

## Abstract

The People's Republic of China's (PRC) militarization of artificial islands in the South China Sea (SCS) represents a challenge to security of, and freedom of navigation in, international waters. Static defenses on these islands enhance Anti-Access and Area Denial (A2AD) efforts, allowing de facto sovereignty in the area sustained by successful radar coverage. While many A2AD tools may not be measured without direct access to the product, conventional radar structure heights may be measured remotely, allowing for indirect measurement of an adversary's radar range. Though estimates for these ranges have been published by various defense thinktanks, this study builds on shadow analysis literature to perform more accurate measurement and projection of radar ranges through use of remote sensing and trigonometry applied to imagery of SCS radar construction in late 2017.

This study uses shadow analysis to measure radar tower heights combined with radio wave propagation equations to provide a viable alternative to rule-of-thumb estimation. This novel methodology is tested on radar arrays identified by the Center for Strategic and International Studies (CSIS) on three key islands in the SCS's Spratly Islands. Radar horizon range measurements provide a detailed analysis of radar coverage at various altitudes, showing that previously published estimates can differ from bespoke analysis by more than double. The study quantifies average range of radar arrays on artificial islands created by the PRC, finding the average radar to reach radar horizon in 23.82 km distance at 0 m altitude; equal to 249.47 km at 3,000 m, or 435.81 km at 10,000 m, respectively.