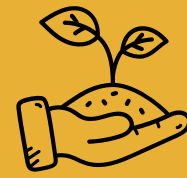


YARILO: A Solution for Post-War Recovery in Ukraine



SDGs:



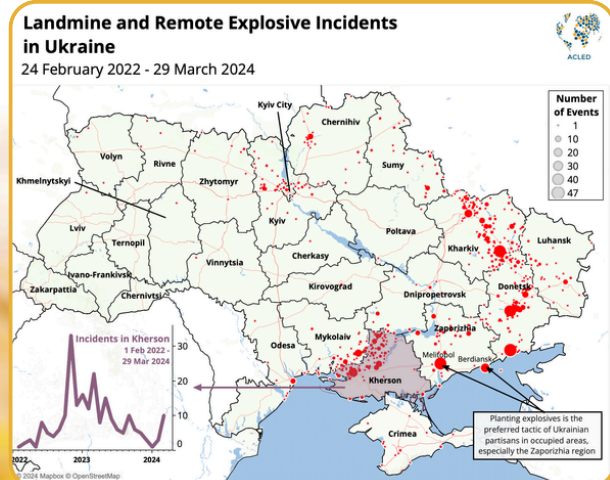
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Problem

Eventually, the war in Ukraine will end and the country will face a long and difficult path of recovery. Ukraine is currently facing and will continue to face a number of problems on this path and now the main problems can already be identified, such as:

- Approximately one-fourth (unofficial statistics) of Ukraine's land is mined because of Russian aggression. This is 150000 km² or 57915 mi² which are equal to entire Illinois State area. Landmine danger covers battlefields, borders with Belarus and Russia on north and some of the civilian non-battle areas.
- The soil ecosystem suffers directly from the effects of landmines (soil contamination by various harmful particles and compounds), which, in turn, makes it infertile and unable to sustain natural regrowth. It is no less important that the mine danger that also impacts civilians, particularly farmers who cultivate the land, and creates significant challenge in rebuilding infrastructure and cities.
- The soil restoration through conservation is estimated to take more than two decades. Considering that cultivation and export of agricultural products are critical to Ukraine's economy, the country will face substantial losses and vulnerability to economic crises. In the future, the threat of mines could create challenges for food production, affecting not only Ukraine but also numerous countries worldwide that suffer from a shortage of humanitarian food supplies such as African countries that are among the primary consumers of Ukrainian grain. For instance, Ukraine has already lost 80 billion \$ USD from agricultural loses.
- As experience shows, agricultural workers still encounter old explosives even from World War II, and this tendency will be observed for the next 50-60 years. In this scenario, the estimated time required to neutralize ALL explosives that were used since the start of the war in Ukraine could take nearly two centuries.
- Currently, the primary method for mine clearance involves direct human participation (i.e., sappers). After the war, the volume of demining work will be immense, creating a massive demand for specialists. Additionally, the need for sappers will continue to grow due to the high mortality risks involved in neutralizing explosives.



Planting explosives is the preferred tactic of Ukrainian partisans in occupied areas, especially the Zaporizhia region

Solution

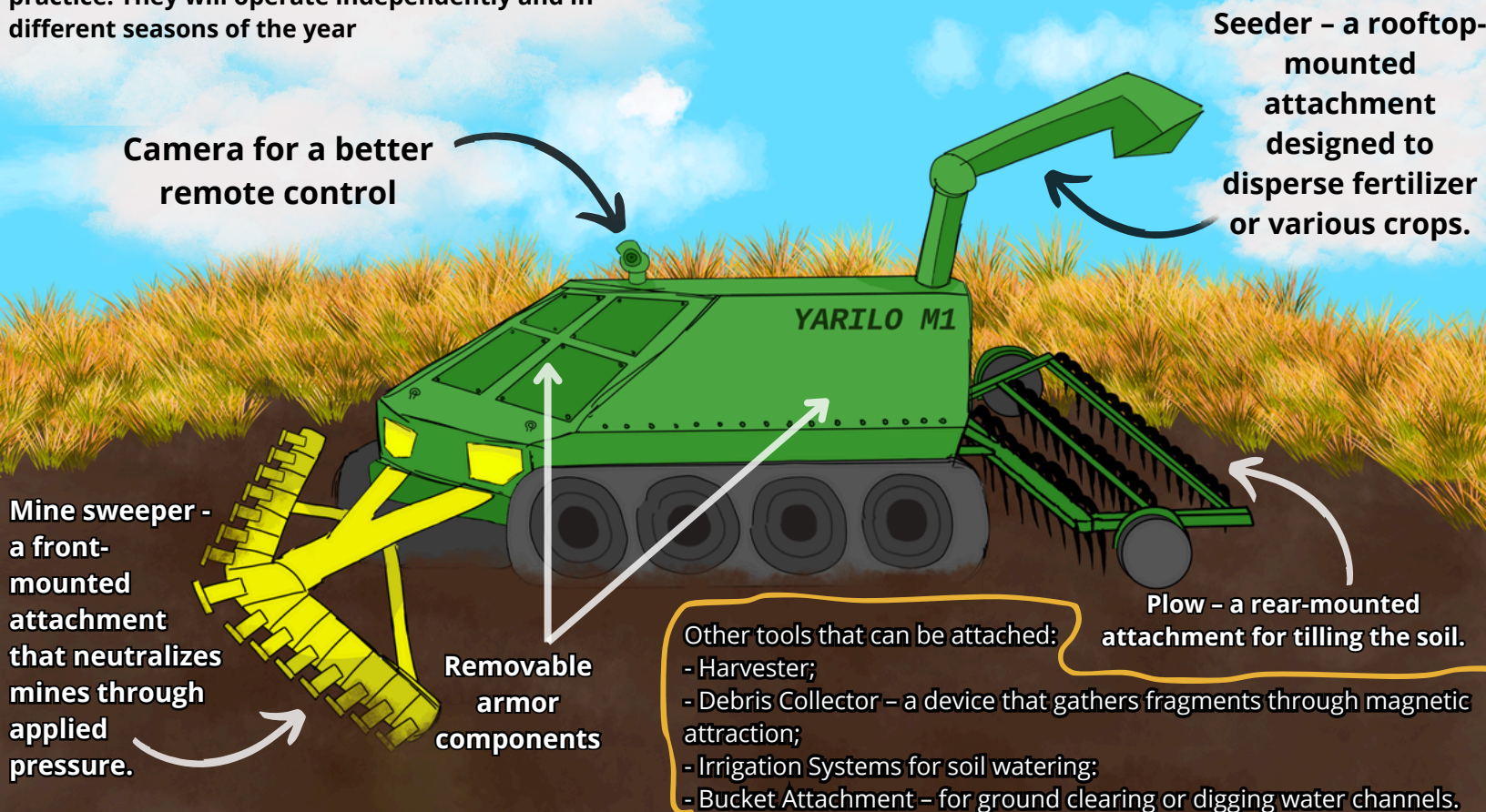
NOTE: YARILO IS AN ANCIENT SLAVIC DEITY OF FERTILITY AND PROSPERITY.

The "Yarilo" project is a concept for a modular remotely controlled machine designed for soil clearing, fertilizing, and seeding (functions will be performed separately from each other).

This machine is modular, meaning it is a sort of "construction set". With a primary mobile tracked frame and a central power system, it offers the possibility to interchange or add various modules with unique functions. To enhance environmental sustainability, the machine is being considered for hybrid power (using both liquid fuel and electricity), and the main components and body will be made from recycled remnants of the war, including metal fragments, debris, and parts from destroyed military and civilian equipment.

NOTE: The modular attachments shown on the concept art will not be used simultaneously in practice. They will operate independently and in different seasons of the year

Concept art of the "Yarilo"



Features and Advantages

Modular design

Yarilo features a primary tracked frame with interchangeable modules for various functions, including mine sweeping, plowing, and seeding.

Versatility

Yarilo can be repurposed for civilian agricultural needs after demining is complete, offering long-term utility.

Safety

Remote operation ensures human safety during field operations, reducing risks for agricultural workers and military personnel.

Eco-Friendly

The machine uses recycled war remnants and a hybrid power system, reducing resource consumption and environmental impact.

Implementation

Stage 1 - «Preparation»



SDG 9 – to produce these machines there will be a need to establish new complexes, which will include: waste processing/utilization and machine-building workshops; personnel training and research centers etc.

SDG 11 – with the restoration and development of industry there will also be a need to restore settlements. Otherwise, if it is impossible, it is envisaged to create new ones to provide personnel and refugees with permanent housing.

SDG 12 – waste from military operations, from shrapnel to (partially) destroyed equipment, will be used to produce this type of equipment.

Stage 2 - «Production and Application»



SDG 8 – the agricultural sector is the main one for Ukraine and the state is interested in restoring soil fertility to stabilize the economy. In addition, the jobs created can be occupied by: volunteers, who are currently engaged in technical equipment of the Ukrainian army; people, who fled their country and then will get back; disabled veterans who can be also engaged, for example, in remote control of such machines.

Stage 3 - «Consequences»



SDG 15 – restoration of the soil ecosystem with the use of «Yarilo» machines will also lead to the restoration of ecosystems of surface flora and fauna.

SDG 2 – thousands of human lives around the world depend on the supply of Ukrainian agricultural products and with the reintegration of the damaged soil, it is possible to increase the volume of supplies to starving regions.

Approximate investment calculations:

- Initial Investment - \$20 million USD
- Production Cost per machine - \$300,000 (with modules)
- Operating Costs - \$6 million USD per year
- Revenue (grants included) - \$22,5 million USD per year
- Net Present Value - \$75 million USD (over 10 years)
- Internal Rate of Return - 19%
- Forecast Production Volume - 75 machines per year
- Payback Period - 4-5 years

Stage 4 - «Further plans»



SDG 17 – cooperation with international organizations for joint work is also considered. War as a phenomenon will not disappear in the coming decades and having such technologies to combat its consequences is an unfortunate necessity. In addition, these technologies can be sent to other regions of the globe that need to be restored after military actions.

Challenges and their Solutions

Possible excessive cost – Ukraine's post-war budget will definitely be depleted and the implementation of such a project, at best, will be difficult, if not impossible. As a solution, it is planned to conclude international agreements with various financial and peacekeeping organizations that oblige them to help Ukraine with the financing of this project, and Ukraine will be obliged to manufacture and provide such machines for current and future peacekeeping missions. In addition, collaboration with giant companies such as «John Deere» and «Goldhofer» may be considered, which can help with the development and production of technologies with the right to co-own shares of capacities that will be located in Ukraine.

Lack of real practical experience in the use of such machines and other risks – as our research shows, there are currently no analogues to our modular machine. The very concept of modular technologies is a fairly novel approach in mechanical engineering and automation, which requires an integrated approach. Before mass production of such machines, there will be an urgent need for more detailed development and testing. To solve the technical problems of the project, consultations with specialists from various organizations such as the UN FAO and the UN IFAD will be necessary.

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