

## For Good Measure

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Measurement is a numbers game. Not just in the values, but also in the process. What do I mean by this? The more measurements that we make, the more confident we can be about our results. The better our known quantities are, the more confident that we can be about our results. And it is in having confidence in our results that allows us to make inferences about the capabilities of novel missile systems.

The Democratic People's Republic (DPRK) has used the Foundation Day Parade as an event in which it can show off novel military hardware, but especially missile related technology. During the October 2015 parade, the Hwasong-13 mod II ICBM was revealed. In October 2010, we saw the Musudan intermediate-range ballistic revealed. [1] This year was no different.



*The novel missile aboard an 11-axel transporter erector launcher made its debut in the 10 October 2020 Foundation Day Parade. Source: Rodong Sinmun/KCNA via Ankit Panda [2]*

During the 10 October 2020 event, the DPRK unveiled an enormous 2-stage liquid propelled missile onboard a behemoth 11-axel transporter erector launcher (TEL). Many people immediately began asking about this new missile. Is this a threat to me? How far can this thing fly? How much can it carry? What're its limitations? Where on earth did that big TEL come from? To answer these, we need measurements.

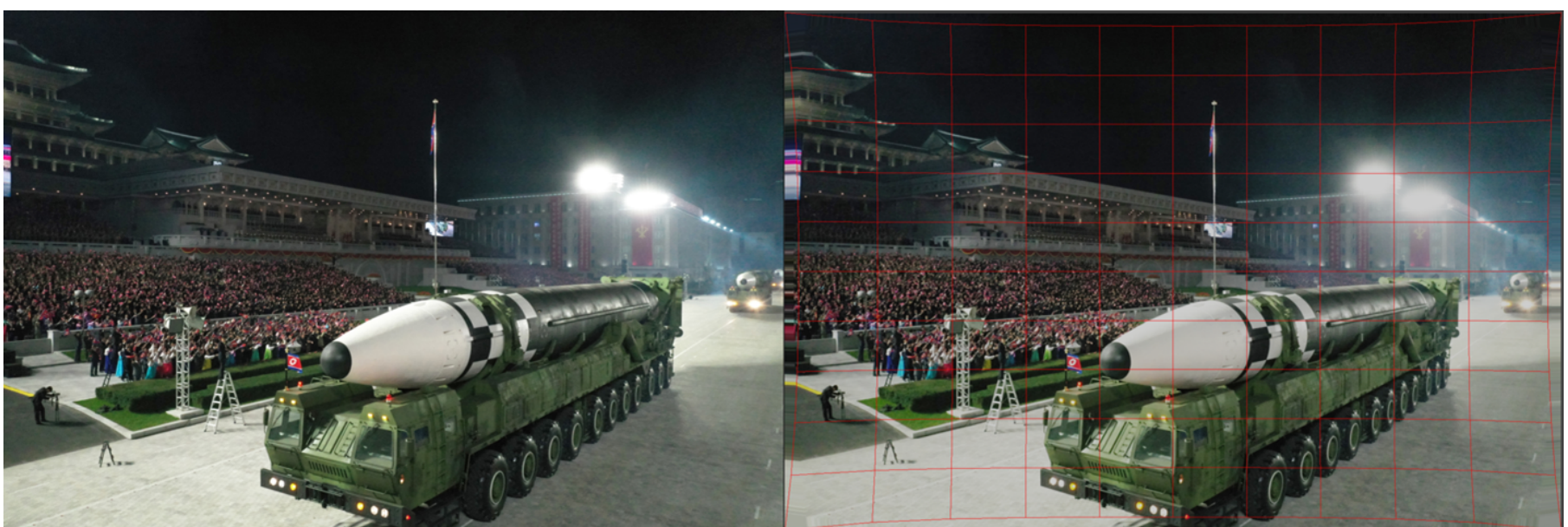
The following will outline one method of measuring that you can do at home. It requires Adobe Photoshop and a little patience. Originally, it was the clever idea of a colleague named Adam Martyn ([@adam\\_measures](#)), but has since been adopted by a number of missile watchers.





Head on view of the 11-axle transporter erector launcher in the 10 October 2020 Foundation Day Parade. Photo Source: KCNA via Ankit Panda [3]

Collection of the best possible images of our subject is the first step. By best, it is not just meant high quality images, but also those that capture other known objects. This is important because this method uses relative sizes and known lengths as a way to determine our desired measurement. Luckily, the Foundation Day Parade was documented with a number of quality images. This isn't always the case though. Some images are distorted through the effects of wide angle lenses – something akin to “fisheye” images. We can attempt to correct for this using the visual effects (VFX) tools in open source software programs like Blender among others.



Left to right: View of novel ICBM at the 10 October 2020 Foundation Day Parade. Same image after correcting lens distortion in Blender 2.90.1. The tool, within the motion tracking suite of the VFX workspace, allows for the adjustment of a polynomial function to compensate for “fisheye” distortions. Photo Source: Rodong Sinmun/KCNA via Ankit Panda [4]

Determining a reference value can be done through known measurements from other images or open source research. A common method is to identify the vehicle make and search for its dimensions. If we are lucky, we may come across manufacturer schematics with precise measurements. For this example though, I used our first image seen again below. In the background on the right side, there is a small white pillar. These pillars bookend the orchestra, which played the revolutionary parade music to spectators.





Searching the background of this image reveals a route to a known measurement. The small white pillar (circled in blue) stands adjacent to the parade orchestra. Photo Source: Rodong Sinmun/KCNA via Ankit Panda [5]



The parade orchestra playing to soldiers garbed in ghillie suits during the 10 October 2020 Foundation Day Parade. The little white pillar (circled in blue) is visible. Photo Source: Rodong Sinmun/KCNA via Ankit Panda [6]

The fantastic thing about orchestras is that modern instruments are often of uniform dimensions. Immediately to the right of our little white pillar sits the woodwind section and the flautists. The western concert flute is 67 cm in length and quite



of our little white pillar sits the woodwind section and the flautists. The western concert flute is 67 cm in length and quite visible in the above image.

Once we choose our image and determine our reference value, we can begin. Open the image in Photoshop and then select the Vanishing Point tool located in the filter menu. Add gridded planes using the Create Plane Tool. This simulates a 3d space within your 2d image and provides a way for your reference value to determine your desired measurement. For best results, planes should lay along flat surfaces that lead to vanishing points. From any plane, additional planes can be extended at known angles until ideally both the reference value and the desired measurement rest on a plane.



By using the flute as a known quantity, other dimensions in the image can be determined. Photo Source: Rodong Sinmun/KCNA via Ankit Panda [7]

Next we use the measurement tool to note our reference value in the appropriate location and another on the desired measurement. Doing so often requires intermediate measurements to be made. As the western concert flute is 67cm, we can solve for the height of the little white pillar, which came to ~129cm. An additional measurement of the cameraman was used as a sanity check. According to the BBC, the average North Korean man's height is between 165.5cm and 170cm. [8] Our cameraman stands at ~168cm, which lends confidence to the measurement of the little white pillar.







Using the reference value, we can solve for our desired measurement. Photo Source: Rodong Sinmun/KCNA via Ankit Panda [9]

Applying the same method to our original image yields a result of a ~2.5m diameter and ~24m length for the new ICBM with a yet-to-be-announced name. The overall vehicle length for this behemoth transporter erector launcher is in excess of 28m. Having a vehicle this large paints a pretty dismal picture for turning radius. Additionally, a liquid-fueled missile of this size poses its own complexities to transporting and filling with propellant.

Repeating the measurement process with as many images and reference values as possible helps refine the desired measurement and increase confidence in its accuracy. To that end, collaboration lends itself to success. Yet ultimately, measurements are only the first step in understanding the capabilities of a missile system, but they are no less important, as better inputs lead to better outputs.

\*\*Note: [ONN Analysts used a different measurement technique](#), but arrived at similar measurements of 26m in length and 2.6m in diameter.

[1] "NK Pro Briefing: What to Make of North Korea's October 10 Military Parade?" Interview of Dr Andrei Lankov and Ankit Panda, moderated by Chad O'Carroll. [https://www.youtube.com/watch?v=VTCRD7AYM0E&feature=emb\\_title](https://www.youtube.com/watch?v=VTCRD7AYM0E&feature=emb_title)

[2] Panda, Ankit. "North Korea: October 10, 2020, Military Parade (Pyongyang)." Flickr Album. <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/> Image URL <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/>

[3] Panda, Ankit. "North Korea: October 10, 2020, Military Parade (Pyongyang)." Flickr Album. <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/> Image URL <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/>

[4] Panda, Ankit. "North Korea: October 10, 2020, Military Parade (Pyongyang)." Flickr Album. <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/> Image URL <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/>

[5] Panda, Ankit. "North Korea: October 10, 2020, Military Parade (Pyongyang)." Flickr Album. <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/> Image URL <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/>

[6] Panda, Ankit. "North Korea: October 10, 2020, Military Parade (Pyongyang)." Flickr Album. <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/> Image URL <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/>

[7] Panda, Ankit. "North Korea: October 10, 2020, Military Parade (Pyongyang)." Flickr Album. <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/> Image URL <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/>

[8] "Nine charts which tell you all you need to know about North Korea." BBC News. 26 September 2017. <https://www.bbc.com/news/world-asia-41228181>

[9] Panda, Ankit. "North Korea: October 10, 2020, Military Parade (Pyongyang)." Flickr Album. <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/> Image URL <https://www.flickr.com/photos/35862761@N06/50473938723/in/album-72157716411702661/>

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