



DMR is a mine-clearing support robot specialized in excavation. Automating manual tasks reduces human risk while improving efficiency.

SAFER DEMINING THROUGH TECHNOLOGY: JAPANESE ROBOTICS BOOSTS A MINE-FREE WORLD

A Japanese startup has developed a mine-clearing support robot that uses proprietary compressed-air excavation technology to make landmine removal safer and more efficient. Following successful trials in Cambodia, the innovative robot is set to be introduced in Ukraine, marking a significant step toward a mine-free world.

It has been 26 years since the Anti-Personnel Mine Ban Convention (Ottawa Treaty) came into force. While the international community has been working on mine-clearing efforts, nearly 60 countries still suffer from the dangers of landmines and unexploded ordnance. Among them is Cambodia, where millions of landmines remain buried from the country's two decades of civil war.

Japan has long supported the Cambodian Mine Action Centre (CMAC)—the country's leading mine-clearing organization—by providing heavy machinery and

contributing to the development of human resources. Thanks to these efforts, the area of land cleared of landmines has steadily expanded.

The demining process, however, still relies heavily on manual labor in remote mountainous regions and on steep slopes, where heavy machinery cannot be deployed. In the search of a safer and more efficient solution, Japanese startup IOS, Inc. developed a compact mine-clearing robot DMR (“demining robot”).

What makes DMR unique is its specific focus on excavation; that is, the process of digging out

buried explosives, one of the most dangerous aspects of landmine removal. With conventional methods, metal detectors are used to locate landmines, before workers use probes or shovels to excavate them. However, this process carries a significant risk of inadvertently triggering the detonation switch and causing an explosion.

In contrast, DMR uses compressed air to blow away the soil surrounding a landmine, leaving it intact. Since only the soil is removed, the mine can be safely extracted manually as long as the position of its switch has been

identified. Moreover, the ability to operate DMR remotely provides the operator with an added layer of safety.

From 2022 to October 2024, CMAC conducted two years of field trials in Cambodia. Results showed that incorporating just one DMR into a mine-clearing team improved overall performance by 20%, demonstrating the robot's value as a technical solution for demining.

However, developing DMR was not without challenges, according to IMAI Kentaro, CEO of IOS. When, through an introduction by the Japan International Cooperation Agency (JICA), CMAC initially requested IOS to develop a demining device in 2017, Imai's team experimented with drill-based excavation, but this method failed to sufficiently reduce the risk of accidental detonation. As IOS explored alternative approaches, the team discovered that compressed-air excavation could effectively remove soil without applying pressure to the detonation switch. This breakthrough marked a turning point, accelerating the development process.

The potential of DMR extends far beyond Cambodia. Through continuous improvements—leading to the development of the fifth, sixth, and now seventh-generation models—DMR is set to be deployed in Ukraine. ANEST IWATA Corporation, the company that developed DMR's air compressor, has donated three units to the HALO Trust Ukraine, a branch of the world's largest



Unlike large, heavy equipment, which destroys landmines upon removal, DMR uses compressed air to blow away soil around landmines, allowing for manual retrieval without collateral damage.

mine action NGO. Aiming toward increasing work automation, the HALO Trust and other stakeholders seeking innovation in mine clearance technology are utilizing AI and drones to collect and analyze data on minefields in Ukraine.

Imai explained, “Significant technological research is being conducted to make a substantial breakthrough. If, in the near future, these advanced landmine detection technologies become the standard, I believe DMR's compressed-air method could be used at the post-detection excavation stage, contributing to the automation of demining operations. If all parties involved collaborate successfully to promote this research, it would represent tremendous progress toward realizing a mine-free world.”

In the future, IOS is also considering expanding its efforts beyond Cambodia and Ukraine to African countries with a high concentration of landmines, such as Zimbabwe and Angola.

From December 1 to 5, 2025, Japan will preside over the 22nd Meeting of the States Parties to the Ottawa Treaty. The country remains fully committed to working closely with all stakeholders to actively advance mine-clearing efforts.

Imai commented, “For people living in mine-affected areas, even a single accidental encounter with a landmine can change the course of their entire life. It is a deeply serious issue. By expanding the use of DMR, I believe we can reduce the number of landmine victims and am determined to keep moving forward.” ●

IMAI Kentaro (seated, right), CEO of IOS, Inc., briefing staff from the HALO Trust, an international NGO, in Cambodia.

