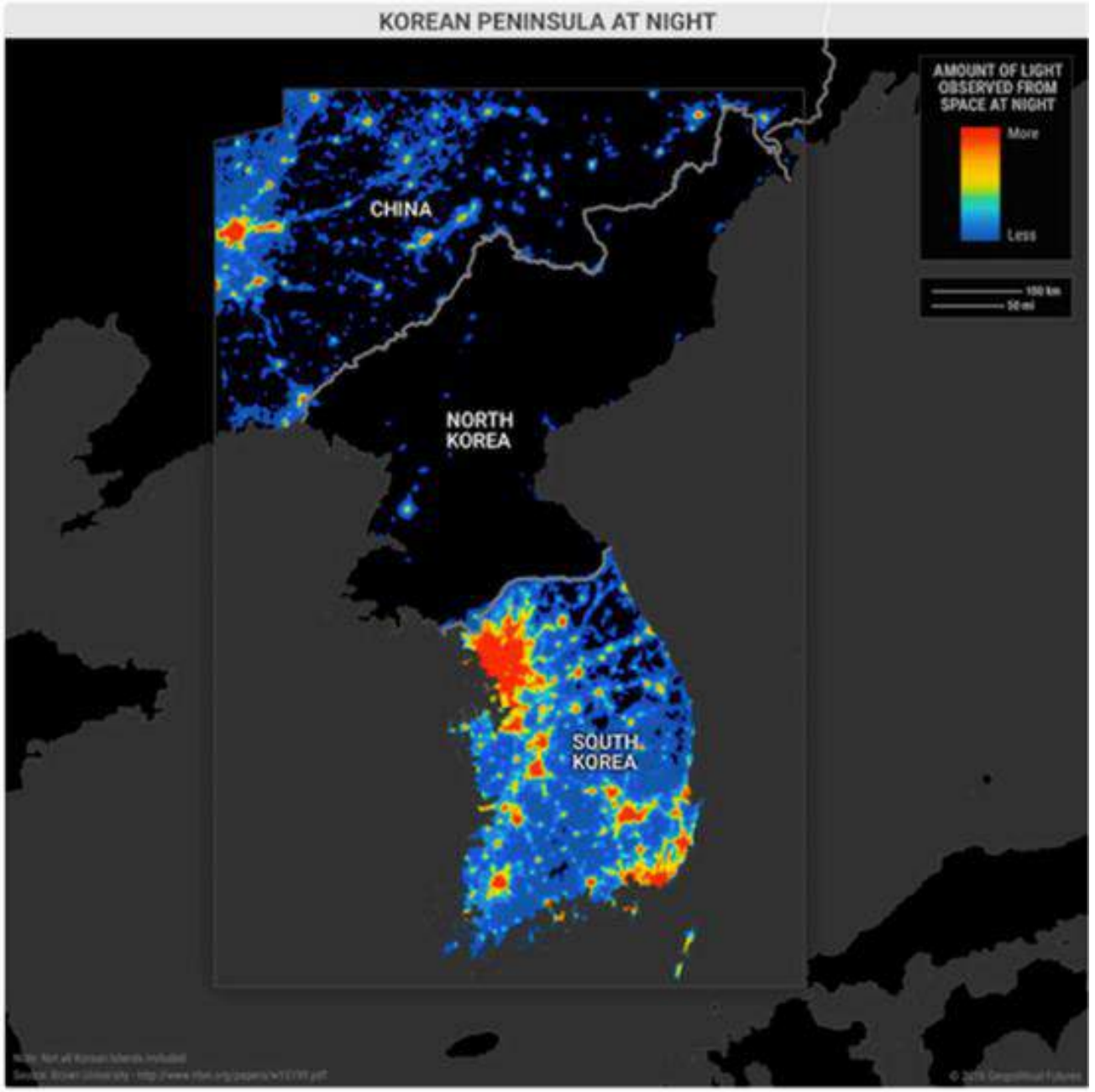
GDP per Capita 2017
(Purchasing Power Parity in $US)



	North Korea	China	South Korea	Japan
GDP per Capita	1,700	16,600	39,400	42,700

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2004.html#kn

Light Versus Darkness



3 maps that explain North Korea's strategy, George Friedman, Mauldin Economics, Apr. 18, 2017, 9:32 AM, http://www.businessinsider.com/3-maps-that-explain-north-koreas-strategy-2017-4

The North Korean Budget vs. Military Spending Paradox

- South Korea has a far more advanced economy and is far more dependent on stable economic operations, imports, and exports.
- Many of the data on North Korea's economy are so low that it is unclear how it can support its current military efforts, and raise key questions about the accuracy of CIA, World Bank, IMF, and UN estimates.
- There are no credible current unclassified estimates of North Korean military spending. The estimates available are also dated, and do not track with any other major sources of economic data.
- The CIA estimate of the total North Korean budget seems to fall significantly below the probable real world level of military and security spending.
- An estimate of a North Korean state budget of an authoritarian command economy whose expenditures are only 0.011% of South Korea's budget raises major credibility problems.

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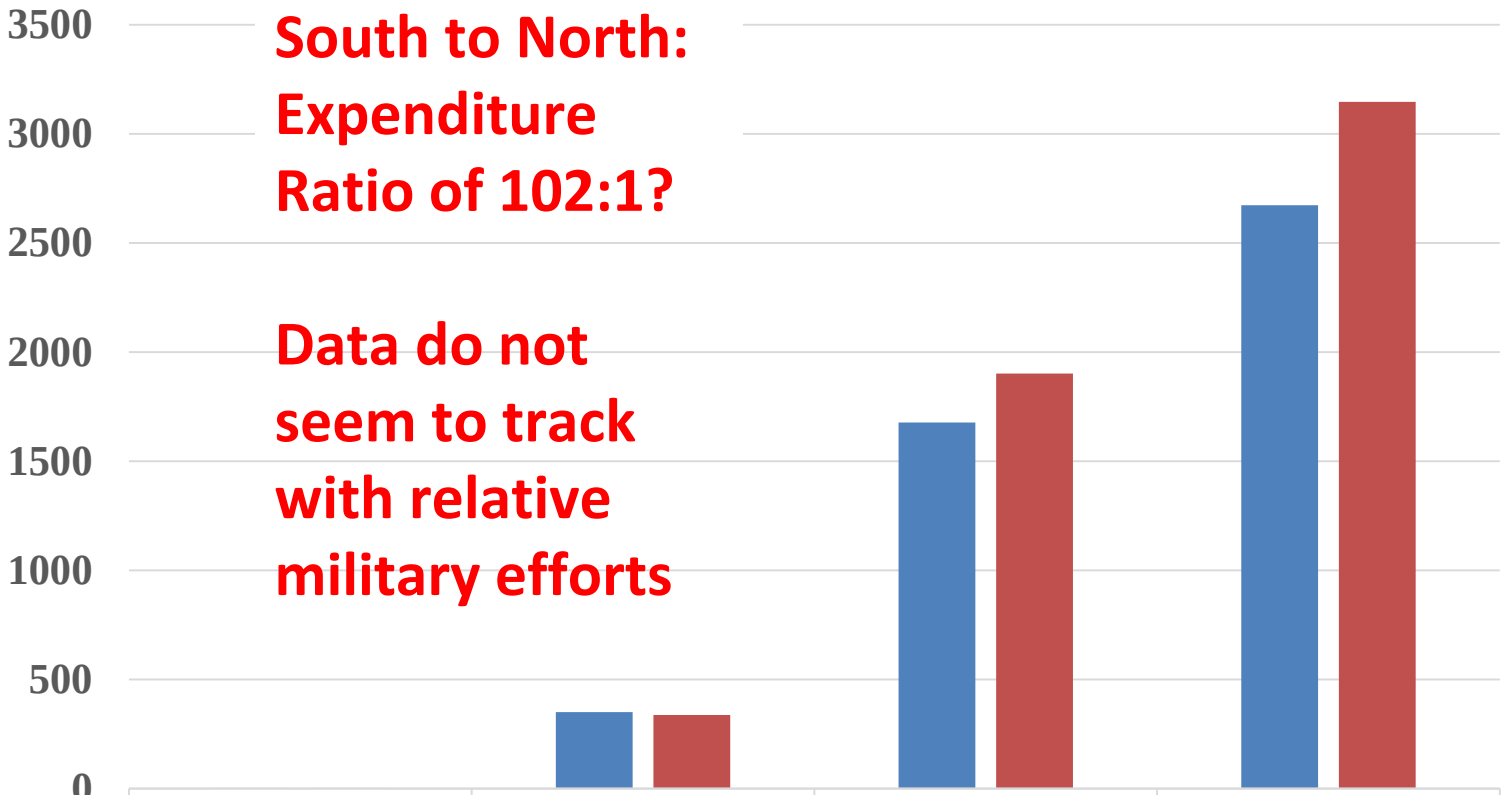
Budgets, by Country, 2017
($US Billions)



	North Korea	South Korea	Japan	China
Revenue	3.2	351.6	1678	2672
Expenditures	3.3	338	1902	3146

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2056.html#ch

Military Spending

- **North Korea: Some estimates equal 159% of total national budget. No IISS or SIPRI estimates. Some guess around $6 billion, and 22% of GDP. Earlier State estimates put at $3.5 to $4 billion.**
- **South Korea: IISS puts IISS puts at $35.7 billion in 2017. SIPRI puts at $36.8 billion in 2016.**
- **Japan: IISS puts at $46 billion in 2017. SIPRI puts at $46.1 billion in 2016.**
- **China: IISS puts at $150.5 billion in 2017. SIPRI puts at $215.2 billion in 2016. ($225-255 billion in 2017?)**
- **United States: IISS puts at $602.8 billion in 2017. SIPRI puts at $611.2 billion in 2016.**

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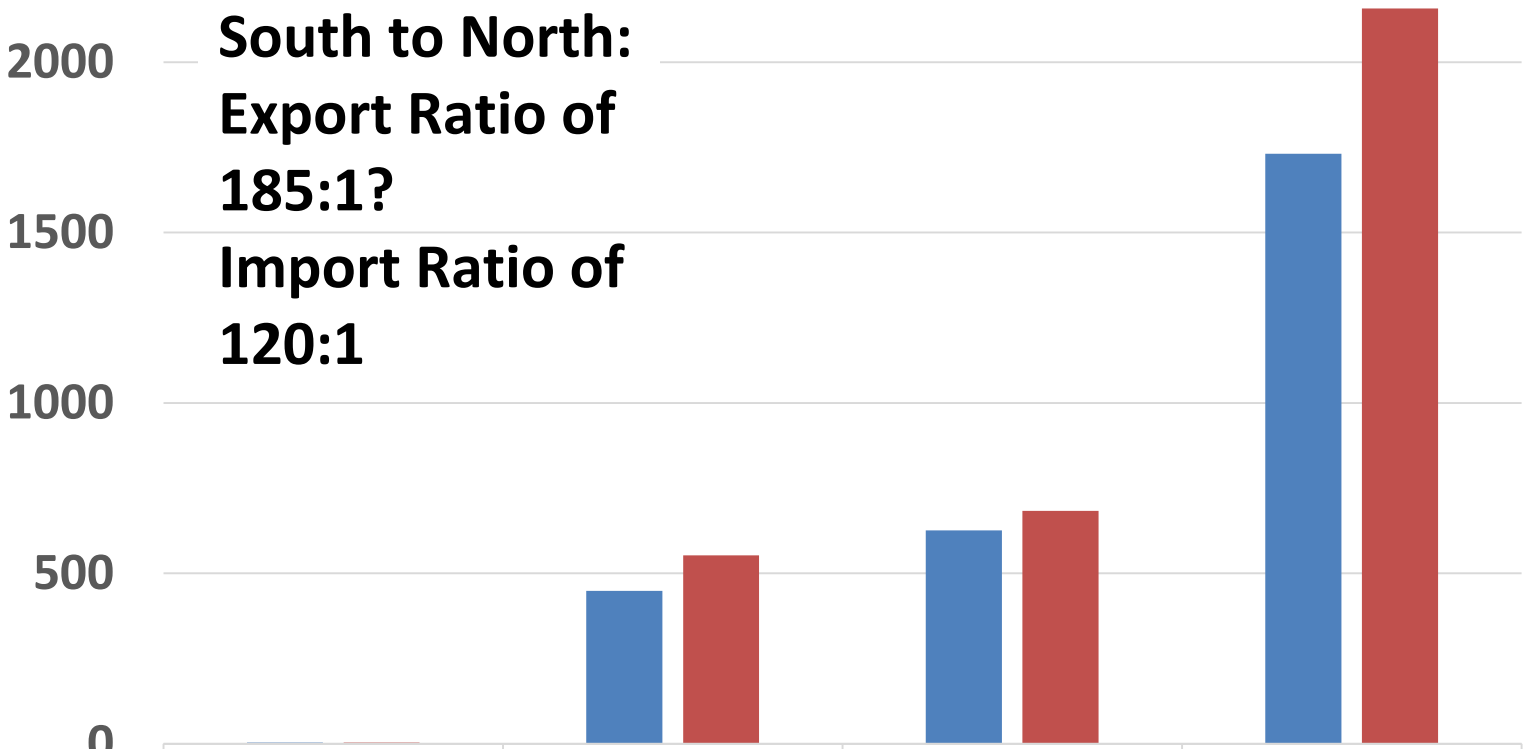
Imports / Exports, by Country, 2017

($US Billions)



	North Korea	South Korea	Japan	China
Imports	3.752	448.4	625.7	1731
Exports	2.985	552.3	683.3	2157

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2087.html#kn , https://www.cia.gov/library/publications/the-world-factbook/fields/2078.html#kn

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Critical Nature of South Korean Trade

Exports:

$552.3 billion (2017 est.) **NORTH KOREA is $2.985 billion (2016 est.) = .006%**

$511.8 billion (2016 est.)

country comparison to the world: 6

Exports - commodities:

semiconductors, petrochemicals, automobile/auto parts, ships, wireless communication equipment, flat displays, steel, electronics, plastics, computers

Exports - partners:

China 25.1%, US 13.5%, Vietnam 6.6%, Hong Kong 6.6%, Japan 4.9% (2016)

Imports:

$448.4 billion (2017 est.) **NORTH KOREA is $3.752 (2016 est.) = .01%**

$391.3 billion (2016 est.)

country comparison to the world: 9

Imports - commodities:

crude oil/petroleum products, semiconductors, natural gas, coal, steel, computers, wireless communication equipment, automobiles, fine chemicals, textiles

Imports - partners:

China 21.4%, Japan 11.7%, **US 10.7%,** Germany 4.7% (2016)

Reserves of foreign exchange and gold:

$374.8 billion (31 December 2017 est.)

$371.1 billion (31 December 2016 est.)

country comparison to the world: 11

Debt - external:

$376.9 billion (31 December 2017 est.)

$358.2 billion (31 December 2016 est.)

country comparison to the world: 31

CIA, "South Korea," World Factbook, accessed April 5, 2018.

ENERGY

North versus South

- South Korea's modern economy makes it a massive importer of oil and gas, and has led it to develop a major nuclear power industry. Its refineries, energy transit and processing facilities make it a target rich energy environment but also give it considerable energy storage capacity and reserves as well as redundancy.
- North Korea's energy production is far lower than South Korea's. It makes only limited use of gas, and it is far more dependent on coal. An EIA study indicated that North Korea had reserves of about 600 million metric tons of coal in 2014, according to BP Plc, compared to recoverable reserves of 251 billion tons for the U.S. and 244 billion for China.
- As for petroleum, China supplied North Korea with 10,000 barrels a day of crude oil before sanctions according to the EIA. This is only equivalent to less than one percent of daily consumption in the U.S. North Korea built a coal gasification plant in 2006 as part of its upgrade of the Namhung Youth Chemical Complex, but its unclear it can turn to coal gasification or liquids on large commercial scale.
- South Korea has about 10 times the installed electric generation capability of North Korea. Electrification is also very different. The CIA estimates that in 2013 some 18.4 million North Koreans were without electricity: 18,400,000: 30% of the total population, 41% for urban areas and 13% rural areas: 13%. It estimates that 100% of South Koreans have electricity.

South Korean Energy Import Dependence

South Korea was the world's ninth-largest energy consumer in 2015…Because South Korea lacks domestic energy reserves, it is one of the top energy importers in the world and relies on imports for about 98% of its fossil fuel consumption.

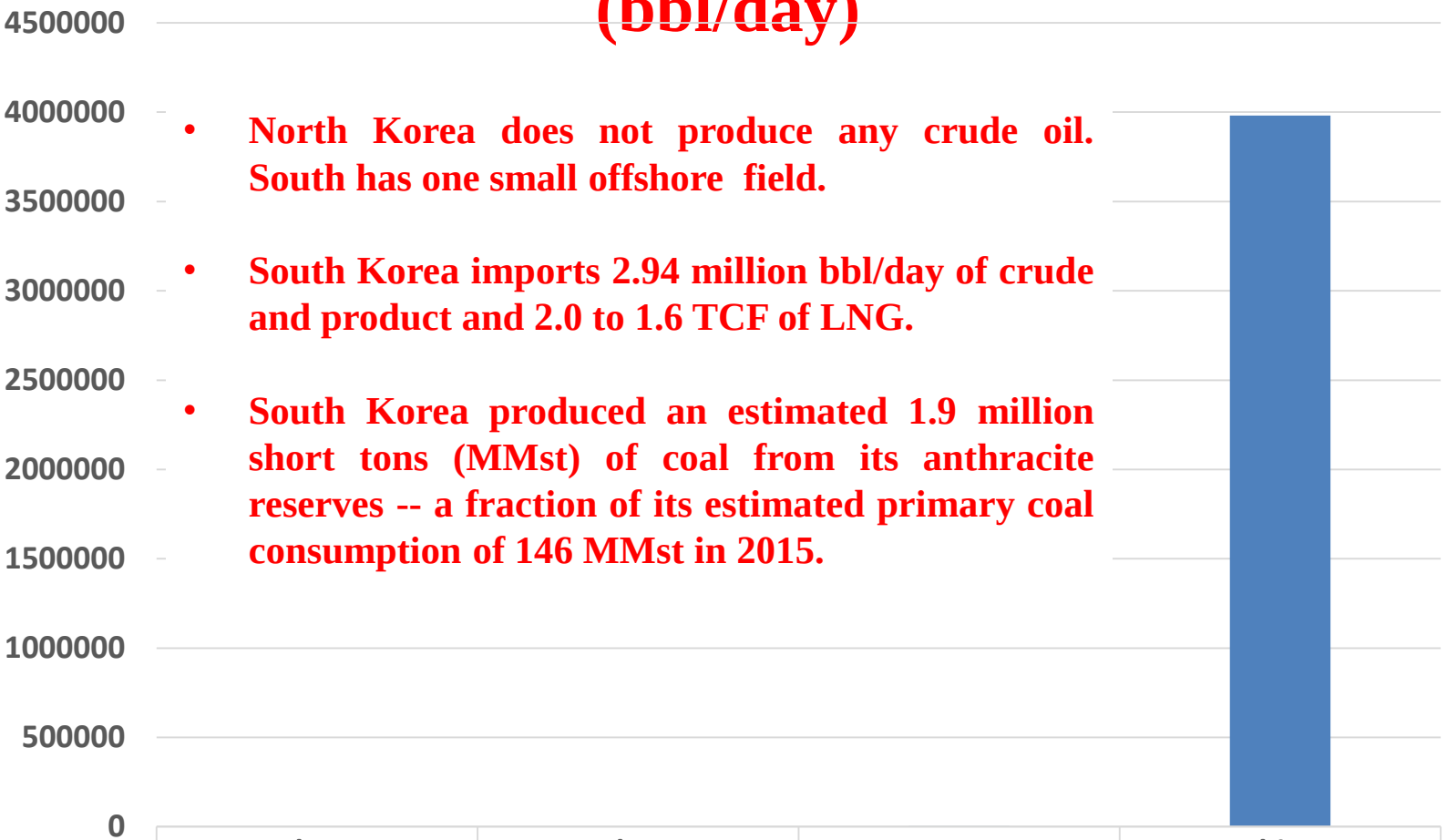
South Korea ranks among the world's top five importers of liquefied natural gas, coal, crude oil, and refined products. South Korea has no international oil or natural gas pipelines and relies exclusively on tanker shipments of LNG and crude oil.

Despite its lack of domestic energy resources, South Korea is home to some of the largest and most advanced oil refineries in the world. In an effort to improve the nation's energy security, oil and natural gas companies are aggressively seeking overseas exploration and production opportunities.

South Korea Energy Profile: Heavily Dependent On Imports – Analysis
January 22, 2017 EIA 0 , https://www.eurasiareview.com/22012017-south-korea-energy-profile-heavily-dependent-on-imports-analysis/

Crude Oil Production/Imports, by Country, 2017 (bbl/day)

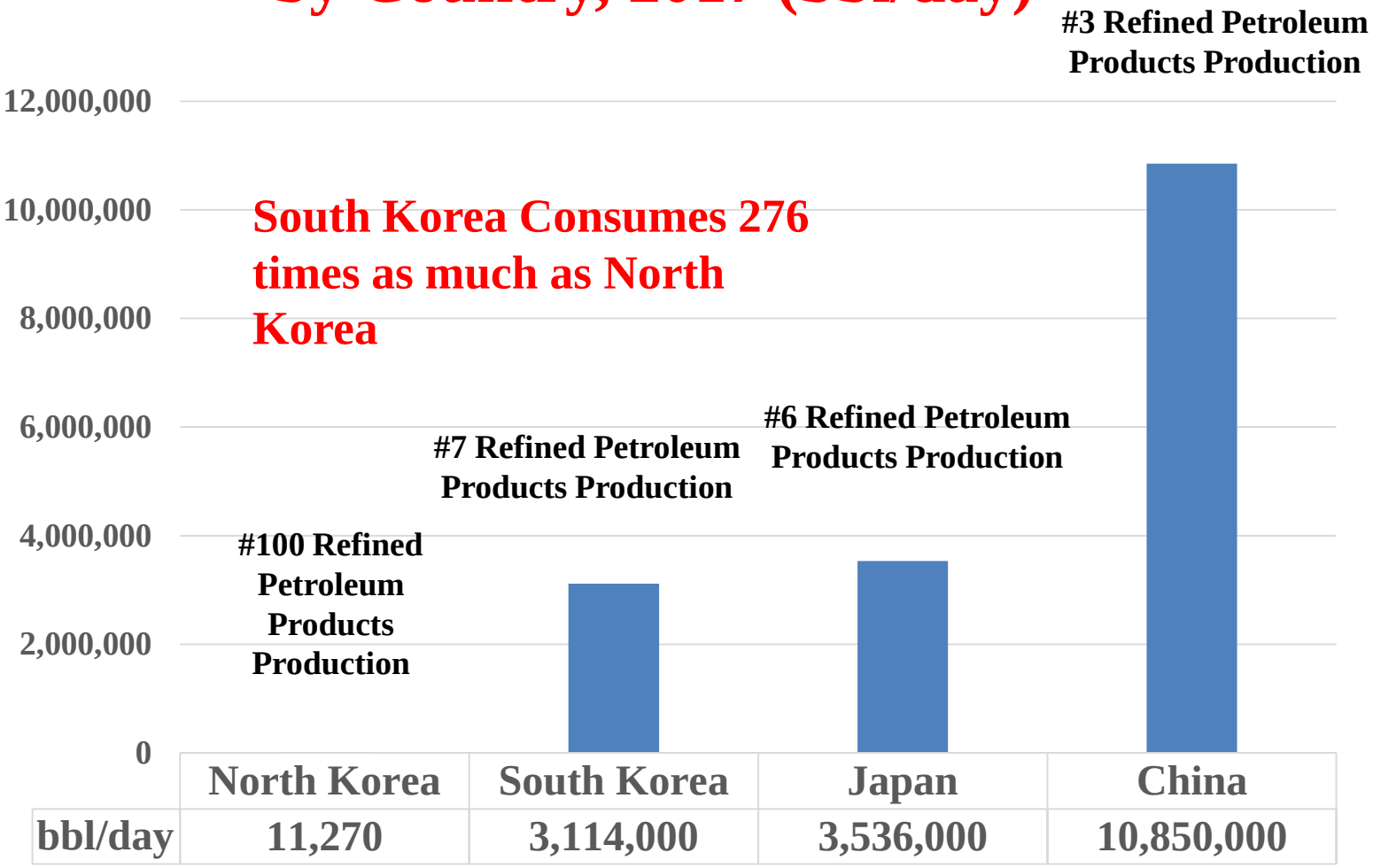
- North Korea does not produce any crude oil. South has one small offshore field.
- South Korea imports 2.94 million bbl/day of crude and product and 2.0 to 1.6 TCF of LNG.
- South Korea produced an estimated 1.9 million short tons (MMst) of coal from its anthracite reserves -- a fraction of its estimated primary coal consumption of 146 MMst in 2015.



	North Korea	South Korea	Japan	China
bbl/day	0	0	3,918	3,981,000

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2232.html#kn

Refined Petroleum Products - Production, by Country, 2017 (bbl/day)

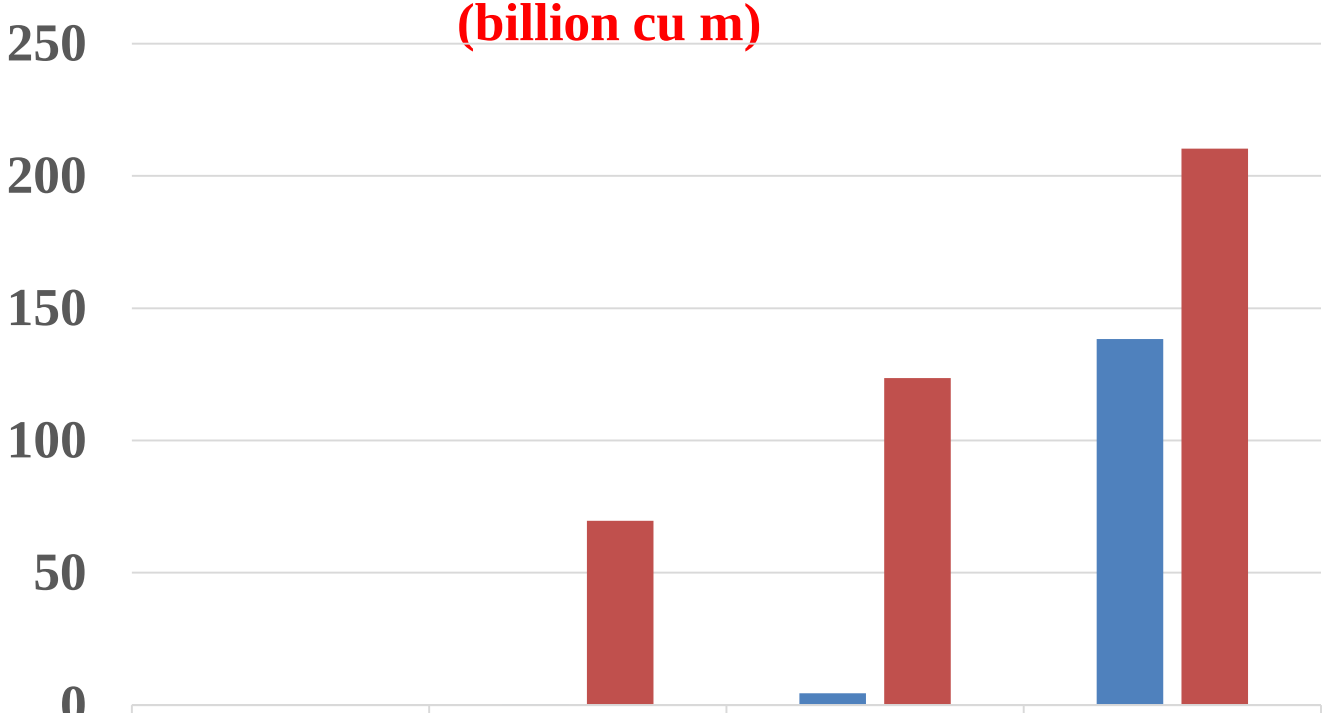


	North Korea	South Korea	Japan	China
bbl/day	11,270	3,114,000	3,536,000	10,850,000

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2245rank.html#kn

Natural Gas Production & Consumption, by Country, 2017

(billion cu m)

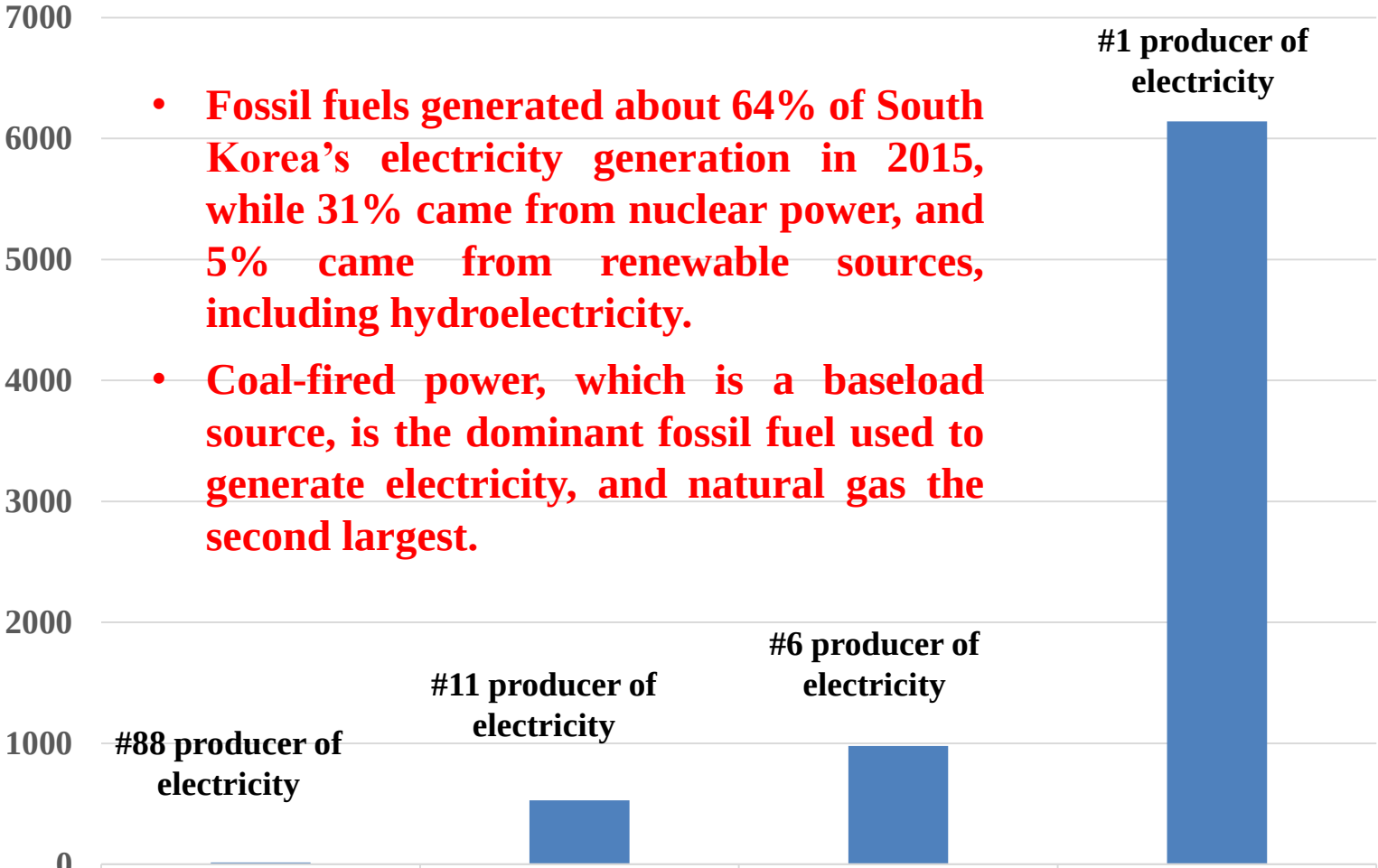


	North Korea	South Korea	Japan	China
Production	0	0.188	4.453	138.4
Consumption	0	69.630	123.6	210.3

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2250.html#ja

Electricity Production, by Country, 2017 (billion kWh)

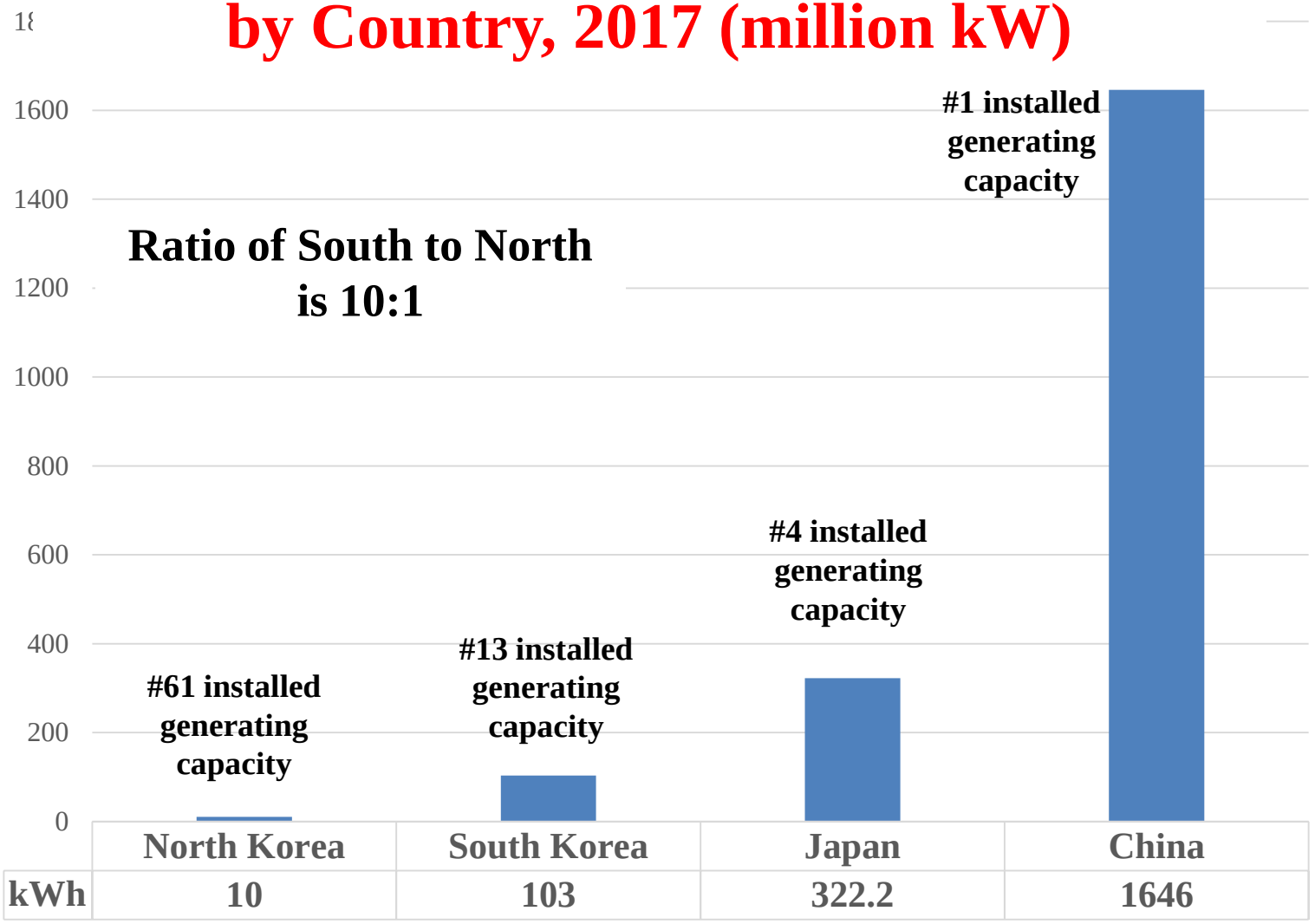
- **Fossil fuels generated about 64% of South Korea's electricity generation in 2015, while 31% came from nuclear power, and 5% came from renewable sources, including hydroelectricity.**
- **Coal-fired power, which is a baseload source, is the dominant fossil fuel used to generate electricity, and natural gas the second largest.**



	North Korea	South Korea	Japan	China
kWh	13.41	528.1	976.3	6142

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2232.html#kn

Electricity- Installed Generating Capacity, by Country, 2017 (million kW)



Installed generating capacity is the total capacity of currently installed generators, expressed in kilowatts (kW), to produce electricity.

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2236rank.html#kn

COMMUNICATION

North versus South

- South Korea permits access to all modern forms of communication on a market basis. North Korea sharply restricts access to communications and media – including satellite receivers, use of radios, cellphones, internet access, and access to all forms of news media.
- The CIA reports that North Korea has no independent media; radios and TVs are pre-tuned to government stations; 4 government-owned TV stations; the Korean Workers' Party owns and operates the Korean Central Broadcasting Station, and the state-run Voice of Korea operates an external broadcast service; the government prohibits listening to and jams foreign broadcasts (2015)
- South Korea is far more dependent on modern communications for all aspects of its economy and social structure, but has far larger and more survivable systems.
- South Korea has 44.153 million Internet users and this covers 89.9 percent of the population: 89.9% (July 2016 est.), making it the 17th largest user in the world. Internet distribution in North Korea is limited to a small number of state sanctioned users.
- South Korea has 24 times more fixed phone lines, and 18 times more cell phones than North Korea.

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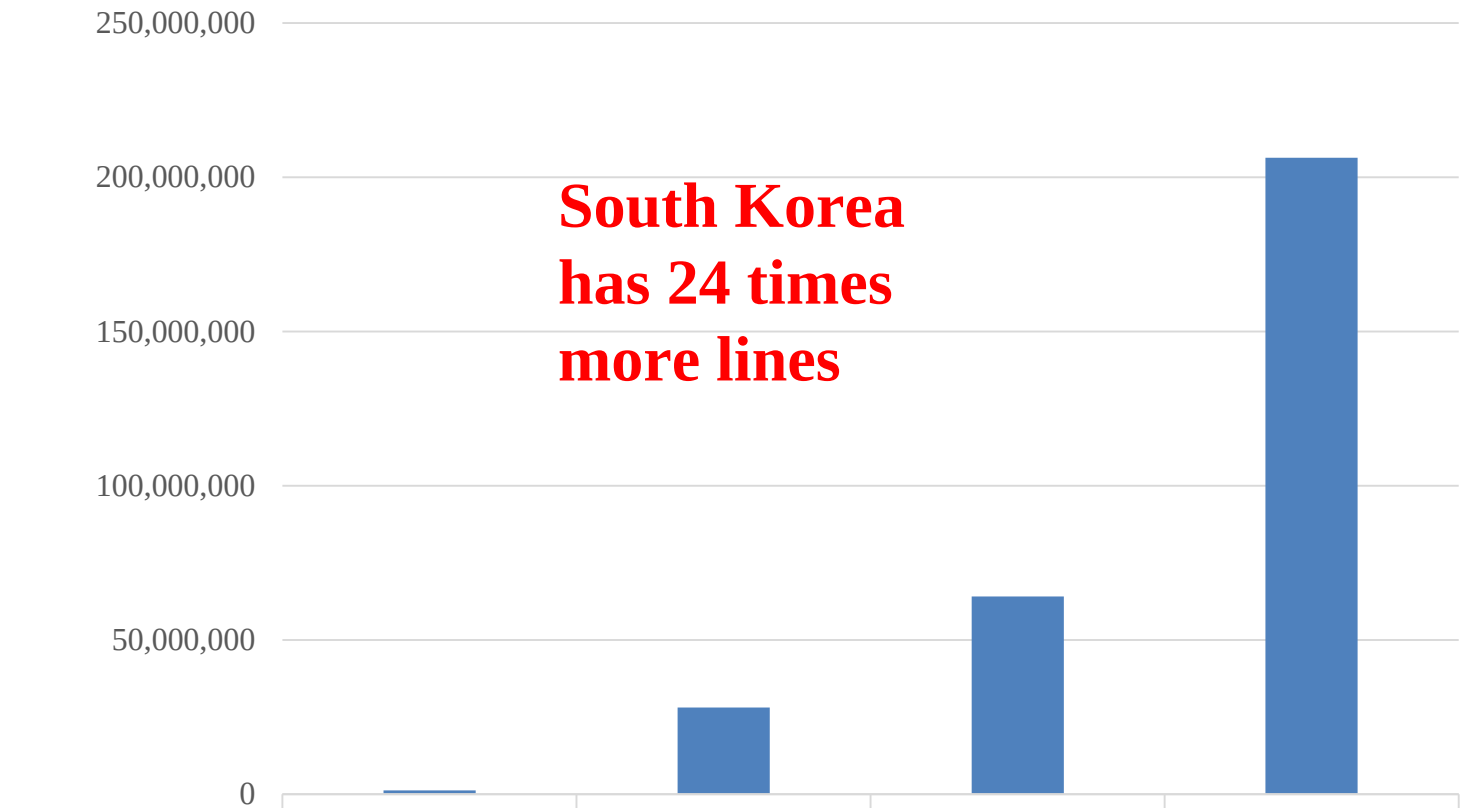
Telephones – Fixed Lines: Total Subscriptions, 2017



	North Korea	South Korea	Japan	China
Fixed Lines	1,180,000	28,035,600	64,024,938	206,264,000

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2150rank.html#kn

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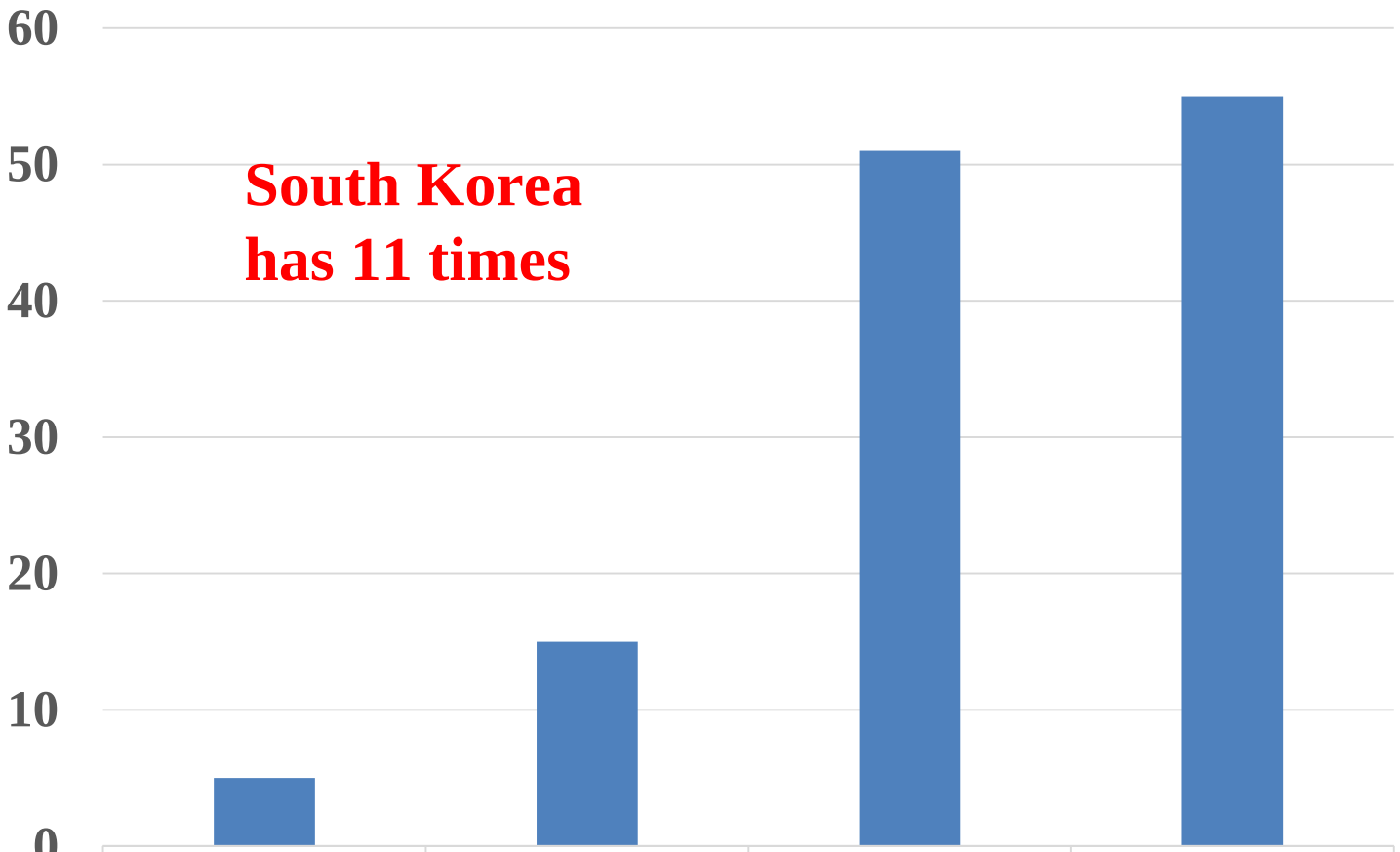
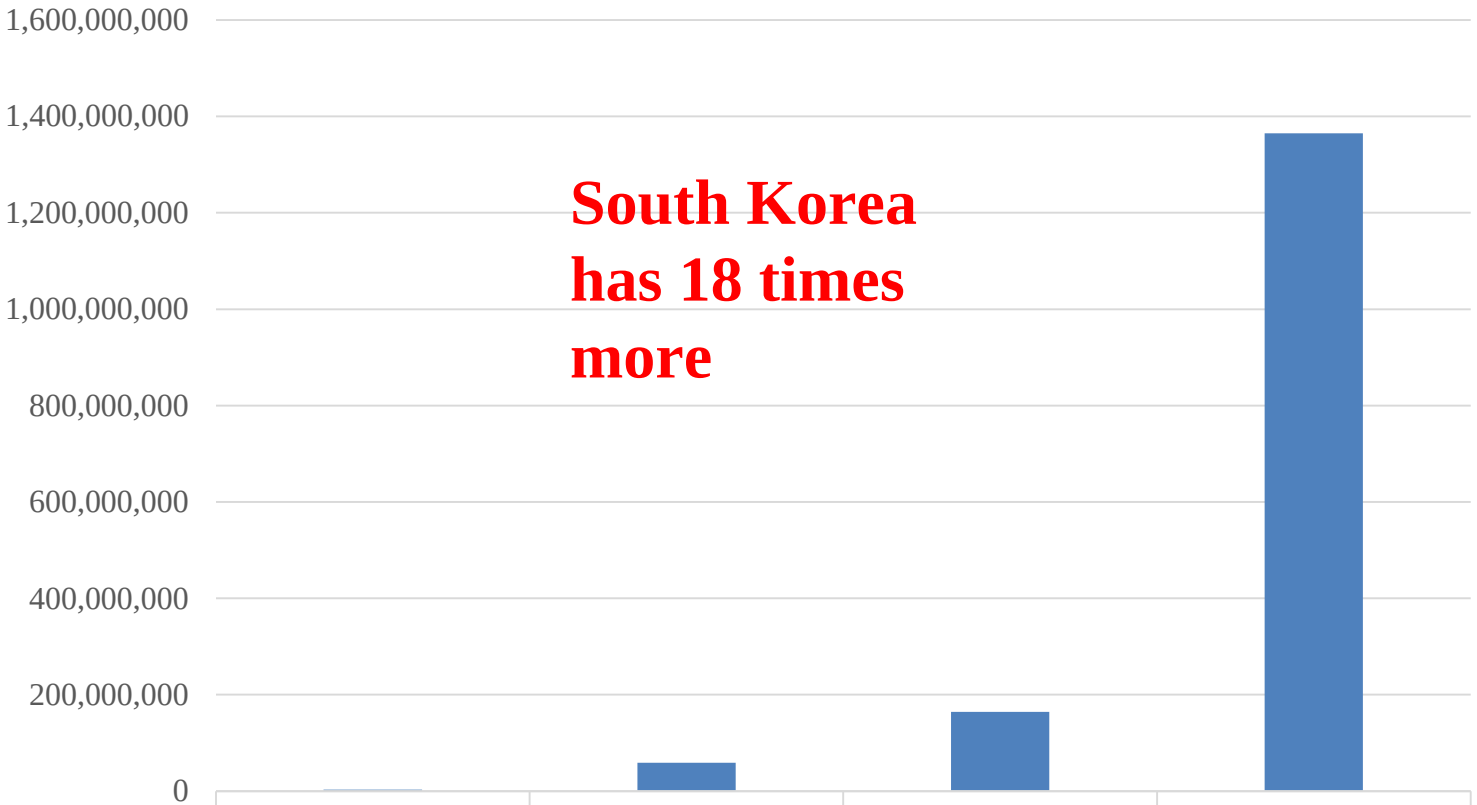
Telephones – Fixed Lines: Subscriptions per 100 Inhabitants, 2017



	North Korea	China	Japan	South Korea
/ 100 Inhabitants	5	15	51	55

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2150rank.html#kn

Telephones – Mobile Cellular, 2017



	North Korea	South Korea	Japan	China
Cellular	3,240,000	58,935,000	164,265,142	1,364,934,0

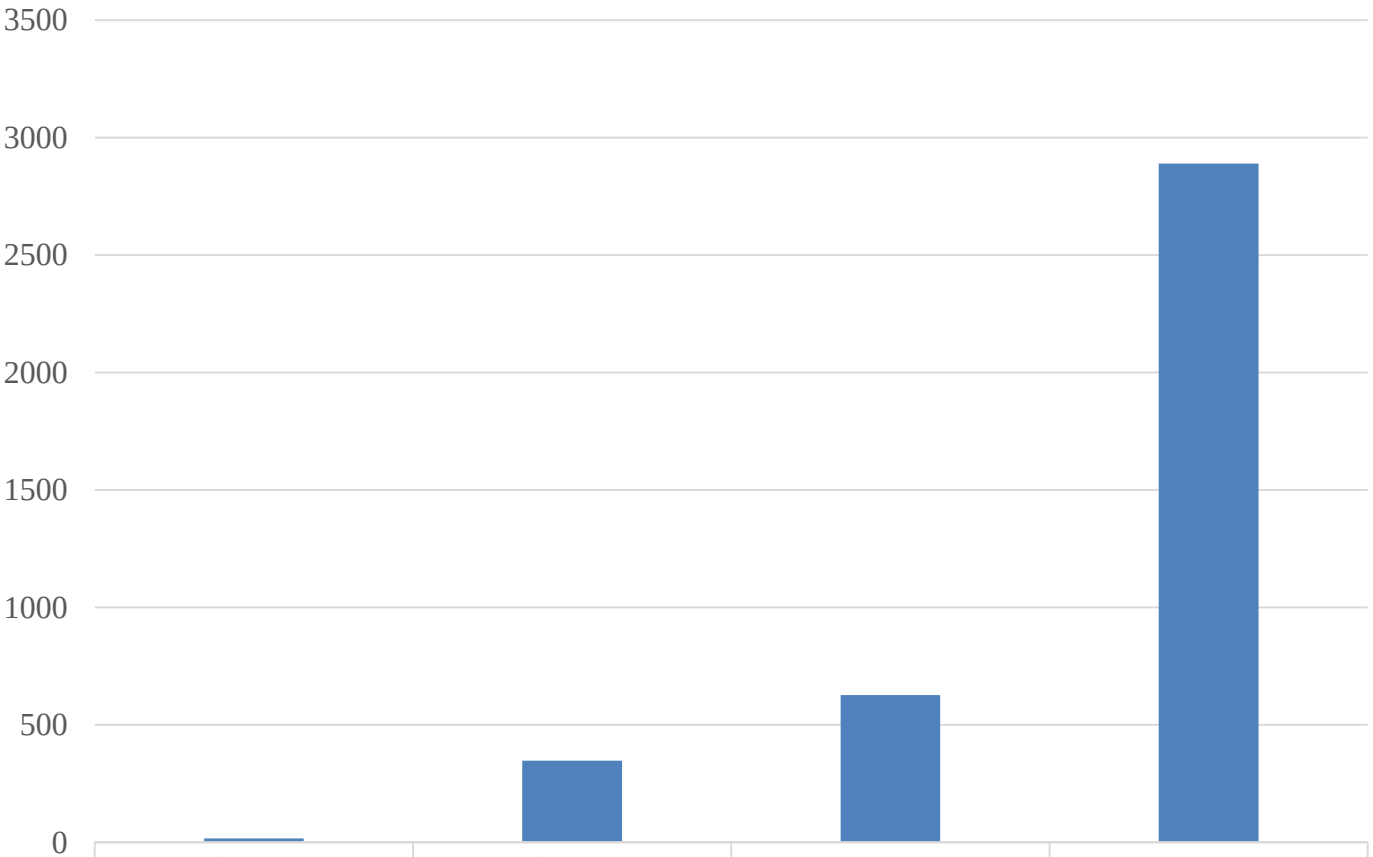
CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2151rank.html#kn

TRANSPORTATION

North versus South

- South Korea has a far more modern and survival transport system.
- South Korea has a modern civil air transportation system with competing airlines and and extensive international connections. North Korea has negligible civil air traffic by comparison.
- South Korea had 348 registered civil aircraft in 2017, carried 65.5 million passengers, and had 11,297 Mt K of air cargo, North Korea had 17 registered civil aircraft in 2017, carried 223,000 passengers, and had 1.6 Mt K of air cargo.
- South Korea has a modern pipeline system. North Korea has one short pipeline.
- North Korea is more reliant on rail transport: 7,435 kilometers versus 3,874 kilometers for the South.
- South Korea has a modern road system with 91,195 km of paved roads, including 4,193 km of expressways. North Korea has only 724 kilometers of paved road.
- South Korea 1,907 ships in its merchant marine vs. 248 for North Korea. It has 3 major container ports and 6 LNG terminals. North Korea has none.

Inventory of Registered Aircraft Operated by Air Carriers, by Country, 2017



	North Korea	South Korea	Japan	China
Aircraft	17	348	627	2890

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2269.html#kn

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Road, Rail, and Sea

North Korea

Pipelines:

oil 6 km (2013)

Railways:

total: 7,435 km

standard gauge: 7,435 km 1.435-m gauge (5,400 km electrified)

note: figures are approximate; some narrow-gauge railway also exists (2014)

country comparison to the world: 29

Roadways:

total: 25,554 km

paved: 724 km

unpaved: 24,830 km (2006)

country comparison to the world: 100

Waterways:

2,250 km (most navigable only by small craft) (2011)

country comparison to the world: 38

Merchant marine:

total: 248

by type: bulk carrier 6, container ship 3, general cargo 184, oil tanker 25, other 30 (2017)

country comparison to the world: 61

Ports and terminals:

major seaport(s): Ch'ongjin, Haeju, Hungnam, Namp'o, Songnim, Sonbong (formerly Unggi), Wonsan

South Korea

Pipelines:

gas 2,216 km; oil 16 km; refined products 889 km (2013)

Railways:

total: 3,874 km

standard gauge: 3,874 km 1.435-m gauge (2,727 km electrified) (2015)

country comparison to the world: 48

Roadways:

total: 99,025 km

paved: 91,195 km (includes 4,193 km of expressways)

unpaved: 7,830 km (2015)

country comparison to the world: 46

Waterways:

1,600 km (most navigable only by small craft) (2011)

country comparison to the world: 50

Merchant marine:

total: 1,907

by type: bulk carrier 100, container ship 89, general cargo 394, oil tanker 201, other 1,123 (2017)

country comparison to the world: 12

Ports and terminals:

major seaport(s): Busan, Incheon, Gunsan, Kwangyang, Mokpo, Pohang, Ulsan, Yeosu

container port(s) (TEUs): Busan (19,469,000), Kwangyang (2,327,000), Incheon (2,368,000) (2015)

LNG terminal(s) (import): Incheon, Kwangyang, Pyeongtaek, Samcheok, Tongyeong, Yeosu

CIA World Factbook, 2018, https://www.cia.gov/library/publications/the-world-factbook/fields/2269.html#kn

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Air

North Korea

National air transport system:

number of registered air carriers: 1

inventory of registered aircraft operated by air carriers: 17

annual passenger traffic on registered air carriers: 223,418

annual freight traffic on registered air carriers: 1,574,719 mt-k

Civil aircraft registration country code prefix:

P (2016)

Airports:

82 (2013)

country comparison to the world: 67

Airports - with paved runways:

total: 39

over 3,047 m: 3

2,438 to 3,047 m: 22

1,524 to 2,437 m: 8

914 to 1,523 m: 2

under 914 m: 4 (2017)

Airports - with unpaved runways:

total: 43

2,438 to 3,047 m: 3

1,524 to 2,437 m: 17

914 to 1,523 m: 15

under 914 m: 8 (2013)

Heliports:

23 (2013)

South Korea

National air transport system:

number of registered air carriers: 12

inventory of registered aircraft operated by air carriers: 348

annual passenger traffic on registered air carriers: 65,482,307

annual freight traffic on registered air carriers: 11.297 billion mt-km (2015)

Civil aircraft registration country code prefix:

HL (2016)

Airports:

111 (2013)

country comparison to the world: 53

Airports - with paved runways:

total: 71

over 3,047 m: 4

2,438 to 3,047 m: 19

1,524 to 2,437 m: 12

914 to 1,523 m: 13

under 914 m: 23 (2017)

Airports - with unpaved runways:

total: 40

914 to 1,523 m: 2

under 914 m: 38 (2013)

Heliports:

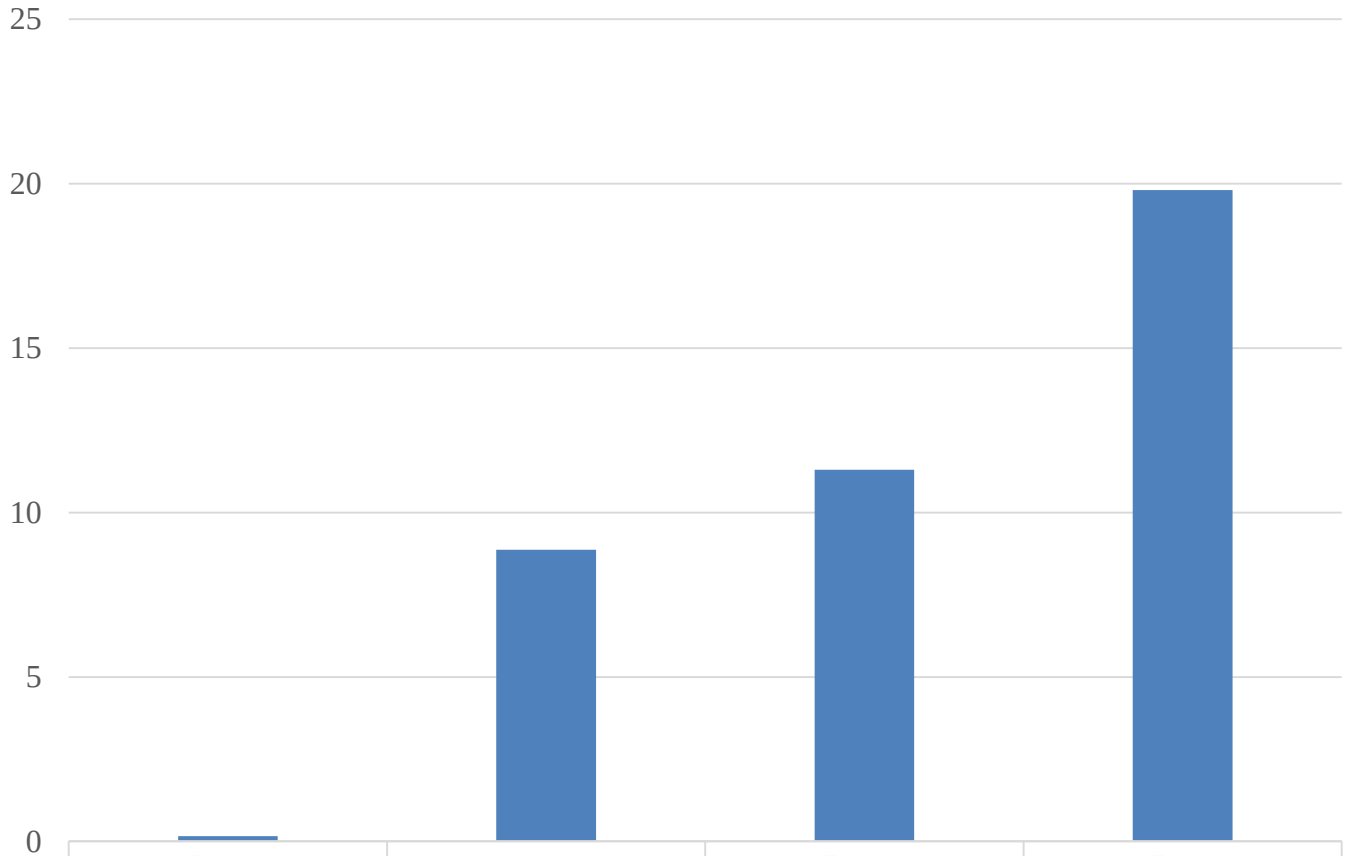
466 (2013)

CIA World Factbook, 2018, https://www.cia.gov/library/publications/the-world-factbook/fields/2269.html#kn

Comparative Civil International Air Traffic (Sample Hour)

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

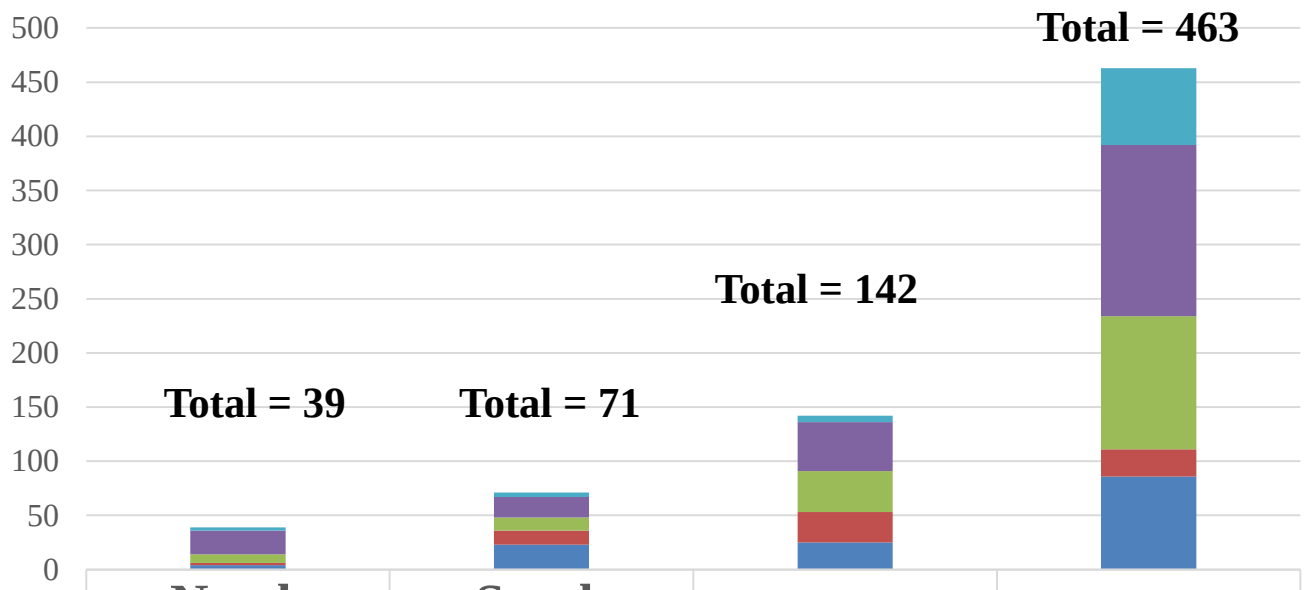
Annual Freight Traffic on Registered Aircraft Carriers, by Country, 2017 (billion mt-km)



	North Korea	Japan	South Korea	China
Aircraft	0.1574719	8.868745	11.297	19.806

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2269.html#kn

Airports (with paved runways), by Country, 2017



	North Korea	South Korea	Japan	China
Over 3,047 m	3	4	6	71
2,438 - 3,047 m	22	19	45	158
1,524 - 2,437 m	8	12	38	123
914 - 1,523 m	2	13	28	25
Under 914 m	4	23	25	86

CIA World Factbook, 2017
https://www.cia.gov/library/publications/the-world-factbook/fields/2030.html#kn

U.S. Military Forces Affecting (and Affected By) the Korean Balance

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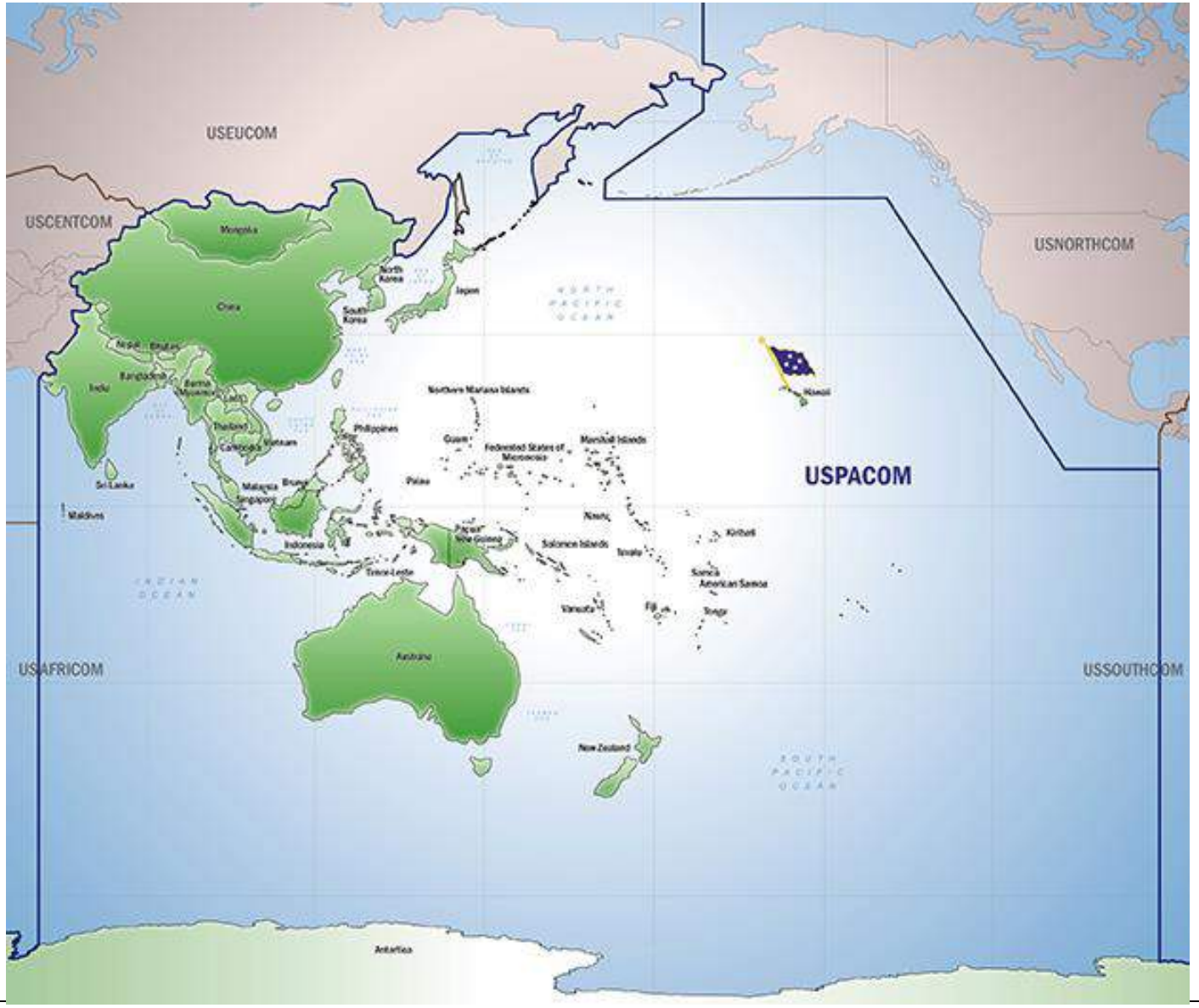
U.S. Forces in PACOM

Approximately 375,000 U.S. military and civilian personnel are assigned to USPACOM and its different components across the Indo-Asia-Pacific region. According to USPACOM, those assignments are broken out as follows:

- **Approximately 28,500 U.S. service members and their families are stationed in the Republic of Korea, while U.S. Forces Japan consists of approximately 54,000 military personnel and their dependents. As of September 2016, approximately 5,000 service members and their families were stationed in Guam.**
- **U.S. Pacific Fleet consists of approximately 200 ships (including five aircraft carrier strike groups), nearly 1,100 aircraft, and more than 130,000 sailors and civilians.**
- **Marine Corps Forces, Pacific includes two Marine Expeditionary Forces and about 86,000 personnel and 640 aircraft.**
- **U.S. Pacific Air Forces comprises approximately 46,000 airmen and civilians and more than 420 aircraft.**
- **U.S. Army Pacific has approximately 106,000 personnel from one corps and two divisions, plus over 300 aircraft assigned throughout the AOR.**
- **These component command personnel figures also include more than 1,200 Special Operations personnel. Department of Defense civilian employees in the Pacific Command AOR number about 38,000.**

Kathleen J. McInnis and others, "The The North Korean Nuclear Challenge: Military Options and Issues for Congress," Congressional Research Service, www.crs.gov, R44994, November 6, 2017

U.S. Pacific Command AOR



USPACOM, http://www.pacom.mil/About-USPACOM/USPACOM-Area-of-Responsibility/, 4.18

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U.S. Allies and Bases in Region

Light blue denotes a treaty ally or an actual part of the United States. | (CSIS)

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

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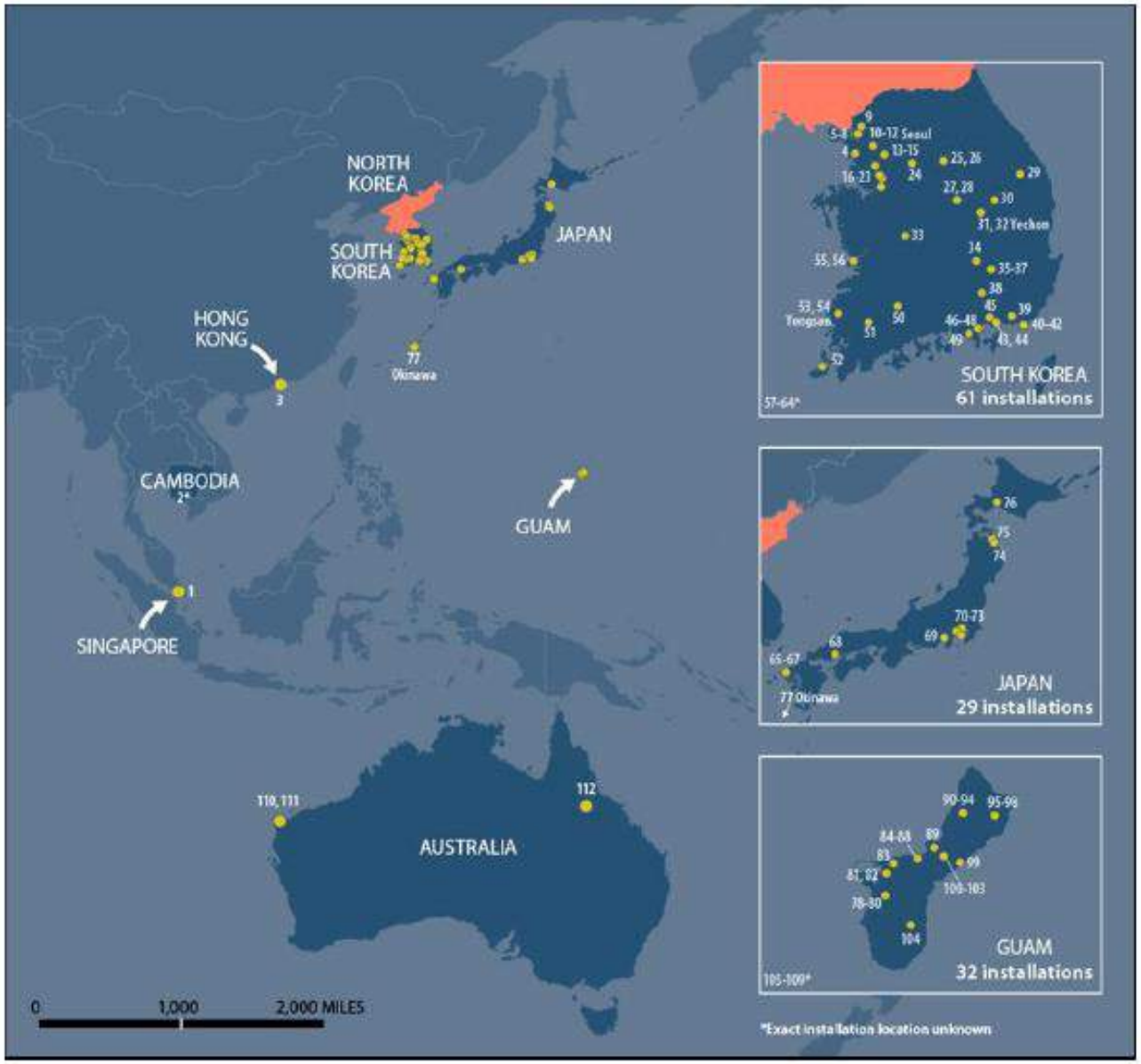
U.S. Bases in Pacific



Sources: Graphic created by CRS. Information generated by Hannah Fischer using data from the Department of Defense Base Structure Report, FY2015, available at https://www.acq.osd.mil/eie/Downloads/BSI/Base%20Structure%20Report%20FY15.pdf; Department of State (2015); Esri (2016).

Kathleen J. McInnis and others, "The The North Korean Nuclear Challenge: Military Options and Issues for Congress," Congressional Research Service, www.crs.gov, R44994, November 6, 2017

U.S. Joint Pacific Exercises in a "Normal" Year

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

U.S. Major Exercises in South Korea in a "Normal" Year

Integrated operation plans include the Ulchi Focus Lens (UFL) exercise, the Reception, Staging, Onward Movement & Integration (RSOI) exercise, the Foal Eagle (FE) exercise, the Team Spirit (TS) exercise, and others.

The Team Spirit exercise, held between 1976 and 1993 by the U.S. and South Korean militaries, was canceled in hopes North Korea would abandon its nuclear program and allow international inspections. Team Spirit continued to be scheduled from 1994 to 1996 but was canceled each year as an incentive to improve relations. About 200,000 U.S. and South Korean service members participated in Team Spirit.

Ulchi Focus Lens, scheduled annually in August, is a computer-based war game exercise with few field activities. About 56,000 South Korean and 20,000 U.S. service members participate. The exercise focuses on how U.S. and South Korean forces would defend against a North Korean attack. North Korea usually denounces the exercise, calling it a preparation for war. The tank crossing on the Han River was one of the most visual parts of Ulchi Focus Lens. Ulchi Focus Lens also included mock air raids and chemical weapons attacks on the capital during which all streets were cleared.

There are now three annual exercises focused on the defense of the Republic of Korea.

- **The first exercise, taking place around April, is Reception, Staging, Onward Movement, and Integration (RSO&I). RSO&I involves simulating the large-scale movement of troops onto the Korean peninsula. At this stage of the simulated engagement, a war with North Korea is imminent, but actual fighting has not yet begun.**
- **The second of the three exercises is Ulchi Focus Lens (UFL), where the first few days of engagement are practiced in a computer-simulated environment.**
- **Foal Eagle continues the scenario and expands upon it using real troops and actual assets in live training environment exercises.**

Adapted from Global Security, https://www.globalsecurity.org/military/ops/ex-usfk.htm.

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U.S. Forces in South Korea

US Pacific Command • 28,500

US Army 19,200

FORCES BY ROLE

1 HQ (8th Army) at Seoul; 1 div HQ (2nd Inf) located at Tongduchon; 1 armd bde; 1 (cbt avn) hel bde; 1 MRL bde; 1 AD bde; 1 SAM bty with THAAD

EQUIPMENT BY TYPE

M1 *Abrams*; M2/M3 *Bradley*; M109; M270 MLRS; AH-64 *Apache*; OH-58D *Kiowa Warrior*; CH-47 *Chinook*; UH-60 *Black Hawk*; MIM-104 *Patriot*/FIM-92A *Avenger*; 1 (APS) armd bde eqpt set

US Navy 250

USAF 8,800

FORCES BY ROLE

1 (AF) HQ (7th Air Force) at Osan AB; 1 ftr wg at Osan AB with (1 ftr sqn with 20 F-16C/D *Fighting Falcon*; 1 atk sqn with 24 A-10C *Thunderbolt* II); 1 ftr wg at Kunsan AB with (2 ftr sqn with 20 F-16C/D *Fighting Falcon*); 1 ISR sqn at Osan AB with U-2S

USMC 250

IISS, Military Balance, 2018, p.60.

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U.S. Forces in Japan

US Pacific Command • 39,950

US Army 2,900; 1 corps HQ (fwd); 1 SF gp; 1 avn bn; 1 SAM bn

US Navy 11,700; 1 HQ (7th Fleet) at Yokosuka; 1 base at Sasebo; 1 base at Yokosuka

FORCES BY ROLE

3 FGA sqn at Atsugi with 10 F/A-18E *Super Hornet*; 1 FGA sqn at Atsugi with 10 F/A-18F *Super Hornet*; 1 EW sqn at Atsugi with 5 EA-18G *Growler*; 1 AEW&C sqn at Atsugi with 5 E-2D *Hawkeye*; 2 ASW hel sqn at Atsugi with 12 MH-60R; 1 tpt hel sqn with 12 MH-60S

EQUIPMENT BY TYPE

1 CVN; 3 CGHM; 2 DDGHM; 7 DDGM (2 non-op); 1 LCC; 4 MCO; 1 LHD; 1 LPD; 2 LSD

USMC 13,600

FORCES BY ROLE

1 mne div; 1 mne regt HQ; 1 arty regt HQ; 1 recce bn; 1 mne bn; 1 amph aslt bn; 1 arty bn; 1 FGA sqn with 12 F/A-18C *Hornet*; 1 FGA sqn with 12 F/A-18D *Hornet*; 1 FGA sqn with 12 F-35B *Lightning* II; 1 tkr sqn with 12 KC-130J *Hercules*; 2 tpt sqn with 12 MV-22B *Osprey*

USAF 11,450

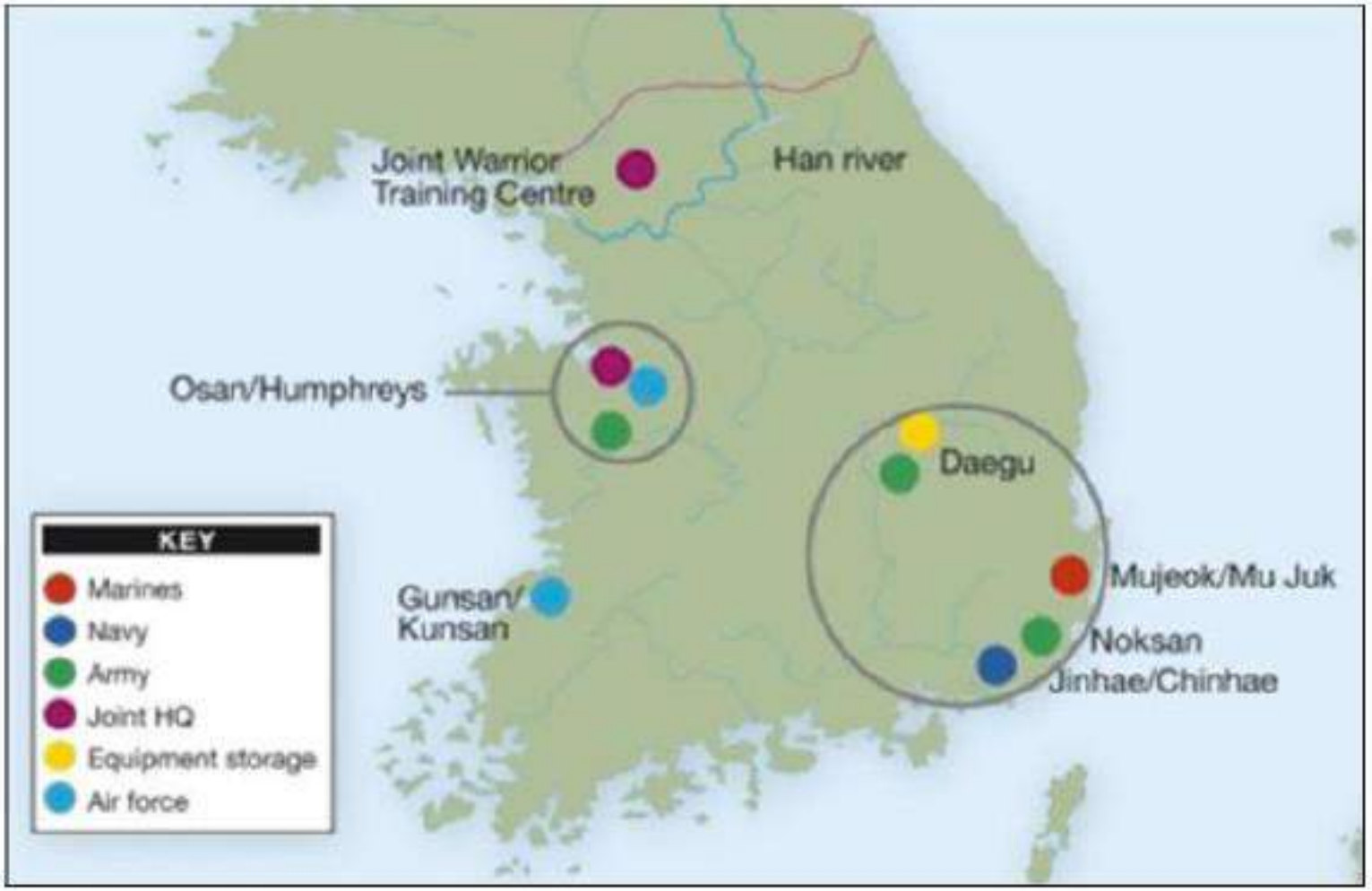
FORCES BY ROLE

1 HQ (5th Air Force) at Okinawa – Kadena AB; 1 ftr wg at Misawa AB with (2 ftr sqn with 22 F-16C/D *Fighting Falcon*); 1 wg at Okinawa – Kadena AB with (2 ftr sqn with 27 F-15C/D *Eagle*; 1 FGA sqn with 12 F-35A *Lightning* II; 1 tkr sqn with 15 KC-135R *Stratotanker*; 1 AEW&C sqn with 2 E-3B/C *Sentry*; 1 CSAR sqn with 10 HH-60G *Pave Hawk*); 1 tpt wg at Yokota AB with 10 C-130H *Hercules*; 3 Beech 1900C (C-12J); 1 Spec Ops gp at Okinawa – Kadena AB with (1 sqn with 5 MC-130H *Combat Talon*; 1 sqn with 5 MC-130J *Commando* II); 1 ISR sqn with RC-135 *Rivet Joint*; 1 ISR UAV flt with 5 RQ-4A *Global Hawk*

US Strategic Command • 1 AN/TPY-2 X-band radar at Shariki; 1 AN/TPY-2 X-Band radar at Kyogamisaki

IISS, Military Balance, 2018, p.60.

U.S. Base Alignment to South



Source: *Jane's Sentinel Security Assessment—China and Northeast Asia*, April 15, 2010.

Kathleen J. McInnis and others, "The The North Korean Nuclear Challenge: Military Options and Issues for Congress," Congressional Research Service, www.crs.gov, R44994, November 6, 2017

Conventional Military Balance

North versus South: Quality vs. Quantity - I

- **Massive North Korean theater and conventional forces for a country of its size in spite of economic weakness: Numerical parity or superiority over South Korea/**
- **This force size raises critical questions about current estimates of North Korea's GDP, and the need for credible estimates of the cost of its military efforts. Put simply, it simply is not clear how North Korea can generate forces so large with an economy the size the CIA estimates.**
- **One possible answer lies in the slow rate of modernization in North Korea's forces. Aside from it ICBMs and MRBM, most of its forces and missiles are based on Soviet designs that date back decades to the Cold War.**
- **Its armor are mixes of T-34/T-54/T-55/T-62/Type-59/Chonma/Pokpoongs -- largely obsolete or obsolescent main battle tanks and obsolete PT-76 light tanks.**
- **Other armored vehicles are largely personnel carriers, rather than fighting vehicles, and while its artillery and artillery rocket are effective, its forces have limited numbers of self-propelled systems.**
- **Does have significant asymmetric naval forces, special forces elements, and relatively modern submersibles. However, its surface navy is also aging, and highly dependent on the SS-N-2 anti-ship missile -- a system that has been significantly upgraded over time, but was developed in the 1960s. Its larger Romeo submarines date back to the 1950s.**

North versus South : Quality vs. Quantity - II

- **North Korea's bombers are obsolete IL-28 Beagles which first flew in1948, and Russia withdrew from service in 1980.**
- **It has no really advanced modern fighters and half of its combat strength consists of MiG-15s, MiG-17s, and MiG-19s. It relies heavily on aging MiG-23s and MiG-21bis, and its most advanced fighters are 18 export versions of the MiG-29.**
- **Its only "modern" attack aircraft consists of 34 Su-25s -- an inferior and dated version of the U.S. A-10.**
- **Its surface-to-air missiles consist largely of 38 obsolescent S-200s SA-5s), 179 Cold War-era SA-2 and 133 Cold War-era SA-3s.**
- **The sheer mass of this forces, its readiness, and the proximity of significant elements to the DMZ boundary of South Korea still make it extremely dangerous, as do the capabilities of its large asymmetric forces, but South Korea has far more modern land, naval, and air forces.**

(For a detailed assessment of the North Korean and South Korean balance see Anthony H. Cordesman with the assistance of Charles Ayers, *The Military Balance in the Koreas and Northeast Asia, 2017*, CSIS, https://www.csis.org/analysis/web-book-military-balance-koreas-and-northeast-asia.)

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Guessing at Military Spending

(Varying estimates for key powers. No credible estimates of North Korea)

- **North Korea: No IISS or SIPRI estimates. Some guess around $6 billion, and 22% of GDP. Earlier State estimates put at $3.5 to $4 billion. One claim is 15.9% of budget.**
- **South Korea: IISS puts IISS puts at $35.7 billion in 2017. SIPRI puts at $36.8 billion in 2016.**
- **Japan: IISS puts at $46 billion in 2017. SIPRI puts at $46.1 billion in 2016.**
- **China: IISS puts at $150.5 billion in 2017. SIPRI puts at $215.2 billion in 2016. ($225-255 billion in 2017?)**
- **United States: IISS puts at $602.8 billion in 2017. SIPRI puts at $611.2 billion in 2016.**

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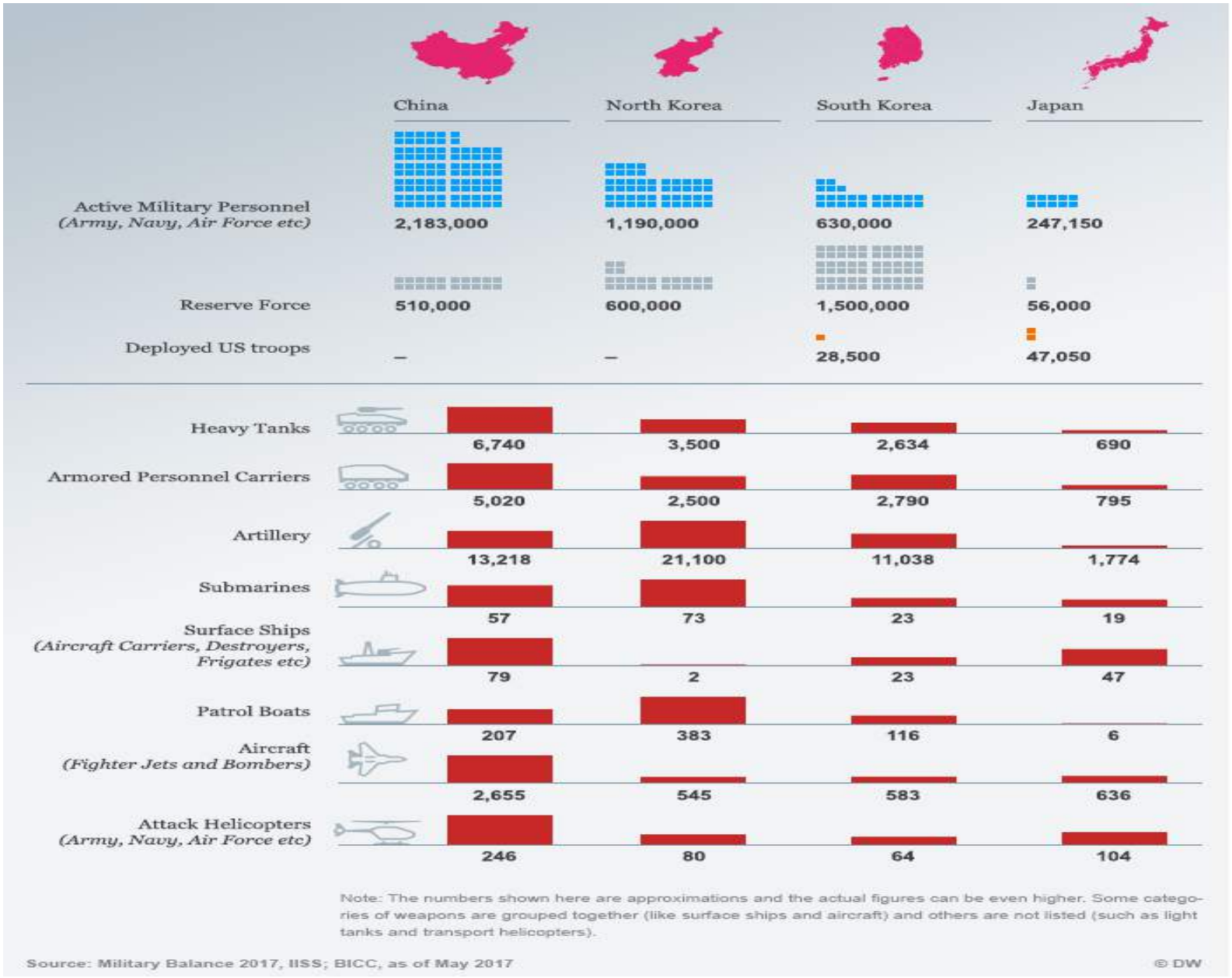
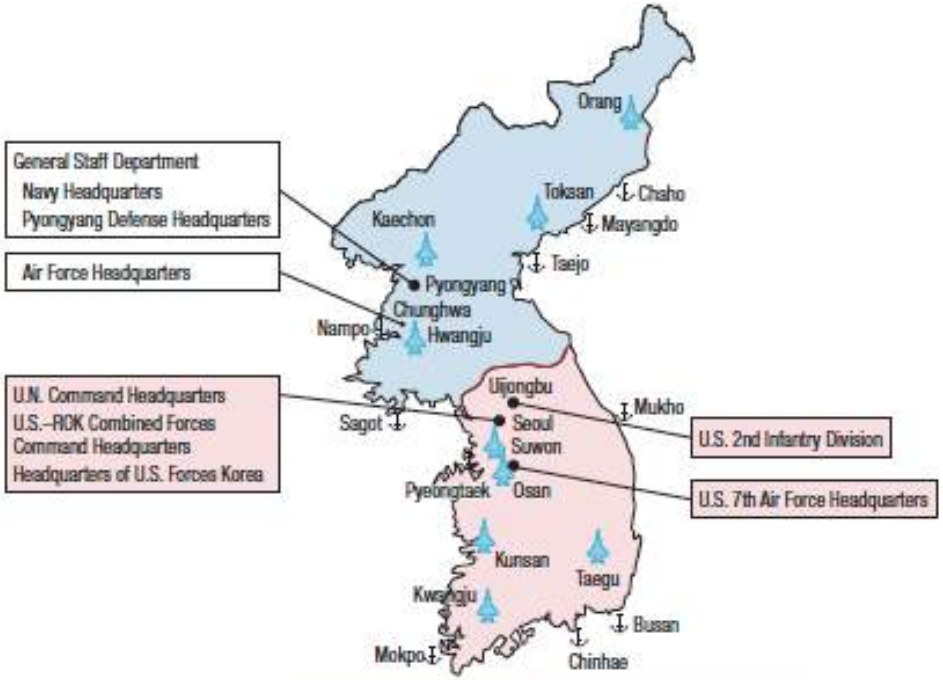
DW Estimate of Balance 2017



Deutsche Welle, "US report warns of China military development overseas," 7.6.17, http://www.dw.com/en/us-report-warns-of-china-military-development-overseas/a-39138715

Japanese Estimate of Korean Balance 2017



		North Korea	ROK	U.S. Forces in Korea
Total armed forces		Approx. 1.19 million personnel	Approx. 630,000 personnel	Approx. 23,000 personnel
Army	Ground troops	Approx. 1.02 million personnel	Approx. 495,000 personnel	Approx. 15,000 personnel
	Tanks	T-62, T-54/-55, etc. Approx. 3,500	M-48, K-1, T-80 etc. Approx. 2,400	M-1
Navy	Naval vessels	Approx. 780; 104,000 tons	Approx. 240; 213,000 tons	Supporting corps only
	Destroyers Frigates Submarines	4 20	12 10 13	
	Marines		Approx. 29,000 personnel	
Air Force	Combat aircraft	Approx. 560	Approx. 620	Approx. 80
	3rd and 4th generation fighter aircraft	Mig-23 x 56 Mig-29 x 18 Su-25 x 34	F-4 x 70 F-16 x 163 F-15 x 60	F-16 x 60
Reference	Population	Approx. 25.1 million	Approx. 50.9 million	
	Term of service	Men: 12 years Women: 7 years	Army: 21 months Navy: 23 months Air Force: 24 months	

Note: Data from "The Military Balance 2017," etc. Data for the troop strength of the United States Forces Korea (USFK) from U.S. DoD Information (December 2016).

Japanese Ministry of Defense, Defense of Japan, 2017, http://www.mod.go.jp/e/publ/w_paper/2017.html, p. 59

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South Korean Estimate of Korean Balance 12/2016

As of December 2016

Category				South Korea	North Korea
Troops (peacetime)	Army			490,000	1,100,000
	Navy			70,000 (including 29,000 Marine Corps troops)	60,000
	Air Force			65,000	110,000
	Strategic Force			-	10,000
	Total			625,000	1,280,000
Major Forces	Army	Units	Corps	12 (including Special Warfare Command)	17
			Divisions	43 (including Marine Corps)	82
			Maneuver Brigades	15 (including Marine Corps)	74 (Reserve Military Training Brigade not included)
		Equipment	Tanks	2,400 (including Marine Corps)	4,300
			Armored Vehicles	2,700 (including Marine Corps)	2,500
			Cannons	5,700 (including Marine Corps)	8,600
			MLRS/MRLs	200	5,500
			Ground-to-ground missiles	60 launchers	100 launchers (Strategic force)
	Navy	Surface Vessels	Combatants	110	430
			Amphibious ships	10	250
			Mine warfare vessels (mine sweeping boats)	10	20
			Support and auxiliary vessels	20	40
		Submarines		10	70
	Air Force	Combat aircraft		410	810
		Surveillance & control aircraft		60 (including those belonging to the Navy)	30
		Transport aircraft (including AN-2)		50	330
		Trainers		180	170
	Helicopters (Army/Navy/Air Force)			690	290
Reserve Troops				3,100,000 (including officer candidates, wartime labor call, and secondment and alternative service personnel)	7,620,000 (including Reserve Military Training Unit, Worker-Peasant Red Guards, and Red Youth Guard)

- Units and equipment of the Marine Corps are included in the number of units and equipment of the Army to compare military strength between the two Koreas.
- North Korean cannon numbers do not include 76.2 mm guns that are infantry regiment-level artillery.
- The table above is a result of quantitative comparisons based on disclosable data, as qualitative assessments are limited.

South Korean Ministry of Defense, Whir Paper 2016, 2017, Appendix, http://www.mod.go.jp/e/publ/w_paper/2017.html, p. 267

The Classic Military Balance – I
Strategic and Nuclear Forces

	North Korea	South Korea	Japan	China
Strategic Forces - Total[d]				
Personnel	20,000	0	0	
Nuclear Weapons	8-24	0	0	270+
Deployed	-	0	0	270?
Stockpiled	8-24?	0	0	?
Retired	-	0	0	NA
ICBMs	6+	0	0	70
IRBM	12	0	0	16
MRBM	20+	0	0	146
SRBM	30+	0	0	189
Bombers	?	0	0	26?
SLBMs	0	0	0	12-48
SSBNs	0	0	0	4
GLCM	0	0	0	54

[d] Nuclear and conventional. North Korean ICBM and IRBM estimates seem speculative.

Source: Estimate by Anthony H. Cordesman based upon open source material in Hans M. Kristensen and Robert S. Norris, "Status of World Nuclear Forces," Federation of American Scientists (FAS), 26 May 2016, available at: http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/; U.S. Nuclear *Posture Review*, February 2018, and the IISS *Military Balance 2018*.

DoD Assessment of North Korean Forces – 2/2018 - I

North Korea's conventional force continues to emphasize large defensive and asymmetric attack capabilities to counter the technologically superior forces of the U.S. and ROK Alliance. The (North) Korean People's Army's (KPA) large artillery force is deployed along the demilitarized zone (DMZ), posing a constant threat to the Greater Seoul Metropolitan Area (GSMA). In 2016, the North publicized tests of a new close-range ballistic missile (CRBM), the KN-SS-X-9, which, if deployed, could extend North Korea's artillery reach to U.S. Garrison Humphreys (current location of U.S. 8th Army HQ and future location of U.S. Forces Korea and the United Nations Command) and beyond. North Korea uses offensive cyberoperations as a cost-effective and deniable asymmetric tool to carry out regime goals on a global scale.

…North Korea's force-modernization goals are aimed at enhancing the credibility of its strategic capabilities by advancing its nuclear and missile programs, and retaining sufficient conventional strength to inflict large-scale damage on the ROK and defend North Korea in the event of an invasion or attack. North Korea is attempting to accomplish this through modest levels of production on new systems and maintaining the credibility of its conventional forces through more realistic training. North Korea directs its scarce resources to areas where it sees the potential for localized comparative advantage.

North Korea offsets logistic resupply problems, resource shortages, and dated equipment by maintaining a large, forward-positioned force. This allows North Korea the ability to initiate an attack against the ROK with little to no warning.

…The Korean People's Army (KPA)—a large, ground-force–centric organization comprising ground, air, naval, missile, and special operations forces (SOF) units—has more than 1 million soldiers, making it the world's fourth-largest military. Six percent of North Korea's 25 million people serve on active duty, and another 25 to 30 percent are assigned to a reserve or paramilitary unit subject to wartime mobilization. About 70 percent of North Korea's ground forces and 50 percent of its air and naval forces are deployed within approximately 60 miles of the Demilitarized Zone (DMZ), making the KPA a continuous threat to ROK and U.S. forces. The KPA's general disposition has not changed in the last two years.

Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018,*

DoD Assessment of North Korean Forces – 2/2018 - II

The KPA primarily fields legacy equipment either produced in or based on designs from the former Soviet Union and China dating to the 1950s, 1960s, and 1970s. Although a few weapon systems are based on modern technology, the KPA has not kept pace with regional military developments. The KPA has not acquired new fighter aircraft in decades, relies on older air defense systems, lacks ballistic missile defense, and its Navy does not train for blue water operations.

North Korea exercises control of the KPA through overlapping state, military, and party organizations. North Korea's State Affairs Commission is the official state authority over the North's military and security services. The Ministry of People's Armed Forces is the KPA's administrative superior, and the General Staff Department exercises operational command and control.

North Korea has a nationwide fiber-optic network and has invested in a modern nationwide cellular network. However, telecommunication services and access are strictly controlled, and all networks are available for military use.

Adapted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018,*

The Classic Military Balance – II: Spending, Personnel and Land Forces

	North Korea	South Korea	Japan	China
Directly Comparable Military Spending (2017)				
SUS Billions	ND	35.7	46.0	$150.5[a]
% of GDP	ND			1.26%
Total Active Military Personnel	1,280,000	625,000	247,150	2,035,000
Paramilitary Personnel	189,000	9,000	13,740	100,000+
Land Forces				
Active Military Personnel	1,100,000	490,000	154,850	975,000-1,150,000
Special Forces Command	88,000	-	-	-
Reserves	600,000	3,100,000[b]	46,000	510,000?
Main Battle Tanks	3,500+	2,514	690	6,740
Heavy Other Armored	3,092	3,330	974	9,870+
SP/Towed Tube Artillery	8,500	4,853	570	8,460
MRLs	5,100	214+	99	1,872
Mortars	7,500	6,000	1,105	2,586
SSM	24+	30+	0	?
Active Attack Helicopters	0?	96	104	240

[a] Does not include substantial expenses. Real figure may exceed $200 billion.

[b] Total pool subject to call up, not deployable forces.

Source: Estimate by Anthony H. Cordesman based upon open source material in Hans M. Kristensen and Robert S. Norris, "Status of World Nuclear Forces," Federation of American Scientists (FAS), 26 May 2016, available at: http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/; U.S. Nuclear *Posture Review*, February 2018, and the IISS *Military Balance 2018*.

DoD Assessment of North Korean Ground Forces – 2/2018

The KPA's ground forces are predominantly regular and light infantry units supported by armored and mechanized units and heavy concentrations of artillery. These forces are forward-deployed, fortified in several thousand underground facilities, and include long-range cannon and rocket artillery forces that are capable of reaching targets in Seoul from their garrisons.

The ground forces have numerous light and medium tanks and many armored personnel carriers. The KPA's large artillery force includes long-range 170-mm guns and 240-mm multiple rocket launchers (MRLs), many deployed along the DMZ posing a constant threat to northern parts of the ROK.

North Korea publicized multiple tests of the KN-SS-X-9 CRBM, the most recent occurring in March 2016, after which Kim Jong Un declared it ready for deployment. If added to the North's ground forces, this system with a range of 118 miles could extend North Korea's long-range artillery and rocket threat to points south of U.S. Garrison Humphreys. In recent years, North Korea has unveiled other new ground-forces equipment, including tanks, artillery guns, armored vehicles, and infantry weapons.

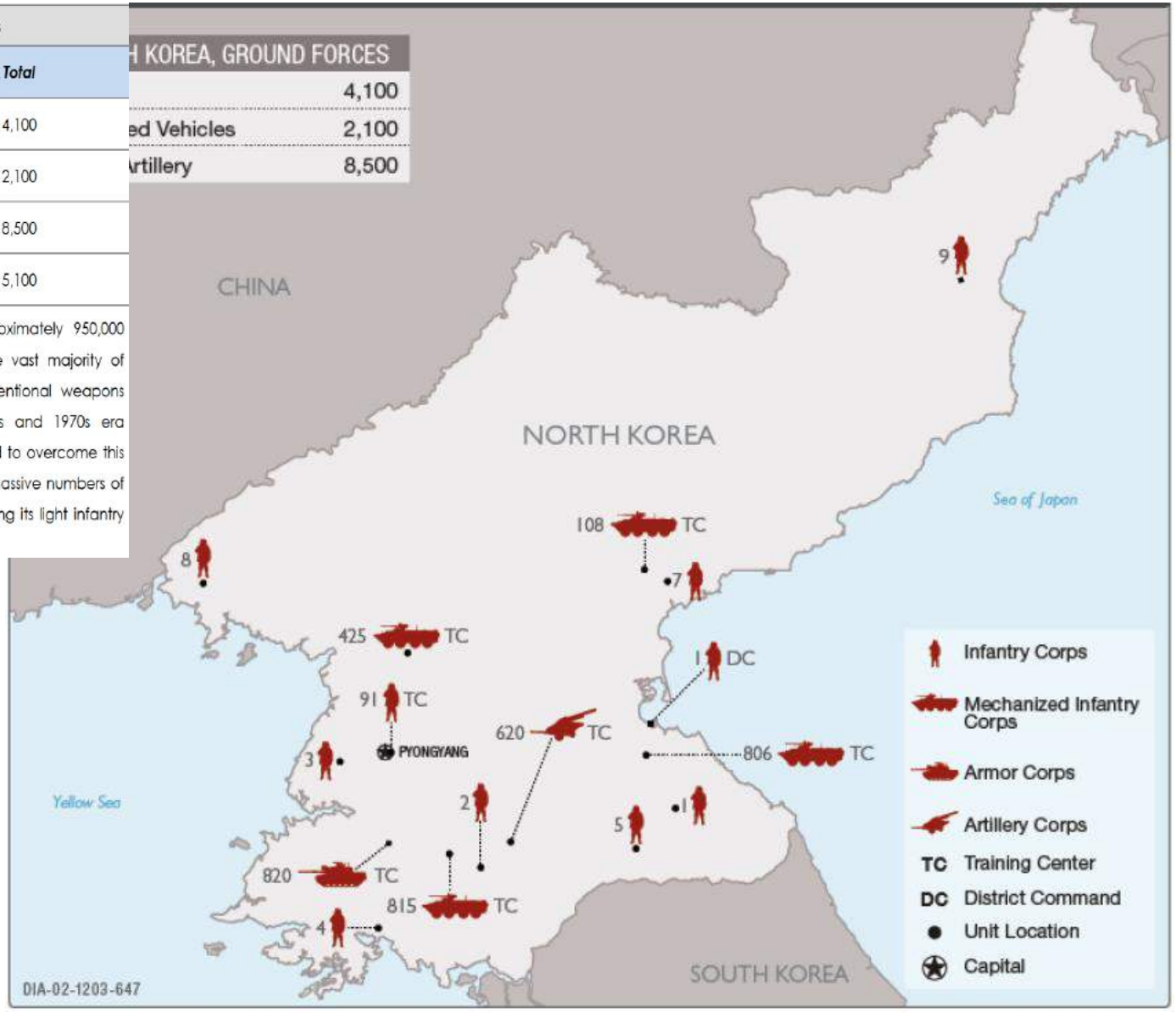
North Korea periodically conducts large live-fire exercises and firepower demonstrations, often coinciding with important national holidays or observances. In one such event held on April 25, 2017, to celebrate the 85th anniversary of the KPA's founding, North Korea fired more than 300 heavy weapons along the east coast into the ocean. These pre-planned, pre-scripted, showcase events are intended for internal propaganda and to demonstrate continued capacity to inflict substantial casualties and damage on the ROK, including in the GSMA.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 11-12*

North Korean Land Forces - 2012

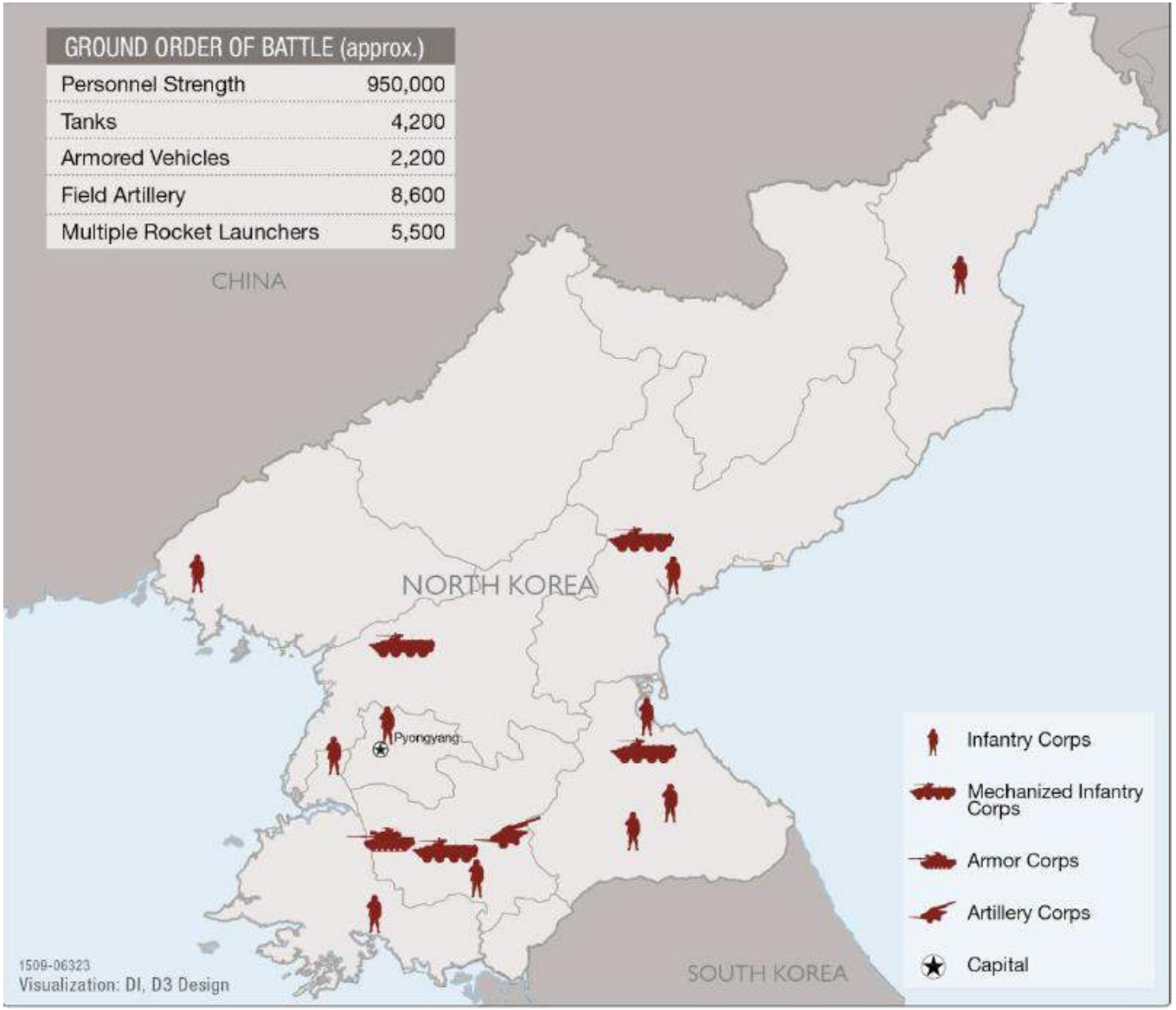
North Korea, Ground Forces	
	Total
Tanks	4,100
Armored Vehicles	2,100
Field Artillery	8,500
MRLs	5,100

Note: With a maximum strength of approximately 950,000 personnel, the ground forces comprise the vast majority of North Korea's military. Most of the conventional weapons systems were developed based on 1960s and 1970s era technology. However, they have attempted to overcome this technological disadvantage by relying on massive numbers of artillery systems while simultaneously increasing its light infantry forces.



Military and Security Developments Involving the Democratic People's Republic of Korea 2012
A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, p. 11

North Korean Land Forces - 2017



Department of Defense, ***Military and Security Developments Involving the Democratic People's Republic of Korea 2017,***
A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018,
p. 18

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The Classic Military Balance: Naval and Marine - III

	North Korea	South Korea	Japan	China
Naval Forces, Marine Corps, and Coast Guard				
Total Active Military Personnel	60,000	70,000	66,990[e]	281,000[e]
Carriers	0	0	4(CVH)	1
Other Major Surface Ships	2	25	43	82
Patrol and Corvettes	383	104	6	206
Missile	55+	33	6	128
Tactical SSN	0	0	0	0
Other Missile Submarines	1	0	0	1
Attack/SSK	20	0	19	48
Other Submarines	32	0	0	?
Mine Warfare	24	10	26	42
Landing/Amphibious Ships/LSTs	10	7	3	83
Landing Craft	257	22	8	87
Fixed Wing, Combat-Capable				
Naval & Marine Aviation	NA	16	74	374
Active Marine Personnel	NA	29,000	0	15,000
Marine Main Battle Tanks	NA	100	0	0
Marine Other Armor	NA	166	0	163
Marine Artillery	NA	?	0	40+

[e] Does not include coast guard

Source: Estimate by Anthony H. Cordesman based upon open source material in Hans M. Kristensen and Robert S. Norris, "Status of World Nuclear Forces," Federation of American Scientists (FAS), 26 May 2016, available at: http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/; U.S. Nuclear *Posture Review*, February 2018, and the IISS *Military Balance 2018*.

North Korean Naval Forces -2012

Military and Security Developments Involving the Democratic People's Republic of Korea 2012
A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, p. 13

North Korean Naval Forces - 2017

Department of Defense, ***Military and Security Developments Involving the Democratic People's Republic of Korea 2017,*** *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 20*

DoD Assessment of North Korean Naval Forces – 2/2018

The North Korean Navy (NKN) is the smallest of the KPA's three main services. This coastal force primarily comprises numerous aging small patrol craft that carry a variety of anti-ship cruise missiles, torpedoes, and guns.

The NKN maintains one of the world's largest, albeit aging, submarine forces, with around 70 attack-, coastal-, and midget-type submarines. In addition, the NKN operates a large fleet of air-cushioned hovercraft and conventional landing craft to support amphibious operations and SOF insertion.

The force is divided into East and West Coast Fleets, each operating a variety of patrol craft, guided-missile patrol boats, submarines, and landing craft.

The NKN has displayed some modernization efforts, highlighted by upgrades to selected surface ships and a small-scale program to produce modern, surface, missile-armed patrol boats and corvettes.

North Korea continues to operate and test its GORAE-class ballistic missile–capable submarine as part of its larger high-priority ballistic missile program.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 13*

The Classic Military Balance: Air and Air Defense - IV

	North Korea	South Korea	Japan	China
Air and Air Defense Forces				
Active Military Personnel (1,000s)	110,000	65,000	46,950	395,000
Total Combat Aircraft	545	587	542	2,397
Bombers	80	0	0	162
Fighters	401+	174	189	819
Fighter/Attack	30	333	143	566
Anti-Tank	34	0	0	240
Recce/IS&R/SIGINT	0	34	55	83
ABM Launchers	0	?	0	0
Surface to Air Missile Launchers[f]				
Heavy	38	48	0	192
Medium	179+	158	283	414
Short-range	133	?	5	338+

[f] Includes army systems

Source: Estimate by Anthony H. Cordesman based upon open source material in Hans M. Kristensen and Robert S. Norris, "Status of World Nuclear Forces," Federation of American Scientists (FAS), 26 May 2016, available at: http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/; U.S. Nuclear *Posture Review*, February 2018, and the IISS *Military Balance 2018*.

North Korean Air Forces - 2012

Military and Security Developments Involving the Democratic People's Republic of Korea 2012
A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, p. 13

North Korean Air Forces - 2017

Department of Defense, ***Military and Security Developments Involving the Democratic People's Republic of Korea 2017,*** *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 19*

DoD Assessment of North Korean Air and Air Defense Forces – 2/2018

The North Korean Air Force (NKAF), a fleet of more than 1,300 aircraft, is primarily responsible for defending North Korean airspace. Its other missions include special operations forces (SOF) insertion, transportation and logistics support, reconnaissance, and tactical air support for KPA ground forces. However, because of the technological inferiority of most of its aircraft fleet, which are mostly legacy Soviet models, and the country's rigid air defense command and control structure. Much of North Korea's air defense is provided by surface-to-air missiles (SAMs) and anti-aircraft artillery (AAA).

The NKAF's most capable combat aircraft are MiG-29s (procured from the Soviet Union in the late 1980s), MiG-23s, and Su-25 ground-attack aircraft. However, the majority of its aircraft—MiG-15s, MiG-17s, MiG-19s, and MiG-21s—are less capable. The NKAF operates a large fleet of An-2 Colt aircraft, which are 1940s-era, single-engine, 10-passenger biplanes, likely tasked with multiple missions, including ground attack and insertion of SOF into the ROK. The NKAF is rounded out with several hundred helicopters that would be used for troop transport and ground attack. These helicopters are predominantly Mi-2 Hoplites but also include some U.S.-made MD-500 helicopters obtained by circumventing U.S. export controls in 1985.

North Korea has a dense, overlapping air defense system of SA-2, SA-3, and SA-5 SAM sites; mobile SA-13 SAMs; mobile and fixed AAA; and numerous man-portable air-defense systems, such as the SA-7. As the NKAF's aircraft continue to age, it increasingly relies on ground-based air defenses and hiding or hardening assets to resist air attacks. During a 2010 military parade, North Korea displayed a new mobile SAM launcher and accompanying radar that bore external resemblance to the Russian S-300 and Chinese HQ-9. North Korea most recently tested this system in May 2017.

North Korea publicized a March 2013 live-fire military drill that for the first time featured an unmanned aerial vehicle (UAV) in flight. The UAV appeared to be a North Korean copy of a U.S.-produced target drone. North Korean press coverage of the event described the UAV as being capable of precision strike by crashing into the target. Between 2013 and 2016, North Korea overflew the ROK with several UAVs configured for intelligence collection.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 12*

Asymmetric Military Balance

North versus South

- South Korea has excellent special forces and intelligence units, but little incentive to initiate raids, raise tension, or create provocative low level attacks and incidents.
- Asymmetric threats like tunnels and artillery near the DMZ pose a useful escalatory threat, and compensate for the weaknesses in DPRK fighting in any negotiation
- North Korea has found well-timed low-level attacks and incidents give it significant leverage at acceptable levels of risk. Seemingly "irrational" behavior has consistently proven rational.
- In actual warfighting, cross border infiltration and asymmetric attacks help compensate for poorer weapons, exploit the fact South Korea is more vulnerable to such attacks.
- The U.S. and South Korea can, however, use asymmetric attacks on the weakest elements in North Korean governance, economy, and ability to sustain operations. North Korea's poor comparative resources make it vulnerable as well – the moment the fighting or crisis seems to justify such escalation.
- The end result is the equivalent of a game of chicken. The side most willing to take risks can win, but only as long as the opposite side doe snot counter strike and counter-escalate.

South Korea: The Vulnerabilities of Success

South Korea's population is highly developed, but approximately 70% of the country is considered mountainous and it is concentrated in cities in the lowland areas, where the population density is very high in a limited number of target areas where displaced persons and refugees have few outside alternatives with any serious surplus capability to provide food, shelter, and services.

The greater Seoul area alone has a population of over 25 million—close to half the 51 million population of the ROK and a far larger population than all of its other cities combined. More than 10 million people live in its city limits, and its core has a population density of well over 17,000 to people per square kilometer and 45,000 per square mile—twice the density of New York, four times that of Los Angeles, and eight times that of Rome. Just one of its 25 districts has 680,000 people. According to some sources, it is the largest single urban complex in the free world.

Five other urban centers define South Korea's broader vulnerabilities and ability to ride-out and recover from a major conflict: Busan (Pusan) 3.216 million; Incheon (Inch'on) 2.685 million; Daegu (Taegu) 2.244 million; Daejon (Taejon) 1.564 million; and Gwangju (Kwangju) 1.536 million (2015). These cities do not have the sheer scale of urban sprawl of many American cities, and—coupled with South Korea's high levels of development– this adds to its urban and national vulnerability.

South Korea's need for secure maritime routes and ports and air traffic and airports adds to its vulnerability. South Korea depends on secure maritime and land transit/access traffic to 7 seaport(s): Busan, Incheon, Gunsan, Kwangyang, Mokpo, Pohang, Ulsan, Yeosu. It depends on 3 major container port(s) (TEUs): Busan (19,469,000), Kwangyang (2,327,000), Incheon (2,368,000) (2015)

CIA, "South Korea," *World Fsctbook 2018*.

DoD Assessment of North Korean Proliferation – 2/2018

North Korea has been an exporter of conventional arms and ballistic missiles for several decades. Despite the implementation of UNSCRs 1718, 1874, 2087, 2094, 2270, 2321, and 2356, which prohibit North Korea from selling weapons and providing related technical training, Pyongyang continues to market, sell, and deliver weapons-related goods and services. Weapon sales are an important source of foreign currency for North Korea's weapons programs and, as such, Pyongyang is unlikely to cease export activity despite UN Security Council sanctions, increased international efforts to interdict North Korea's weapons-related exports, and the implementation of Executive Order 13382, under which designated WMD proliferators' access to the United States and global financial systems are targeted.

Global concern about North Korea's proliferation activities continues to mount, which has led some countries, such as Namibia, to halt new purchases from North Korea and has prompted other nations to take action to prevent arms-related deliveries. Although the international community has interdicted some of North Korea's weapons-transfer attempts, North Korea very likely will continue to attempt arms shipments via new and increasingly complex methods.

North Korea has demonstrated a willingness to proliferate nuclear technology. Using the proliferation network of Pakistani nuclear scientist AQ Khan, North Korea provided Libya under Moamar Qaddafi with uranium hexafluoride, the form of uranium used in the uranium enrichment process to produce fuel for nuclear reactors and nuclear weapons. North Korea also provided Syria with nuclear reactor technology until the facility was destroyed in 2007.

…In addition to Iran and Syria, past clients for North Korea's ballistic missiles and associated technology have included Egypt, Iraq, Libya, Pakistan, and Yemen. Burma has begun distancing itself from North Korea, but concerns remain regarding lingering arms trade ties between the two countries.

North Korea uses various methods to circumvent UNSCRs, including falsifying end-user certificates, mislabeling crates, sending cargo through multiple front companies and intermediaries, and using point-to-point air cargo deliveries for high-value and sensitive arms exports, thus limiting interdiction opportunities.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 21-22*

North Korean vs. South Korean Special Forces

- The Special Forces Brigades of the Republic of Korea (ROK) are six special forces brigades and one oversea deployment group under the command and control of the Republic of Korea Army Special Warfare Command (ROK-SWC). These units were modelled after United States Army Special Forces (Green Berets).
- Members of the brigades receive special training for various unconventional warfare missions
- These seven units are part of ROK Special Forces, founded in 1958 and fall under the jurisdiction of the Republic of Korea Army Special Warfare Command, which was created in 1969.
- ROK special forces brigades main tasks include guerrilla warfare, special reconnaissance, unconventional warfare, direct action, collecting information in enemy territory and conducting special missions.
- The North Korean special operation force (NKSOF), officially the Korean People's Army Special Operation Force, consists of specially equipped and trained elite military units trained to perform military, political, or psychological operations for North Korea.
- The units are active in testing the defenses of South Korea and have been detected operating in or around South Korea many times in the decades since the end of the Korean War. There are about 180,000 special operational forces soldiers.

Source: SOUTH KOREA |VS| NORTH KOREA | MILITARY SPECIAL FORCES | HAND TO HAND COMBAT ROK/SEAL VS NKSOF, NIO - 520: Military Published on Mar 16, 2018, https://www.youtube.com/watch?v=iHlXa7iPi6M, and IISS, *Military Balance*, 2018.

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DoD Assessment of North Korean Special Forces – 2/2018

North Korean SOF personnel are among the most highly trained, well-equipped, best-fed, and highly motivated forces in the KPA.

Strategic SOF units dispersed across North Korea appear designed for rapid offensive operations, internal defense against foreign attacks, or limited attacks against vulnerable targets in the ROK. They operate in specialized units, such as reconnaissance, airborne and seaborne insertion, commando, and other specialty units.

All emphasize speed of movement and surprise attack to accomplish their missions. SOF may be airlifted by An-2 Colts or helicopters (and possibly Civil Air Administration transports), moved by maritime insertion platforms, or travel on foot over land or via suspected underground cross-DMZ tunnels to attack high-value targets, such as command and control nodes or airbases in the ROK.

In 2016, Kim Jong Un publicly unveiled a possible new SOF battalion of KPA Unit 525 that may be tasked with decapitation missions. During a publicized exercise in December 2016, the SOF battalion assaulted a full-scale mockup of the Blue House, the official residence of the President of the Republic of Korea, practicing helicopter insertion, probable abduction of the ROK President, and eventual destruction of the building.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 13*

DoD Assessment of North Korean Cyber Forces – 2/2018

North Korea possesses increasingly sophisticated cyber warfare capabilities, including offensive capabilities, which are capable of damaging and disruptive cyberattacks.

North Korean cyber effects operations have been implicated in malicious cyber activity since 2009 and challenge widely recognized norms of state behavior in cyberspace. North Korea has invested in developing its cyber capabilities and probably views cyber operations as an appealing, cost-effective, and deniable means by which to collect intelligence and cause disruption against its highly networked adversaries, notably the ROK, Japan, and the United States.

North Korea likely believes it can conduct cyber effects operations with little risk of reprisal, in part because its networks are largely separated from the Internet and disruption of Internet access would have minimal impact on its economy. In November 2014, North Korean cyber actors using the nom de guerre "Guardians of Peace" attacked Sony Pictures Entertainment, shutting down employee access and deleting data. For these types of attacks, North Korea likely uses Internet infrastructure from third-party nations.

Pyongyang probably is increasingly using cybercrime to offset financial losses resulting from international sanctions, especially given stricter Chinese enforcement of these sanctions. For example, North Korea probably was involved in the theft of $81 million from the Central Bank of Bangladesh in February 2016. North Korean cyber actors also are using malware to blackmail individuals and companies into paying large fees to keep sensitive information (such as personally identifiable information) from being publicly released.

In 2017, North Korea carried out the malicious "WannaCry" ransomware attack that spread across the world damaging civilian infrastructure, including the United Kingdom's National Health Service and Chinese firms. North Korea exploited an existing vulnerability that allowed it to encrypt a target's hard drive, then demanded payment in cryptocurrency within a set time period or else the users' data would be wiped. Even individuals and firms which paid the ransom did not recover their data.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 13*

DoD Assessment of North Korean Intelligence Forces – 2/2018

Intelligence Services. **North Korean intelligence and security services collect political, military, economic, and technical information through open sources, human intelligence, cyber intrusions, and signals intelligence capabilities. North Korea's primary intelligence collection targets remain the ROK, the United States, and Japan. They likely operate anywhere North Korea has a diplomatic or sizable economic overseas presence.**

The Reconnaissance General Bureau (RGB) **is North Korea's primary foreign intelligence service, responsible for collection and clandestine operations. The RGB comprises six bureaus with compartmented functions, including operations, reconnaissance, technology and cyber capabilities, overseas intelligence, inter-Korean talks, and service support.**

The Ministry of State Security (MSS) **is North Korea's primary counterintelligence service and is an autonomous agency of the North Korean Government reporting directly to Kim Jong Un. The MSS is responsible for operating North Korean prison camps, investigating cases of domestic espionage, repatriating defectors, and conducting overseas counterespionage activities in North Korea's foreign missions.**

The United Front Department (UFD) **overtly attempts to establish pro–North Korean groups in the ROK, such as the Korean Asia-Pacific Committee and the Ethnic Reconciliation Council. The UFD is also the primary department involved in managing inter-Korean dialogue and North Korea's policy toward the ROK.**

The *225th Bureau* is responsible for training agents to infiltrate the ROK and establish underground political parties focused on fomenting unrest and revolution.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 14-15*

DoD Assessment of North Korean Arms Sales – 2/2018

North Korea uses a worldwide network to facilitate arms-sales activities. It has a core, but dwindling, group of customers that includes Iran and Syria. Others core customers, such as Sudan and Uganda, have recently agreed to end arms cooperation with Pyongyang. North Korea has transferred ballistic missile–related equipment, components, materials, and technical assistance to countries in Africa, Asia, and the Middle East. Conventional weapons sales have included ammunition, small arms, radars, and SAMs, as well as repair services, technical support services, and military equipment production facilities.

In late 2009, North Korea was implicated in the attempted sale of rocket-propelled grenades and other heavy weapons to Iran or possibly to Hizballah when Thailand interdicted and seized a cargo plane laden with arms. In 2013, Panamanian authorities held a North Korean ship, the Chong Chon Gang, as it attempted to transit the Panama Canal laden with 240 tons of military equipment, including a MiG-21 fighter aircraft concealed under a licit cargo shipment of sugar. North Korea claimed that it was repairing the equipment for Cuba.

In August 2016, Egypt inspected and seized a shipment of 30,000 PG-7 rocket-propelled grenades concealed under a cargo of iron ore, which was a UNSCR-proscribed item. According to the final report of the UN Panel of Experts established pursuant to UNSCR 1718, this was the largest interdicted ammunition consignment in the history of sanctions against North Korea.

In addition to Iran and Syria, past clients for North Korea's ballistic missiles and associated technology have included Egypt, Iraq, Libya, Pakistan, and Yemen. Burma has begun distancing itself from North Korea, but concerns remain regarding lingering arms trade ties between the two countries.

North Korea uses various methods to circumvent UNSCRs, including falsifying end-user certificates, mislabeling crates, sending cargo through multiple front companies and intermediaries, and using point-to-point air cargo deliveries for high-value and sensitive arms exports, thus limiting interdiction opportunities.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 23*

Tension as Leverage: Key North Korean "Incidents"

North and South Korea sign an armistice on July 27, 1953 and a Korean Demilitarized Zone (DMZ) is established near the 38th parallel. It is never ratified by a formal peace treaty, leaving the two Koreas technically still at war.

INFILTRATIONS AND ATTACKS

Since the end of the war, numerous attacks, troop infiltrations and clashes, mostly provoked by Pyongyang, have threatened the fragile ceasefire.

Pyongyang has on several occasions placed its troops on a war footing:

January 21, 1968: a team of 31 North Korean commandos is sent to Seoul to assassinate President Park Chung Hee, but is intercepted by South Korean security. All but two are killed, and only one of those captured.

August 18, 1976: North Korean soldiers attack a work party trying to chop down a tree inside the demilitarized zone. Two US army officers are killed in what becomes known as the "axe murder incident".

October 9, 1983: An attempt to kill South Korean President Chun Doo Hwan takes place when North Korea plants a bomb in a mausoleum in Yangon, Myanmar during a visit by Chun. He survives but 21 people, including some government ministers, are killed.

November 29, 1987: A bomb planted on a Korean Air flight explodes over the Andaman Sea, killing all 115 people on board. Seoul accuses Pyongyang, which denies involvement.

September 18, 1996: A North Korean submarine on a spying mission runs aground off the eastern South Korean port of Gangneung. After a 45-day manhunt, 24 crew members and infiltrators are killed.

DIRECT CONFRONTATION

June 15, 1999: South Korean and North Korean naval ships clash off South Korea's Yeonpyeong island. North Korean casualties are estimated at around 50.

March 26, 2010: The South Korean corvette Cheonan sinks, killing 46 sailors. An international investigation concludes it had been torpedoed by a North Korean submarine. Pyongyang denies the charge.

November 23, 2010: North Korea fires 170 artillery shells at Yeonpyeong, the first attack on an area populated by civilians since the war: four are killed, including two civilians. South Korea's troops fire back with cannon.

August 20, 2015: South and North Korea trade artillery fire across their border.

Straits Times, "A timeline of more than 60 years of tensions between North and South Korea, January 5, 2018, http://www.straitstimes.com/asia/east-asia/a-timeline-of-more-than-60-years-of-tensions-between-north-and-south-korea

South Korean Estimate of North Korean Infiltrations and Local Provocations: 1950-2016

Status of Infiltrations and Local Provocations by Year

Category	Total	1950	1960	1970	1980	1990	2000	2010-2014	2015	2016
Total	3,094	405	1,340	406	228	222	241	220	26	6
Infiltrations	1,977	386	1,011	311	167	63	16	21	2	0
Local Provocations	1,117	19	329	95	61	159	225	199	24	6

* 2016 is until November 30

Detailed Status of Infiltrations and Local Provocations by Year and Type

Category		Total	1950	1960	1970	1980	1990	2000	2010-2014	2015	2016
Total		3,094	405	1,340	406	228	222	241	220	26	6
Infiltrations	Direct	1,759	381	990	300	38	50	0	0	0	0
	Indirect	179	0	0	0	127	13	16	21	2	0
	South Korean defectors to NK or those abducted by North Korea sent as spy agents	39	5	21	11	2	0	0	0	0	0
	Subtotal	1,977	386	1,011	311	167	63	16	21	2	0
Local Provocations	Contact area provocations	507	7	300	51	45	51	42	7	4	0
	Contact waters provocations	559	2	22	28	12	107	180	188	15	5
	Aerial provocations	51	10	7	16	4	1	3	4	5	1
	Subtotal	1,117	19	329	95	61	159	225	199	24	6

South Korean Ministry of Defense, White Paper 2016, 2017, Appendix, http://www.mod.go.jp/e/publ/w_paper/2017.html, pp. 288-289

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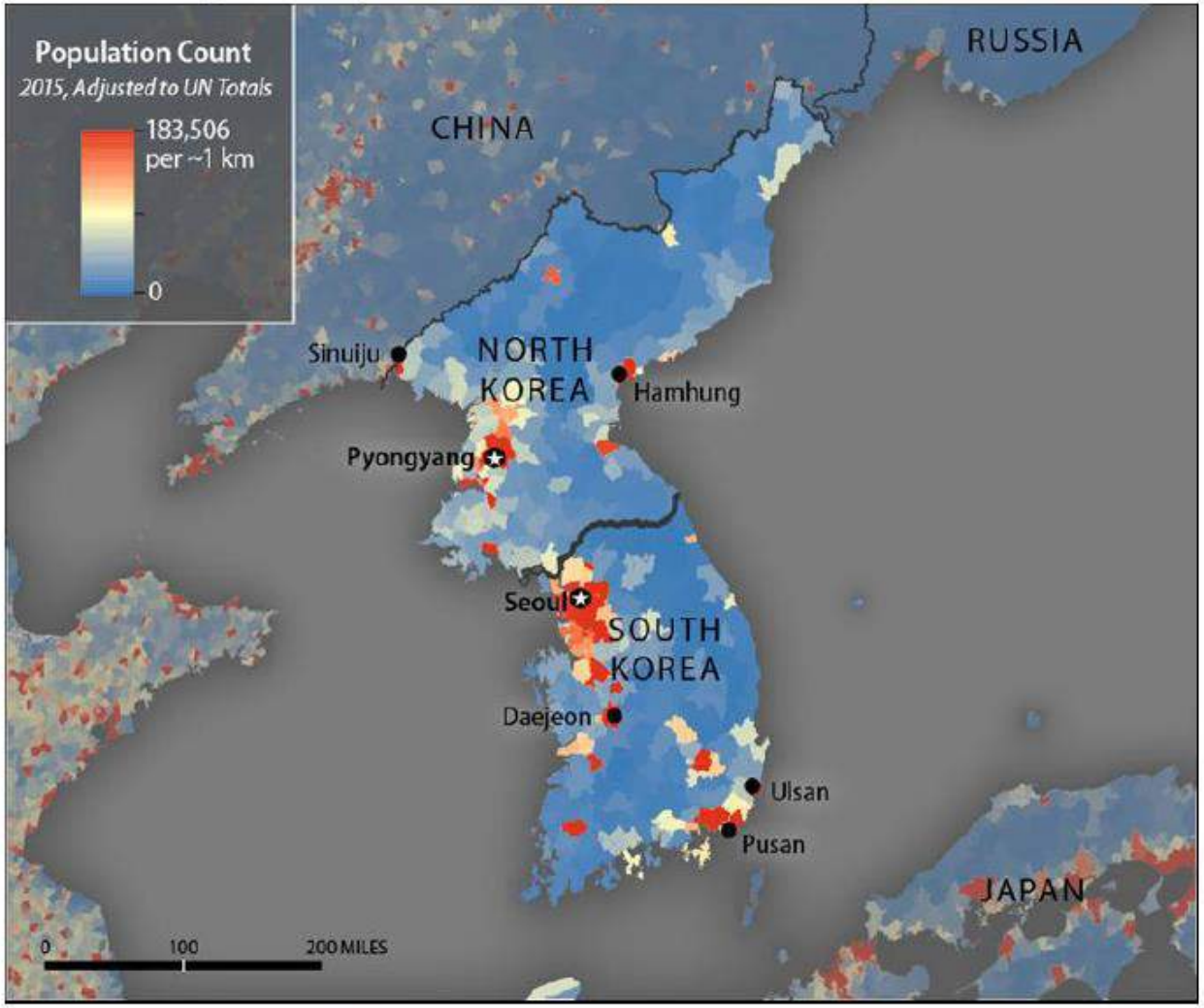
South Korean Chronology of North Korean Infiltrations and Local Provocations: 2014-2016

Date	Descriptions
December 5, 2014	Enemy patrol boat violates the NLL west of Yeonpyeongdo Island in the West Sea
February 19	One North Korean iron ship violates the NLL east of Dokdo Island in the East Sea
April 21, 2015	Enemy armed patrol boat violates the NLL north of Baengnyeongdo Island in the West Sea
May 16	Enemy armed patrol boat violates the NLL west of Yeonpyeongdo Island in the West Sea
June 11	Enemy armed patrol boat violates the NLL north of Baengnyeongdo Island in the West Sea
June 11	Enemy armed patrol boat violates the NLL northeast of Socheongdo Island in the West Sea
June 12	Enemy armed patrol boat violates the NLL southeast of Socheongdo Island in the West Sea
June 16	Enemy armed patrol boat violates the NLL northwest of Baengnyeongdo Island in the West Sea
June 23	Enemy patrol boat violates the NLL northwest of Baengnyeongdo Island in the West Sea
June 30	Enemy armed patrol boat violates the NLL west of Yeonpyeongdo Island in the West Sea
July 2	Enemy troops violate the MDL at Cheolwon, Gangwon
July 11	Enemy troops violate the MDL at Cheolwon, Gangwon
August 4	Enemy troops conduct mine-laying in Paju, Gyeonggi
August 20	Enemy troops fire howitzers and direct fire weapons to the south of MDL
August 22	Enemy small UAV violates the MDL in the forward area of Hwacheon
August 23	Enemy small UAV violates the MDL in the forward area of Hwacheon
August 24	Enemy small UAV violates the MDL in the forward area of Hwacheon (twice)
August 31	Enemy armed patrol boat violates the NLL northeast of Baengnyeongdo Island in the West Sea
September 8	Enemy patrol boat violates the NLL southeast of Socheongdo Island in the West Sea
September 25	Enemy patrol boat violates the NLL west of Yeonpyeongdo Island in the West Sea
October 24	Enemy patrol boat violates the NLL northeast of Yeonpyeongdo Island in the West Sea
November 30	Enemy armed patrol boat violates the NLL northeast of Socheongdo Island in the West Sea

Date	Descriptions
December 14	One North Korean fishing boat violates the NLL north of Baengnyeongdo in the West Sea
December 14	Enemy armed patrol boat violates the NLL north of Baengnyeongdo Island in the West Sea
January 13, 2016	Enemy small UAV violates the MDL in the forward area of Munsan, Gyeonggi
February 8	One North Korean tug boat violates the NLL west of Yeonpyeongdo Island in the West Sea
February 8	Enemy armed patrol boat violates the NLL southeast of Socheongdo Island in the West Sea
April 10	One North Korean fishing boat violates the NLL west of Yeonpyeongdo Island in the West Sea
May 27	Enemy patrol boat and fishing boat violate the NLL west of Yeonpyengdo Island in the West Sea
June 8	One North Korean fishing boat violates the NLL east of Geojin in the East Sea

South Korean Ministry of Defense, White Paper 2016, 2017, Appendix, http://www.mod.go.jp/e/publ/w_paper/2017.html, pp. 288-289

Human Targets: Population Density



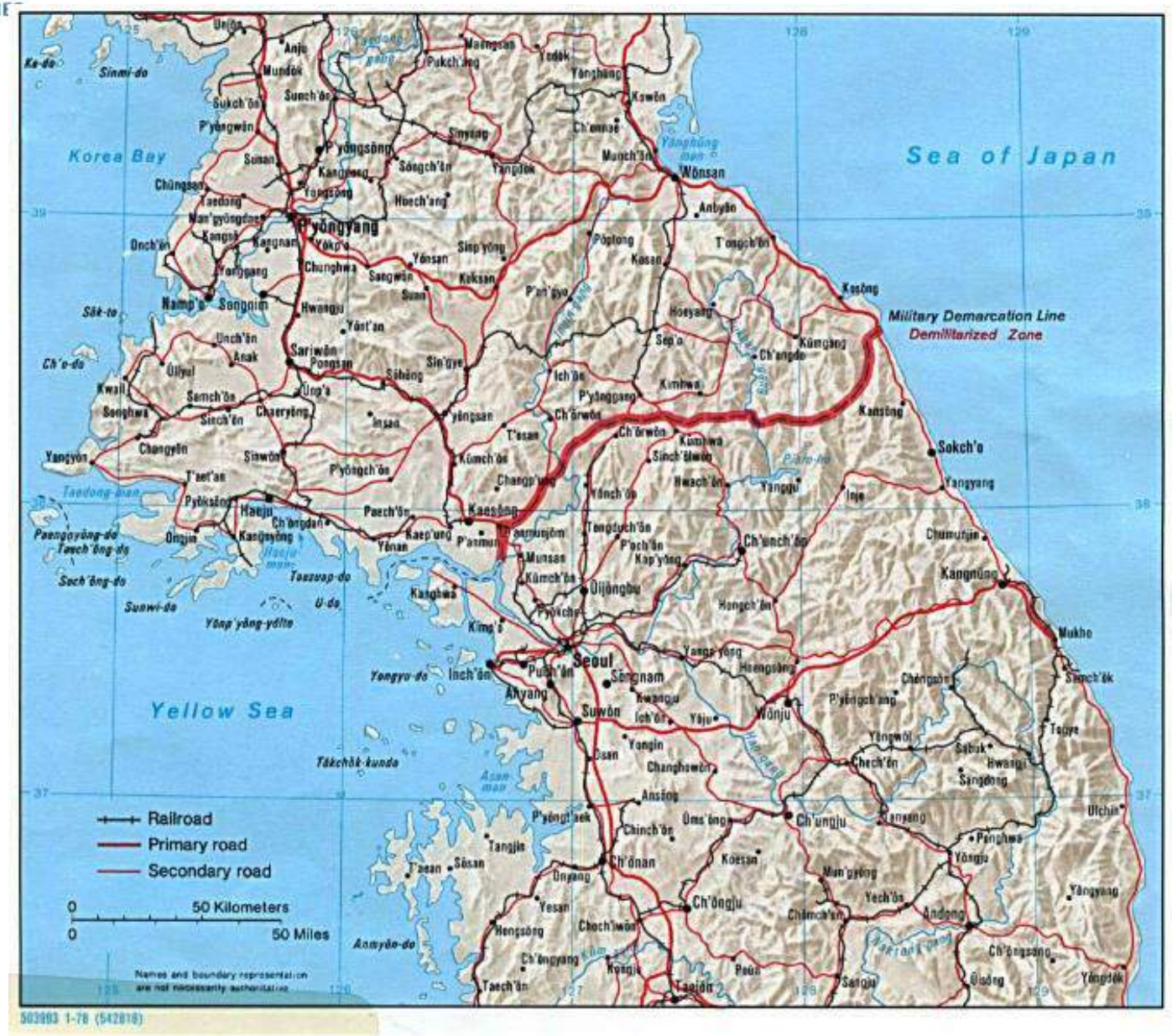
Sources: Graphic created by CRS. Information generated by Hannah Fischer using data from the NASA Socioeconomic Data and Applications Center's Gridded Population of the Word, v4, with a UN-adjusted population count (2015), available at http://sedac.ciesin.columbia.edu/data/set/gpw-v4-population-count-adjuste to-2015-unwpp-country-totals; Department of State (2015); Esri (2016); DeLorme (2016).

Kathleen J. McInnis and others, "The The North Korean Nuclear Challenge: Military Options and Issues for Congress," Congressional Research Service, www.crs.gov, R44994, November 6, 2017

DMZ Roads and Topography

250 kilometers (160 miles) long, approximately 4 km (2.5 mi) wide.

Shortest direct distance from the northern boarder of Seoul to DMZ is only 23.8km; is 56km to main part of city



Google, http://www.maps-of-the-world.net/maps/maps-of-asia/maps-of-north-korea/detailed-map-of-the-Korean-Peninsula-Demilitarized-Zone-Area-with-relief-1978.jpg

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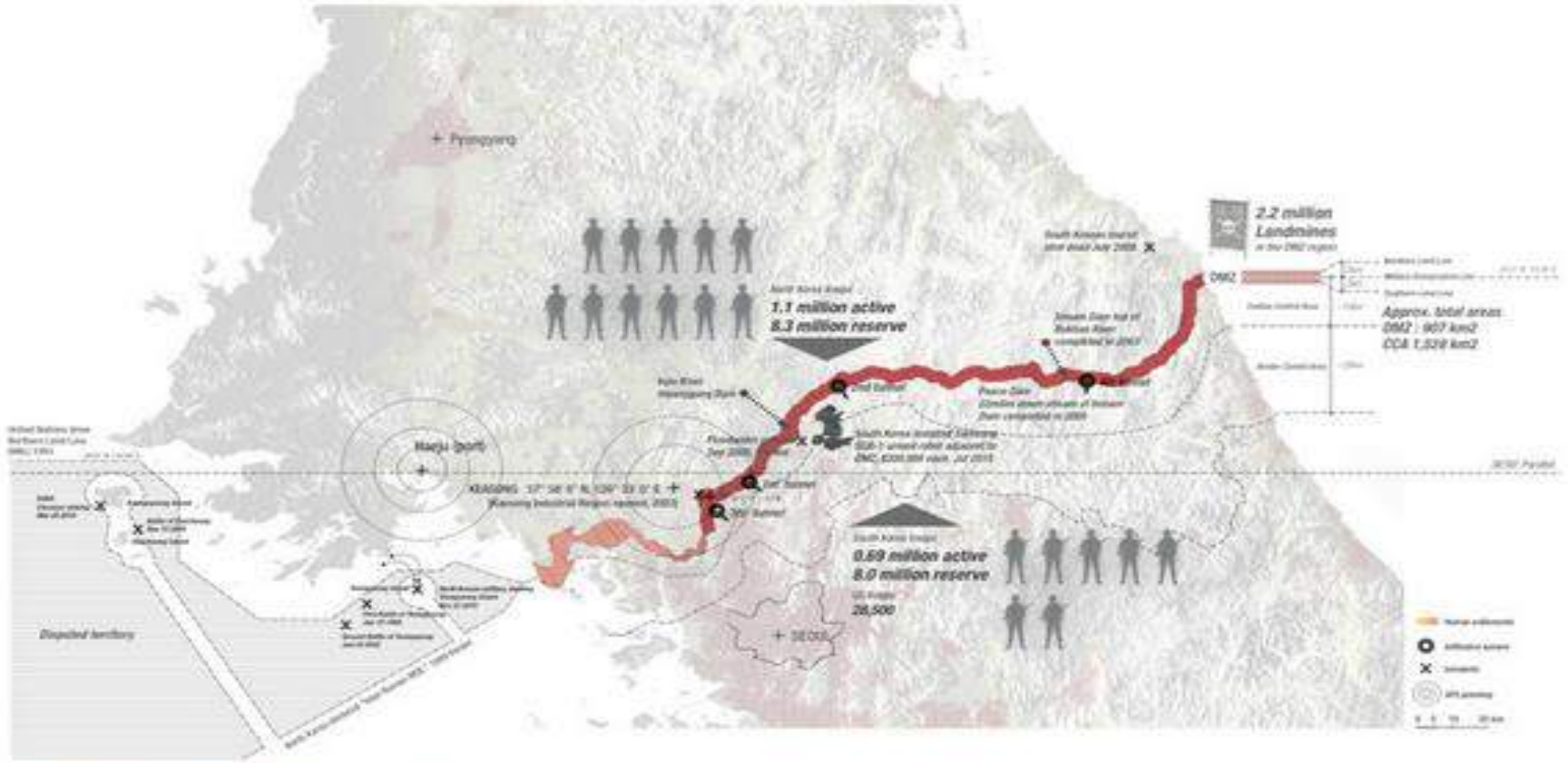
Militarization of DMZ



(Dongsei Kim/Harvard School of Design)

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

The DMZ and 4 Known (Out of 20-25?) Tunnels

The four tunnels were dug by North Korea after the war as part of an invasion plan, but were discovered and now can be visited by tourists. | (Rishabh Tatiraju)

IHS Janes reports that North Korea has built approximately 20-25 such tunnels under the DMZ, and only four have been publicly identified and neutralized by South Korean/US forces. One of the tunnels that has been discovered had a total length of 3,300 meters, and went 1,100 meters into South Korean territory. It was 50-150 meters deep, and two meters by two meters. Janes reports that as many as 8,000 troops an hour could move through them

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps; IHS Janes. Sentinel series.

Artillery as a Weapon of Mass Destruction?

- **North Korea does have significant capability to fire long-range systems at Seoul. Such fires would take time to suppress and could disrupt major amounts of economic activity.**

But,

- **The real world capability to deliver massive amounts of firepower with serious killing capability against targets in built-up areas over a major portion of Seoul is far less clear.**
- **Claims of high levels of dead are not supported by transparent analysis, and credible rates of fire, range calculations, civilian vulnerability, or estimates of counter-artillery and rocket capability.**
- **Vulnerability and deterrence work in two directions. Pyongyang is vulnerable to a variety of missile, stealth, and other attacks, and critical to DPRK regime operations and survivability.**

North Korean Artillery Concentration

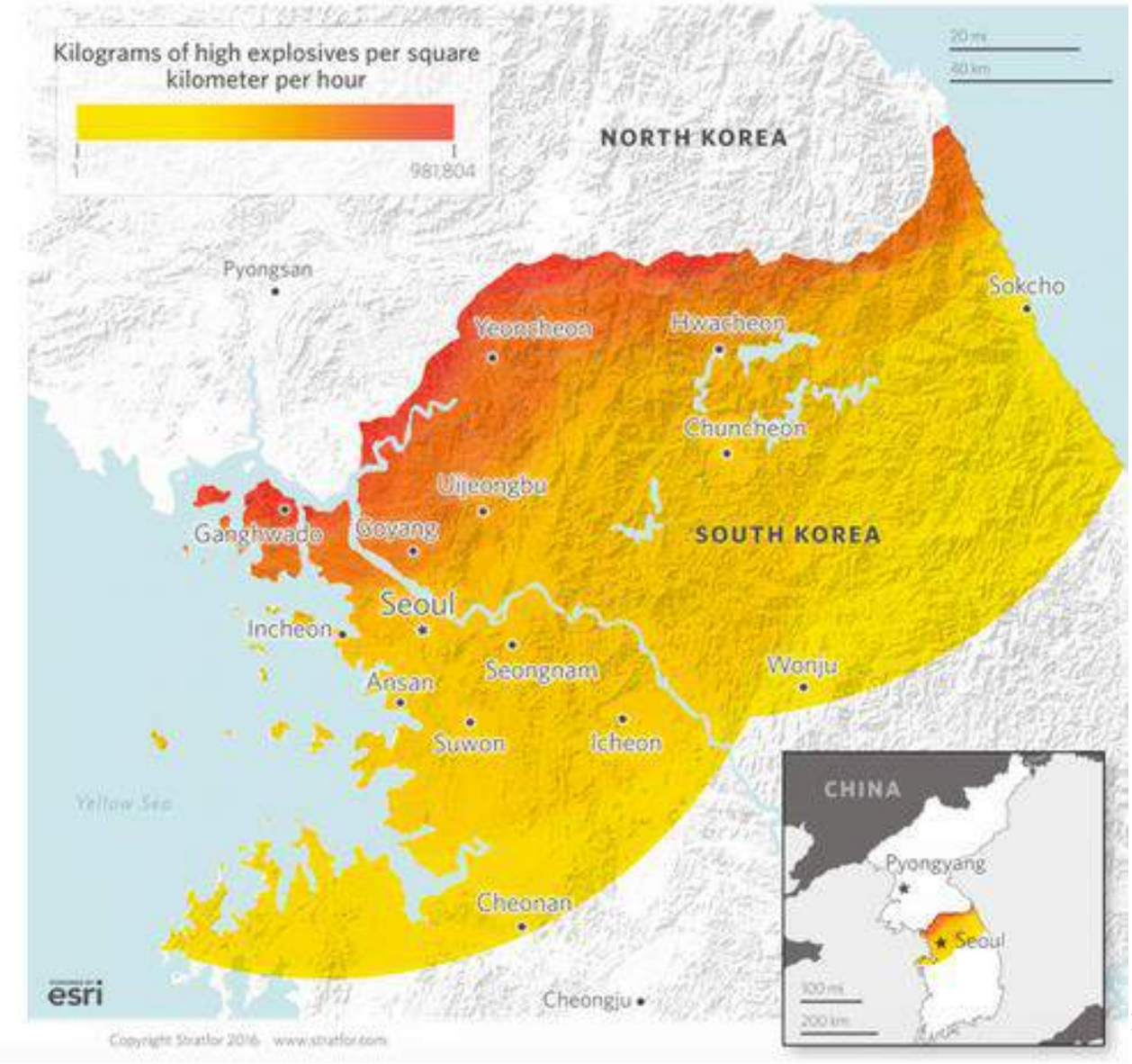
Some estimates go as high as 12,000 artillery and 2,300 MRLs deployed in sheltered sites with movable artillery and blast doors.

Includes MRLs and tubes, not missiles.

Seoul, is one of the densest major cities in the world, with 27,000 people per square mile.

A South Korean simulation conducted in 2004 estimated that there could be up to 2 million casualties in the first 24 hours of a conflict alone — before protracted ground conflict.

However, most could only reach city's northern outskirts



Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

South Korean Counters to North Korean Artillery

On March 19, South Korean media reported that the ROK Army will deploy a new guided missile unit to counter North Korea's long-range artillery sites. "The Ministry of National Defense has approved a plan to create an artillery brigade under a ground forces operations command to be inaugurated in October. The plan is to be reported to President Moon Jae-in next month as part of the 'Defense Reform 2.0' policy," a source told Defense News. The counter-artillery force will be armed with two variants of a new short-range ballistic missile system, known as Korea Tactical Surface-to-Surface Missile (KTSSM). The KTSSM reportedly has a range of approximately 120 km, can penetrate hardened targets, and is highly accurate with a reported CEP of 2 meters.

Other reports indicate that two variants of the KTSSM—the KTSSM-I and KTSSM-II were developed for rapid counterbattery fire against North Korean artillery emplacements, multiple rocket launch systems (MRL), and short-range ballistic missiles, including close-range solid-fuel missiles like the KN02 Toksa. With a range of more than 120 kilometers, KTSSM-I can range most of North Korea's conventional artillery systems. Longer-range systems, like ballistic missiles and the KN09 300mm MRL, will be capable of firing at South Korean targets from farther inside North Korea's territory, but South Korea has other precision strike ballistic missiles to hold these targets at risk.
In a conflict, the Republic of Korea Air Force and U.S. Air Force would also be deployed to strike at any ballistic missiles that may be capable of launching nuclear weapons.

Source: Shaan Shaikh, South **Korea Plans New Guided Missile Brigade** Published: March 23, 2018, and CSIS Missile Defense Project, https://missilethreat.csis.org/country/south-korea/

Missile Forces

The North-South Missile Balance

- As is the case with Iran, North Korea's missile programs give it some capability to compensate for its acute qualitative inferiority to South Korean, U.S. and Japanese air power and surface to air missiles.
- At present, however, North Korean has no ballistic missiles with precision strike capability. It would have to fire volleys to achieve significant damage and real-world accuracy levels ensure that hits would be random and have to be directed at area targets.
- South Korea and the U.S. have major qualitative advantage in surface-to-air missiles and are beginning to deploy theater missile defenses.
- South Korea is acquiring and deploying longer-range precision guided cruise missiles. It now emphasizes "Kill Chain" and "Korea Massive Punishment and Retaliation" (KMPR) to preempt, attack and/or retaliate against North Korea.
- U.S. naval surface and submarine forces can deliver large numbers of precision cruise missile strikes.
- The U.S. has removed past missile range limits and South Korea can increasingly strike at any target in North Korea.

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South Korean Missile Types

Missile	Class	Range	Status
Hyunmoo 3D/4	LACM	3,000 km	In development
Hyunmoo 3C	LACM	1,500 km	Operational
Hyunmoo 3B	LACM	1,000 km	Operational
NHK-2	SRBM	180-250 km	Operational
NHK-1	SRBM	180 km	Obsolete
Hyunmoo 3A	LACM	500 km	Operational
Hyunmoo-2C	SRBM	800 km	In development
Hyunmoo-2A	SRBM	300 km	Operational
Hyunmoo-2B	SRBM	500-800 km	Operational
Haeseong III	LACM	1,500 km	Operational
Haeseong II	LACM	500 km	Operational
Haeseong I	ASCM	150-250 km	Operational

A Note on 'Hyunmoo' Naming Conventions

The NHK missile family includes: NHK-1, NHK-2, NHK-2A, NHK-2B, and NHK-2C. The missiles are more commonly known as 'Hyunmoo,' although analysts differ in their Hyunmoo missile designations: some start the 'Hyunmoo-1' designation with the NHK-1, whereas others do so with the NHK-2. In order to minimize confusion, *Missile Threat* designates the first two variants according to their NHK names, and starts using the Hyunmoo designation for the NHK-2A.

Source: CSIS Missile Defense Project, https://missilethreat.csis.org/country/south-korea/

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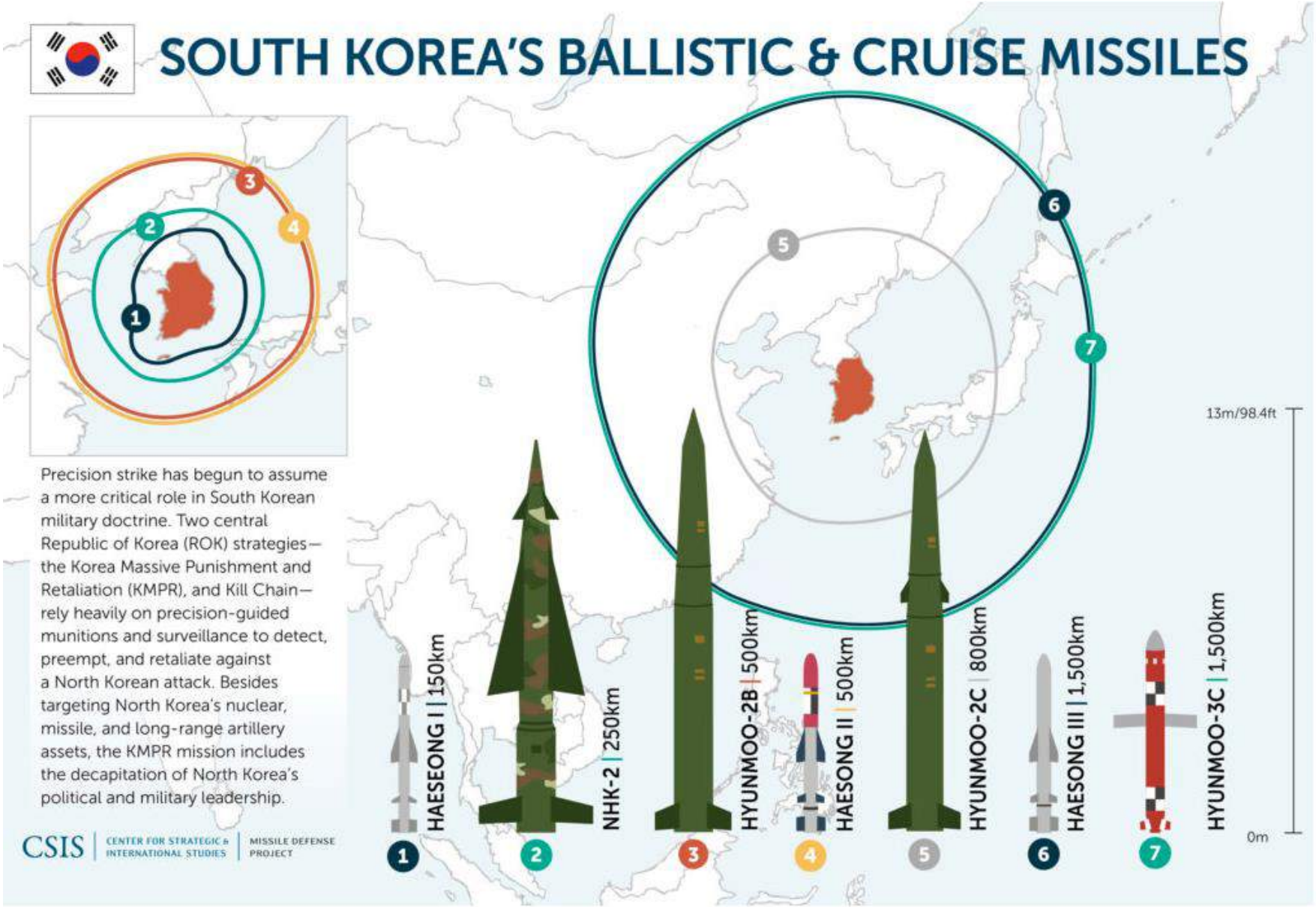
South Korean Missile Ranges



Source: CSIS Missile Defense Project, https://missilethreat.csis.org/country/south-korea/

DoD Assessment of North Korean Missiles – 2/2018 - I

North Korea has an ambitious ballistic missile development program that has made substantial advances in the last two years. North Korea has several hundred short- and medium-range ballistic missiles (SRBMs and MRBMs) available for use against targets on the Korean Peninsula and Japan and is developing longer-range systems.

North Korea is committed to developing a nuclear-armed ICBM that is capable of posing a direct threat to the United States. On July 4, 2017, North Korea flight-tested an ICBM for the first time; a second test followed on July 28, 2017. These events marked a significant milestone in North Korea's ballistic missile development process—the first flight tests of intercontinental ballistic missiles intended to reach the U.S. mainland.

However, ICBMs are extremely complex systems that require multiple flight tests to identify and correct design or manufacturing defects. ICBM trajectories impart significant structural and thermal stresses on the reentry vehicle (RV), requiring repeated testing to ensure that the RV will survive and that the warhead will operate as designed.

In the last two years, North Korea has diversified its ballistic missile force to include longer-range, solid-fueled systems. In 2017, North Korea test- launched a new solid-propellant MRBM from a tracked transporter-erector-launcher (TEL), describing this system as a land-based variant of its submarine-launched ballistic missile (SLBM). The North successfully flight-tested its SLBM from a submerged submarine in August 2016. In May 2017, after North Korea's second successful SLBM launch, Kim approved deployment of the land-based variant.

Kim's public emphasis on the missile force has continued, highlighted by an April 2017 military parade that included four previously unseen missile systems and other equipment. These included a modified SCUD SRBM on a tracked transporter-erector-launcher (TEL), a new liquid-propellant IRBM on a modified Musudan TEL, and launchers for two canister-launched probable solid-propellant systems. One of the canister systems was

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 9-10*

DoD Assessment of North Korean Missiles – 2/2018 - II

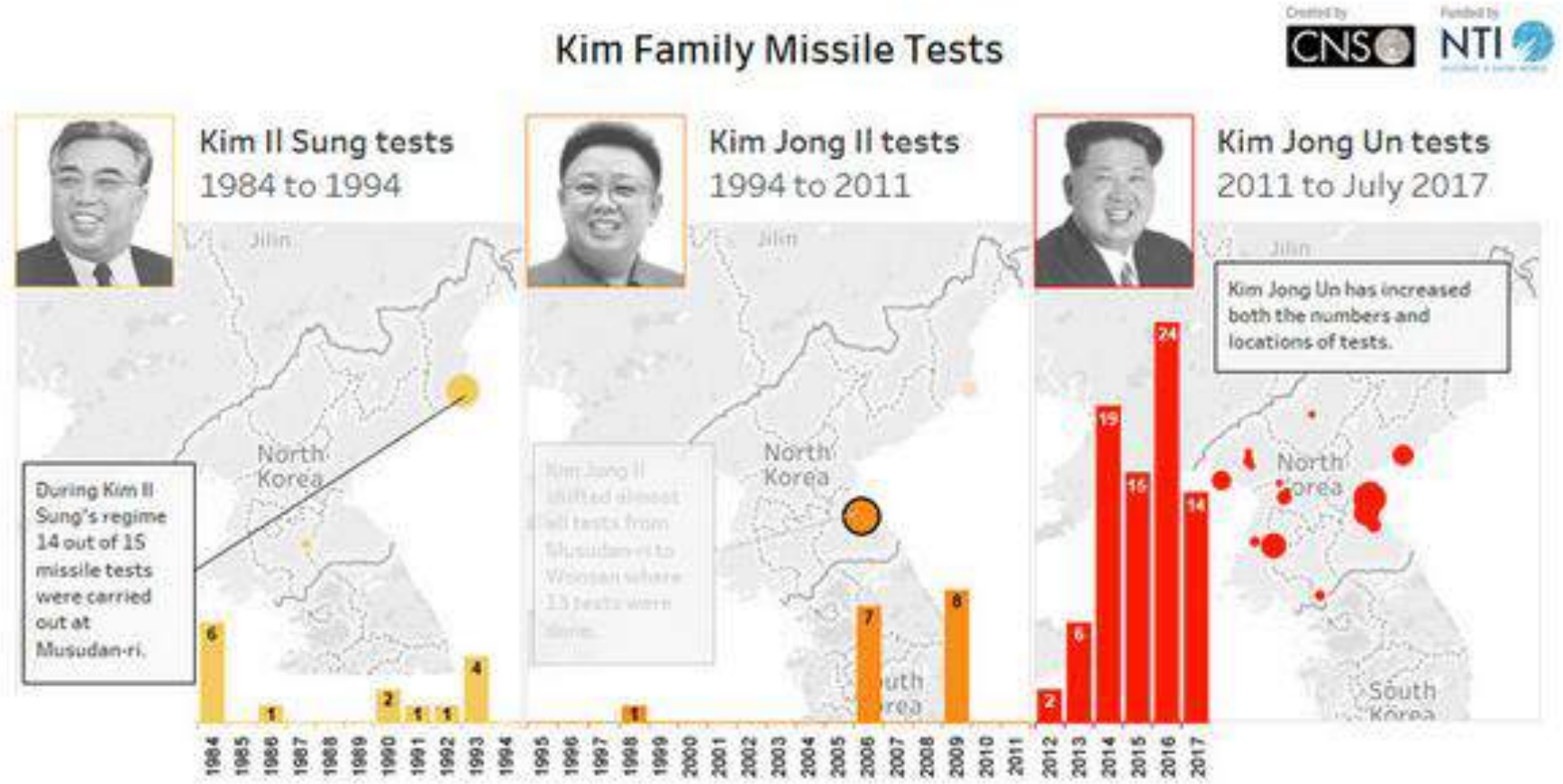
mounted on a modified Hwasong-13 eight-axle TEL, and the other canister system was mounted on a semitrailer or mobile-erector-launcher with a three-axle prime mover. Although airframes were not displayed, the canister systems probably can support IRBMs and ICBMs.

North Korea also still has the TD-2, an ICBM configured as a space launch vehicle (SLV), which could reach the continental United States if configured as an ICBM. The past use of the TD-2 as an SLV contributed to the long-range ballistic missile capability North Korea now possesses because the two configurations have many shared technologies. However, a space launch does not test a reentry vehicle (RV).

Advances in ballistic missile delivery systems, coupled with developments in nuclear technology discussed in Chapter 4, are in line with North Korea's stated objective of being able to strike the continental United States. North Korea followed its 2016 nuclear tests with a campaign of media releases and authoritative public announcements reaffirming its need to counter perceived U.S. hostility with nuclear-armed ICBMs. In photos published by North Korean state media the day before Pyongyang's September 2017 nuclear test, Kim Jong Un appeared with a device it described as a hydrogen bomb capable of being mounted on an ICBM. North Korea continues to devote scarce resources to these programs, but the pace of its progress may depend partly on how much technology and other aid it can acquire from other countries.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 9-10*

North Korean Missile Tests: 1984-2017



(Center for Non-Proliferation Studies/Nuclear Threat Initiative)

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

DoD Assessment of North Korean Missile Tests – 2/2018

In 2016, North Korea conducted more than 20 missile launches with a similar number in 2017. In addition to testing new longer-range missiles, North Korea has also made progress with solid-propellant technologies, submarine-launched ballistic missiles, and probably has an interest in countermeasures against U.S. and allied missile defenses.

…North Korea conducted more than 20 missile launches in 2016 alone with a similar number in 2017. 2017 also saw North Korea's first intercontinental ballistic missile (ICBM) flight tests in July and intermediate-range missile (IRBM) tests over Japan in August and September. In addition to ICBMs, North Korea is developing and testing longer-range solid-propellant missile systems, submarine-launched ballistic missiles (SLBM), and short-range ballistic missiles (SRBM) as countermeasures against U.S. and allied missile defenses. North Korea conducted its sixth and largest nuclear test in September 2017 after two in 2016, and continues to invest in its nuclear infrastructure.

North Korea conducted its inaugural test of an ICBM on July 4, 2017, followed by a second test less than four weeks later on July 28, 2017. In August 2017, the UN Security Council adopted UNSCR 2371, which included sectoral bans for the first time. These bans target North Korean coal, iron ore, lead, and seafood.

In early August 2017, North Korea threatened to launch four IRBMs toward Guam, a U.S. territory, and in late August and September 2017, North Korea tested an IRBM over Japan. North Korea conducted a sixth and significantly larger nuclear test on September 3, 2017, claiming that the detonation had been a "successful hydrogen bomb test for an ICBM."

Department of Defense, ***Military and Security Developments Involving the Democratic People's Republic of Korea 2017,*** *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 20*

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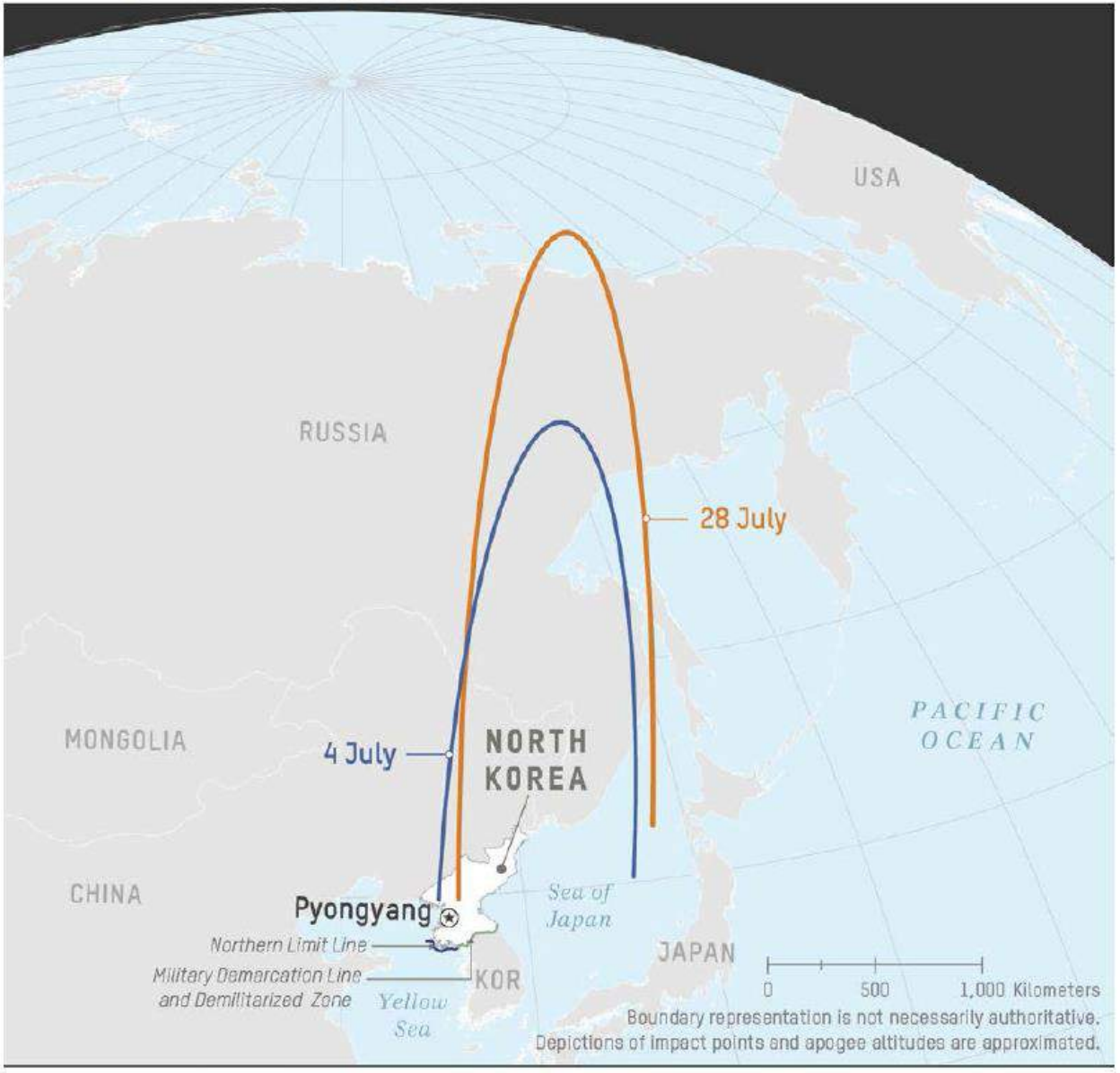
North Korean ICBM Flight Tests – July 2017

DATE	LOCATION	APOGEE	RANGE
4 July	Panghyon Aircraft Plant	~2,800 km	~930 km
28 July	Mupyong Ni Arms Plant	~3,700 km	~1,000 km



Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017,* *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 16*

North Korea's Ballistic Missiles

North Korea's ballistic missile program is one of the most rapidly developing threats to global security. In recent years, an unprecedented pace of missile testing has included new and longer range missiles, sea-launches, and the orbiting of satellites. The most notable of these advances has been North Korea's development of two new intercontinental ballistic missiles, the Hwasong-14 and -15, which can likely reach the continental United States.

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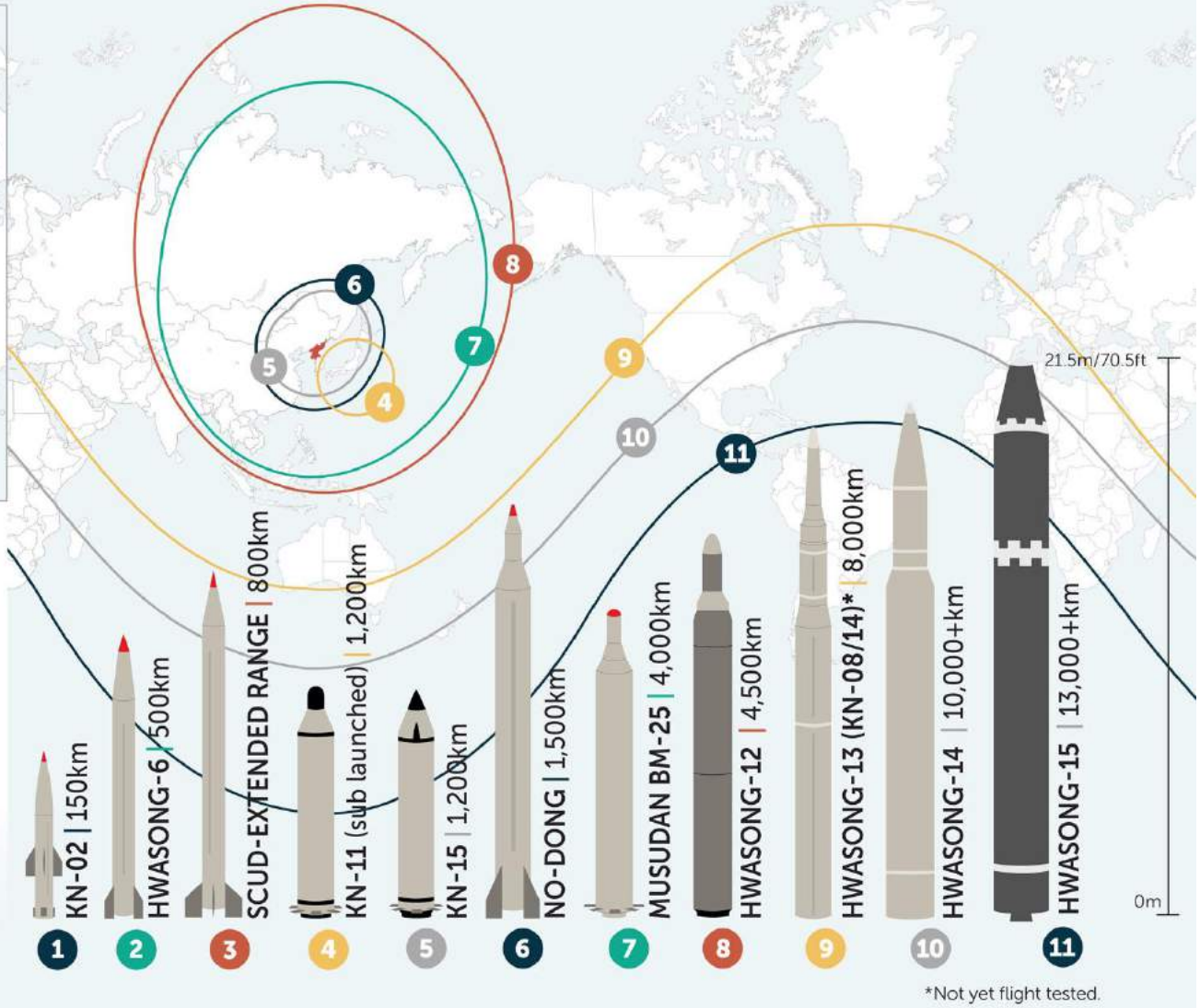
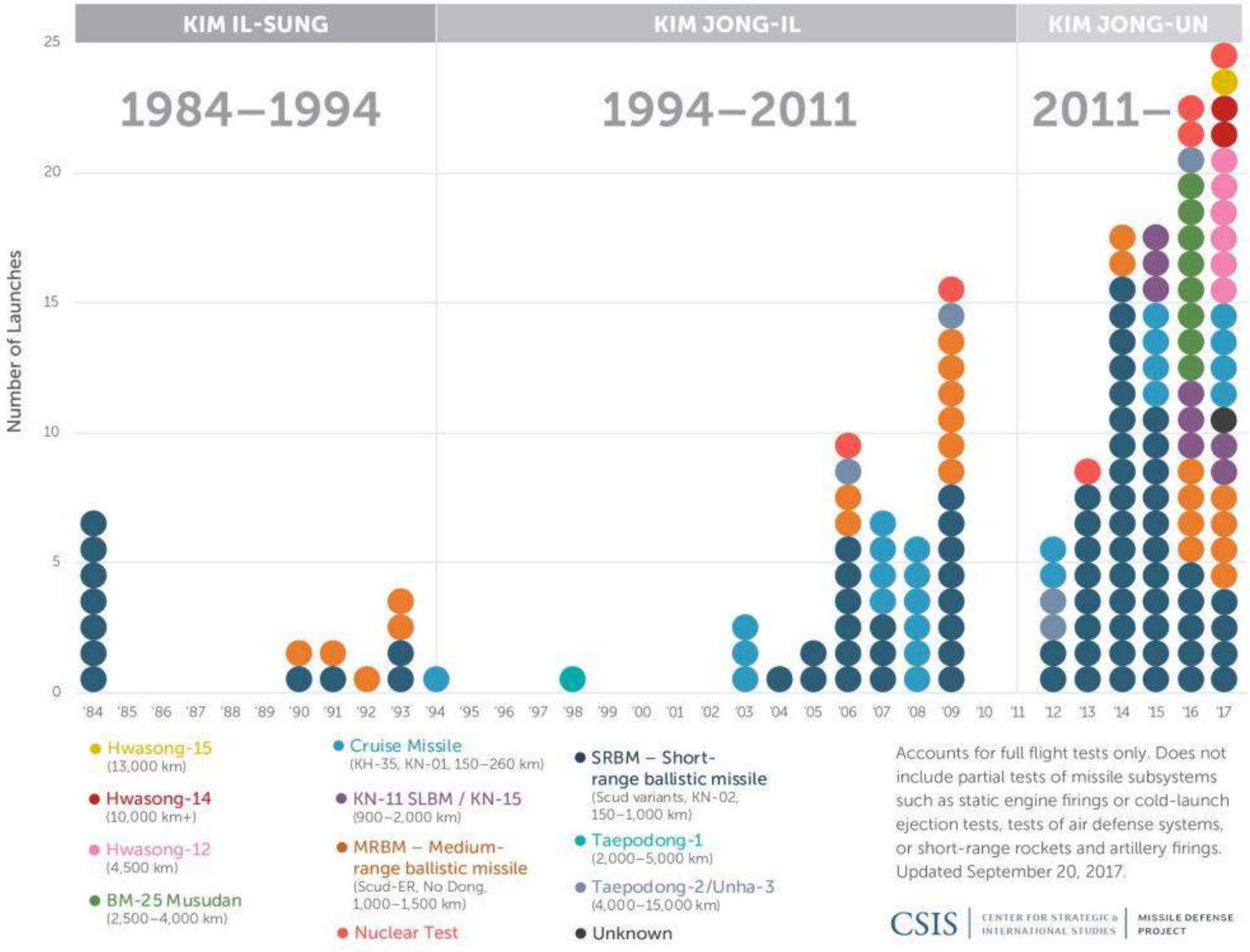


https://www.google.com/search?q=North+Korean+missile+type+charts&client=firefox-b-1&tbm=isch&source=iu&ictx=1&fir=rghiCq2-6-2LUM%253A%252CWFhVBbGqDT2wyM%252C_&usg=__lAZVTsme1E1xLv3qtDerCsgwmVI%3D&sa=X&ved=0ahUKEwjDypv0wZ7aAhURwlkKHcilBI0Q9QEIQjAD#imgrc=rghiCq2-6-2LUM:

North Korean Missile Launches



Source: CSIS Missile Defense Project, https://missilethreat.csis.org/country/dprk/

North Korean Missile Types

Missile	Class	Range	Status
Hwasong-15	ICBM	8,500-13,000	In Development
Hwasong-14	ICBM	10,000+ km	In Development
KN-08	ICBM	5,500-11,500 km	In Development
KN-14	ICBM	8,000-10,000 km	In Development
Hwasong-12	IRBM	4,500 km	In Development
BM-25 Musudan	IRBM	2,500-4,000 km	In Development
KN-15 (Pukkuksong-2)	MRBM	1,200-2,000	In Development
KN-11	SLBM	1,200 km	In Development
KN-18 (MaRV Scud Variant)	SRBM	450+ km	In Development
No-Dong	MRBM	1,200-1,500 km	Operational
Scud-ER	SRBM	800-1,000 km	Operational
Hwasong-6	SRBM	500 km	Operational
Hwasong-5	SRBM	300 km	Operational
KN-02	SRBM	120-170 km	Operational
Taepodong-2	SLV	4,000-10,000 km	Operational
Taepodong-1	IRBM	2,000-5,000 km	Obsolete
Kumsong-3	ASCM	130-250 km	Possibly Operational
KN-01	ASCM	110-160 km	Operational
KN-09	MLRS	190 km	In Development
M1985/M1991	MLRS	40-60 km	Operational
Koksan M1978	Artillery	40-60 km	Operational
KN-06	SAM	150 km	Operational

Source: CSIS Missile Defense Project, https://missilethreat.csis.org/country/dprk/

DoD Estimate of North Korean Ballistic Missile Forces - 2017

System	Range Class	# of Launchers	Estimated Range
SCUD B	SRBM	Fewer than 100	185 miles
SCUD C	SRBM		310 miles
SCUD ER	SRBM/MRBM		435–625 miles
No Dong	MRBM	Fewer than 50	800 miles
Pukguksong-2	MRBM	Unknown	620+ miles
Hwasong-10 (Musudan)	IRBM	Fewer than 50	2,000+ miles
Hwasong-12	IRBM	Unknown	1,800+ miles
Pukguksong-1	SLBM	At least 1	Unknown
TD-2	SLV/ICBM	Unknown*	7,400+ miles
Hwasong-13	ICBM	Unknown	Intercontinental**
Hwasong-14	ICBM		Intercontinental**
Unidentified ICBM	ICBM		Intercontinental**

Tested Untested

Note: The TD-2 has been used only in a space launch role but probably could reach the United States if configured as an ICBM.

* Launches of the TD-2 have been observed from both east and west coast launch facilities.

** ICBM is defined as a ballistic missile (land-based) capable of a range in excess of 5,500 kilometers (3,418 miles).

Visualization: DIA, D3 Design • 1709-14451

Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017,* *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, p. 17*

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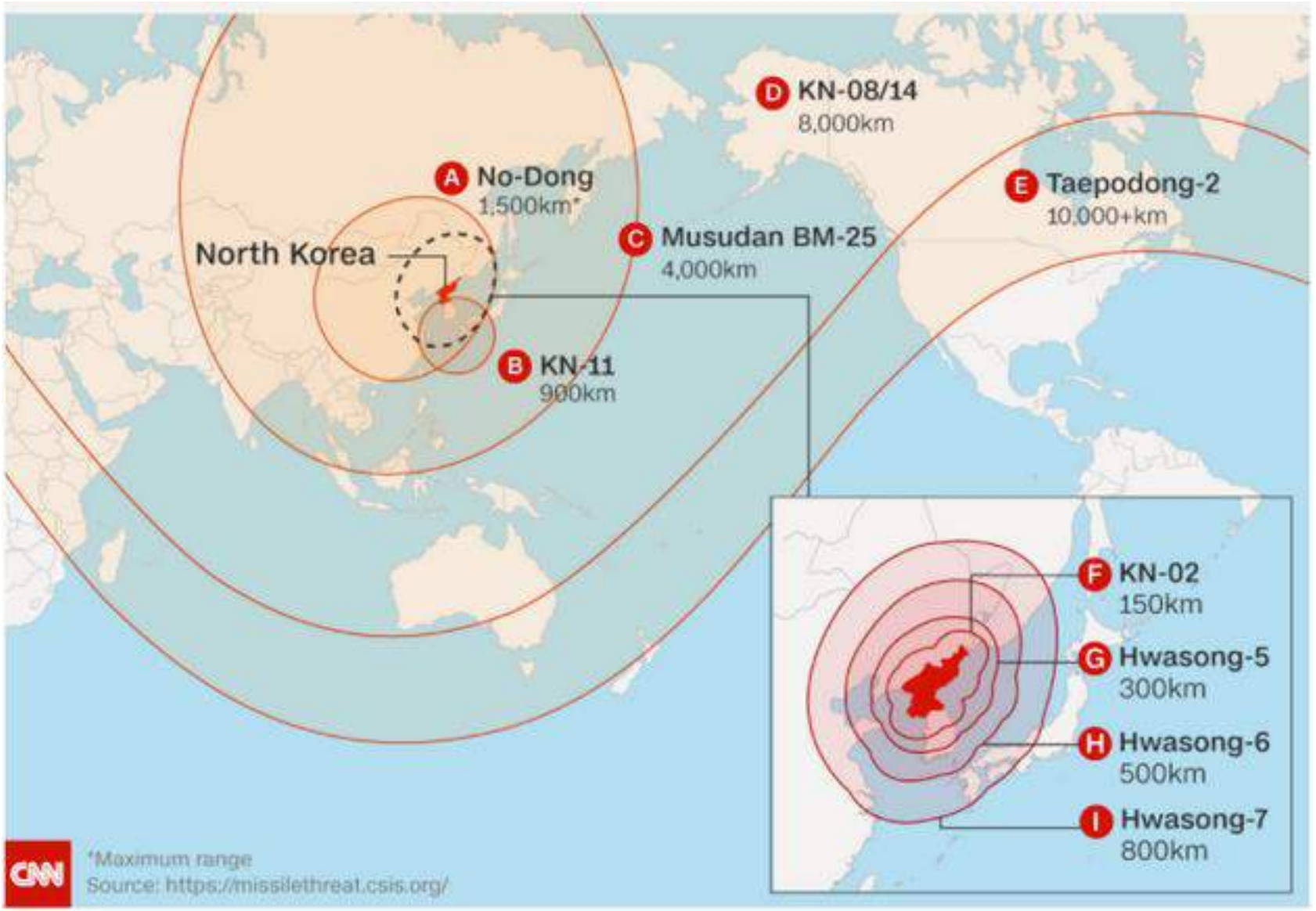
North Korean Missile Ranges -1



https://www.google.com/search?q=north+Korea+missile+ranges+chart&client=firefox-b-1&tbm=isch&source=iu&ictx=1&fir=eIEtkTU_7imPBM%253A%252CWcHJ48lBNZdt9M%252C_&usg=__btKN4gjG04LMpUcwKF5-OIiKYEI%3D&sa=X&ved=0ahUKEwjjlfeivp7aAhVSTt8KHQAoC54Q9QEILzAC#imgrc=eIEtkTU_7imPBM:

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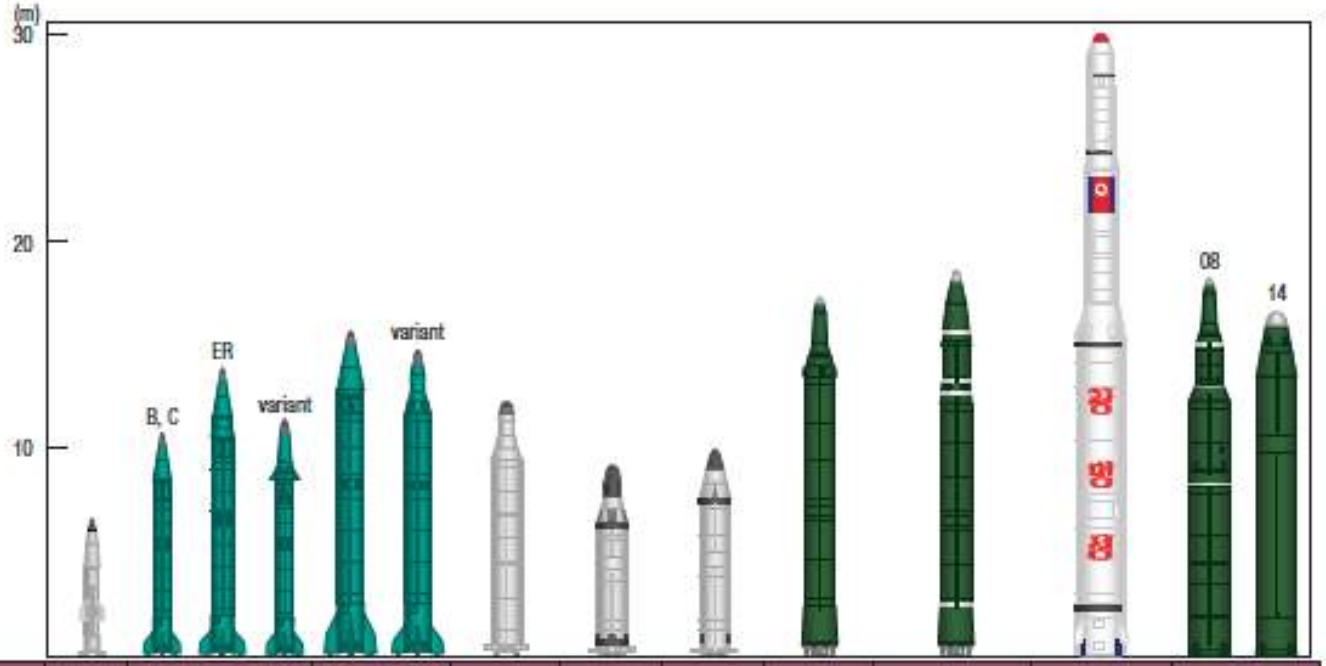
North Korean Missile Ranges - 2

Heritage, Washington Post, https://www.google.com/search?q=north+Korea+missile+ranges+chart&client=firefox-b-1&tbm=isch&source=iu&ictx=1&fir=eIEtkTU_7imPBM%253A%252CWcHJ48lBNZdt9M%252C_&usg=__btKN4gjG04LMpUcwKF5-OIiKYEI%3D&sa=X&ved=0ahUKEwjjlfeivp7aAhVSTt8KHQAoC54Q9QEILzAC#imgrc=Pocpw-Wt-8MIKM:

Japanese Estimate of North Korean Missiles

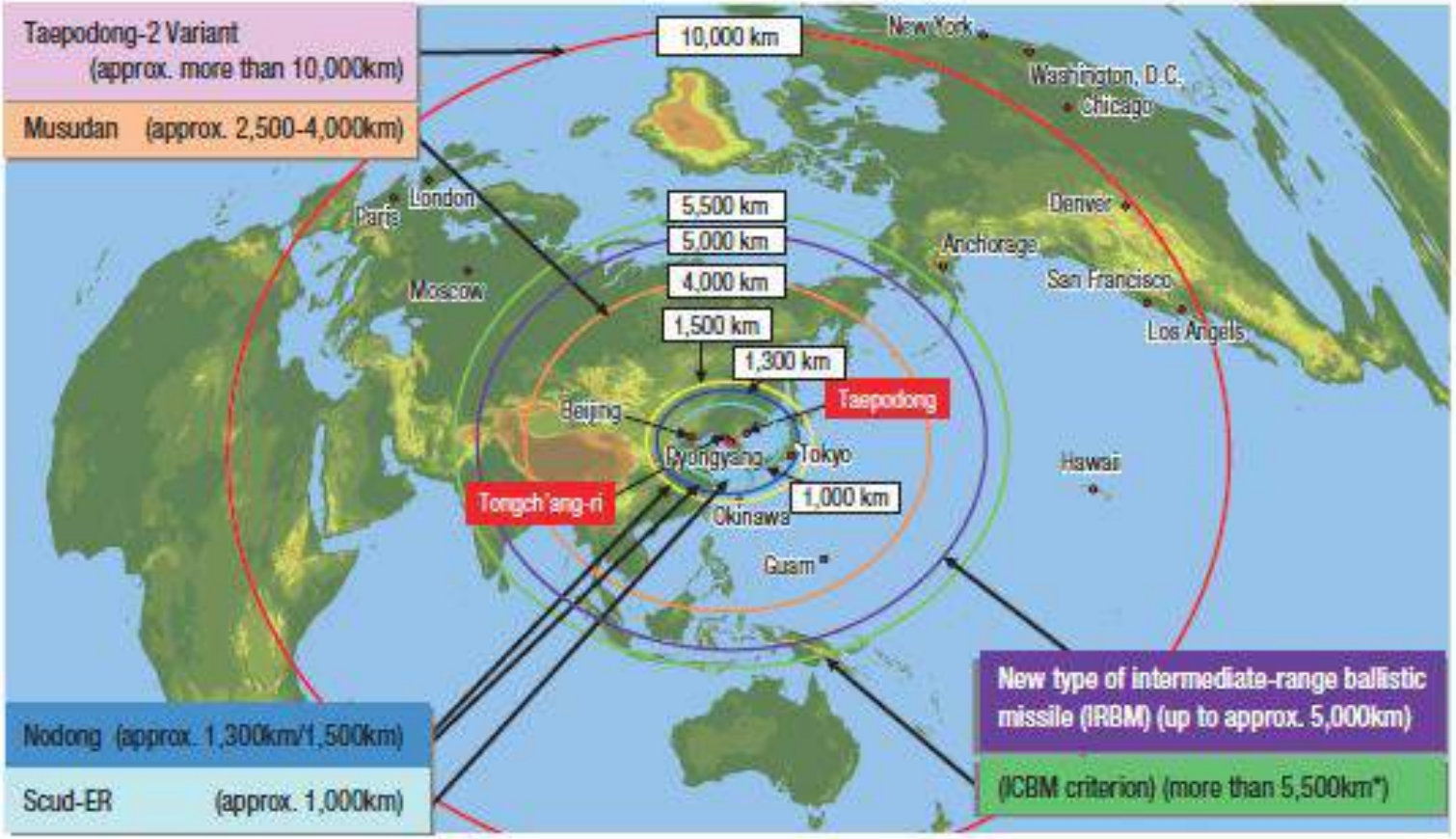


	Toksa	Scud B, C, ER, Modified	Scud B, C, ER, Modified	Musudan	SLBM	Modified SLBM	New type, IRBM	New type, intercontinental-range ballistic missile	Taepodong-2 variant	KN-08/KN-14
Range	Approx. 120 km	Approx. 300 km/ Approx. 500 km/ Approx. 1,000 km/ Under analysis	Approx. 1,300 km/ Approx. 1,500 km	Approx. 2,500–4,000 km	1,000 km or more	1,000 km or more	Maximum approx. 5,000 km	5,500 km or more	Approx. 10,000 km or more	5,500 km or more (ICBM (repeatedly))
Fuel	Solid	Liquid	Liquid	Liquid	Solid	Solid	Liquid	Liquid	Liquid	Liquid
Operation platform	TEL	TEL	TEL	TEL	Gorae-class submarine	TEL	TEL	TEL	Launch site	TEL

Source: Made by MOD based on Jane's Strategic Weapon Systems, etc.

Japanese Ministry of Defense, Defense of Japan, 2017, http://www.mod.go.jp/e/publ/w_paper/2017.html, p. 66

Japanese Estimate of North Korean Missile Ranges



Japanese Ministry of Defense, Defense of Japan, 2017, http://www.mod.go.jp/e/publ/w_paper/2017.html, p. 66

U.S. Bases and North Korean Nuclear/ Missile Facilities

Vox,
https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

Missile Defense Options

THAAD
Is a theater level endo-atmospheric ballistic missile defense system
With an effective range of roughly 125 miles. THAAD has successfully shot down target missiles in 13 practice tests.

Vox, https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

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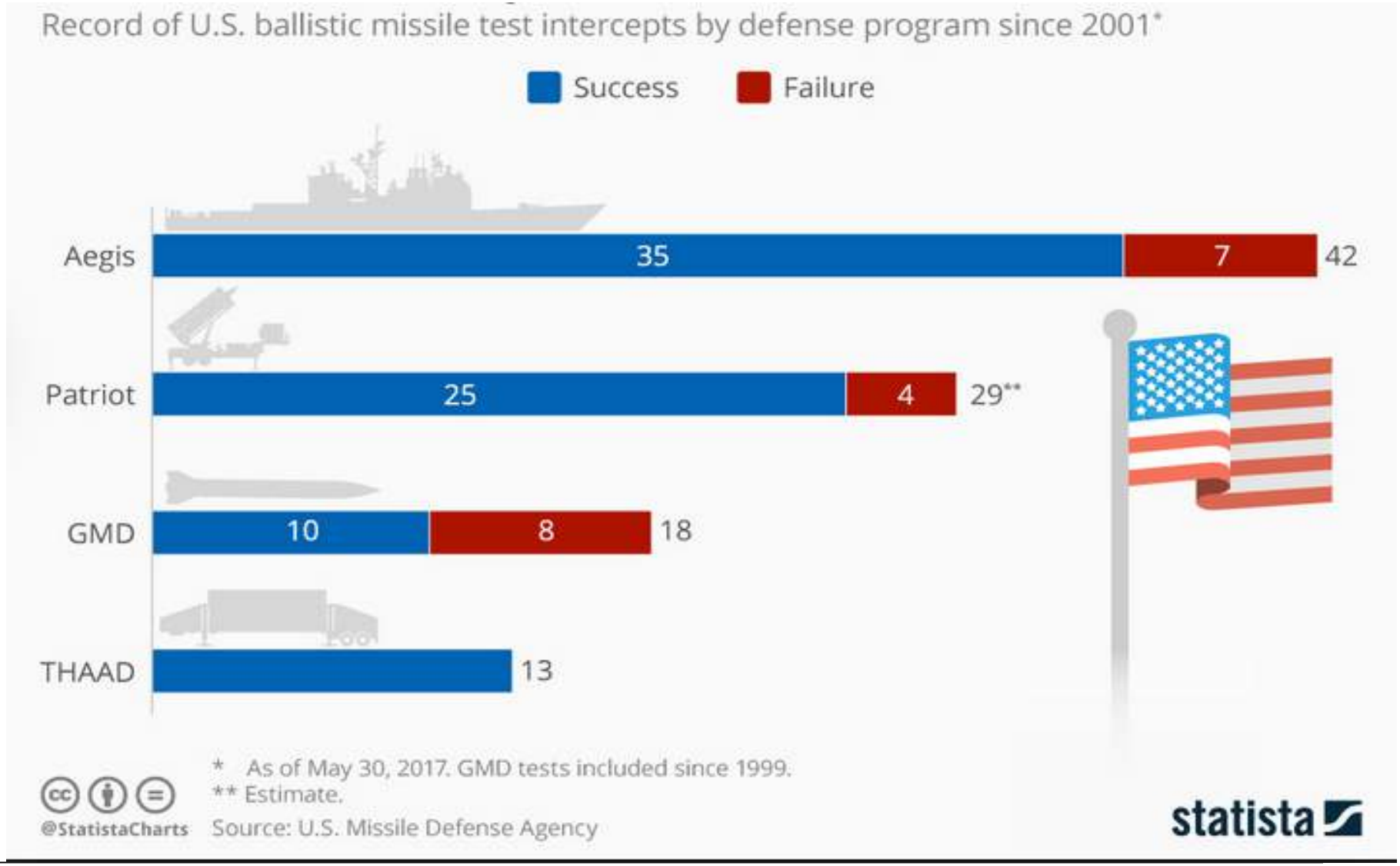
Missile Defense Performance to Date



Statista, https://www.google.com/search?q=Charts+of+North+Korean+attacks+on+South+Korea&client=firefox-b-1&tbm=isch&source=iu&ictx=1&fir=E2E-VW5KMDdySM%253A%252CDkx6zanwEw_PfM%252C_&usg=__Y60eC0kkxw3BXj8wD5afzu-ck5E%3D&sa=X&ved=0ahUKEwiCuLOt0qDaAhXsmuAKHQjIByAQ9QEIfTAH#imgrc=D6kMVWvRLtFH_M:

The Nuclear Dimension

North versus South

- Both North and South Korea are "one bomb" countries to some extent. A nuclear strike on either Seoul or Pyongyang would cripple key aspects of each regime and economy.
- The U.S. and South Korean can conduct devastating precision conventional and stealth attacks, but the political and strategic impact of a nuclear strike would be far greater.
- Even the most effective missile and air defenses cannot guarantee security.
- North Korean nuclear weapons can threaten Japan and U.S. bases in the region, as well as targets in the U.S.
- Steadily rising North Korean yields, range, and accuracy would pose a growing threat.
- Counters are U.S. extended deterrence, South Korea going nuclear, or North Korean freeze/dismantling of effort.

South Korean Nuclear Vulnerability – The More Vulnerable "One Bomb" Country?

- Highly urbanized with very dense population
- Mixed terrain and many high rise and solidly built buildings. Most damage models assume a flat plain.
- National recovery unclear after major strike on Seoul, which has very high percentage of population, core leaders, and critical elements of economy.
- Limited dispersal capability around cities to absorb population fleeing strikes.
- Limited ability to sustain refugee or IDP populations, provide medical and other services.
- High vulnerability to interruption of imports
- "Offset" targeting and height of burst can radically increase fallout effects.

DoD Assessment of North Korean Nuclear Program: 2/2018 - I

North Korea ultimately seeks the capability to strike the continental United States with a nuclear-armed ICBM. This pursuit supports North Korea's strategy of deterring the United States as well as weakening U.S. alliances in the region by casting doubt on the U.S. commitment to extended deterrence.

…North Korea's relations with Japan deteriorated in the last decade and remain stagnant. Tokyo has become increasingly alarmed over North Korea's nuclear and missile development, as Japan is within range of its medium-range and intermediate-range ballistic missiles (IRBMs). North Korean IRBMs overflew Hokkaido in August and September 2017, and a number of North Korean missiles have dropped in Japan's exclusive economic zone.

…North Korea's national military strategy is designed to support its national security strategy by defending the Kim regime's rule. This strategy relies heavily on deterrence: strategic deterrence through its nuclear weapons program and supporting delivery systems; and conventional deterrence through the fielding of a large, heavily armed, forward-deployed military that presents a constant threat to the ROK, particularly the GSMA.

… North Korea's illegal pursuit of a nuclear weapons program is well documented. North Korea continues to invest in its nuclear infrastructure and could conduct additional nuclear tests at any time. It conducted nuclear tests in 2006, 2009, 2013, two in 2016, and one in 2017, according to seismic detections and public claims by North Korean media.

In April 2013, less than two months after its third nuclear test, North Korea promulgated a domestic "Law on Consolidating Position as a Nuclear Weapons State" to provide both a legal basis for its nuclear program and another signal that it does not intend to give up its pursuit of nuclear development. The law says that "the nuclear weapons of the DPRK can only be used by a final order of the Supreme Commander of the Korean's People's Army [i.e., Kim Jong Un] to repel invasion or attack from a hostile nuclear weapons state and make retaliatory strikes."

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018,*

DoD Assessment of North Korean Nuclear Program: 2/2018 - II

In 2010, North Korea revealed a uranium enrichment facility at Yongbyon that it claimed was for producing fuel for a light water reactor then under construction. In April 2013, North Korea announced its intent to restart and refurbish the nuclear facilities at Yongbyon, including the nuclear reactor that had been shut down since 2007 as well as the uranium enrichment facility.

The Director of the DPRK Atomic Energy Institute confirmed in September 2015 that all of the nuclear facilities in Yongbyon, including the uranium enrichment plant and reactor, were "adjusted and altered" following the April 2013 announcement and restarted for the purpose of building North Korea's nuclear force. The Director also claimed that scientists and technicians were enhancing the levels of various nuclear weapons in quality and quantity.

These activities violate North Korea's obligations under multiple UNSCRs, most recently 2371 and 2375; contravene its commitments under the September 19, 2005, Six-Party Talks Joint Statement; and increase the risk of proliferation.

…North Korea has demonstrated a willingness to proliferate nuclear technology. Using the proliferation network of Pakistani nuclear scientist AQ Khan, North Korea provided Libya under Moamar Qaddafi with uranium hexafluoride, the form of uranium used in the uranium enrichment process to produce fuel for nuclear reactors and nuclear weapons. North Korea also provided Syria with nuclear reactor technology until the facility was destroyed in 2007.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018,*

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North Korean Nuclear Efforts

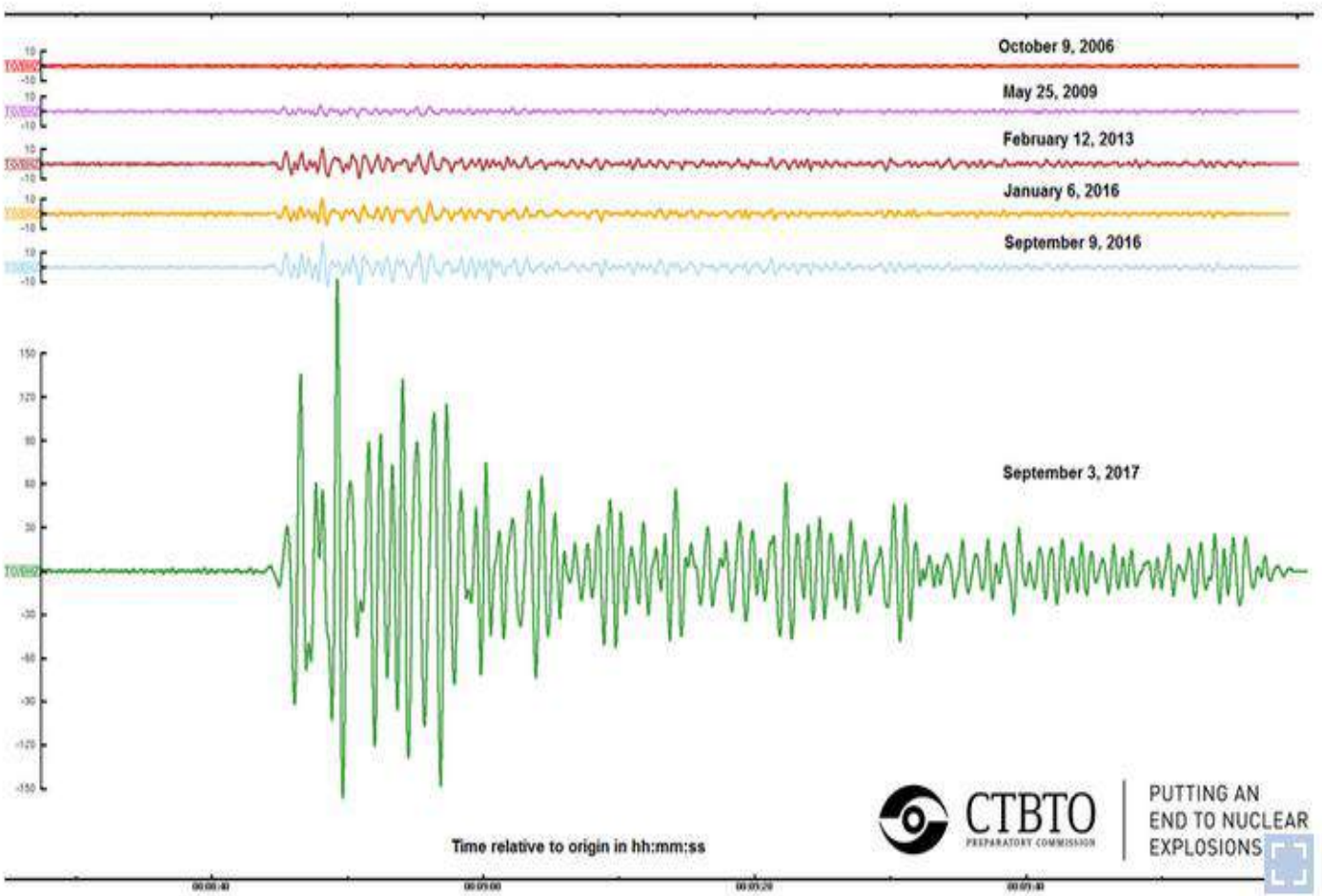
- **Five underground nuclear tests in 2006, 2009, 2013, and 2016;**
- **Restart and refurbishment of the small five megawatt-electric (MWe) reactor at Yongbyon after a several year halt;**
- **Separation of several kg of plutonium in 2009 and again in 2016 from the 5 Mwe reactor at the Radiochemical Laboratory at Yongbyon;**
- **On-going construction of an experimental light water reactor (ELWR) at Yongbyon (type of reactor is uncertain);**
- **Construction by a nuclear organization of a new graphite production facility;**
- **Revelation of a centrifuge plant at Yongbyon in 2010 and subsequent doubling of its floor size a few years later;**
- **Construction of facilities to make thermonuclear materials, including a lithium 6 enrichment plant and an Isotope Production Facility able to separate tritium;**
- **Modernization and construction of many buildings at Yongbyon, including likely one able to manufacture fuel for the ELWR and others to support reactor and centrifuge operations;**
- **Refurbishing of uranium mines and mills;**
- **The development and manufacture of nuclear weapons at sites unknown;**
- **A great deal of work related to the development and manufacture of ballistic missiles;**
- **These activities have been supported by extensive overseas procurements of equipment, material, and technology.**

1

Source: David Albright*," **North Korea's Nuclear Capabilities: A Fresh Look,"** Institute for Science and International Security April 22, 2017, www.isis-online.org, www.isisnucleariran.org (*Mark Gorwitz contributed importantly)*

North Korean Nuclear Tests - Seismic

36 of the CTBTO's seismic stations contributed to the initial analysis and more than 100 recorded the event, which the organization says was equivalent to a magnitude 6.1 earthquake. (The U.S. Geological Survey put the blast closer to 6.3 in magnitude.)



North Korea has conducted six nuclear tests. As this chart of seismic activity shows, the latest test on Sept. 3 was roughly an order of magnitude larger than earlier ones.

CTBTO

Geoff Brumfiel, NPR, September 7, 2017, https://www.npr.org/sections/thetwo-way/2017/09/07/549155856/here-s-how-big-north-korea-s-latest-nuclear-test-actually-was. Based on CTBTO data.

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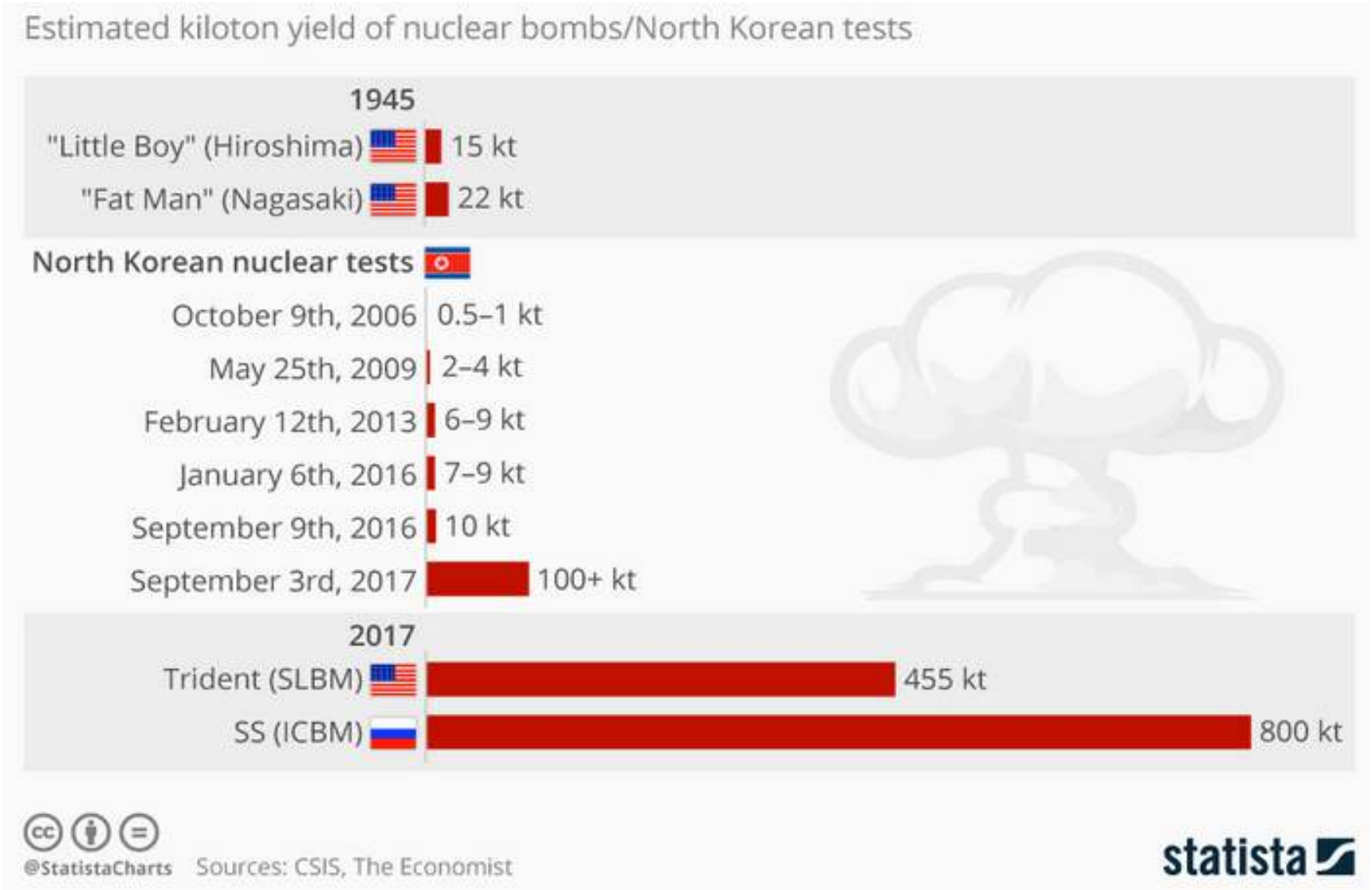
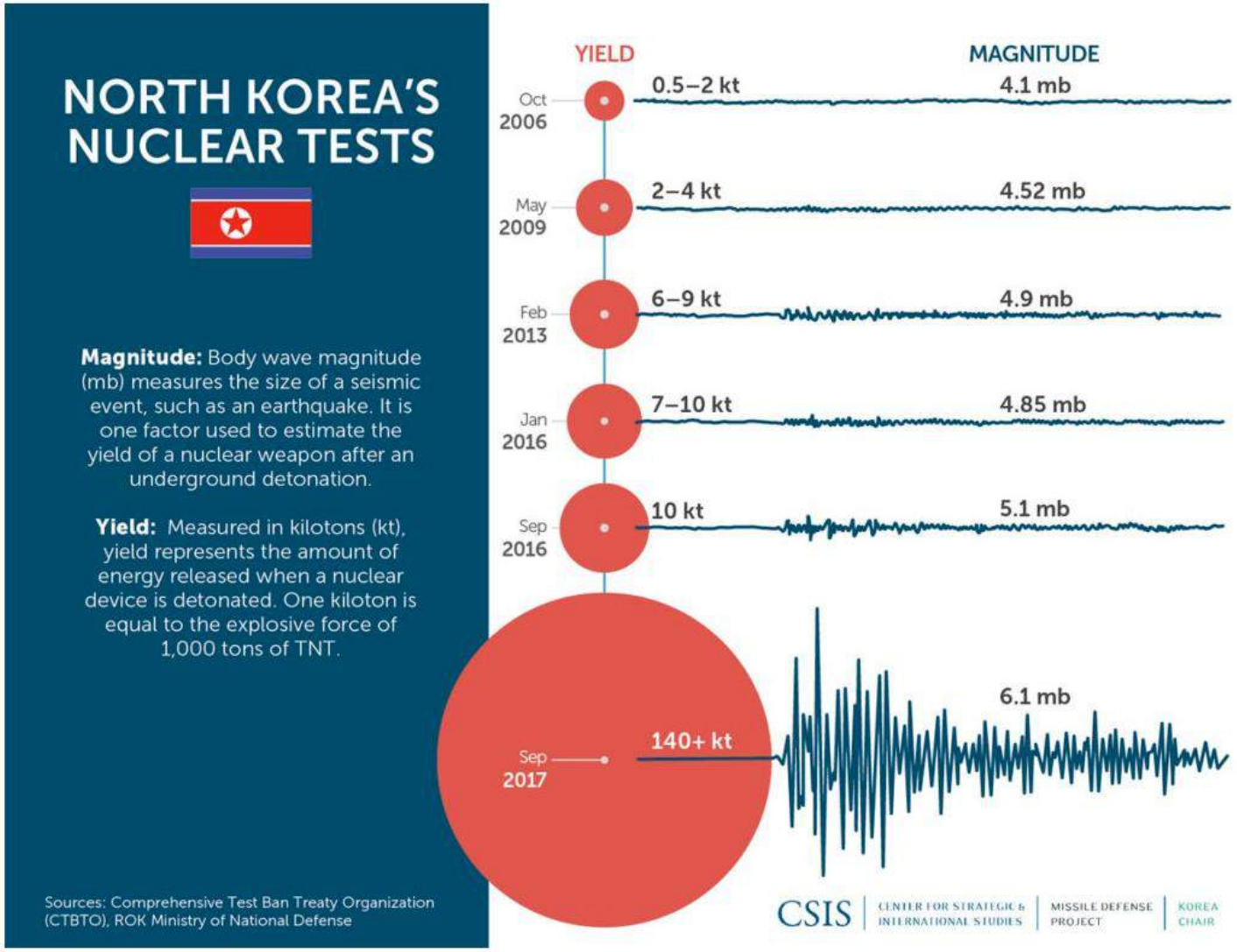
North Korean Nuclear Tests - Yield



https://www.google.com/search?q=north+Korea+nuclear+test+charts&client=firefox-b1&tbm=isch&source=iu&ictx=1&fir=znJDcjOjExmsuM%253A%252CTyl-ZovMljstuM%252C_&usg=___6qzUh6PTZhS1ykVrZgU4zrZUIc%3D&sa=X&ved=0ahUKEwjg86Xpup7aAhVsk-AKHXDcBJwQ9QEIQzAC#imgrc=EG08Do5GsRgSPM:

North Korean Nuclear Tests



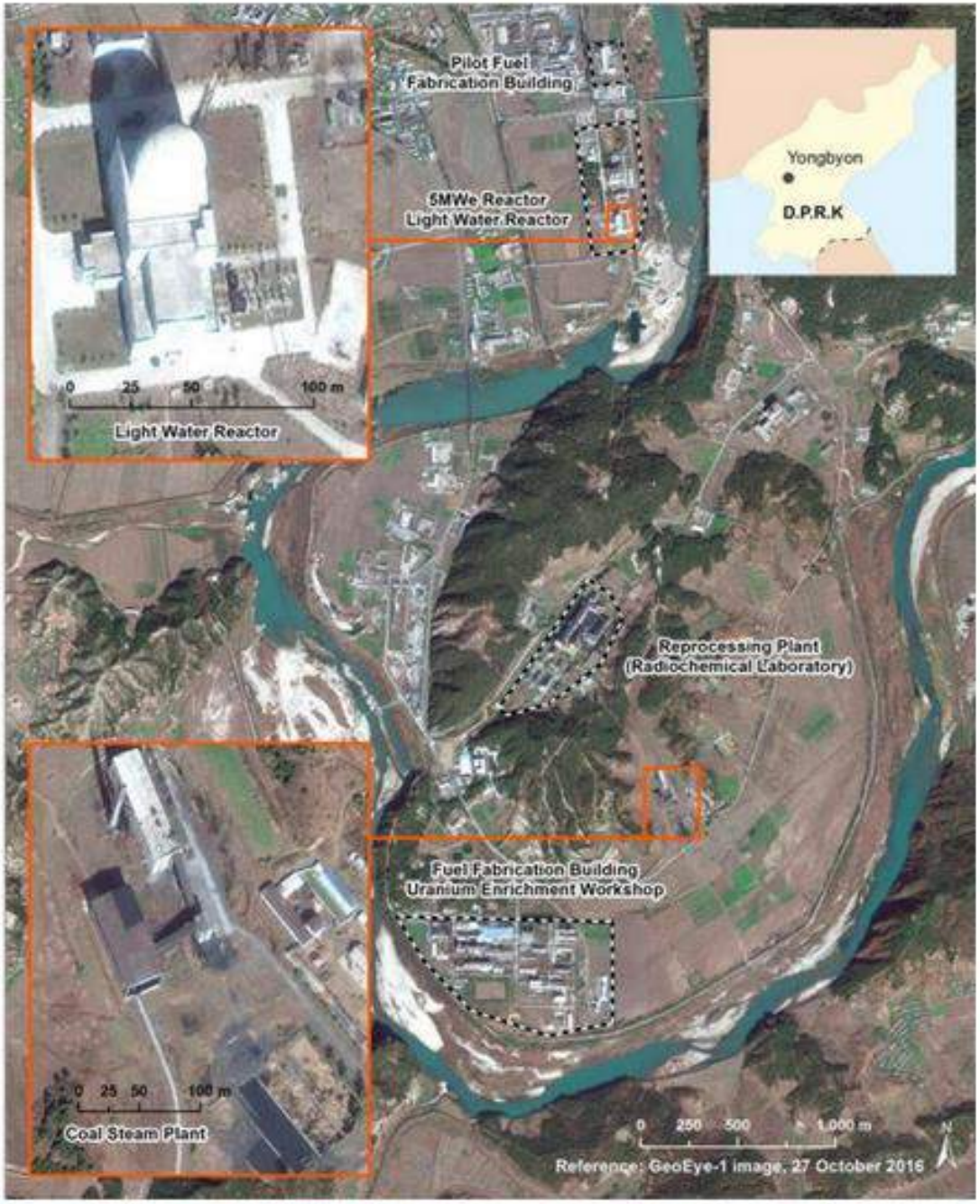
Source:
CSIS Missile Defense Project, https://missilethreat.csis.org/country/dprk/

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

Yogbyon

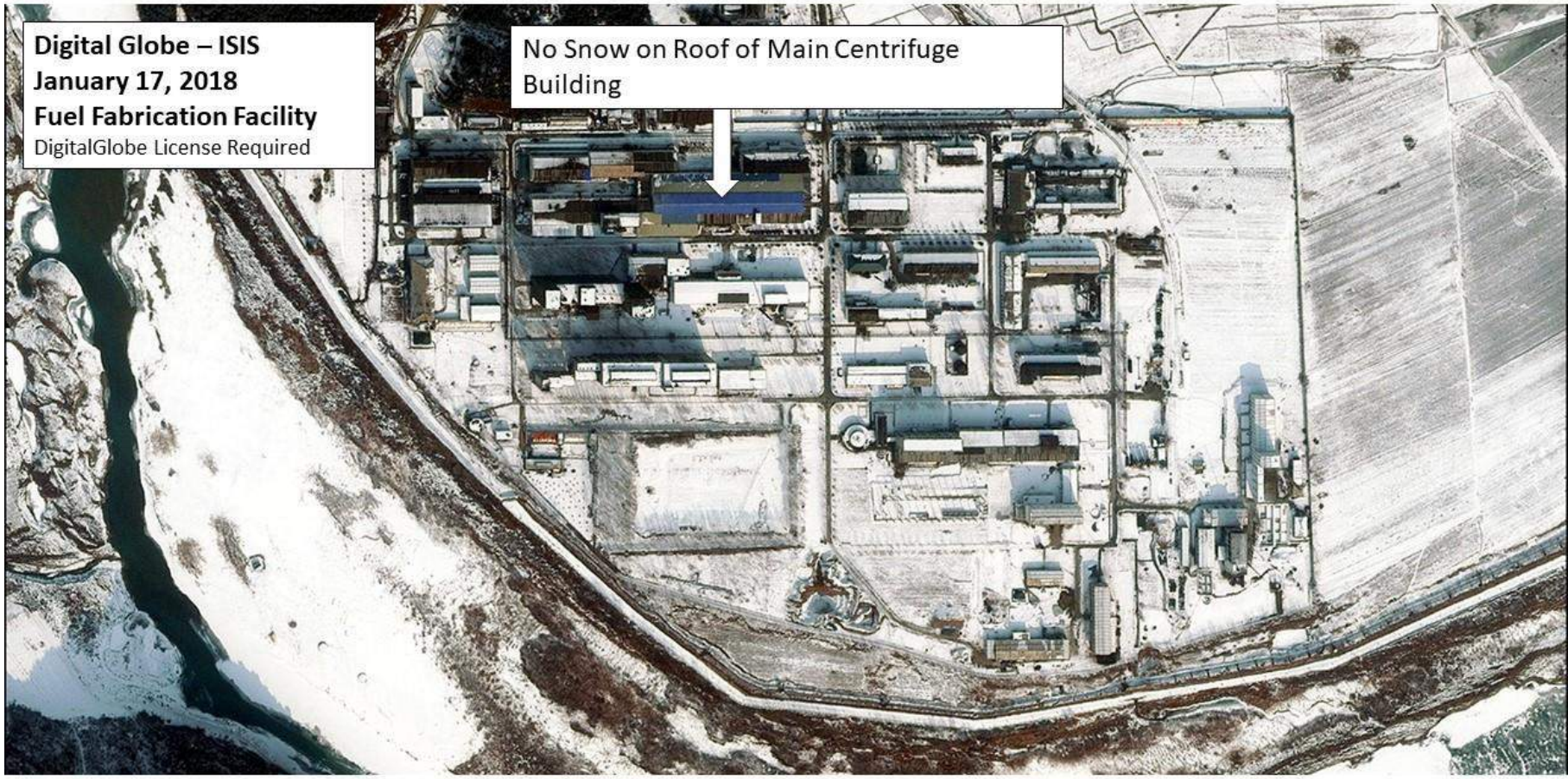
(50 kilometers from Pyongyang)

October 2016



Vox,
https://www.vox.com/world/2017/8/29/16079076/north-korea-maps

North Korean Nuclear Growth?



- **Second Plutonium reactor?**
- **One-two centrifuge facilities**
- **Thermonuclear components and materials?**

David Albright, Sarah Burkhard, and Allison Lach, "On-Going Monitoring of Activities at the Yongbyon Nuclear Site," ISIS February 13, 2018

Gas Centrifuge Plant and Possible Tritium Separation at Yongbyon for Thermonuclear Devices

Source: David Albright*," **North Korea's Nuclear Capabilities: A Fresh Look,"** Institute for Science and International Security April 22, 2017, www.isis-online.org, www.isisnucleariran.org (*Mark Gorwitz contributed importantly)*

Possible Fission Weapons Totals: 2020

Case	Mass Pu	Mass WGU	Weapons-Equivalent Pu	Weapons-Equivalent WGU	Weapons-Equivalent Total(b)	Weapons (70% FM) Pu	Weapons (70% FM) WGU	Weapons (70% FM) Total
5 MWe reactor, one Centrifuge plant (scenario 2)	48	409	13.8	20.8	35	9.7	14.5	**24**
5 MWe reactor two Centrifuge plants (scenarios 1 & 2)	48	1120	13.8	56.4	70	9.7	39.5	**49**
5 Mwe reactor, two Centrifuge plants, and LWR (scenarios 1 & 2)	91.8	1120	26.5	56.4	83	18.5	39.5	**58**
Composite cores (2 kg plutonium per core; rest WGU)								
No LWR					24.			17
LWR					46			32

Comments

(a) For ease of projections, no further nuclear tests are assumed. If there are further tests, these numbers will need to be reduced.

(b) Values do not add precisely because of nature of statistical calculation and rounding

Source: David Albright*," **North Korea's Nuclear Capabilities: A Fresh Look,"** Institute for Science and International Security April 22, 2017, www.isis-online.org, www.isisnucleariran.org (*Mark Gorwitz contributed importantly)*

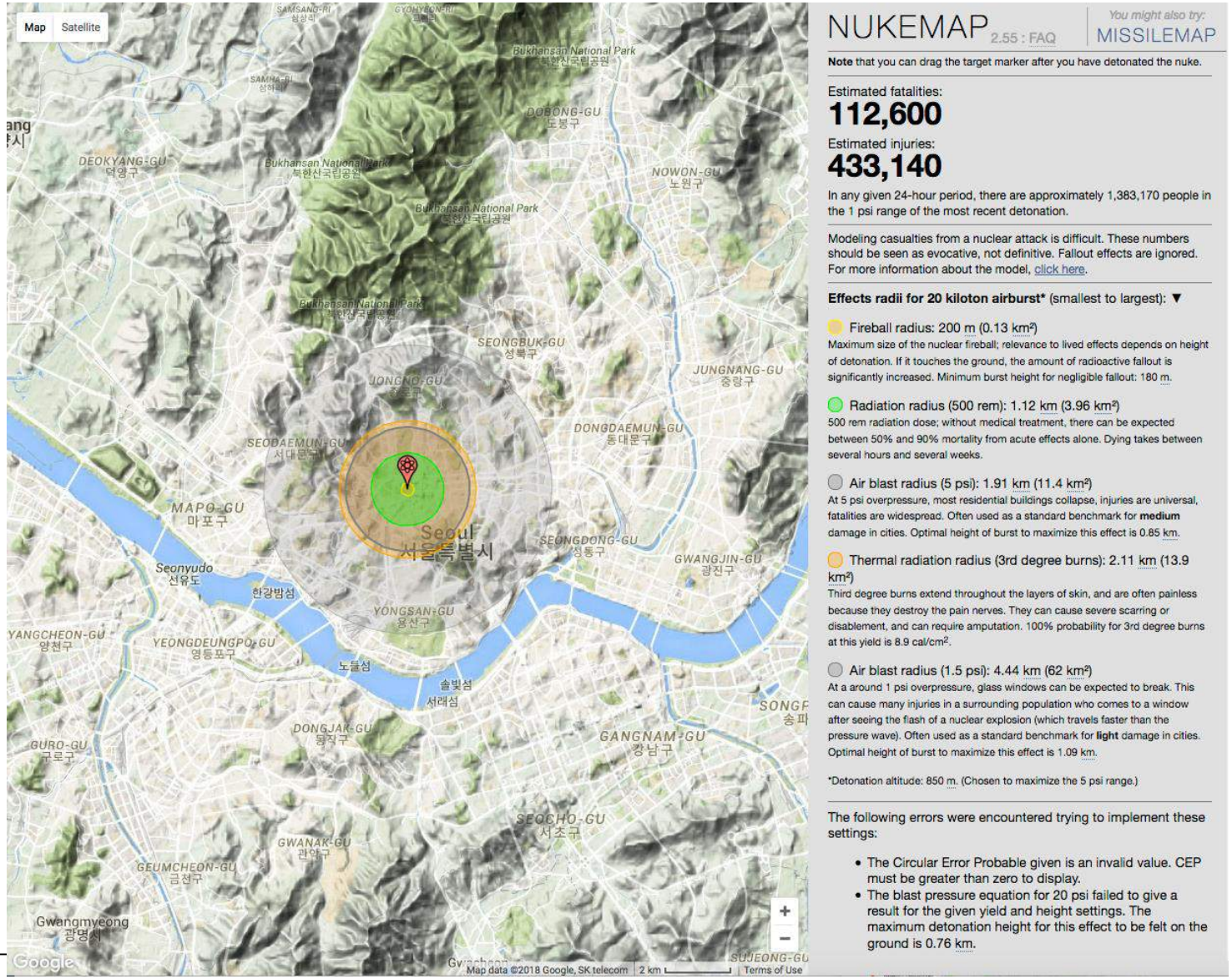
Thermonuclear Weapons? ISIS

- **We tend to discount the first two types, namely two-stage thermonuclear and U.S.-style boosted weapon, as beyond North Korea's capabilities for some time.**
- **The third type, or one-stage designs, involves many subtypes of varying difficulty, although all are complex to achieve. They allow less plutonium or weapon-grade uranium per weapon or increase the yield of a nominal fission device.**
- **Several types of one-stage designs are judged as within North Korea's capability.**

Source: David Albright*," **North Korea's Nuclear Capabilities: A Fresh Look,"** Institute for Science and International Security April 22, 2017, www.isis-online.org, www.isisnucleariran.org (*Mark Gorwitz contributed importantly)*

20 KT Attack on Seoul – Less Fallout

Alex Wellerstein, nuke map, https://nuclearsecrecy.com/nukemap/?&kt=10&lat=41.8842458&lng=-87.6301432&hob_opt=1&hob_psi=5&hob_ft=2207&casualties=1&psi=20,5,1.5&cep=1&fatalities=174987&injuries=208450&psi_1=591272&zm=10



NUKEMAP 2.55 : FAQ

You might also try: MISSILEMAP

Note that you can drag the target marker after you have detonated the nuke.

Estimated fatalities:

112,600

Estimated injuries:

433,140

In any given 24-hour period, there are approximately 1,383,170 people in the 1 psi range of the most recent detonation.

Modeling casualties from a nuclear attack is difficult. These numbers should be seen as evocative, not definitive. Fallout effects are ignored. For more information about the model, click here.

Effects radii for 20 kiloton airburst* (smallest to largest): ▼

Fireball radius: 200 m (0.13 km²)
Maximum size of the nuclear fireball; relevance to lived effects depends on height of detonation. If it touches the ground, the amount of radioactive fallout is significantly increased. Minimum burst height for negligible fallout: 180 m.

Radiation radius (500 rem): 1.12 km (3.96 km²)
500 rem radiation dose; without medical treatment, there can be expected between 50% and 90% mortality from acute effects alone. Dying takes between several hours and several weeks.

Air blast radius (5 psi): 1.91 km (11.4 km²)
At 5 psi overpressure, most residential buildings collapse, injuries are universal, fatalities are widespread. Often used as a standard benchmark for **medium** damage in cities. Optimal height of burst to maximize this effect is 0.85 km.

Thermal radiation radius (3rd degree burns): 2.11 km (13.9 km²)
Third degree burns extend throughout the layers of skin, and are often painless because they destroy the pain nerves. They can cause severe scarring or disablement, and can require amputation. 100% probability for 3rd degree burns at this yield is 8.9 cal/cm².

Air blast radius (1.5 psi): 4.44 km (62 km²)
At a around 1 psi overpressure, glass windows can be expected to break. This can cause many injuries in a surrounding population who comes to a window after seeing the flash of a nuclear explosion (which travels faster than the pressure wave). Often used as a standard benchmark for **light** damage in cities. Optimal height of burst to maximize this effect is 1.09 km.

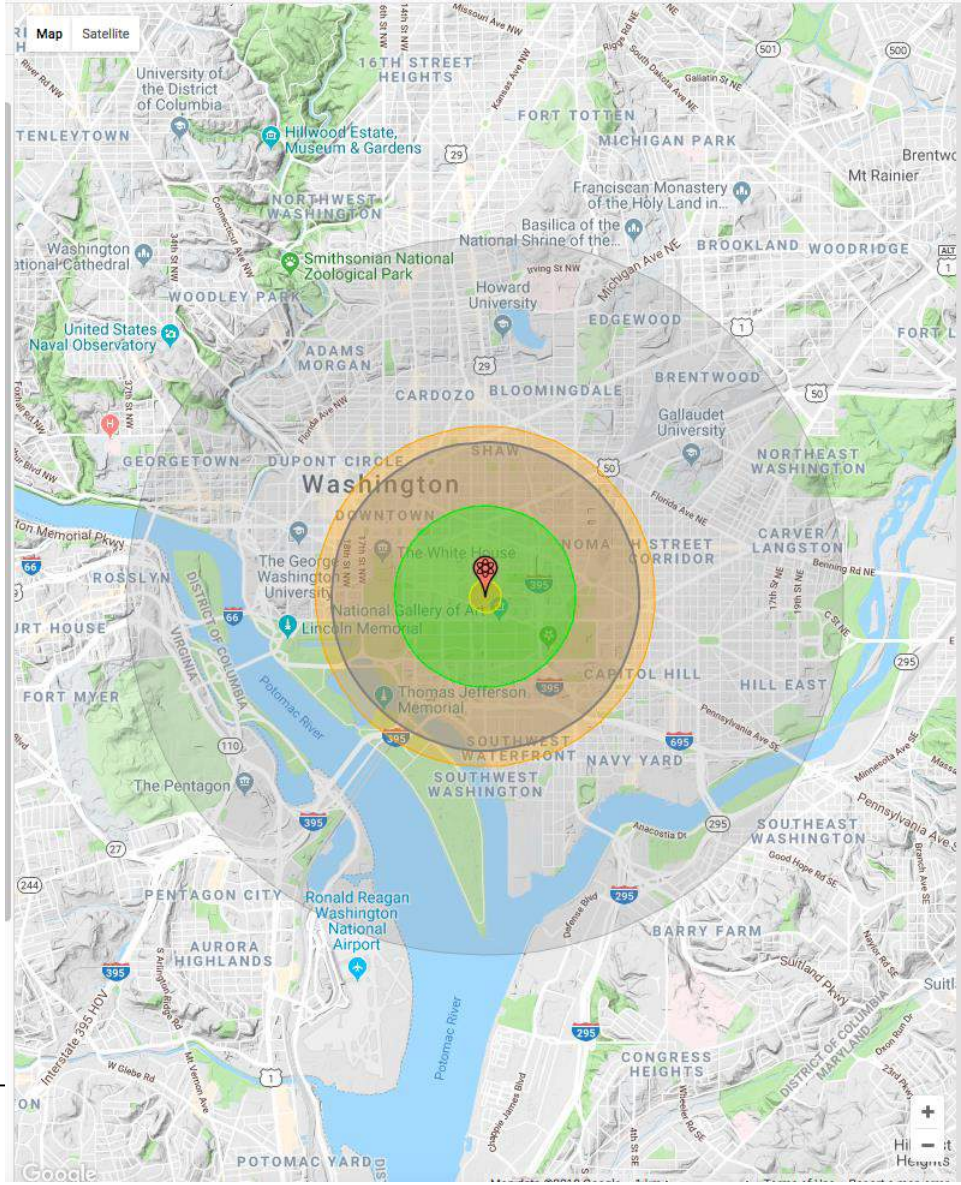
*Detonation altitude: 850 m. (Chosen to maximize the 5 psi range.)

The following errors were encountered trying to implement these settings:

- The Circular Error Probable given is an invalid value. CEP must be greater than zero to display.
- The blast pressure equation for 20 psi failed to give a result for the given yield and height settings. The maximum detonation height for this effect to be felt on the ground is 0.76 km.

20 KT Attack on Washington – Less Fallout

Alex Wellerstein, nuke map, https://nuclearsecrecy.com/nukemap/?&kt=10&lat=41.8842458&lng=-87.6301432&hob_opt=1&hob_psi=5&hob_ft=2207&casualties=1&psi=20,5,1.5&cep=1&fatalities=174987&injuries=208450&psi_1=591272&zm=10



NUKEMAP 2.55 : FAQ

You might also try: MISSILEMAP

Estimated fatalities:

111,780

Estimated injuries:

221,620

In any given 24-hour period, there are approximately 627,287 people in the 1 psi range of the most recent detonation.

Modeling casualties from a nuclear attack is difficult. These numbers should be seen as evocative, not definitive. Fallout effects are ignored. For more information about the model, click here.

Effects radii for 20 kiloton airburst* (smallest to largest): ▼

Fireball radius: 200 m (0.13 km²)
Maximum size of the nuclear fireball; relevance to lived effects depends on height of detonation. If it touches the ground, the amount of radioactive fallout is significantly increased. Minimum burst height for negligible fallout: 180 m.

Radiation radius (500 rem): 1.12 km (3.96 km²)
500 rem radiation dose; without medical treatment, there can be expected between 50% and 90% mortality from acute effects alone. Dying takes between several hours and several weeks.

Air blast radius (5 psi): 1.91 km (11.4 km²)
At 5 psi overpressure, most residential buildings collapse, injuries are universal, fatalities are widespread. Often used as a standard benchmark for **medium** damage in cities. Optimal height of burst to maximize this effect is 0.85 km.

Thermal radiation radius (3rd degree burns): 2.11 km (13.9 km²)
Third degree burns extend throughout the layers of skin, and are often painless because they destroy the pain nerves. They can cause severe scarring or disablement, and can require amputation. 100% probability for 3rd degree burns at this yield is 8.9 cal/cm².

Air blast radius (1.5 psi): 4.44 km (62 km²)
At a around 1 psi overpressure, glass windows can be expected to break. This can cause many injuries in a surrounding population who comes to a window after seeing the flash of a nuclear explosion (which travels faster than the pressure wave). Often used as a standard benchmark for **light** damage in cities. Optimal height of burst to maximize this effect is 1.09 km.

*Detonation altitude: 850 m. (Chosen to maximize the 5 psi range.)

The following errors were encountered trying to implement these settings:

- The Circular Error Probable given is an invalid value. CEP must be greater than zero to display.
- The blast pressure equation for 20 psi failed to give a result for the given yield and height settings. The maximum detonation height for this effect to be felt on the ground is 0.76 km.

Note: Rounding accounts for any inconsistencies in the above numbers

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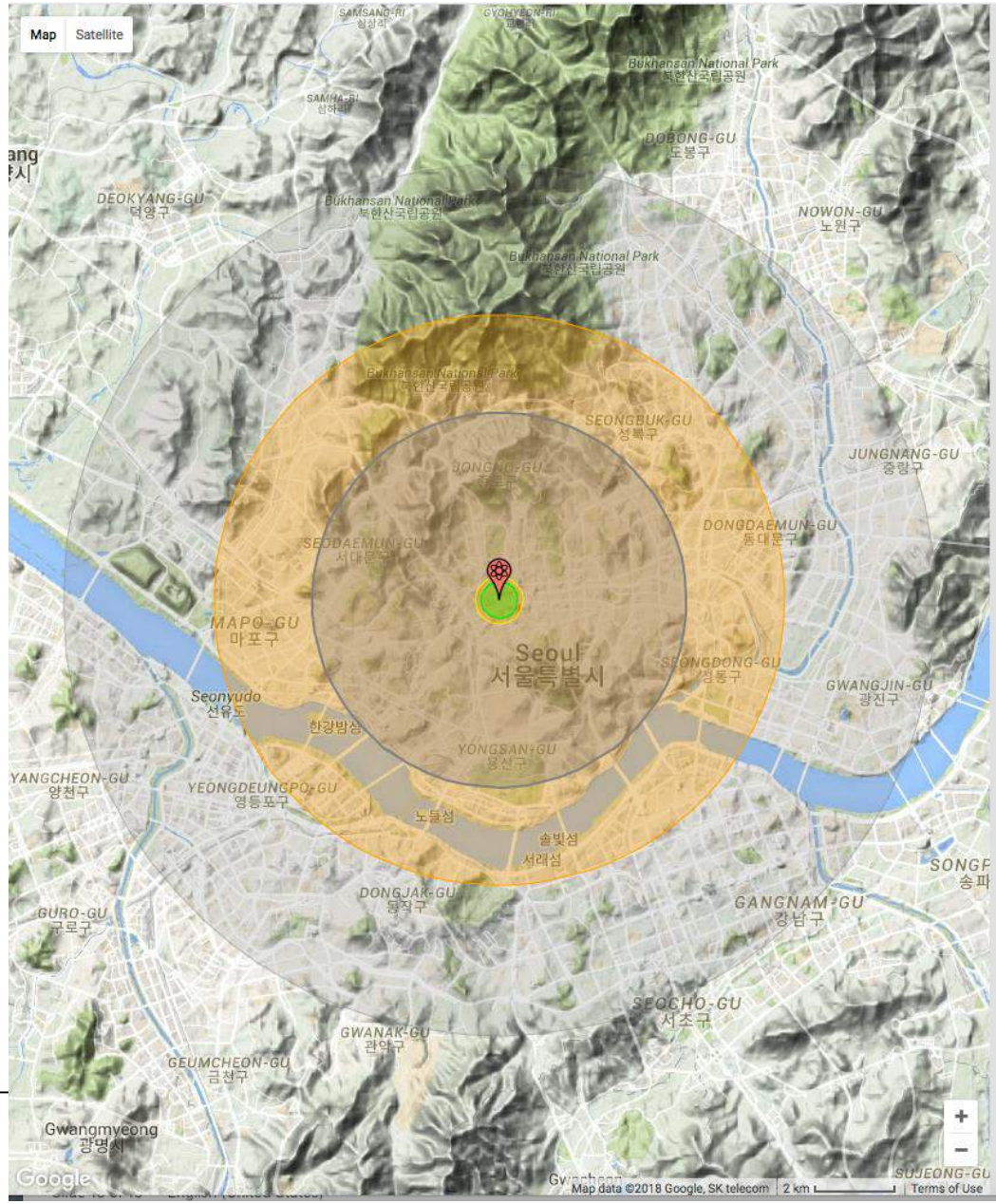
300 KT Attack on Seoul – Less Fallout

Alex Wellerstein, nuke map, https://nuclearsecrecy.com/nukemap/?&kt=10&lat=41.8842458&lng=-87.6301432&hob_opt=1&hob_psi=5&hob_ft=2207&casualties=1&psi=20,5,1.5&cep=1&fatalities=174987&injuries=208450&psi_1=591272&zm=10



NUKEMAP 2.55 : FAQ

You might also try: MISSILEMAP

Estimated fatalities:

706,310

Estimated injuries:

2,869,540

In any given 24-hour period, there are approximately 8,789,624 people in the 1 psi range of the most recent detonation.

Modeling casualties from a nuclear attack is difficult. These numbers should be seen as evocative, not definitive. Fallout effects are ignored. For more information about the model, click here.

Effects radii for 300 kiloton airburst* (smallest to largest): ▼

Radiation radius (500 rem): 460 m (0.67 km²)

500 rem radiation dose; without medical treatment, there can be expected between 50% and 90% mortality from acute effects alone. Dying takes between several hours and several weeks.

Fireball radius: 0.6 km (1.12 km²)

Maximum size of the nuclear fireball; relevance to lived effects depends on height of detonation. If it touches the ground, the amount of radioactive fallout is significantly increased. Minimum burst height for negligible fallout: 0.54 km.

Air blast radius (5 psi): 4.71 km (69.6 km²)

At 5 psi overpressure, most residential buildings collapse, injuries are universal, fatalities are widespread. Often used as a standard benchmark for **medium** damage in cities. Optimal height of burst to maximize this effect is 2.09 km.

Thermal radiation radius (3rd degree burns): 7.17 km (161 km²)

Third degree burns extend throughout the layers of skin, and are often painless because they destroy the pain nerves. They can cause severe scarring or disablement, and can require amputation. 100% probability for 3rd degree burns at this yield is 10.6 cal/cm².

Air blast radius (1.5 psi): 11 km (377 km²)

At a around 1 psi overpressure, glass windows can be expected to break. This can cause many injuries in a surrounding population who comes to a window after seeing the flash of a nuclear explosion (which travels faster than the pressure wave). Often used as a standard benchmark for **light** damage in cities. Optimal height of burst to maximize this effect is 2.69 km.

*Detonation altitude: 2,090 m. (Chosen to maximize the 5 psi range.)

The following errors were encountered trying to implement these settings:

- The Circular Error Probable given is an invalid value. CEP must be greater than zero to display.
- The blast pressure equation for 20 psi failed to give a result for the given yield and height settings. The maximum detonation height for this effect to be felt on the ground is 1.89 km.

Note: Rounding accounts for any inconsistencies in the above numbers

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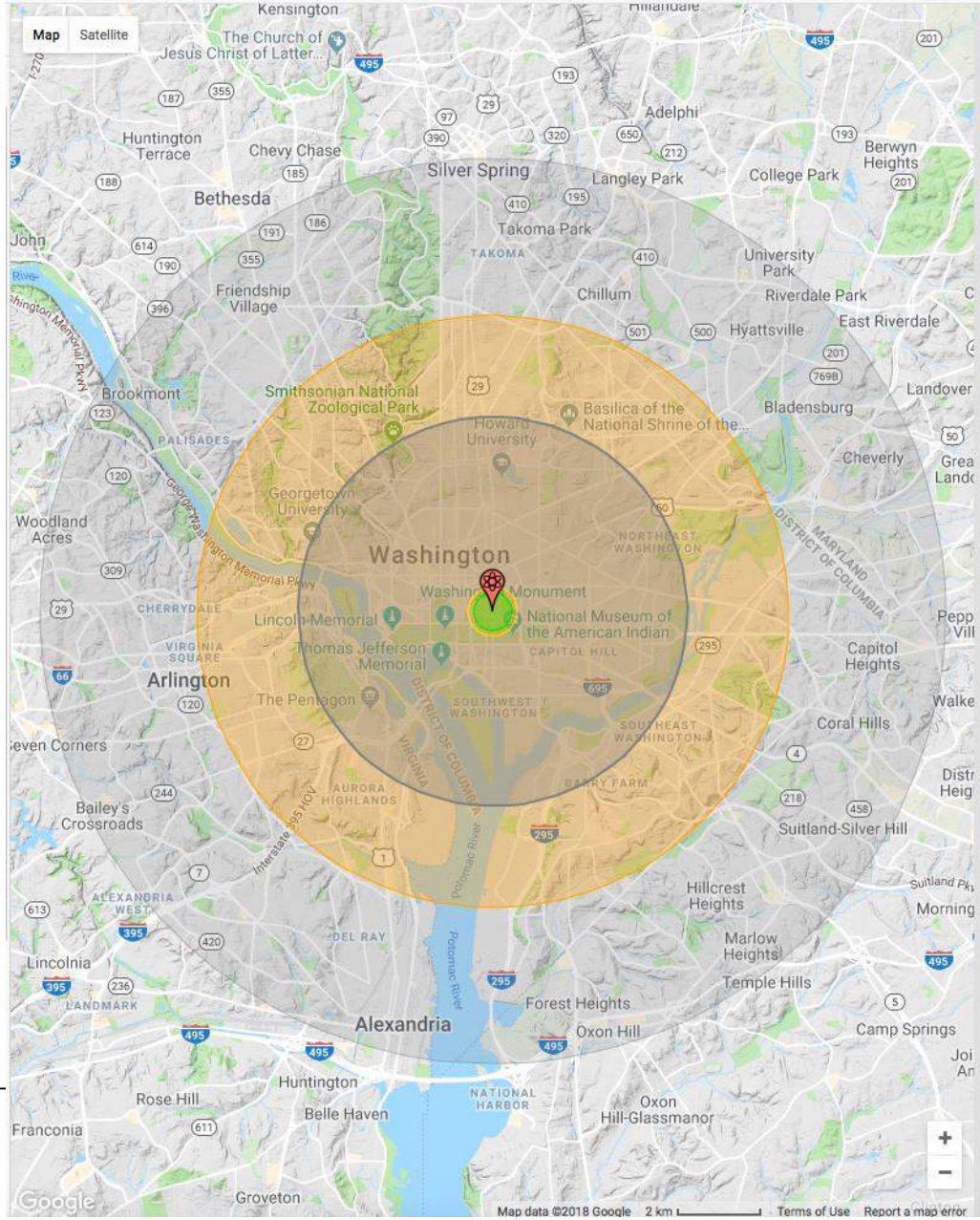
300 KT Attack on Washington – Less Fallout

Alex Wellerstein, nuke map, https://nuclearsecrecy.com/nukemap/?&kt=10&lat=41.8842458&lng=-87.6301432&hob_opt=1&hob_psi=5&hob_ft=2207&casualties=1&psi=20,5,1.5&cep=1&fatalities=174987&injuries=208450&psi_1=591272&zm=10



NUKEMAP 2.55 : FAQ

You might also try: MISSILEMAP

Note that you can drag the target marker after you have detonated the nuke.

Estimated fatalities:

342,210

Estimated injuries:

587,720

In any given 24-hour period, there are approximately 1,769,925 people in the 1 psi range of the most recent detonation.

Modeling casualties from a nuclear attack is difficult. These numbers should be seen as evocative, not definitive. Fallout effects are ignored. For more information about the model, click here.

Effects radii for 300 kiloton airburst* (smallest to largest): ▼

Radiation radius (500 rem): 460 m (0.67 km²)

500 rem radiation dose; without medical treatment, there can be expected between 50% and 90% mortality from acute effects alone. Dying takes between several hours and several weeks.

Fireball radius: 0.6 km (1.12 km²)

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Thermal radiation radius (3rd degree burns): 7.17 km (161 km²)

Third degree burns extend throughout the layers of skin, and are often painless because they destroy the pain nerves. They can cause severe scarring or disablement, and can require amputation. 100% probability for 3rd degree burns at this yield is 10.6 cal/cm².

Air blast radius (1.5 psi): 11 km (377 km²)

At a around 1 psi overpressure, glass windows can be expected to break. This can cause many injuries in a surrounding population who comes to a window after seeing the flash of a nuclear explosion (which travels faster than the pressure wave). Often used as a standard benchmark for **light** damage in cities. Optimal height of burst to maximize this effect is 2.69 km.

*Detonation altitude: 2,090 m. (Chosen to maximize the 5 psi range.)

The following errors were encountered trying to implement these settings:

- The Circular Error Probable given is an invalid value. CEP must be greater than zero to display.
- The blast pressure equation for 20 psi failed to give a result for the given yield and height settings. The maximum detonation height for this effect to be felt on the ground is 1.89 km.

DoD Assessment of North Korean Proliferation – 2/2018

North Korea has been an exporter of conventional arms and ballistic missiles for several decades. Despite the implementation of UNSCRs 1718, 1874, 2087, 2094, 2270, 2321, and 2356, which prohibit North Korea from selling weapons and providing related technical training, Pyongyang continues to market, sell, and deliver weapons-related goods and services. Weapon sales are an important source of foreign currency for North Korea's weapons programs and, as such, Pyongyang is unlikely to cease export activity despite UN Security Council sanctions, increased international efforts to interdict North Korea's weapons-related exports, and the implementation of Executive Order 13382, under which designated WMD proliferators' access to the United States and global financial systems are targeted.

Global concern about North Korea's proliferation activities continues to mount, which has led some countries, such as Namibia, to halt new purchases from North Korea and has prompted other nations to take action to prevent arms-related deliveries. Although the international community has interdicted some of North Korea's weapons-transfer attempts, North Korea very likely will continue to attempt arms shipments via new and increasingly complex methods.

North Korea has demonstrated a willingness to proliferate nuclear technology. Using the proliferation network of Pakistani nuclear scientist AQ Khan, North Korea provided Libya under Moamar Qaddafi with uranium hexafluoride, the form of uranium used in the uranium enrichment process to produce fuel for nuclear reactors and nuclear weapons. North Korea also provided Syria with nuclear reactor technology until the facility was destroyed in 2007.

…In addition to Iran and Syria, past clients for North Korea's ballistic missiles and associated technology have included Egypt, Iraq, Libya, Pakistan, and Yemen. Burma has begun distancing itself from North Korea, but concerns remain regarding lingering arms trade ties between the two countries.

North Korea uses various methods to circumvent UNSCRs, including falsifying end-user certificates, mislabeling crates, sending cargo through multiple front companies and intermediaries, and using point-to-point air cargo deliveries for high-value and sensitive arms exports, thus limiting interdiction opportunities.

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 21-22*

Chemical and Biological Dimension

(For more details, see Anthony H. Cordesman,
"More Than A Nuclear Threat: North Korea's Chemical, Biological, and Conventional Weapons
Revised: March 11, 2018, https://www.csis.org/analysis/more-nuclear-threat-north-koreas-chemical-biological-and-conventional-weapons-0)

North versus South

- Threat ranges from adding real or potential terror weapons to North Korean inventory to potential equivalent of nuclear attack.
- Chemical threat real, but lethality probably exaggerated. More terror than weapon of mass destruction.
- Terror, however, can be enough. Simply testing or disbursing chemical rounds can have a powerful effect.
- U.S. and South Korea can develop defenses but not create a matching offensive threat.
- The biological option gives North Korea a credible alternative to sustaining its nuclear program with much depending on North Korea's level of efforts or claims.
- One key issue with biological weapons is either side's ability to determine real world effects without significant large-scale human testing.

Uncertain Threats

- **Supposedly official South Korean data on CBW is highly suspect. Often seems little more than media reports based on guesstimates or propaganda.**
- **While estimates of volume of chemical rounds and agents seem exaggerated, North Korea has long been a chemical weapons power and the threat is real.**
- **Lethality estimates of chemical weapons seem to sharply exaggerate operational history of lethality from WWI through Iran-Iraq War.**
- **Biological weapon capability is unknown and sources as to agents seem to be guesswork derived from Soviet data.**
- **Real world operational lethality is unknown but potentially could rival nuclear weapons and South Korean could again be exceptionally vulnerable.**
- **South Korea and U.S. cannot dismiss wild card risk equal to nuclear threat.**

Comparative Effects of Biological, Chemical, and Nuclear Weapons Delivered Against a Typical Urban Target

Using missile warheads: Assumes one Scud-sized warhead with a maximum payload of 1,000 kilograms. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient. It is unclear this is realistic.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people Per Square Kilometer
Chemical: 300 kilograms of Sarin nerve gas with a density of 70 milligrams per cubic meter	0.22	60-200
Biological 30 kilograms of Anthrax spores with a density of 0.1 milligram per cubic meter	10	30,000-100,000
Nuclear: One 12.5 kiloton nuclear device achieving 5 pounds per cubic inch of over-pressure	7.8	23,000-80,000
One 1 megaton hydrogen bomb	190	570,000-1,900,000

Using one aircraft delivering 1,000 kilograms of Sarin nerve gas or 100 kilograms of Anthrax spores y. Assumes the aircraft flies in a straight line over the target at optimal altitude and dispensing the agent as an aerosol. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people Per Square Kilometer
Bright Sunny Day		
Sarin Nerve Gas	0.74	300-700
Anthrax Spores	46	130,000-460,000
Overcast day or night, moderate wind		
Sarin Nerve Gas	0.8	400-800
Anthrax Spores	140	420,000-1,400,000
Clear calm night		
Sarin Nerve Gas	7.8	3,000-8,000
Anthrax Spores	300	1,000,000-3,000,000

Source: Adapted by Anthony H. Cordesman from Office of Technology Assessment, Proliferation of Weapons of Mass Destruction: Assessing the Risks, US Congress OTA-ISC-559, Washington, August, 1993, pp. 53-54.

North Korean Chemical Weapons

During 1991 a CIA report stated that, "North Korea can produce nerve, blister, choking, vomiting, and blood agents. Pyongyang may possess the blood agent cyanogen chloride and the nerve agent VX. We judge that some of these agents have been weaponized."

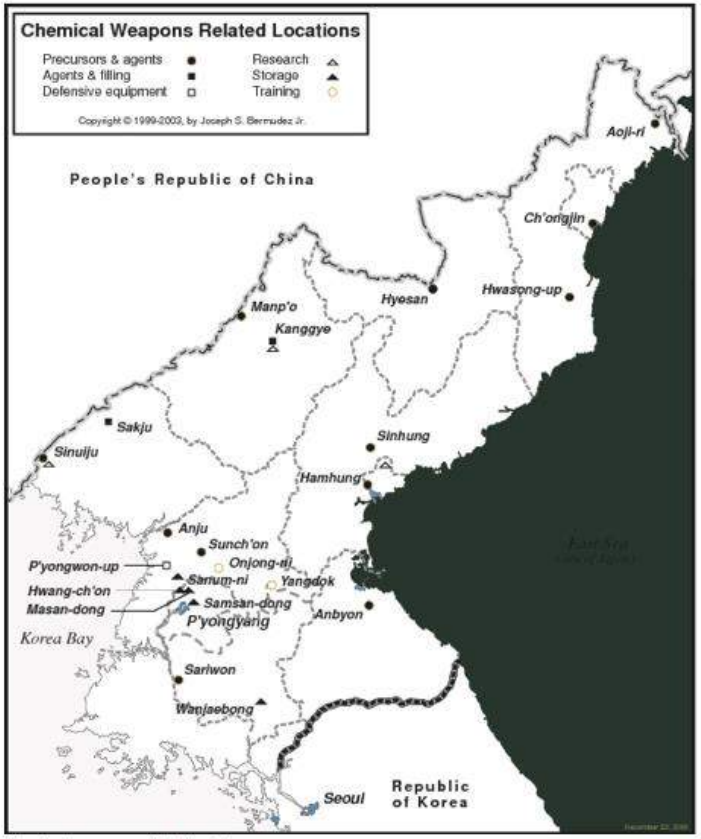
Today, chemical agents currently reported to be in the KPA inventory include, but are not necessarily limited to, adamsite (DM), chloroacetophenone (CN), chlorobenzylidene malononitrile (CS), chlorine (CL), cyanogen chloride (CK), hydrogen cyanide (AC), mustard-family (H, HD or HL), phosgene (CG and CX), sarin (GB), soman (GD), tabun (GA), and V-agents (VM and VX).

It is important to note that, according to KPA defectors, North Korea produces a total of 20 different chemical agents for use in weapons. For a variety of reasons, not the least of which is North Korea's capability to produce or acquire certain precursors, it is believed that the KPA has concentrated upon sulphur mustard, chlorine, phosgene, sarin, and the V-agents.

Although not as toxic as cyanide - and thus needing to be employed in significant larger quantities - sulphur mustard or nerve agents, chlorine, and phosgene are industrial chemicals that are easily manufactured.

As an example of production challenges North Korea faces, the production of GD requires the use of pinacolyl alcohol, which is currently produced by only a few companies in the world and in extremely small amounts. It has no commercial uses and is on the Australia Group's list of restricted products.

To date, there have been no public indications that North Korea produces binary chemical agents.



Chemical weapons-related locations

0529632

Source: IHS Jane's Sentinel Series, *North Korea, 2017*

DoD Assessment of North Korean Biological & Chemical Weapons – 2/2018

Biological Weapons. **North Korea may consider the use of biological weapons as an option, contrary to its obligations under the Biological and Toxins Weapons Convention (BTWC). Most aspects of biological weapons research is inherently dual-use and North Korea continues to develop its biological research and development capabilities that would enable a biological weapons program. Pyongyang has never declared any relevant developments and has failed to provide a BTWC Confidence-Building Measure declaration since 1990.**

Chemical Weapons (CW**). In February 2017, North Korea likely assassinated Kim Jong Un's older half-brother Kim Jong Nam in a crowded Malaysian airport via VX nerve agent—a class I weapon of mass destruction under the Chemical Weapons Convention (CWC). Malaysia is still investigating North Korea's role in the incident. If proven, this supports the argument that North Korea has a CW stockpile from a longstanding CW program with the capability to produce nerve, blister, blood, and choking agents. North Korea probably could employ CW agents by modifying a variety of conventional munitions, including artillery and ballistic missiles. In addition, North Korean forces are prepared to operate in a contaminated environment; they train regularly in chemical defense operations. North Korea is not party to the CWC.**

Excerpted by the authors from Department of Defense, *Military and Security Developments Involving the Democratic People's Republic of Korea 2017*, *A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2012, February 2018, pp. 21-22*

Speculation on North Korean Biological Weapons

TYPE	SYMPTOMS/CHARACTERISTICS	STATUS
Bacteria		
Bacillus anthracis (Anthrax)	Pulmonary (inhalation): difficulty breathing, exhaustion, toxemia, terminal shock. Cutaneous (skin): itching, small lesions and possible blood poisoning. Intestinal: nausea, fever, diarrhea. Mortality (if untreated): Pulmonary 80–95%; Cutaneous 5–20%; Intestinal 25–60%. Incubation period: Symptoms usually occur with 7 days. Not contagious.	Possibly weaponized, with delivery system
Vibrio cholera (Cholera)	Diarrhea, vomiting, and leg cramps. Rapid loss of body fluids, dehydration and shock. Mortality (if untreated): 5–10%. Death in 1–3 hours. Not contagious.	Unknown
Yersinia pestis (Plague)	Fever, headache, exhaustion, swollen lymph nodes, blood infection, and pneumonia. Mortality (if untreated): 50–60%. Incubation period: 1–3 days, death in 2–6 days. Contagious.	Unknown
Salmonella Typhi (Typhoid Fever)	Fever, malaise, chills, stomach pains, headache, loss of appetite, and rash. Mortality (if untreated): 12–30%. Contagious.	Unknown
Typhus	Fever, headache, chills, whole body rash, and general pains. Mortality (if untreated): 30–50%. Incubation Period: 6–12 days. Not contagious.	Unknown
Mycobacterium tuberculosis (tuberculosis)	Coughing, chest pain, fatigue, loss of appetite, chills, fever, and coughing blood. Mortality (if untreated): 30–50%. Incubation period: 14 days–1 year. Contagious.	—
Virus		
Hemorrhagic fever (Korean Strain)	Fever, fatigue, dizziness, muscle aches, exhaustion, internal bleeding, coma, delirium, and seizures. Mortality (if untreated): 5–15%. Incubation period: 7–17 days. Contagious.	Unknown
Variola (smallpox)	Fever, malaise, aches, rash, and crusting scabs. Mortality (if untreated): 30–40%. Incubation: 7–17 days. Contagious.	Unknown
Yellow Fever	High fever, chills, headache, muscle aches, and vomiting; can lead to shock, kidney, and liver failure. Mortality (if untreated): 5–40%. Incubation: 3–6 days. Not contagious.	—
Toxin		
Clostridium Botulinum (Botulism)	Nausea, weakness, vomiting, and respiratory paralysis. Mortality (if untreated): 60–90%. Incubation: 12–36 hours after inhalation. Death in 24–72 hours. Not contagious.	Unknown

Note: World Health Organization, http://www.who.int/csr/delibepidemics/en/annex3May03.pdf; NATO, *Handbook on the Medical Aspects of NBC Defensive Operations AmedP-6(B)*, http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/2toc.htm; and US Army Medical Research Institute of Infectious Diseases, *Medical Management of Biological Casualties Handbook*, http://www.usamriid.army.mil/education/bluebook.html; and Centers for Disease Control, http://www.cdc.gov.
Source: Nuclear Threat Initiative, "North Korea: Biological," http://www.nti.org/country-profiles/north-korea/biological/; Chipman, "North Korea's Chemical and Biological Weapons (CBW) Programs," *North Korea's Weapons Programs*, 50.

Speculation on North Korean Biological Facilities

Aeguk Compound Microbe Center	R&D and production of microbial-based fertilizer supplements.
Aeguk Preventative Medicine Production Factory	Comprised ten laboratories and various workshops devoted to R&D and production of vaccines and medicines. The main product has been hepatitis B vaccine.
Branch Academy of Cell and Gene Engineering	One of nine research branches of the Academy of Sciences. Conducts research on cellular biology and genetic engineering.
National Sanitary and Anti-Epidemic Research Center	Administers quarantines and provides inoculations against various diseases.
Endocrinology Institute	Mainly diagnoses and treats diabetes.
Industrial Microbiology Institute	R&D and production of microbial cultures.
Munchon Agar Plant	Agar (growth media) production. As of 1992, the annual agar production capacity was 200 tons.
Pharmaceutical Institute of the Academy of Medical Sciences	R&D of medicaments. Reportedly located in Pyongyang.
Pyongyang Pharmaceutical Factory	As of August 2000, the factory produced seven drugs, including antibiotics and multivitamins. Has received raw materials and support from UNICEF and Diakonie Emergency Aid of Germany.
Synthetic Pharmaceutical Division, Hamhung Clinical Medicine Institute	R&D of medicaments and clinical diagnostics.
Taedonggang Reagent Company	R&D of vaccines. Previously known as the November 19 Institute.

Sources: NTI, "North Korea: Biological"; "DPRK's NAS Pursues Cultivation of Stock Bacteria for Microbial Fertilizers," Chungang Ilbo, January 17, 2000; "DPRK Korea Donor Update," UNICEF Emergency Programs, August 7, 2000, http://www.reliefweb.int; Chipman, "North Korea's Chemical and Biological Weapons (CBW) Programs," *North Korea's Weapons Programs*, 50.

Lethality and Stability of FSU Biological Weapons

Weapons Type	Q_{50} in Open Air Deployment (liter or kilogram per square kilometer)	Stability
Liquid Plague	3.5-4.5	--1-2 hours in air
Dry Tularemia	3.0-4.0	--several hours to one day in air
Old Dry Anthrax	15-20	--days and weeks in the air, and
New Dry Anthrax	4.5-5.0	years on surfaces
Liquid Anthrax	5.0-5.5	
Dry Brucellosis	3.5-4.5	--up to 2 days in air
Liquid Glanders/Meliodosis	4.5-5.5	--several hours in air
Liquid Smallpox	3.5-4.0	--up to 24 hours in air
Dry Marburg	minus 1.0 dry	--30 minutes liquid in air and several hours
Q fever	-	-- to several days in air
Glanders	-	--several hours in air
Liquid Ebola	- dry	--30 minutes liquid in air and several hours
Coccidioidomycosis	-	--days and weeks in the air

Q_{50} = Amount of agent needed to infect 50% of the exposed population or troops evenly distributed over a square kilometer. These calculations are based on a lethal dose (LD_{50} of 10000-20000 spores for anthrax, 200-400 (up to 1,000?) bacterial cells for Brucellosis, 100-200 (up to 1,000?) bacterial cells for Glanders, 500-1500 bacterial cells for Plague, 10-100 bacterial cells for Tularemia, 1-3 cells for Q fever, 1-10 virons for Ebola, 1-10 virons for Marburg, 5-10 virons (up to 50?) for smallpox, and 10-100 arthospors for Coccidioidomycosis.

Source: adapted from Ken Alibek, "Biological Weapons/Bioterrorism Threat and Defense, - Past, Present, and Future," Paper prepared for the ETH international conference on "Meeting the Challenges of Bioterrorism: Assessing the Threat and Designing Biodefense Strategies, Furigen, Switzerland, April 22-23, 2005.

Area Coverage and Casualty Impact of Line Source Type of Biological Attack

Agent	Downwind Area Reach in Kilometers	Number of Casualties	
		Dead	Incapacitated
Rift Valley Fever	1	400	35,000
Tick Borne Encephalitis	1	9,500	35,000
Typhus	5	19,000	85,000
Brucellosis	10	500	125,000
Q Fever	20+	150	125,000
Tularemia	20+	30,000	125,000
Anthrax	20+	95,000	125,000

Note: Assumes 50 kilograms of agent along a two-kilometer line upwind of a population center of 500,000.

Source: George Christopher et al, "Biological Warfare: A Historical Perspective," Journal of the American Medical Association, 278, No. 5, August 6, 1997.

The Range of Scenarios - I

- **Creating a Phantom Threat:** North Korea's leader has already effectively signaled that North Korea has the technology to produce biological weapons. Disproving a negative is notoriously difficult, particularly since some commercial dual-use biological, medical, and food processing facilities can be converted relatively quickly, and intent is almost impossible to verify. Sending more specific false signals could not only give North Korea added leverage, but potentially drive the U.S. and its partners into a wide range of high cost defensive measures, and confront nuclear attack planning with the issue of combining nuclear and biological counterforce targeting.

- **Creating a Dual Nuclear-Biological Threat:** North Korea may not be able to create a major nuclear-armed ballistic missile threat to the U.S. for years, but developing a deterrent/strategic leverage strategy based on developing a parallel capacity to attack the

- **Substituting Biological Weapons for Nuclear Weapons:** The cost and timelines for developing a strategy that sacrifice nuclear weapons for biological weapons could well be far cheaper, far harder to contain, and far harder to launch counterforce attacks against that a nuclear weapons strike – particularly if North Korea calculates it does not need intercontinental capabilities to attack the U.S. if it can attack key allies like Japan. It is also far from clear that any biological weapons control and inspection arrangements can be as effective as those for controlling nuclear weapons efforts.

- **Covert and In-Place Attacks:** North Korea might smuggle in infectious agents, use simple low-cost delivery systems like UAVs or sprayers, or even create limited covert production facilities in South Korea, Japan, and the U.S. Even a phantom version of such a threat could take on a new impact. North Korean exercises using biological weapons covertly to attack the U.S. would also present a major challenge to the U.S. in creating effective defenses – particularly if they are exercised as "defensive" reactions

The Range of Scenarios - II

- **Infectious Weapons:** Most studies assume that no leader or nation would risk using weapons whose spread could not be controlled and where using nation could not immunizes its own population and possibly that of its allies. North Korea's leader has already risked the equivalent of a "doomsday" scenario by going nuclear. Threatening – and actually using – a weapon that would present major control problems is at least a possibility. Attacking Japan, the U.S., or Guam might offer North Korea the equivalent of secure target areas, and so might the use of the DMZ as a barrier to movement by the infected population. Such control would be tenuous, but might be acceptable to North Korea's leader.
- **Use an "Unproven" or Uncertain Agent:** North Korea might weaponize. threaten to use, or actually use an agent whose lethality would not be proven reliably, taking a wide range of risks that its effects could be far smaller or greater than it could predict, whether infectious or non-infectious.
- **Create or Exploit a Biological Weapons Test or "Accident:"** A report of a suspicious death -- particularly from a weaponizable disease or one not found in North Korea -- could be used to signal North Korean capability and be the equivalent of a nuclear test, but would still be deniable.
- **Creating Truly Advanced Biological Weapons:** There are serious debates over the level of biotechnology in North Korea, and over how quickly such weapons can be developed and deployed. As work by the Jason Study made clear in the early 2000s, however, the
- **Ethnic/Racial/Sub-Group Weapons:** An outlier with today's weapons, but tailoring diseases to attack given races, ethnic groups, or subgroups by unique genetic characteristics. Being able to distinguish Japanese, U.S./Western forces, other nationalities or key subgroups.
- **Using Biological Weapons to Limit Escalation to Nuclear Weapons or as a Warning Signal of Intent:** A limited demonstrative use of biological weapons might take place in a major crisis as a signal that North Korea was actually prepared to use nuclear weapons, or respond to any number or all-out conventional attack by using them far more widely.

The Range of Scenarios – III

- **Agricultural warfare:** Attacking crops or animals for longer-term economic and political effects.
- **BW Terrorist Attacks:** Using limited biological attacks to show the credibility of the North Korean BW threat, intimidate given countries or populations, escalate, target key facilities, or arm proxies, non-state actors, and third parties.
- **Non-Lethal and Incapacitating Attacks:** North Korea might use such attacks to incapacitate key parts of the economy, threaten or undermine a target, demonstrate the credibility of more lethal attacks, and limit the levels of U.S., South Korean, and Japanese response or escalation.
- **Infectious attacks with delayed effects:** Infectious agents can be used that take time to bring on the effects of disease while still being highly infectious – effectively use normal population movement as the main method of dissemination and delivery.
- **Use the DMZ as an attack line and attempt barrier to infection:** South Korea's population would be highly vulnerable to even an artillery/multiple rocket launcher attack with biological weapons, and how close Chinese and Japanese populating centers are.
- **Carry Out Human Testing.** One of the key problems in biological weapons development is to determine the real-world effects of a given agent. IHS Jane's seems to rely on uncertain sources, but the character and past conduct of the regime makes the following reporting at least possible.

Anthony H. Cordesman, "More than a Nuclear Threat: North Korea's chemical, Biological, and Conventional Weapons," CSIS, March 11, 2018.