



## **Where are the PLA's other laser dazzling facilities?**

**Kristin Burke**

In December 2022, U.S. researchers again updated their analysis of the People's Liberation Army's (PLA's) laser research, development, and testing facilities in the desert of China's Xinjiang province. This time, they described how their review of commercial satellite imagery had led them to hypothesize that "China is utilizing a vehicle-mounted laser system, or seeks to develop one, for more destructive types of laser [counterspace] operations."<sup>1</sup>

This article seeks to flesh out and redirect that hypothesis with three arguments discussed in more detail below. First, PLA media and academy theorists more often discuss the benefits of laser dazzling and other reversible counterspace laser effects. Second, the PLA highly likely already has a mobile laser dazzling capability, and it would be extremely useful to catch those with satellite imagery, rather than more imagery of the Bohu laser facility in Xinjiang. Third, there are diminishing payoffs from focusing on Bohu for understanding China's now 15 years of experience with counterspace lasers; in particular other PLA services have used those facilities and have developed truck mounted laser weapons, but not for space or counterspace applications.<sup>2</sup> Lastly, the report includes imagery to facilitate follow up research.

Western emphasis on Bohu is probably the result of analysts assuming that the PLA intends destructive effects with the laser counterspace systems. After all, Bohu is one of the known facilities that clearly houses probably enough fuel for a high-power chemical laser. However, while achieving a reliable ability to use ground-based laser weapons to destroy satellites is potentially one aim of the PLA laser counterspace program, the less sexy and more operationally effective satellite dazzling is a repeated PLA priority to slow the 'opposing side's' information acquisition cycle. The PLA's Academy of Military Sciences 2013 textbook on space operations says, "[S]oft kills...such as [with] low power lasers...can achieve the effects needed in operations without producing other collateral damage." The text further explains that reversible counterspace attacks, or "soft kills," with lasers are an important means of "commanding space" because "they are not easy to discover, and it is hard to trace their source, so that it is possible to conceal operational intentions fairly well."<sup>3</sup>

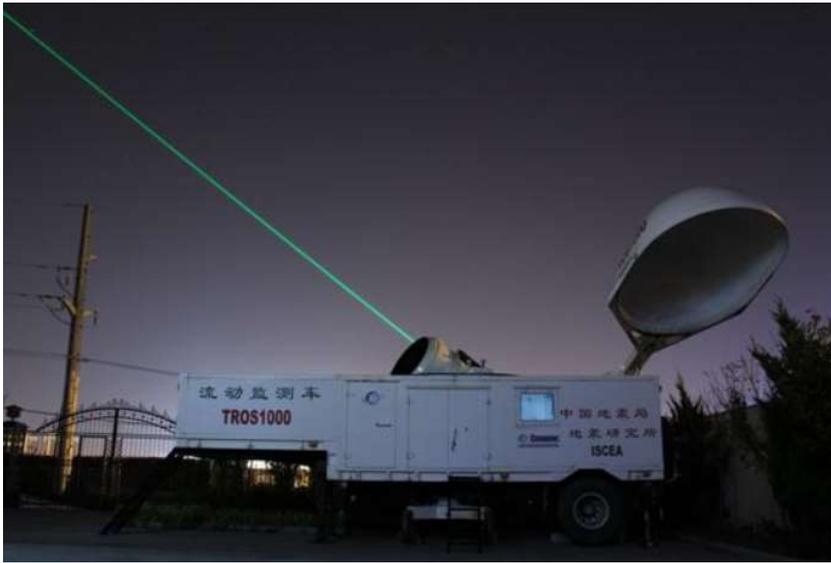
Even after the creation of the Strategic Support Force (SSF) and the transition of the former General Armaments Department's (GAD's) laser test facilities to new SSF units, PLA authors have still emphasized the operational effectiveness of dazzling over destructive effects. PLA media in January 2021 stated that "laser blinding weapons have entered the golden age," and included dazzling satellites as one of the many operationalized uses.<sup>4</sup> In particular, just after

the creation of the SSF, the SSF conducted a technical study on the use of ground-based laser dazzling “stations” to carry out camouflage and concealment operations. They determined that in order to prevent a low Earth orbit satellite constellation from imaging a sensitive military operation for one hour, they would need anywhere between 17-27 laser dazzling stations to achieve the minimum of a 72% imagery suppression rate.<sup>5</sup>

Considering the consistent tempo of PLA discussions on the operationalization of laser dazzling “stations,” it is instructive to more deeply consider U.S. Space Force's General David Thompson's November 2021 comments to the Washington Post. He said that U.S. government satellites were experiencing reversible counterspace attacks “every single day.”<sup>6</sup> If it is possible that laser dazzling accounted for a third of the incidents in 2021, and if only half were from China, that would still be five instances of dazzling from the PRC a month. It is highly unlikely that each of those is from Bohu. It is also possible that there are unintentional instances of dazzling as more Chinese commercial telemetry, tracking, and control companies get involved.<sup>7</sup>

In an attempt to extend analysis beyond Bohu, different researchers have noted that China has other stationary facilities which look like those in Xinjiang and even other facilities that participate in international satellite laser ranging.<sup>8,9</sup> This article, however, takes a different approach by emphasizing that those facilities don't meet the PLA's stated operational use of dazzling satellites to protect sensitive PLA activities. Researchers should instead investigate the PLA's mobile tracking stations which have laser ranging capabilities, and have been in use since at least 2011.<sup>10,11</sup> The China Aerospace Studies Institute has published Chinese media photography of some of the remote tracking trucks, but satellite imagery of them deployed with the laser range finders would be extremely beneficial.<sup>12</sup> Easy places to start looking are around space launch facilities, especially when China is launching one of its “quick response” satellite launch vehicles or around the time of a ballistic missile defense test.<sup>13,14,15</sup>

To foot stomp, this report is not claiming that all laser ranging facilities in China are intended for counterspace use. Rather, this report is saying that in combination with the PLA's stated operational uses and U.S. technical experts' explanations that it is possible but difficult to use a laser ranging facility to dazzle a satellite, it is worth more analysis.<sup>16,17,18</sup> It would be especially possible for a military practicing such a tactic for 15 years (2006-2021). The PRC's national mobile laser ranging capabilities have also significantly advanced. In reference to regularly ranging the PRC's navigation satellite system called Beidou, a speaker from the Shanghai Astronomical Observatory under the Chinese Academy of Sciences in 2020 said, “the first set of mobile all-weather satellite laser ranging system[s] in China [has been] developed, which broke through the key technologies such as daytime laser pointing and targeting, real-time signal identification and detection of high-orbit satellites under movable platform conditions.”<sup>19</sup> This is probably in reference to the TROS1000, image below, but a quick search did not find any hits of the PLA using this version.<sup>20</sup> Chinese official media state that as of 2017 China's mobile satellite laser ranger trucks have been operationalized in Hubei and Shandong provinces, with plans for Xinjiang, Inner Mongolia, and Qinghai provinces.<sup>21</sup>



The last reason to not overly focus on Bohu as the primary site for PLA laser counterspace activities is because those facilities are also used by many PLA services and organizations for testing non-counterspace, terrestrial laser weapons. For nearly two decades the PLA has been developing what it calls “new concept weapons,” which includes all forms of directed energy weapons, amongst other types.<sup>22,23</sup> For

those readers more familiar with other Chinese technology plans, new concept weapons can be understood like a category of technologies in “Made in China 2025;” the CCP intends the grouping to focus lower-level research and development efforts, and incentivizes them with subsidies and other support.<sup>24</sup> The takeaway is that a lot of PLA units are working on laser weapons. Even with technical expertise married with an analytical Mandarin reader, it is hard to parse what PLA papers are talking about anti-satellite weapons versus anti-UAV, anti-missile, anti-ship, and anti-tank laser applications. Even the former GAD unit 63650, the military unit cover designator (MUCD) for former GAD Base 21 and its subordinate Unit 63655’s research has supported terrestrial and non-counterspace applications.<sup>25,26,27</sup> In other words, while researchers have recently contributed excellent analysis of satellite imagery showing the position of sliding roofs on laser facilities in Bohu, Xinjiang, an increased operational tempo at those facilities does not directly correlate with improvements in counterspace weapons development. Other PLA units have also likely used those facilities to develop their truck mounted laser weapons, but not for space or counterspace applications.<sup>28</sup>

To explore the hypothesis that the PLA already has mobile laser ranging capabilities capable of and used for dazzling satellites, we flagged the TROS1000 for the Arms Control Wonk and the Middlebury Institute of International Studies based on their extensive commercial imagery analysis and recent publications.<sup>29</sup> They found a similarly looking domed truck in August 2022 at what is thought to be the Xinjiang facility supporting the PLA’s direct ascent anti-satellite missile tests (41.53666, 86.35573).<sup>i</sup> The China Aerospace Studies Institute pursued this lead and determined that this truck is camouflage green in color imagery, and was parked at the facility, with the dome closed unlike in the TROS1000 image above, between July 23, 2022 and September 14, 2022. It was not present as early as July 4 nor as late as September 22, 2022.

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<sup>i</sup> Special thanks to Jeffrey Lewis and Decker Eveleth.

Additional research is encouraged to explore its location during the PRC's June 2022 missile intercept test. See a U.S. National Geospatial-Intelligence Image below.



**China: PLA Mobile Probable Laser Ranger Capable of Satellite Dazzling**

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GEO: 413212N/0862120E | MGRS: 45TVF 46254 98528 Geographic coordinates are approximate and should not be used for navigation or targeting purposes.



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The above report provides three reasons why open-source researchers should redirect their satellite imagery analysis of the PLA's counterspace laser weapons development towards mobile stations already in use for nearly ten years. It also provides an example of a PLA truck to further investigate at non-Bohu based sites. Without more publicly available instances of probable satellite dazzling, but the U.S. Space Force's General David Thompson saying it is still happening, looking for these trucks might be the best near-term solution for improving the public's understanding.

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## ENDNOTES

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