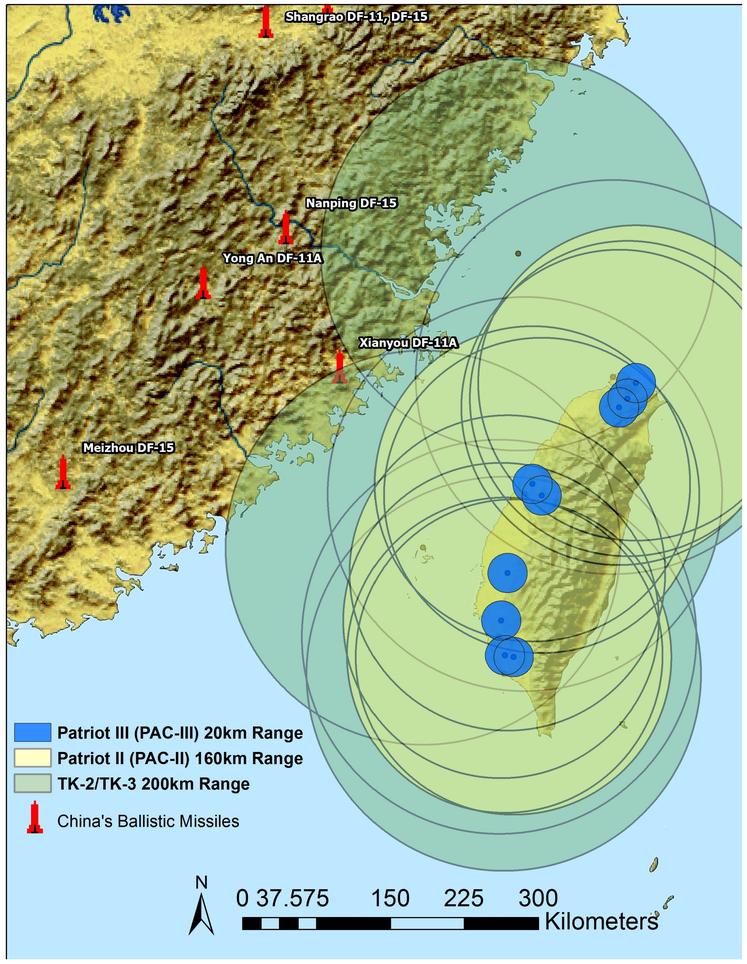
Who to Protect? Taiwan's SAM Systems and the Distribution of Protection



Background

Taiwan Strait today stands as the most heavily militarized area in the world. China has repeatedly threaten the use of military force to invade the democratic island of Taiwan, its People's Liberation Army (PLA) fields nearly **2,000** medium and short-range ballistic missiles (MRBM & SRBM) across Taiwan Strait which would likely be used to attack Taiwan at the outset of conflict so as to pave way for larger scale invasion to follow.

To counter this threat, Taiwan has constructed perhaps the most robust and sophisticated **air and missile defense network** (**SAM**) in the world. This includes not only the Patriot missile system purchased from the United States, but also large number of Taiwan's indigenous anti-air missile systems and extensive investments into early-warning radars and other defensive measures. Information regarding Taiwan's SAM network however is highly classified and rarely discussed among the public.

The study aims to shed light on the strategy and logic behind Taiwan's SAM network through Imagery Intelligence (IMINT) and GIS analysis, and to highlight the efforts Taiwan invested in defending its own air space and population.

Methodology

Imagery Intelligence (IMINT) analysis: By analyzing publicly available satellite imagery on Google Earth combine with other verifiable sources including news reports, government disclosures, and social media discussions among Taiwanese veterans, this study was able to geographically located and identified all known Patriot missile sites (9 in total) and all known Tien Kung missile sites (6 in total) across Taiwan and Taiwan's outer islands.

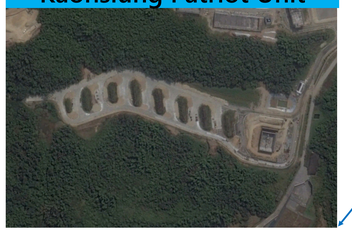
Coverage analysis: Based on the known locations of Taiwan's SAM systems and their range capabilities, and combine with Taiwan's population density data at village level, this study was able to calculate the precise population and area protected by the SAM systems and the various levels of protections provided.

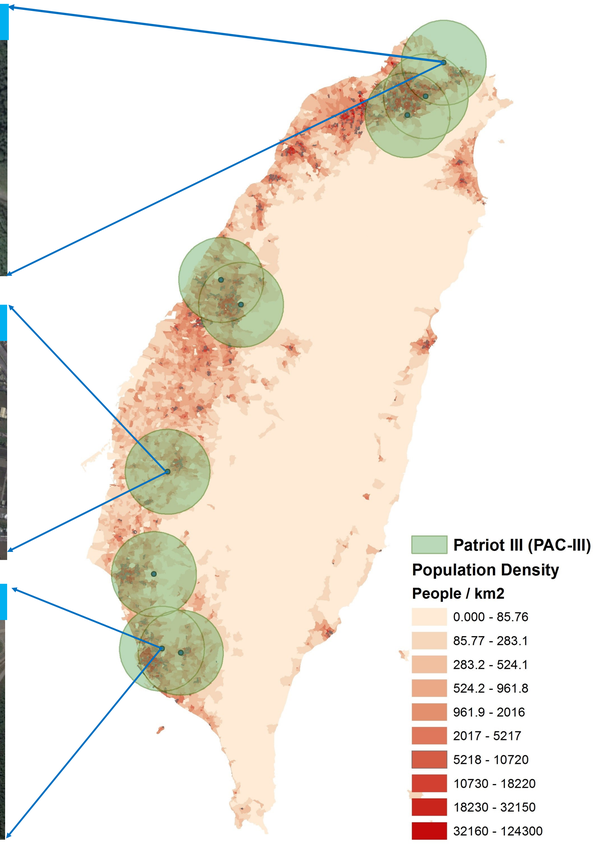
IMINT Analysis on Selected Patriot Missile Sites

Keelung Patriot Unit

Chiayi Patriot Unit

Kaohsiung Patriot Unit





Weapon Platforms

Patriot III (**PAC-III**) is the upgrade version of PAC-II and is specifically designed to intercept **ballistic missiles**. PAC-III missiles are smaller, more agile, more accurate and deploy in larger number which make them **highly effective** against ballistic missiles. However due to the small size of missiles PAC-III has a limited range of **20 km**.

Patriot II (**PAC-II**) Missile System is a surface-to-air missile (SAM) system developed by the United States and also used by many U.S. allies including Taiwan. PAC-II is capable of intercepting both incoming enemy aircraft and ballistic missile and has a range of **160 km**.

Tien-Kung II & III, also known as Sky Bow (**TK-II/TK-III**) is a long range surface-to-air missile system indigenously-produced by Taiwan and is capable of intercepting both incoming enemy aircraft and ballistic missile and has a range of **200 km**.

People's Republic of China deploys nearly **2,000 ballistic missiles** including DF-11, DF-15 and other types against Taiwan. They can be used to attack Taiwan's military, population centers, and other civilian targets.

Protective Coverage on Taiwan's Population and Area

Protection Levels	Area Protected (km²) (Total Area = 36,179 km²)	Population Protected	Percentage of Population Covered (Total Population = 23,545,680)
3 Overlapping PAC-IIIs plus PAC-II & TK-II/TK-III	329 km² (0.9%)	1,599,346 (1.6 Million)	6.8%
2 Overlapping PAC-IIIs plus PAC-II & TK-II/TK-III	3,356 km² (9.2%)	10,245,226 (10 Million)	43.5%
1 PAC-III Unit plus PAC-II & TK-II/TK-III	6,745 km² (18.6%)	4,952,058 (5 million)	21%
PAC-II & TK-II/TK-III Only	25,749 km² (71%)	6,749,050 (7 million)	28.6%

Limitation

The study concerns only with the efficiency of geographic distribution of protection provided by Taiwan's SAM systems, and should not be taken as an evaluation of the operational effectiveness of the SAM systems.

Evaluating a real-world "shooting war" scenario between Taiwan's SAM systems and China's ballistic missiles would involve far more complexity and assumption on the part of Chinese ballistic missile performances, and is not within the scope of this study.

Data Sources

Sources: Esri, HERE, Delorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordance Survey, Esri Japan, Meti, Esri China (Hong Kong), swisstopo, MapmyIndia, OpenStreetMap contributors, and the GIS User Community. National Land Surveying and Mapping Center, Ministry of the Interior, Taiwan.

Satellite imagery from DigitalGlobe via Google Earth and analyses done by Po-Chang Huang.

Conclusion

The study demonstrates that Taiwan's SAM network is logically designed and deployed to protect Taiwan's population centers from the immense security threats posed by China's ballistic missiles.

Specifically, Taiwan deploys its **PAC-III** missile system, which has the most effective anti-ballistic missile capabilities among the three major SAM weapon platforms but also has the shortest (20km) range, to protect Taiwan's most densely populated urban areas around Taipei, Taichung, and Kaohsiung.

As a result, **16.7 million** (**71.3%**) of Taiwan's **23.5** million population are protected by at least one PAC-III missile unit, even though all 9 PAC-III units combine only provide coverage to **28.7%** of Taiwan's total landmass. Among them, **10 million** are protected by two overlapping PAC-III units and **1.5 million** in Taipei area enjoy the most protected coverage of three overlapping PAC-III units.

Future analyses can focus on evaluating how Taiwan's SAM systems can protect Taiwanese military installations and sites such as airbases and naval ports, which are not evaluated by this study. In addition, highly vulnerable sites such as nuclear power plants can also be incorporated in future analyses on this topic.

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May 9, 2017 DHP P207 GIS for Int'l Applications
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