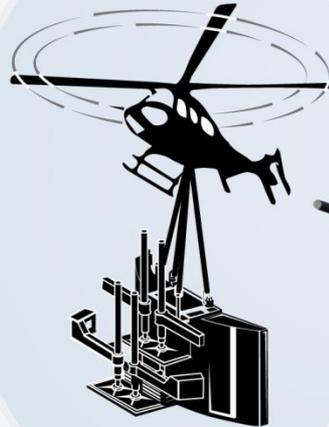
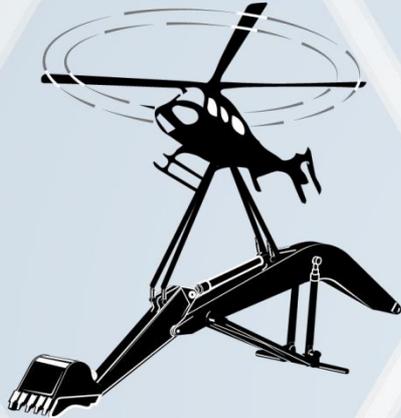


AIRBORNE & SELF-ASSEMBLY EXCAVATOR



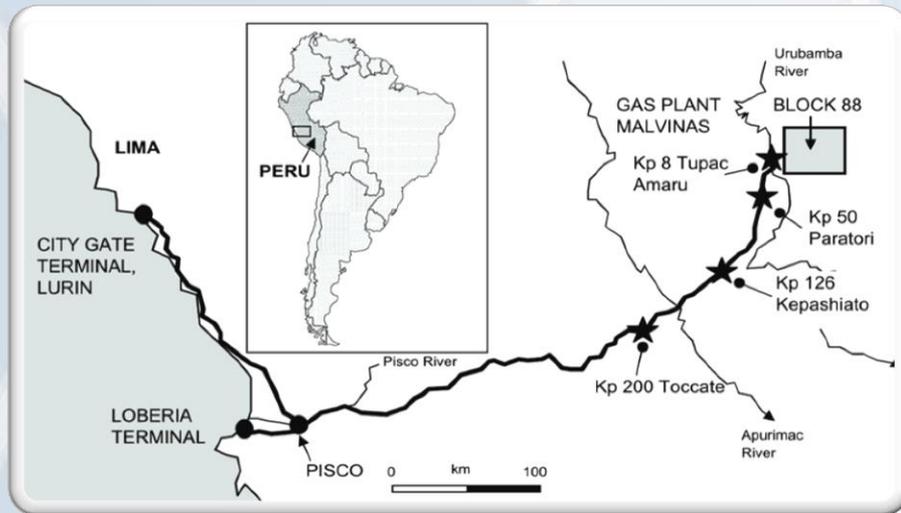
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IPLOCA New Technology Award 2021

In September 2020 Sicim Succursal del Peru in association with another Party was awarded the “Contrato de Servicios de **Mantenimiento**, Geotecnia Atención de Emergencias del Sistema de Transporte de Gas Natural y Líquidos de Gas Natural de **Camisea**” by **Coga** (Compañía Operadora de Gas), for the maintenance services of the main natural gas transport system of Peru, the “Camisea” gas pipeline system.



Under an operational point of view, one of the critical requirements in these types of services is fronting **emergency conditions** (e.g. pipeline breakage). **Mobilization** of resources required for the repair, in a very limited timeframe, is a key factor.

The main element that has been identified is the transport of a **13-Ton Class excavator** to extremely remote areas, completely inaccessible by land, which has to be necessarily done **by helicopter**, such as a MI - 17, manufactured by JSC Russian Helicopters.

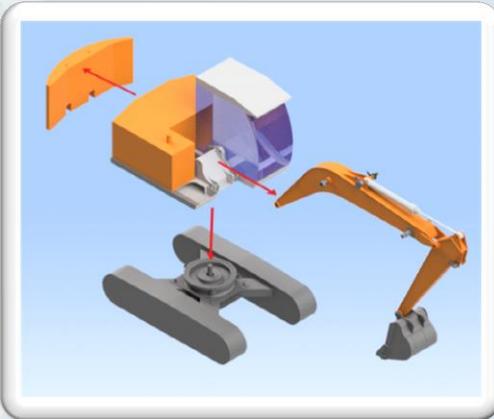
In order to make it feasible, **two essential conditions** need to be met:

- 1) The **excavator** has to be **disassembled** in elements not heavier than **3,9 Ton**, which corresponds to the maximum lifting capacity of the helicopter;
- 2) After transport, the **excavator** has to be **reassembled** to its original configuration **without** the use of any auxiliary **equipment** which most likely would not be available in that remote location. A team of trained mechanics will only use common hand tools and specific devices already attached to the excavator.

Sicim's Engineering Team has developed a study by 3D Design Software aimed to identify specific configuration that can meet the above stated criteria.

The 13 Ton **Hitachi ZX130** excavator has been rearranged in four elements as described below:

EXCAVATOR DISASSEMBLED IN FOUR MAIN PARTS

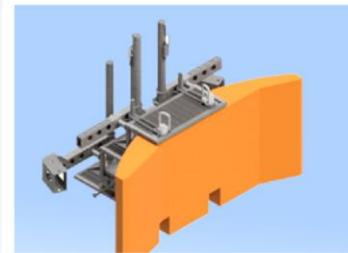


DEVICES TO EXCAVATOR REASSEMBLY



The specific **devices** to be utilized for the reassembly have been engineered and statically **verified** with the use of Finite Element Analysis.

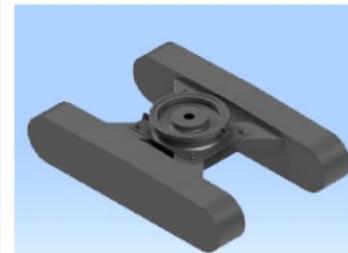
AIRBORNE PARTS WITH CALCULATED LIFTING POINTS



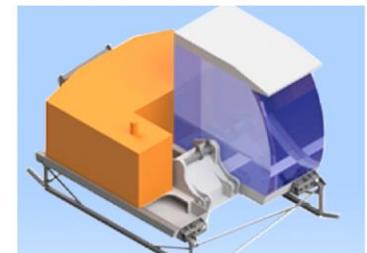
COUNTERWEIGHT ASSY



BOOM ASSY



UNDERCARRIAGE ASSY



MAIN BODY ASSY

Structural verification of each new designed part carried out **by FEM** (Finite Element Method) Software.

Making available a fleet of airborne and self-assembly excavators for use in **remote areas** and emergency situations. All four **elements** meet relevant **requirements** for transport by **helicopter**.

LIFTING ELEMENTS



ASSEMBLY STEPS



1) Assembly of the **main body** on the **crawler undercarriage**. Each movement is powered by the excavator hydraulic system.

2) Assembly of the **boom** on the excavator **main body**. Lifting and alignment of the boom connecting pin to its housing is again powered by the hydraulic system of the excavator.

3) The last step consists of the installation of the **counterweights**.

The use of a derrick allows **lifting** the **counterweights** by simply **extending** the excavator's **arm**.

By **lowering** the **boom** it's finally possible to **move forward** the **counterweights** in order to obtain the **proper alignment** with the excavator's body.



KEY FEATURES

- **Assembly time:** less than **2 hours and 45 minutes**;
- **Disassembly time:** less than **2 hours and 30 minutes**;
- **No additional equipment needed**;
- The airborne and self assembling excavator **meets all safety** requirements as defined by the equipment manufacturer and **EU applicable standards**;
- This project has been developed as immediate **response** to an **emergency** situation arising out the failure or accidental damage of gas/ oil pipeline, with the intent to **limit** contamination of the **environment** as **consequence** of spill of hydrocarbons.