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## Long-Range Ballistic Missile Development: A Tale of Two Tests

North Korea's failed attempt to launch a satellite from its Unha-3 space rocket on April 13 and India's successful flight test of the Agni-5 long-range missile on April 19 marked significant events in the ballistic missile development programs of the two countries. These two ballistic missile test events not only reveal technical information about system performance, but also invite reflection on U.S. policy responses. The demonstration of North Korean failure and Indian success is only the most readily accessible feature of the story. The broader implications for U.S. nonproliferation and security policies are more complicated and less obvious. Both cases imply U.S. failure to accurately assess threats and to adopt appropriate responses for mitigating those threats.

### HIGHLIGHTS

- North Korea's unsuccessful satellite launch attempt on April 13 was the country's fourth consecutive mission failure in long-range ballistic missile flight tests over a 14-year period.
  - Two days later, North Korea rolled out what first appeared to be six road-mobile intercontinental ballistic missiles (ICBMs) at a parade in Pyongyang but were actually mockups, according to a consensus of experts analyzing detailed photographs of the event.
- Given flight-testing evidence to date, and the assessed limitations of North Korean missile manufacturing technology, it will take the country many years to develop and deploy operational ICBMs.
  - The 1998 Rumsfeld Commission had predicted that North Korea could have an ICBM capability by 2003; a 1999 U.S. National Intelligence Estimate predicted the first North Korean ICBM flight test within months.
  - These projections were cited in justifying the U.S. Missile Defense Act of 1999, the 2001 decision to withdraw from the 1972 Anti-Ballistic Missile Treaty, and the rush to deploy strategic missile defenses by 2004.
- The flight test of a 5,000 kilometer-range missile on April 19 was India's next evolutionary step in its Agni solid-fueled ballistic missile development program.
  - The apparent success of this test suggests the Agni-5 could become operational by the middle of the decade, ensuring India's ability to put Beijing at risk.
- Beijing's low-key reaction to the test was commendable; Washington's low-key reaction was not. The White House urged caution, but cited India's "solid nonproliferation record"—thereby undermining the credibility of U.S. nonproliferation policies.
  - India was the first to introduce nuclear weapons into South Asia and continues its refusal to sign the nuclear Nonproliferation Treaty and the Comprehensive Test Ban Treaty. Augmenting its long-range ballistic missile arsenal is just the latest example of India's failure to honor the nonproliferation directives of the UN Security Council.
- The United States has overreacted militarily to North Korea's ballistic missile program, leading to huge and unnecessary missile defense expenditures and major missed opportunities for achieving reductions in U.S. and Russian strategic arsenals.
- Washington's political underreaction to India's ballistic missile program has damaged U.S. ability to achieve critical nonproliferation goals.

# The Long-Range Missiles of April

## NORTH KOREA

On February 29, 2012, North Korea announced its agreement to a moratorium on long-range missile and nuclear weapons tests, and a suspension of uranium enrichment, in exchange for receiving 240,000 tons of food aid. International hopes for nonproliferation progress with North Korea were soon dashed, however, by Pyongyang's subsequent announcement that it intended to launch a satellite on the occasion of the 100th birthday of Kim Il Sung, the country's founder. Because the rocket and the procedures used in the launch would incorporate most of the technological elements needed to develop a long-range military missile system, the United States regarded this action as renegeing on the so-called Leap Day agreement.

On Friday, April 13, North Korea attempted unsuccessfully to launch a weather satellite using the Unha-3, a three-stage liquid-fueled rocket, which appeared very similar to rockets it had used for unsuccessful launches in 2006 and 2009. The first stage in each case was assessed to be based on a cluster of four Nodong medium-range ballistic missile (MRBM) engines; the second stage was assessed to be a BM-25 Musudan intermediate-range ballistic missile (IRBM), based on the R-27, a Russian submarine-launched ballistic missile (SLBM) designed in the 1960s.

North Korea untypically allowed foreign press access to the rocket prior to launch from the new Tongchang-dong Missile and Space Launch Facility (known in North Korea as the "Sohae Satellite Launching Station") in the northwest corner of the country. However, the press was not allowed at the actual launch and, while waiting in Pyongyang, was told nothing of its status for some four hours afterward. According to Western press accounts sourced to the U.S., Japanese, and South Korean governments, the North Korea rocket exploded over the Yellow Sea a little over a minute into its flight.

Although critics of the Leap Day agreement quickly attacked the Obama administration for naïveté, the launch and its aftermath ultimately proved to be a serious public relations and economic setback for North Korea. By the end of April, the country again had been censured by the UN Security Council, including by its Chinese benefactors, and had lost the prospect of feeding its hungry population. The episode also proved a political embarrassment in Pyongyang's launch of the Kim dynasty's third-generation leadership.

**Table 1: Ballistic Missile Range Categories**

SRBM (Short-range ballistic missile)	<1,000 km
MRBM (Medium-range ballistic missile)	1,000-3,000 km
<b>Long-range</b>	
IRBM (Intermediate-range ballistic missile)	3,000-5,500 km
ICBM (Intercontinental-range ballistic missile)	>5,500 km

## Going the Distance

This short flight was the fourth in a series of North Korean mission failures in seeking to develop long-range ballistic missiles or space rockets. Making a delivery vehicle operational is necessary for North Korea to have even a marginally credible nuclear threat against U.S. territory. But after 14 years of trying, it has demonstrated little progress.

Information is scarce about North Korea's ability to convert its limited stockpile of fissile material into nuclear warheads, but scientist Siegfried Hecker of Stanford University's Center for International Security and



Pedro Ugarte/AFP/Getty Images

**The North Korean Unha-3 space launch vehicle is pictured at the country's west coast space center on April 8. The rocket lifted off the pad five days later, but exploded a little more than a minute into its flight to place a satellite in orbit.**

Cooperation is dubious about North Korea's current ability to make a warhead small enough for a missile.<sup>1</sup> If North Korea succeeded in using its current plutonium stockpile to develop and deploy a nuclear warhead, the Nodong MRBM would be its most likely delivery vehicle. This single-stage, liquid-fueled ballistic missile is North Korea's longest-range operational strike system, reaching beyond South Korea to Japan, including Okinawa. The Nodong is a derivative of the 1950s-vintage Soviet Scud short-range ballistic missile, and also the genesis for Pakistan's Gauri MRBM and Iran's Shahab 3 MRBM.

North Korea appears not to have the technology to develop a large rocket engine. It has therefore relied on clustered engines for the first-stage building block of its ICBM/space launch vehicle (SLV) prototype and the BM-25 Musudan for its second stage.

ICBM development programs normally involve some failures in the course of multiple flight tests over a period of years, but three consecutive flight-test failures of a similar prototype over six years without a success does not imply a healthy program trajectory. Combined with this prototype's lack of mobility and survivability, its future does not seem promising.

There has been speculation about other ICBM designs, fed by public statements from Secretary of Defense Robert Gates in which he said, for example, that North Korea "was clearly developing longer-range missiles, including potentially a mobile ICBM."<sup>2</sup> None of the systems alluded to have been observed in flight tests, however.

### Birth of the Rogue State ICBM Bogeymen

The "Report of the Commission to Assess the Ballistic Missile Threat to the United States" (popularly known as the "Rumsfeld Commission" after its chairman, the former and future secretary of defense, Donald Rumsfeld) was released in July of 1998. The unclassified executive summary of this report contained alarming characterizations of the threat posed by the newer ballistic missile-equipped nations. North Korea and Iran were specifically cited as being "able to inflict major destruction on the U.S. within about five years of a decision to acquire such a capability." The report further stated that both countries placed "a high priority on threatening U.S. territory, and each is even now pursuing advanced ballistic missile capabilities to pose a direct threat to U.S. territory."<sup>3</sup>

The urgent warnings of the report appeared to have been validated by a National Intelligence Estimate issued in September 1999, which predicted a North Korean

## Figure 1

### North Korea's Long-Range Ballistic Missile/Space Launch Vehicle Launches

#### Taepo Dong-1 Space Launch Vehicle (SLV)

- **Date of launch:** August 1998
- **Stages:** CSS-2 derived 1st stage: Nodong 2nd stage; solid-fueled 3rd stage
- **Performance:** 3rd stage failed to place satellite in orbit

#### Taepo Dong-2 Intercontinental Ballistic Missile

- **Date of launch:** July 2006
- **Stages:** Clustered Nodong 1st stage: BM-25 Musudan 2nd stage; 3rd stage unknown
- **Performance:** 1st stage failed after 42 seconds

#### Unha-2 SLV

- **Date of launch:** April 2009
- **Stages:** Clustered Nodong 1st stage: BM-25 Musudan 2nd stage; 3rd stage unknown
- **Performance:** 3rd stage failed

#### Unha-3 SLV

- **Date of launch:** April 2012
- **Stages:** Clustered Nodong 1st stage: BM-25 Musudan 2nd stage; 3rd stage unknown
- **Performance:** 1st stage failed after 90-100 seconds

*Source: Arms Control Association, from multiple sources*

Taepo Dong-2 ICBM flight test by the end of that year and probable ICBM threats to the United States appearing during the next 15 years "from Russia, China, and North Korea, probably from Iran, and possibly from Iraq."<sup>4</sup> Combined with the unexpected attempt by North Korea to launch a satellite in August 1998, these assessments created a political tidal wave that profoundly affected the course of U.S. strategic and arms control policies for years into the future.

In the Missile Defense Act of 1999, the U.S. Congress established the goal of "deploying an effective national missile defense system as soon as technologically possible." All of those speaking for the bill on the floor of the Senate cited the conclusions of the Rumsfeld Commission. Even opponents of the bill, such as Senator Joe Biden (D-Del.), accepted the commission's warning

about the imminence of the North Korean ballistic missile threat: “[O]ur concern today is over the North Korean threat. At some point in the near future, the North Koreans may achieve a limited ability to strike U.S. territory.”<sup>5</sup> Missile Defense Act language became executive branch policy, enthusiastically so following the presidential election of 2000. It was explicitly adopted as the charter of the Missile Defense Agency, which went on to receive and spend over \$8 billion per year during the next decade.

In the wake of the September 11 attacks, President George W. Bush was successful in accelerating strategic missile defense system procurement and deployment. He announced U.S. withdrawal from the Anti-Ballistic Missile (ABM) Treaty in late 2001, in spite of virtually unanimous international opposition, and voiced a commitment to deploy (unproven) strategic defense interceptors by 2004 in California and Alaska.

Congressional supporters of ABM Treaty withdrawal and the deployment of strategic missile interceptors harkened back to the threats identified by the Rumsfeld Commission. Senator James Inhofe (R-Okla.) commented: “I was very pleased when the Rumsfeld commission established in 1997 that the threat is very real, the threat is imminent, and the long range threat could emerge

without warning at that time.”<sup>6</sup> Senator Jeff Sessions (R-Ala.) stated: “Admiral [Thomas] Wilson [then director of the Defense Intelligence Agency] says specifically as to North Korea, it is ‘developing an ICBM capability with its Taepo Dong-2 missile judged capable of delivering a several-hundred kilogram payload to Alaska and Hawaii and a lighter payload to the Western half of the United States.’ They have that capability in North Korea now.”<sup>7</sup>

In response to U.S. withdrawal from the ABM Treaty on June 13, 2002, Russia announced one day later that it would no longer consider itself bound by the START II agreement limiting offensive systems, consistent with the Duma’s ratification terms in 2000, which were contingent on continuation of the ABM Treaty.<sup>8</sup> Thus, U.S. determination to escape from strategic missile defense strictures led to the loss of an opportunity to secure verifiably lower limits and stabilizing measures in strategic offensive forces.

### North Korea Showcases Fake Missiles

Two days after the failed space launch, during a parade in Pyongyang, North Korea rolled out what first appeared to be six road-mobile ICBMs of a type designated KN-08 by the United States. Closer inspection of photographs revealed to technical experts, however, that these



Pedro Ugarte/AFP/Getty Images

One of six mobile KN-08 ICBMs on Chinese-made transporter-erector-launchers appearing in an April 15 parade moves through Pyongyang. Western missile experts have judged these to be mockups rather than real missiles.

missiles were mockups, each slightly different from the others, with conspicuous design abnormalities, including “androgynous” features on the same missile that would be unique identifiers of either solid- or liquid-fueled systems.<sup>9</sup>

The view of U.S. nongovernmental missile experts

ment Programme, initiated in 1989 to develop nuclear-capable missiles for the Indian Army’s Strategic Force Command. The Agni-3 is a two-stage ballistic missile with a 3,200-kilometer range—at the lower end of the IRBM spectrum—and now operational. The Agni-4, which was flight-tested in November 2011, moved to the

**[T]he rush to deploy ground-based strategic missile interceptors against a nonexistent North Korean ICBM threat was an enormous overreaction.**

surveyed after the launch failure and exposure of mockups is that it may take five years or more to get the Taepo Dong-2/Unha design working. Massachusetts Institute of Technology expert Theodore Postol predicted that the missile “will probably not achieve some form of reliability for 10 years or more.”<sup>10</sup>

Given the fresh evidence of persistent problems with the existing ICBM/SLV design, the absence of evidence that there are other untested long-range missiles waiting in the wings, and the recurring doubts about North Korea’s current ability to build a reliable nuclear warhead for its missiles, the potential prospect of an actual North Korean ICBM threat to the U.S. mainland appears to be sliding into the next decade.

Whatever prudent worst-case assumptions may have been justified a decade ago, it is time to conclude with hindsight that the U.S. rush to deploy ground-based strategic missile interceptors (GBIs) against a nonexistent North Korean ICBM threat was an enormous overreaction, which has cost billions of dollars and squandered precious opportunities for improving U.S. national security. It is therefore time to recalibrate the U.S. response to this threat—perhaps by mothballing the GBI base in Alaska and using the four California GBI launchers for research and development.

## **INDIA**

On April 19, India conducted the first launch of the Agni-5, a 5,000 kilometer-range, three-stage, solid-fueled ballistic missile, capable of delivering a nuclear warhead to potential targets throughout China, including Beijing and Shanghai. The Indian defense minister called the test “immaculate.”<sup>11</sup> The mission director for the test said: “We have achieved exactly what we wanted to achieve in this mission.”<sup>12</sup> This missile launch is the latest step in India’s Integrated Guided Missile Develop-

ment Programme, initiated in 1989 to develop nuclear-capable missiles for the Indian Army’s Strategic Force Command. The Agni-3 is a two-stage ballistic missile with a 3,200-kilometer range—at the lower end of the IRBM spectrum—and now operational. The Agni-4, which was flight-tested in November 2011, moved to the

## **Methodical Missile Development**

Unlike the comparable programs of Pakistan or North Korea, most of India’s missile advances have been the result of indigenous development efforts. India’s methodical pattern of proving technologies before moving to more-advanced systems stands in significant contrast to the practices of North Korea. India has been a spacefaring nation for more than 30 years, compiling a record of two dozen successful satellite launches in 37 attempts (see Figure 2). North Korea has yet to succeed once. India declared its Agni-3 IRBM operational after four successful developmental launches. North Korea deployed its Nodong MRBM after only one successful flight test.

Even though the Agni-5 falls short of the ICBM range floor of 5,500 kilometers—a figure chosen during the Cold War to reflect the geographic separation between the United States and the Soviet Union—it would fulfill for India the same strategic function as the superpowers’ ICBMs did then, putting at risk of nuclear attack key targets throughout the territory of its most powerful potential opponent. The Agni-5 may be operational within a couple of years. An even longer-range Agni-6 ICBM is rumored to be under development, but it is not clear what the advantage for India of additional range would be.

The Agni-5 flight test continues the tail-chasing dynamic of regional nuclear and missile proliferation in Asia. The modest Chinese arsenal of nuclear-tipped missiles is the primary driver of (or excuse for) India’s strategic forces. India’s nuclear arsenal and superior conventional forces are the primary drivers of Pakistan’s strategic forces.

## Official Reactions

The official rhetorical responses of both the Chinese and Pakistani governments to India's latest test were subdued. A Chinese Foreign Ministry spokesman described India and China as "not competitors but partners," adding that the two countries should "work hard to uphold friendly strategic cooperation."<sup>13</sup> However, the state-controlled press in China was dismissive of India's strategic status in comparison with China's, questioning the accuracy of the Agni-5's guidance systems and alleging its weight made it less mobile and therefore vulnerable to attack.<sup>14</sup> Pakistan, for its part, had little to say about the test, but conducted its own flight test of the Hatf-4/Shaheen-1A MRBM a few days later and claimed it was successful.

The official U.S. reaction to the Agni-5 launch fell just short of an endorsement. After urging "all nuclear-capable states to exercise restraint regarding nuclear

capabilities," State Department spokesman Mark Toner noted without elaboration that "India has a solid non-proliferation record."<sup>15</sup> White House spokesman Jay Carney commented to reporters that "India's record stands in stark contrast to that of North Korea."<sup>16</sup>

Comparing India to North Korea would seem to be rather faint praise for India's nonproliferation record. Tepid Indian support for international sanctions to pressure Iran on nuclear nonproliferation objectives seems to suggest less solidity. A more objective determination of India's record might be derived from the reported agenda of Secretary of State Hillary Rodham Clinton's post-missile launch visit, which included efforts to win greater Indian cooperation in international attempts to sanction Iran.

The line about India's solid nonproliferation record is also ironic in light of India's status as a possessor of nuclear weapons that has not joined the nuclear Non-

## Figure 2

### India's Space Launch Vehicle/Long Range Ballistic Missile Launches

#### Satellite Launch Vehicle-3

- **Type:** Experimental SLV
- **Fuel:** Solid
- **Number of launches:** 4 (1 failure; 1 partial failure)
- **First/last launch:** 1979/1983
- **Payload:** Experimental satellites

#### Augmented Satellite Launch Vehicle

- **Type:** Experimental SLV
- **Fuel:** Solid
- **Number of launches:** 4 (2 failures; 1 partial failure)
- **First/last launch:** 1987/1994
- **Payload:** Experimental satellites

#### Polar Satellite Launch Vehicle

- **Type:** SLV
- **Fuel:** Solid and liquid
- **Number of launches:** 22 (1 failure)
- **First/last launch:** 1993/2012 and continuing
- **Payload:** Remote sensing/communication/meteorological satellites

#### Geosynchronous Satellite Launch Vehicle Mark I & II

- **Type:** SLV
- **Fuel:** Solid and liquid
- **Number of launches:** 7 (3 Failures)
- **First/last launch:** 2001/2010
- **Payload:** Communications satellites

#### Agni-3

- **Type:** Intermediate-Range Ballistic Missile (IRBM)
- **Fuel:** Solid
- **Number of launches:** 5 (1 failure)
- **First/last Launch:** 2006/2010
- **Payload:** Capable of carrying nuclear warhead

#### Agni-4

- **Type:** IRBM
- **Fuel:** Solid
- **Number of launches:** 1
- **First launch:** 2011
- **Payload:** Capable of carrying nuclear warhead

#### Agni-5

- **Type:** IRBM
- **Fuel:** Solid
- **Number of launches:** 1
- **First launch:** 2012
- **Payload:** Capable of carrying nuclear warhead

Sources: Indian Space Research Organization, Indian Defence Research and Development Organisation, Arms Control Association

proliferation Treaty (NPT). U.S. tolerance for Indian enhancements of nuclear delivery vehicle capabilities has increased significantly since 1998 when Washington voted for adoption of UN Security Council Resolution 1172, calling for India and Pakistan “to cease development of ballistic missiles capable of delivering nuclear weapons.”

The shift in U.S. position on India’s nonproliferation record is conspicuous. If the record of the state that first introduced nuclear weapons to South Asia, declined to join the NPT and refused to sign the Comprehensive Nuclear Test Ban Treaty is now “solid,” then it is reasonable to reach two conclusions: Nonproliferation has been relegated to a low priority in the U.S.-Indian bilateral relationship and India is being set apart from the “bad” states of proliferation concern and subjected to completely different standards.

Considering congressional passage of the U.S.-Indian nuclear cooperation agreement in 2008 and ongoing bilateral dialogue about India joining nonproliferation groups such as the Missile Technology Control Regime (MTCR), it is clear that the U.S. position articulated in 1993 is no longer operative in the case of India. The policy then was to “support prudent expansion of the MTCR’s membership to include additional countries that subscribe to international nonproliferation standards, enforce effective export controls and abandon offensive ballistic missile programs.”<sup>17</sup>

A case can be made that cooperation rather than confrontation with India may ultimately lead to more progress on containing various proliferation threats to international peace. One can also argue that each missile development milestone should be judged on its merits in terms of whether it contributes to or detracts from crisis and arms race stability, rather than in terms of adherence to a rigid formula. This does not mean, however, that India should be encouraged to repeat the counterproductive path of the superpowers during the Cold War.

### Help Needed to Control Nuclear Weapons

India is rumored to be considering pursuit of an Agni-6 ICBM as the next step in its ballistic missile development efforts.<sup>18</sup> Yet even given India’s own definition of its security requirements, there is little beyond prestige to justify development and deployment of a globe-spanning ICBM. Similarly, India is actively pursuing strategic missile defense, an undertaking that can only encourage its neighbors to increase their strategic offensive arsenals, without providing greater net protection to the

Indian population.

Even if India believes its security currently requires a nuclear arsenal, it need not ape the Cold War superpowers in buying the excessive insurance of a triad and egregiously redundant warhead numbers. It has already departed from Cold War orthodoxy by declaring minimal deterrence as its goal and abjuring a first-strike option. It should also seek opportunities to achieve mutual, negotiated limits on the nuclear arsenals of its potential enemies.

India and Pakistan today are sitting on a nuclear powder keg. Their nuclear weapons endanger the populations not only of South Asia, but of the entire planet. A recent report by International Physicians for the Prevention of Nuclear War concluded that a nuclear war between India and Pakistan alone could put at risk more than a billion people worldwide over the course of a decade.<sup>19</sup>

The United States therefore cannot be indifferent to any developments that augment the destructive capabilities of nuclear arsenals or increase the prospects that nuclear weapons will proliferate. Washington should encourage India to forgo taking steps that undermine international nonproliferation efforts. This means not only “exercise[ing] restraint” in developing nuclear weapons and avoiding sales of sensitive technologies,



India's Defence Research and Development Organisation

**India’s Agni-5 IRBM is launched from Wheeler Island, off India’s east coast, on April 19, 2012. When operational, the missile would be able to deliver nuclear warheads to both China’s capital and its largest city.**

but also setting an example for other emerging powers to follow.

### One Too Hot and One Too Cold

Last month's juxtaposition of two long-range ballistic missile flight tests within less than a week of each other invites comparisons of their significance and the contrasting reactions they elicited from Washington. Both launches originated from regions that remain candidates for the most likely location of the planet's next use of nuclear weapons in war.

In the case of North Korea, the launching state is one of the world's most hostile and belligerent countries. The United States (and the United Nations) is still officially at war with it. In the case of India, the launching state is an emerging power with which the United States has developed increasingly close relations. Yet neither state is now a member of the NPT. Both states are increasing and enhancing their nuclear weapons arsenals, thereby making global movement toward nuclear disarmament more difficult.

The U.S. government has continued, either deliberately or inadvertently, to exaggerate North Korea's progress in and prospects for developing long-range ballistic missiles. This assessment failure has cost a great deal in resources and missed opportunities. The United States has downplayed the steady buildup of Indian strategic power, as if it somehow helps in the Asian balance of power and can occur independently of U.S. nonproliferation objectives. The missile events of April should prompt some serious reassessment and policy recalibration.

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