

**Brief:**  
**Countering China's Rendezvous Spacecraft,  
Ground-Based Lasers, and Electronic Jammers in the 2020s and Beyond**

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China is developing rendezvous spacecraft, ground-based lasers, and ground-based electronics jammers. These antisatellite (ASAT) systems have potential to disable critical satellites without creating significant amounts of space debris, the production of which might otherwise provoke international opprobrium or place China's own satellites at risk.

### **Rendezvous Spacecraft Threat**

Since 2018, at least [11 space officials and intelligence agencies](#) at the highest level have expressed serious concerns regarding dual-use spacecraft capable of rendezvous and proximity operations (RPO). Many of them will be deployed with robotic arms to remove space debris or refuel, repair, upgrade and reposition satellites already in orbit. Such capabilities are inherently dual-use: if a satellite can grapple a space object for service, they can do the same to disable our satellites.

No [international law or shared understanding](#) exists regarding 'rules of the road' that would limit the ability of states to position such spacecraft in close proximity to another country's satellites. As a result, China could preposition rendezvous spacecraft near U.S. [early warning satellites, and communications satellites in a nuclear-disrupted environment](#) during peacetime, providing the ability to attack suddenly from close range at a moment's notice. While these rendezvous spacecraft are slow-moving, such prepositioning could leave us defenseless. By the second half of the 2020s, China could have about 100 small, cheap spacecraft serving as effective proximity ASATs.

Much like the coronavirus, [protecting satellites](#) from this threat requires three things: "vaccination," by building immunity to the underlying threat by shifting to proliferated constellations of cheap and small satellites. However, some existing and future critical constellations are not possible or prohibitively expensive to be replaced by proliferated constellations. They need to be protected by "social-distancing," through establishment of warning/self-defense zones around them; and the use of "masks," by deployment of cheap and small bodyguard spacecraft.

### **Ground-based Laser Threat**

The Defense Intelligence Agency (DIA) [warned](#) in January 2019 that China would likely field in 2020 a ground-based laser weapon capable of damaging space-based sensors in low earth orbit. By the mid-to-late 2020s it may field higher-powered systems capable of damaging the external structures, such as solar panels, of low-orbit optical and non-optical satellites. [Analysts have already](#) identified five Chinese bases with lasers of power probably

about [50-100 kilowatt](#) (as of 2005<sup>1</sup>) and apparently DIA's warning is referring to this type of lasers. On the other hand, these bases can be located and are vulnerable to aerial attacks, making our attack at the source a potential response to this threat.

In addition, China operates [five fixed and two mobile](#) satellite laser ranging (SLR) stations with low power of [3 to 60 watts](#), while the world has about [50 such stations](#) (as of 2014). These systems, used to accurately determine the orbits of satellites and space debris, currently lack sufficient power to cause permanent damage to a satellite sensor in low-orbit, but this could change over time as it uses far more powerful lasers for ranging and other applications. Moreover, there is a cooperative SLR station of [China and Argentina](#) in San Juan. This suggests that China could use laser to temporarily or permanently damage our satellite sensors from stations outside China.

The first set of potential responses [reduce the impact of sensor damage by ground-based lasers](#). For example, one could take pictures whenever possible during peacetime, as the chance of damage is much higher in a crisis; avoid passing over the area and update imagery less frequently, because fewer trips means a smaller chance of being hit; and use the lowest image resolution sufficient for a given task, as low-resolution sensors and their satellites are cheap and numerous compared to dedicated military imagery satellites. Additionally, the United States should secure imagery of all needed resolutions, including 10cm or better, any way it can during peace, crisis, and war, including the use of both commercial and dedicated military systems. Finally, to the extent that Washington is able to bring China into arms negotiations with the Russians, it should prioritize getting Beijing to formally agree to prohibitions on interference with national technical means of verification, including sensor-carrying satellites.

Second, it will be necessary to deter and defend against China's use of high-powered lasers to damage the exterior structures of our low-orbit satellites. The five such existing lasers with enough power would be sufficient to ensure that at least several of our low-orbit satellites can be in range and damaged every day. Therefore, Washington will have to make our satellite constellations resilient such as via proliferated constellations, harden some satellites' exteriors and sensors, and be prepared to disable China's laser systems if necessary.

Finally, China's ground-based lasers might go mobile sometime in the latter half of the 2020s. The United States and its allies should minimize the risk that mobile lasers will be used as ASATs by pushing for international agreement to register all mobile lasers (including their locations) that are usable or convertible for ASAT purposes; and require one month's advance warning of intended movement and real-time broadcasting of said movement.

## **Ground-based Electronic Jammers**

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<sup>1</sup> This and other old numbers in this brief call for our government to provide better data to the public.

Electronic jamming is [reversible](#): once the jamming signal is turned off, the targeted services such as positioning, navigation and timing (PNT) or communications can resume. DIA pointed out that electronic jamming can be “[challenging](#) to attribute and distinguish from unintentional interference.” Its jamming can be “[directed](#) at ground [and airborne] users, such as a ground forces unit [or airplanes] using satellite navigation to determine their location.”

DIA continued that “[the PLA routinely](#) incorporates jamming and anti-jamming techniques against multiple communication, radar systems, and GPS satellite systems in exercises. China continues to develop jammers dedicated to targeting SAR [Synthetic Aperture Radar] aboard military reconnaissance platforms, including LEO [Low Earth Orbit] satellites. Additionally, China is developing jammers to target SATCOM [satellite communications] over a range of frequency bands, including military protected extremely high frequency communications.”

Countering jamming requires three things. First, the United States and its allies must have reliable means to discern that the jamming is caused by a hostile act of China. Measures to achieve this include more comprehensive monitoring from orbit and increased integration of commercial forensics data. Second, the U.S. should minimize vulnerability in three ways: by increasing *passive* hardening of key satellites and ground stations (e.g. [controlled reception pattern antennas](#)); adopting *active* anti-jamming technologies (e.g. [artificial intelligence-driven jamming suppression](#)); and employing redundant platforms both in space and terrestrially. Finally, the U.S. can clarify and employ unilateral response options, including but not limited to potential in-kind responses or infliction of proportionate cross-domain costs.