

Satellite imagery analysis of China's alleged 2020 nuclear test at Lop Nur

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ANALYSIS

On February 6, the United States Undersecretary for Arms Control and International Security Thomas DiNanno accused China of conducting nuclear weapons tests that achieved supercritical yields, including one test on June 22, 2020. While this is not the first time that the United States has expressed concern about China's nuclear testing activities, DiNanno's February 6 statements at the UN Conference on Disarmament contained significantly more detail than previous US statements about Chinese nuclear testing.

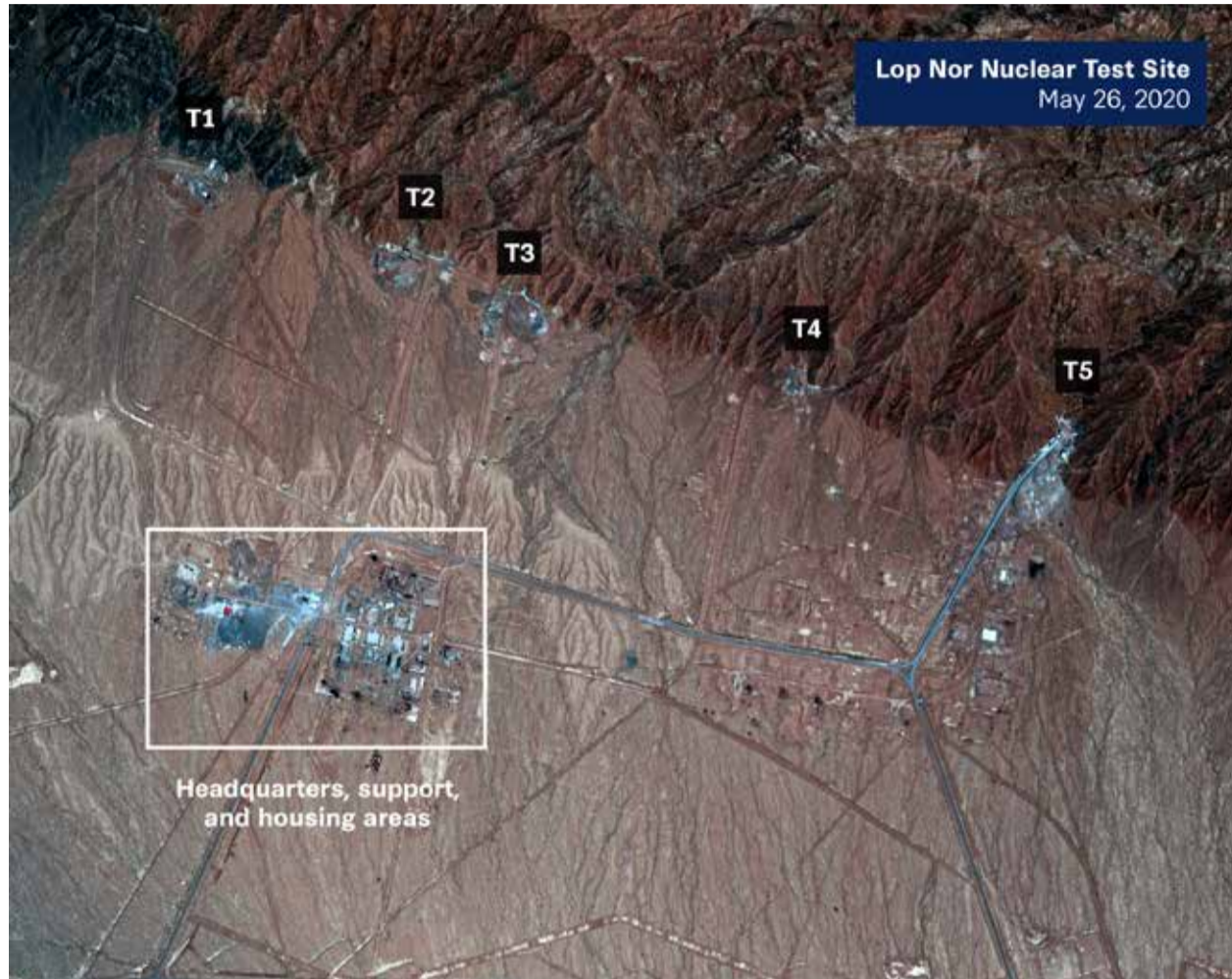
The US statement arrives four months after President Donald Trump stated that the United States would "start testing our Nuclear Weapons on an equal basis" as China and Russia in a Truth Social post. This follows a multiyear trend of escalating rhetoric regarding testing activities. In 2019, the director of the Defense Intelligence Agency accused Russia of "probably" conducting low-yield nuclear tests in violation of their moratorium. The annual US Department of State Arms Control Verification and Compliance report has consistently stated that Russia has not adhered to its nuclear testing moratorium. The compliance report has raised concerns about Russian noncompliance and Chinese activity at Lop Nur, China's nuclear test site, since 2019.

The United States claims that Russia and China are both conducting low-yield nuclear tests in deep underground tunnels. Specifically, DiNanno mentioned that China has used "decoupling" to reduce the detectability of its nuclear tests. A decoupling experiment detonates a nuclear weapon in a large underground cavern — typically a salt dome. The blast's explosive force reverberates through the cavern, muffling and reducing its seismic signature.

Both the United States and the Soviet Union conducted decoupling experiments prior to the nuclear testing moratorium. For example, the United States detonated the Sterling nuclear test to explore decoupling in the Tatum Salt Dome near Hattiesburg, Mississippi. Because Lop Nur is built into a salt lake, the environment is geologically suited for such activities. However, the technical ground truth of what happened at Lop Nur on June 22, 2020, is difficult to verify.

Attempts at open-source verification

While commercially available imagery of Lop Nur during this timeframe is limited, CSIS analyzed Vantor images from March



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26, 2020, and June 25, 2020, of the northern tunnel test area. Before China's testing moratoria, China allegedly conducted underground nuclear tests with explosive yields of less than 10 kilotons in this area. Analysts have noted significant activity at Tunnel 5 since 2020. CSIS imagery analysis of Lop Nur's northern test tunnel area, including Tunnel 5, saw no significant activity or changes between March 26, 2020, and June 25, 2020. However, Lop Nur is a large facility. It is possible that China conducted an underground nuclear test at another area. It is also possible that the testing did indeed take place at this tunnel, and there are no optical indicators in these two images.

The satellite imagery did not provide any conclusive findings to support or disprove the US allegations. Furthermore, the CSIS Project on Nuclear Issues also searched several geologic databases to determine whether there were any indicators of seismic activity around Lop Nur on June 22, 2020. No signatures of any seismic events at the Lop Nur site were found. While the US Geological Survey did record a magnitude 4.1 seismic event at 6:38 p.m. local time on June 22, the epicenter was approxi-

mately 200 kilometers away at a depth of 10 kilometers — making it unlikely to be related to activity at the test site. To further confirm this point, the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) Executive Secretary Robert Floyd issued a statement on February 6, saying:

"The CTBTO's International Monitoring System (IMS) is capable of detecting nuclear test explosions with a yield equivalent to or greater than approximately 500 tonnes of TNT... Regarding reports of possible nuclear tests with yields in the hundreds of tonnes, on 22 June 2020, the CTBTO's IMS did not detect any event consistent with the characteristics of a nuclear weapon test explosion at that time. Subsequent, more detailed analyses have not altered that determination."

CSIS's analysis yielded no indicators of a nuclear test on June 22, 2020. If the US claims are true, China conducted a covert decoupling test. They would have gone to extensive effort to hide optical and seismic signatures. While satellite imagery and seismology are inconclusive in the open source, the United States intelligence community has access to many more sources of data.

Another significant part of the problem in deciphering whether China "cheated" is the lack of an international agreement on what constitutes a nuclear test. Even the Comprehensive Nuclear Test Ban Treaty (CTBT) lacks an agreed-upon definition. The United States has long championed a "zero-yield" interpretation, meaning no experiment should produce a self-sustaining chain reaction. However, in practice, this remains more of a political distinction than a purely technical one. Defining the line between spontaneous fission in a subcritical mass and a self-sustaining chain reaction is a difficult technical challenge, one that the international community chose to leave undefined in the CTBT.

Why test? Four possible explanations

If China did indeed cross the supercritical threshold on June 22, 2020, then the most important question is why. What would China stand to gain from very low-yield, decoupled nuclear tests? There are at least four possible explanations.

1. To enhance safety and security: The United States conducted a series of very low-yield nuclear tests to enhance

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