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### Assessing 'Mako': Another US Hypersonic Effort

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The world is witnessing a renewed interest in developing and deploying hypersonic weapon systems. Major powers such as Russia and China have already showcased deployment of their hypersonic weapons. On the other hand, the US, finally, after multiple failures and delayed timelines, is now looking to develop its hypersonic weapon—the Mako. However, as has been the case for the US hypersonic programme, the deployment of Mako needs to be put into perspective to analyse its capabilities.

**'Mako'**

In April 2024, Lockheed Martin showcased the world's first air-launched hypersonic missile designed to be carried and launched from the internal weapons bay of the stealth fighters, the F-22 and F-35.<sup>1</sup> The missile, named after the fastest shark in the seas, is being developed to give the US much-needed standoff capabilities, mainly through hypersonic systems. Lockheed Martin, which is Mako's prime developer, has stated that this system can also be mounted externally on F/A-18, F-16, F-15, and P-8.<sup>2</sup> Unlike the traditional hypersonic systems, such as hypersonic glide vehicles (HGV), which require boosters, and hypersonic cruise missiles (HCM), which rely on heavy bombers, Mako seems to overcome this issue quite easily, thus giving it an edge in terms of its mounting capabilities. Currently, only Russia operates an aircraft-delivered hypersonic ballistic missile—the Kinzhal. However, Kinzhal can only be mounted externally on the aircraft due to its size and weight, whereas Mako can be mounted both externally and internally on the aircraft.

**Comparison of Mako and Kinzhal Missile Systems**

<b>Name of the Hypersonic System and Country of Origin</b>	<b>Diameter</b>	<b>Height</b>	<b>Weight</b>
The US: Mako <sup>3</sup>	1.083ft (13 inches)	13ft	589.67kg (1,300 pounds)
Russia: Kinzhal <sup>4</sup>	3.3ft	26ft	4,300kg

Source: The table has been created by the Author based on data from <https://www.lockheedmartin.com/en-us/news/features/2024/mako-a-hypersonic-missile-thats-more-than-ready.html>, Accessed on September 02, 2024 & <https://www.ainonline.com/aviation-news/defense/2018-03-02/putin-unveils-kinzhal-hypersonic-missile>, Accessed on September 02, 2024.

Another critical aspect of Mako that Lockheed Martin has showcased is the missile system's versatility. While Mako is an air-launched hypersonic system, it can also be modified for surface and subsurface systems.<sup>5</sup> It is one of several hypersonic systems the US has been trying to develop and deploy for over a decade. However, Mako will be the direct outcome of the Stand-in Attack Weapon programme, first initiated in 2020.

### **Stand-in Attack Weapon Programme (SiAW)**

Mako is being developed under the US Air Force's SiAW programme. The programme was initiated in 2022, and Lockheed Martin has been awarded USD \$35 million under development phases 1.1, 1.2, and 1.3. The prime purpose of SiAW is to "effectively engage China's anti-access/area denial assets in the Pacific."<sup>6</sup> The anti-access/area denial (A2/AD) essentially means:

Counter-intervention strategy [which] include[s] accurate ballistic and cruise missiles; integrated multilayer surface-to-air defenses; large number of fourth generation fighter aircraft and high-yield air-to-air-missile; near real time distributed surveillance and reconnaissance systems, and command and control networks; electronic warfare systems; anti-satellite weapons; and cyber weapons.<sup>7</sup>

The Chinese concept of A2/AD, first introduced in the early 2000s, moved away from the doctrine of 'people's war' and introduced the idea of 'informatised' war. This was mainly meant to strengthen high-tech combat forces by instrumentalising the A2/AD means.<sup>8</sup> Over the years, China has worked on its A2/AD capabilities, and the above-mentioned abilities are now part of its warfighting strategy.<sup>9</sup> The SiAW programme is being developed to leverage the US Navy's Advanced Anti-Radiation Guided Missile-Extended Range programme (AARGM-ER). The AARGM-ER is, however, a classified programme under the acquisition category IB programme.<sup>10</sup>

### **Adding Stealth with Speed and Manoeuvrability**

Introducing the Mako hypersonic system is significant as it presents some critical target engagement capabilities. Its ability to be launched from a stealth fighter complicates the work of adversaries' air-defence radars, making it more difficult to track and intercept the inbound threat. The already existing hypersonic systems, such as HGV and HCM, are complex to track and intercept because of their speed, which goes beyond Mach 5+, and manoeuvrability throughout the flight trajectory. Interception becomes even more challenging when speed and manoeuvrability are combined with stealthiness. From Lockheed Martin Missiles and Fire Control, Paul Sudlow stated, "Mako does not travel in a pure arcing

ballistic flight path. It is a true hypersonic weapon that operates and manoeuvres in a high-latitude hypersonic regime.”<sup>11</sup>

## **Shifting Goal Post**

While Lockheed Martin initially developed the Mako hypersonic system for the US Air Force, the US Navy might eventually deploy the missile. This is because the SiAW programme contract was ultimately awarded to Northrop Grumman in 2023.<sup>12</sup> Lockheed Martin has made sure to develop Mako for all the variants of the F-35. If the US Navy finally procures this hypersonic system, the F-35C will be an appropriate aerial platform. Mako’s hypersonic system can also be fitted on surface platforms such as destroyers and cruises. Still, additional boosters will be required for Mako to reach the required altitude to perform the hypersonic flight.

## **Conclusion**

If deployed, the Mako hypersonic system can change how hypersonic programmes have been understood and developed in the US. So far, the US has struggled to deploy hypersonic systems due to several factors, including cost, technical challenges, and the need to balance the development of existing advanced strike weapons. Mako’s hypersonic system seems to have overcome cost-related hurdles. Lockheed Martin has used a digital design process to test the system, which helps produce a mature design at the onset of operational testing, thus reducing the associated costs of real-world production.<sup>13</sup> Concerning technical barriers, Lockheed Martin has stated that “the firm... brought manufacturing engineers in at the earliest stages of development to help streamline the sometimes messy transition from advanced prototyping to serialized production.”<sup>14</sup>

**NOTES:**

<sup>1</sup> Huma Siddiqui, "Strengthening US Security: The Introduction of the Mako Hypersonic Missile," *Financial Express*, July 27, 2024, <https://www.financialexpress.com/business/defence-strengthening-us-security-the-introduction-of-the-mako-hypersonic-missile-3566391/>. Accessed on September 02, 2024.

<sup>2</sup> "A Hypersonic Missile That's More Than Ready," Lockheed Martin, July 22, 2024, <https://www.lockheedmartin.com/en-us/news/features/2024/mako-a-hypersonic-missile-thats-more-than-ready.html>. Accessed on September 02, 2024.

<sup>3</sup> Ibid.

<sup>4</sup> Vladimir Karnozov, "Putin Unveils Kinzhal Hypersonic Missile," *Aviation International News*, March 02, 2018, <https://www.ainonline.com/aviation-news/defense/2018-03-02/putin-unveils-kinzhal-hypersonic-missile>. Accessed on September 02, 2024.

<sup>5</sup> Alex Hollings, "MAKO: Arming the F-35 with Hypersonic Missiles," *Sandboxx News*, April 18, 2024, <https://www.sandboxx.us/news/mako-arming-the-f-35-with-hypersonic-missiles/>. Accessed on September 03, 2024.

<sup>6</sup> Alex Hollings, "Lockheed's Mako Missile: The F-22 and F-35 Get a Hypersonic Upgrade," *The National Interest*, August 28, 2024, <https://nationalinterest.org/blog/buzz/lockheed%E2%80%99s-mako-missile-f-22-and-f-35-get-hypersonic-upgrade-212008>. Accessed on September 03, 2024.

<sup>7</sup> M. G. Yevtodyeva, "Development of the Chinese A2/AD System in the Context of US-China Relations," *Herald of the Russian Academy of Sciences*, Vol. 92, September 29, 2022, p. S535, <https://link.springer.com/article/10.1134/S1019331622120048>. Accessed on September 03, 2024.

<sup>8</sup> Ibid.

<sup>9</sup> Fabian-Lucas Romero Meraner, "China's Anti-Access/Area-Denial Strategy," *The Defence Horizon Journal*, February 09, 2023, <https://tdhj.org/blog/post/china-a2ad-strategy/>. Accessed on September 04, 2024.

<sup>10</sup> "AGM-88G Advanced Anti-Radiation Guided Missile-Extended Range, US," *Naval Technology*, May 08, 2024, <https://www.naval-technology.com/projects/agm-88g-aargm-er-us/?cf-view>. Accessed on September 04, 2024.

<sup>11</sup> Hollings, n. 6.

<sup>12</sup> Ibid.

<sup>13</sup> Ibid.

<sup>14</sup> Ibid.