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China's ASAT Weapon: Capabilities and the Potential Threat

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Much has been said about China's 11 January 2007 test of an anti-satellite (ASAT) weapon but few analysts have based their comments on a scientific determination of the weapons capabilities. This paper presents such an analysis derived from the observed pattern of debris, as observed by NORAD and posted on-line by NASA. It is clear that this was a direct hit-to-kill weapon (as opposed to a fragmentation-type explosive warhead), it massed about 600 kg, and was capable of accelerations of at least 6 Gs. It can be inferred with a reasonable degree of confidence that it used an on-board optical tracker, most likely operating in visible light. Furthermore, since the closing speed between the target satellite and the interceptor was 8 km/s during the test, this weapon could be used to attack satellites at higher altitude orbits, such as NAVSTAR/GPS and geostationary satellites that include communications and early warning satellites. This test produced ten times as many pieces of debris as an earlier US hit-to-kill ASAT test which, because of their higher altitudes, will last thousands of years—hundreds of times longer than the debris in the US test. China's test increased the chances of some low earth orbit satellite being hit by a piece of debris by 50%, from about 12% to 18% each year. Given this weapon's capabilities, it is possible to “war game” what an all-out Chinese ASAT attack would look like and what responses the US could take. (It is important to emphasize that this is a capabilities-based exercise and not based on Chinese intentions.) If China did launch such an attack, it could eliminate a large fraction of US military satellites in low earth orbit including photo-reconnaissance and electronic intelligence satellites, but not all of them, in the first 24 hours; the requirement that the target satellites be illuminated by the sun limits the attack. Furthermore, the US could maneuver its LEO satellites in the first hours of the attack and greatly complicate the task of their destruction. If coupled by attacks on China's largest radars, the US could save a number of their LEO satellites. China would have to choose to attack either US GPS satellites or communications satellites, but not both, since its launch capabilities are insufficient. If it attacked the GPS constellation, it could not prevent the US from using precision guided munitions.