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The Politics of Patriot Missiles

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Abstract:

The US congressional hearing were held between Professor Theodore Postol and Mr. Robert Stein, manager at Raytheon, Patriot's manufacturer, where its effectiveness was openly debated in April, 1992. The key topic was what is considered to be the success of Patriot. However, Raytheon's criteria on the success of Patriot was not easy to establish and even raised further questions on Patriot's effectiveness. At the end, Raytheon even emphasized its political success; regardless of Patriot's defense effectiveness in air, Patriot ended up keeping the US policy among the allied nations in a region.

Keywords: Projectile, trajectory, air friction; non-linear effects, butterfly effects, Patriot, Scud, ballistic missiles,

1. Introduction

Patriot is a US air defence system by Raytheon, the manufacturer of its system. In the middle of the war in Ukraine at this moment, it is considered to be one of the key military components against Russian missile attacks. However, according to some Russian reports, Patriot is almost useless in defending Ukraine's airfield from the Russian side. Even some in the Western world also question whether the Patriot is really as effective as it is said to be.

For many years, Professor Theodore Postol at MIT has been noted for his strong opinion on the effectiveness (or rather ineffectiveness) of the Patriot system. In this article, a brief sketch of Postol's skeptical argument will be given so that readers can have a deeper historical understanding of the limitations of a modern high-tech weapon system, such as the Patriot, with some historical and political perspectives involved.

2. Non-linear Butterfly Effects in Air

A fast-moving object in the air behaves in a way that makes it almost impossible to anticipate its trajectory in any current-day computational simulations. Still, a college physics textbook description of a trajectory motion with no air friction (Tipler & Mosca, 2007) is quite simple enough to give a popular image of a parabolic motion which is very far away from a realistic trajectory in air. In other words, frictions in air cause unexpected high-degree non-linear "butterfly" effects (Shapiro, 1961), and the idealistic parabolic trajectory of a motion is far from the actual one. These effects on a fast-moving object include vibrations, rotations, and motions of circling and swing, which will make it very difficult for a defence system such as Patriot to effectively counteract the incoming enemy threats.

3. Operation Desert Storm

After Iraqi troops occupied Kuwait in 1990, the US-led allied forces invaded Kuwait in 1991, which is more commonly known as Operation Desert Storm. Iraq then launched their Scud missiles to Israel and Saudi Arabia. In this situation, however, those Scud missiles were all effectively defended by the missile defence system called Patriot by Raytheon. The success of Patriot was so lively that it was reported on-site by many mainstream mass media outlets around the world. The general public had 100% confidence in the success of Patriot from these live mass media coverages without casting any doubts on its effectiveness. It looked as though those Scuds were following exactly their anticipated trajectories, and Patriot knew exactly how to handle all of them in time. In other words, Scuds were anticipated, and the Patriots were accurate. However, those Scuds in the air never follow classic parabolic trajectories. Instead, they will show unexpectedly high-degree non-linear "butterfly" effects on their trajectories. As described above, these effects include incoming Scuds' vibrations, rotations, and motions of circling and swing. Could Patriot effectively handle these effects? Some end up questioning Patriot's effectiveness, casting serious doubts on its overall success against Scuds.

4. The Debate

Questioning Patriot's effectiveness has been ongoing since the majestic Western mass media covered its success in the Middle East during Operation Desert Storm of 1991. In fact, Theodore Postol, Professor of Science, Technology, and National Security Policy in the Program in Science, Technology, and Society at MIT, raised the very question of Patriot's effectiveness.

Scud missiles will be rocket-propelled up to 35 miles above the ground. Then, due to its inertia, Scuds continue to ascend up to 100 miles from the ground even after its rocket burns out. Afterwards, Scuds descend with an acceleration of up to 4400 miles per hour toward a target. On the other hand, a radar system of Patriot starts tracing Scuds as high as 25

miles above the ground. Patriot will then be launched with a maximum speed of 3800 miles per hour before exploding itself into pieces with its debris speed of 1800 miles per hour. Thus, the maximum speed of the debris and the speed of the Patriot combined is 5600 miles per hour. This means that the relative speed between Scud and Patriot is up to 10000 miles per hour or 5km per second.

On top of it, Scuds can also break into pieces due to the violent vibrations caused by friction in the air. The pieces then act like some multi-warheads once they approach a target in the atmosphere. In other words, Scuds have some unexpected features that are more advanced than modern multi-head missiles. With these unexpected features of Scuds, together with air frictions causing non-linear "butterfly" effects on Scuds, Professor Postol claimed that it is simply out of the reach of modern technology for Patriot to effectively defend incoming Scuds within the short time and distance given in a war zone situation.

Eventually, the US congressional hearing was held between Professor Theodore Postol and Mr. Robert Stein, manager at Raytheon. In this public discussion, the effectiveness of Patriot was openly debated in April 1992. The key topic they discussed was what is considered to be the success of Patriot, in other words, the criteria for its success. The following are Raytheon's own suggested criteria.

1. "duded": Scud had no explosion.
2. "damaged": Scud's strength was reduced.
3. "diverted": Scud was off an alleged target.
4. "intercepted": Patriot exploded as planned.

As seen above, Raytheon's criteria for the success of Patriot were not easy to establish and even raised further questions on Patriot's effectiveness.

At the end of the debate, Raytheon even emphasized its political success. Raytheon claimed that Patriot did not allow Israel to counter-attack Iraq, which in turn made Saudi Arabia remain in the allied forces with Israel. For Saudi Arabia, no matter how bad Iraqis were, they were still Islamic neighbors. Thus, Patriot made the allied forces remain strongly together during and after the operation desert storm, while the public morale was high enough to encourage Patriot's ongoing sale. Consequently, the US policy in the Middle East can be sustained. Therefore, Patriot had obvious political success, regardless of its military effectiveness in air against Scuds (Collins, 2012).

Some similar lines of reasoning can be applied to Patriot stationed in far eastern countries. North Korea's ongoing threats on Japan may be due to North Korea's anticipation that South Korea cannot possibly support Japan together in the allied forces once Japan counter-attacks North Korea. For South Korea, no matter how bad North Koreans are, both Koreans are still sharing many things together in history. Thus, Japan's counter-attack action against North Korea was made unnecessary due to Patriot provided by the US, regardless of Patriot's effectiveness. In turn, the US regional policy can be sustained by keeping the allied relationships tight among the US, Japan and South Korea.

5. Conclusion

According to its manufacturer, some of Patriot's successes are political. Regardless of Patriot's defense effectiveness in air, Patriot can keep the US policy among the allied nations in a region such as the Middle East and the Far East.

6. References

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