



CUXS CHRONICLE

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A FINANCIAL BATTLE IN THE AIR

“The advantage is always with the defense” is an adage that, while often true, does not apply to air and missile defense, and especially not that niche of CUAS. The cost of detecting, tracking, identification, and defeat of an enemy’s air assets is almost always exponentially higher when compared to the cost of that air asset. The air and missile defense fight is a constant evaluation of value. To put it into perspective, a scenario utilizing the current conflict in Ukraine can be illustrated, demonstrating the cost incursions of the defensive forces vs. the relatively inexpensive offensive UAS.

THE SCENARIO

THE THREAT: Shahed-136/Geran-2



\$290K

For the offensive UAS in the scenario, the Shahed-136/Geran-2 will be utilized. The Shahed-136 was developed by Iran, imported by Russia, and is now being built within the Russian Federation. It is a direct attack UAS and has caused devastation against the Ukrainian infrastructure. The reported costs of the Shahed-136/Geran-2 vary from \$20K to \$375K. In this scenario we are using the reported large buy price of \$290K. The Shahed-136/Geran-2 has a reported range of 2,000-2,500 km making it an incredibly dangerous capability across even a large battlefield.

Detection of UAS is an intricate and difficult process. There are two main methods of detection, active and passive. Active detection sends out pulses and registers the response, while passive systems detect the active uplink of the UAS and controller.



\$400M

ACTIVE DETECTION: The Patriot System

With this scenario, the primary detection system utilized is the AN/MPQ-53/65 radar, a component of the Patriot AMD system. It is currently employed by 15 countries and depending on the configuration can run upwards of \$400M. It is utilized for a broad range of missions to include the defeat of tactical ballistic missiles, enemy fixed wing aircraft and large UAS.

PASSIVE DETECTION: Handheld EW Systems

The alternate method of detection is utilizing electronic warfare (EW) systems to detect the uplink and downlink between the UAS and the controller. This system has a far more limited range than a radar and only functions with UAS that utilize uplink/downlink within the spectrum that the EW system is tuned into. There are many providers of this capability with models averaging around \$50K.



\$50K

If the defenders are able to detect the UAS, which it is possible they don't, there is still the issue of how to defeat it. Like detection, defeat is a complex issue. Missile systems often require complex radars to guide them onto target. Those that utilize heat signatures often have trouble locking onto the smaller, cooler UAS. It becomes a numbers game again, in that the more expensive the missile, the higher the potential for defeat



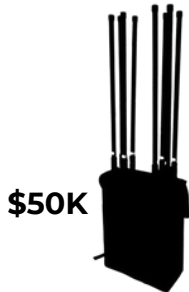
DEFEAT: Patriot Missiles

Patriot missiles range in cost and capability, as with any military technology that has been around for over forty years. They are the costliest choice in the scenario and can be over ten times the cost of the UAS they're used to defeat. Patriot missiles have a high potential to defeat the threat, but with the incredible cost, magazine depth becomes an issue at scale, and UAS are not the only threat that Patriot missiles are intended to defeat.



DEFEAT: FIM-92 Stinger / SA-7 Strela-2

Man-portable air defense systems are more cost efficient than fixed site air defense systems, however, they are limited in range and often require heat signatures at temperatures that UAS don't provide and also require some level of advanced warning. In the scenario presented, the Shahed-136/Geran-2 would have to fly within line of sight of the MANPADS, the MANPADS team would have to be warned of its approach and vector. The variance in cost of MANPADS correlates to its abilities, and cheaper MANPADS struggle to engage UAS targets.



DEFEAT: Handheld EW

Electronic warfare defeat systems are the most cost-efficient detection and defeat system; however, they are incredibly limited in both range and level of success. Their ability to jam is often also connected to the level of power they're able to output through their antennae versus the power able to be put out through the controller's antenna. Handheld EW kits are a useful part of a layered defense but have limited range and low success rates against advanced enemy UAS.

The cost of air defense operations often seems exceptionally high when looking simply at the threat and the defense capability. To put the true cost into perspective, it is important to understand the value of defended assets.



DEFENDED ASSET: Apache Attack Helicopter

Airfields and infrastructure have been focal targets of UAS attacks during the Russian-Ukraine conflict. Utilizing an Apache attack helicopter as an example in this scenario, the defended assets value is over \$40M, more than one hundred times the value of the threat. This is also ten times more expensive than the Patriot missile utilized to defend it.

\$12-80M**DEFENDED ASSET: F-16**

An alternative defended asset is the F-16, currently employed by Ukraine against Russia. While dominant in the air and able to defend themselves, modern fighter jets are sitting ducks at airfields without hardened shelters. Utilizing the Shahed-136/Geran-2, the UAS threat is able to threaten an asset that is over two hundred times its value.

There is a massive delta between the cost of conducting air defense operations against UAS and the operation of those UAS. That delta is the reason for increased use of UAS in large scale conflict. Ukraine built over one million first person view (FPV) UAS in 2024, with the goal of building four million in 2025. The cost of not conducting air defense operations against UAS is even more costly, with the ability to inflict hundreds of times the cost of a UAS in damage.

A SHIFT IN INVESTMENT

There is currently a large shift across global defense spending to expand unmanned programs. Countries like Ukraine and Russia are innovating and shifting the way they fight due to on-going conflict. As countries learn from the conflict, more militaries are acquiring unmanned capability. Japan has gone as far as to give up on the acquisition of new attack and observation helicopters, instead acquiring UAS to execute the same missions. Cost efficiency isn't the only reason for these shifts. With unmanned platforms there is an understandable reduced risk to personnel. The cost savings of UAS allow for greater numbers to be employed, which enables operational flexibility, saturating an enemy's air space and putting strain on an enemy's air defense assets. UAS's small size and relative cost also allows for technological upgrades and developments at a quicker rate than their larger manned counterparts.

This increase in investment in UAS capability by military powers must be matched by the development and acquisition of capability that is able to detect, track, ID, and defeat it. The need for robust counter-UAS measures to counter the more agile UAS threats will become increasingly relevant in military strategic planning efforts. Layering conventional integrated air and missile defense with smaller and more agile C-UAS capabilities will provide the required defense that ensures success against the deadly UAS threat.

Countering the unmanned threat is not solely a capability gap. The delta between the cost of UAS and CUAS can be diminished through a comprehensive solution of training, planning, threat assessments, vulnerability assessments, passive air defense techniques and intelligence efforts. These efforts ensure that detection occurs as early as possible, the right mitigation method is utilized, and that gaps in defense are identified and closed at the lowest level.

Please note that all values and data presented in this article are approximate and have been sourced from a variety of external references. While every effort has been made to ensure accuracy, the information provided may not be fully comprehensive or up-to-date. Readers are encouraged to verify details from authoritative sources.