

A Dog And Pony Show

North Korea's New ICBM

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On April 15, 2012, North Korea presented six road-mobile Intercontinental Ballistic Missiles (ICBMs) at a parade in Pyongyang. At first glance, the missile seems capable of covering a range of perhaps 10,000 km. However, a closer look reveals that all of the presented missiles are mock-ups. Therefore, the situation has not changed: There is still no evidence that North Korea actually has a functional ICBM.



Figure 1: One of Six KN-08 ICBMs Presented in North Korea

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Missile Characteristics at First Glance

The missile, by now designated the “KN-08” by Western analysts, was presented on an 8-axle Transporter Erector Launcher (TEL) that looked quite different than the previously known North Korean TELs, which all had showed clear signs of Russian/Belarusian origin.

The presented ICBM seems to be a three stage design with separable warhead. The missile is perhaps 18 m long, with a first and second stage diameter of slightly less than 2 m. A solid-fueled rocket with these dimensions should weigh around 40 t, and slightly less if liquid-fueled.

On first glance, the design looks like a solid-fueled rocket, which complies with all known road-mobile long range missiles (from a certain size, liquid-fueled missiles have problems with cross loads and bending moments if transported on a TEL, especially in fueled condition).

Assuming modern solid fuel technology, this missile should be able to throw a warhead of less than 1 ton over a distance of around 10,000 km – true intercontinental range.

Transporter Erector Launcher (TEL)

As readers of the website armscontrolwonk.com already figured out, the TEL is based on a Chinese truck, namely the WS51200 of the Hubei Sanjiang Space Wanshan Special Vehicle Co., Ltd., part of the China Sanjiang Space group, and a subsidiary of the China Aerospace Science and Industry Corporation (CASIC). The maximum total weight of the vehicle is 122 t. It is therefore oversized for a less than 40 t rocket, even considering the truck’s weight and any additional installations that come with the modification for TEL use.

Warhead Design

The warhead is once again completely different in design and shape than every previous North Korean warhead. With the designs known from the Scud, KN-02, Nodong (conical and triconic design), and Musudan missiles, North Korea now has “developed” six different warhead designs. While this is not a major issue for a conventional High Explosives (HE) design, this approach makes no sense if a nuclear capability is assumed: Each nuclear warhead has to be carefully designed considering aspects such as center of gravity, center of dynamic pressure, other aerodynamic issues, internal and external heating, thermal protection system, trigger mechanism, and so on. The same is true for biological and chemical warheads. If the North Koreans had really developed a non-conventional warhead, one would expect them to stick with one design, and not repeat the efforts again and again.

This alone implies an interesting conclusion: If they had a real nuclear warhead program, they would not develop six different warhead designs. If they do not develop a real nuclear warhead, they have no need to develop functional long range missiles (due

to their poor accuracy, these long range missiles only make sense with nuclear warheads!). With this, the observed variety of warhead designs only makes sense if the missile program is more show than real threat. This chain of thoughts is somewhat naïve, but hard to ignore.

Missile Details

However, any discussions about the ICBM's warhead are pointless at this stage, since the presented warheads are poor mock-ups.

At a closer look, it is impossible to find a real warhead separation plane on any of the observed ICBMs. The white band, which might hide a separation plane, is located right above the third stage's tank, without any room for a separation mechanism. And in that case, the complete guidance section would still be attached to the warhead, since the guidance system has to be located in the slightly conical section above the white band – there is no room anywhere else in the third stage.



Figure 2: KN-08 Launch Table and Warhead

The surface structure is another indication that the warhead is a mock-up. On several photos, it is easy to see that the warhead's surface is undulated, as if a thin metal sheet was fixed onto a simple inner frame consisting of numerous stringers (see Figure 2). A real warhead's casing has to resist thermal and structural loads of an atmospheric reentry and is certainly not designed this way.

The rest of the ensemble offers various other anomalies.

The missiles are not perfectly aligned with the launch table, and there seems to be an empty space between the table – where the missile should stand on once erected – and the missile itself. Usually, missiles are fixed onto the launch table by bolts. There are round elements at the launch tables that are designed to serve as the contact area for the missile, and to hold the bolt, but at the presented ICBM, the hole that might hold the bolt aligns with the outer diameter of the missile, or very close to it (again, see Figure 2). Therefore, it is not possible to securely bolt this missile to this launch table.

But more important, and confusing, the missile shows characteristics of both solid-fueled and liquid-fueled propulsion technology.

As previously mentioned, a road-mobile missile of this size is always solid-fueled, not only for structural reasons, but also for a simple operational reason: Transportation of a liquid missile in empty state might be possible, but fueling the missile once it is erected would probably take more than one hour. During that time, the missile is a sitting duck, an easily visible and stationary target for any enemy forces.

Complying with the solid-fuel requirement, the cable duct positions running along the missile body suggest that all stages are solid-fueled. At first and third stage, the cables are routed back into the missile's interior at the very end of the stage, indicating tanks (or combustion chambers for solid-fueled propulsion, which at the same time are the "tanks" for the solid fuel) that run the total length of the stage, leaving no room for a liquid-fuel rocket engine. This is typical for solid-fueled rockets, with their nozzle integrated in their combustion chamber section. However, there are liquid-fueled missiles with similar cable ducts, for example the old Soviet R-27/SS-N-6. In that case, the rocket engine is submerged in the propellant tank – a technology that is not easy to master, and only required if the missile is designed with severe length restrictions. Therefore, this approach was only used for SLBMs (Sea Launched Ballistic Missiles or submarine based missiles). There is no need to apply this technology at other rockets, and especially not at the observed ICBM.

Nonetheless, there are elements visible at each stage that look like filling or draining valves for liquid propellants, marked in typical old Soviet fashion with a white circle and a short inscription (in that case in Korean, and not yet deciphered). These elements only make sense on a liquid-fueled stage. Therefore, the ICBM shows characteristics of both liquid and solid propulsion.

This confusing observation becomes irrelevant with another insight: Each of the presented missiles is different.



Figure 3: Examples for Different Details on KN-08 Missiles

Every presented missile features slightly different cable duct positions, covers that are mounted either in horizontal or vertical position, small boxes or retro rockets on one missile that are missing on others, and slightly different positions of the ominous white bands (see Figure 3 for examples). It seems that these bands were added only for the looks, since no functional meaning can be identified – maybe they were added to suggest the position of stage separation planes to observers. (Or perhaps to comply with the TEL's neat white-rim tires.)

It is therefore clear that the presented missiles are only mock-ups of low quality. Any inconsistencies that arise by analyzing these missiles might come from that fact, since a

mock-up does not necessarily have to look like a real rocket – it might look the same, it might look close to a real model, but it might as well be a complete fantasy design. Therefore, any further analysis about a North Korean ICBM's technical details and capabilities are pure speculation.

Summary and Conclusion

North Korea obviously presented the World's first liquid-fueled solid missile, in six different versions. There is no doubt that these missiles were mock-ups – of better quality than the Musudan mock-ups that were presented in 2010, but nonetheless poor. It remains unknown if they were designed this way to confuse foreign analysts, or if the designers simply did some sloppy work.

The question is now if these mock-ups were modeled after a real design that is still hiding behind the curtain, or if the whole presentation was staged just for show, to celebrate Kim Il Sung's 100th birthday and to gain some strategic leverage.

Judging from other insights about the North Korean missile program, the latter seems more likely. Nonetheless, close monitoring of future developments is advised.

Only once a North Korean ICBM lifts off the pad for the first time, as a proof of concept for the design's functionality, the development work really starts. After that, it will take many years and many, many flights to arrive at a deployable and operational ICBM force, since the development of a modern ICBM is extremely demanding. To put things into perspective: The development of the Soviet/Russian Topol-M ICBM is said to have cost 142.8 billion Rubles (in 1992 prices – at that time, the Ruble exchange rate was around one US Dollar). Looking at the Musudan missile's "development history" – not a single launch –, and considering North Korea's poor situation in every dimension, it seems unlikely that this first launch will ever happen.

For now, the ICBM presentation was nothing else than a nice dog and pony show.