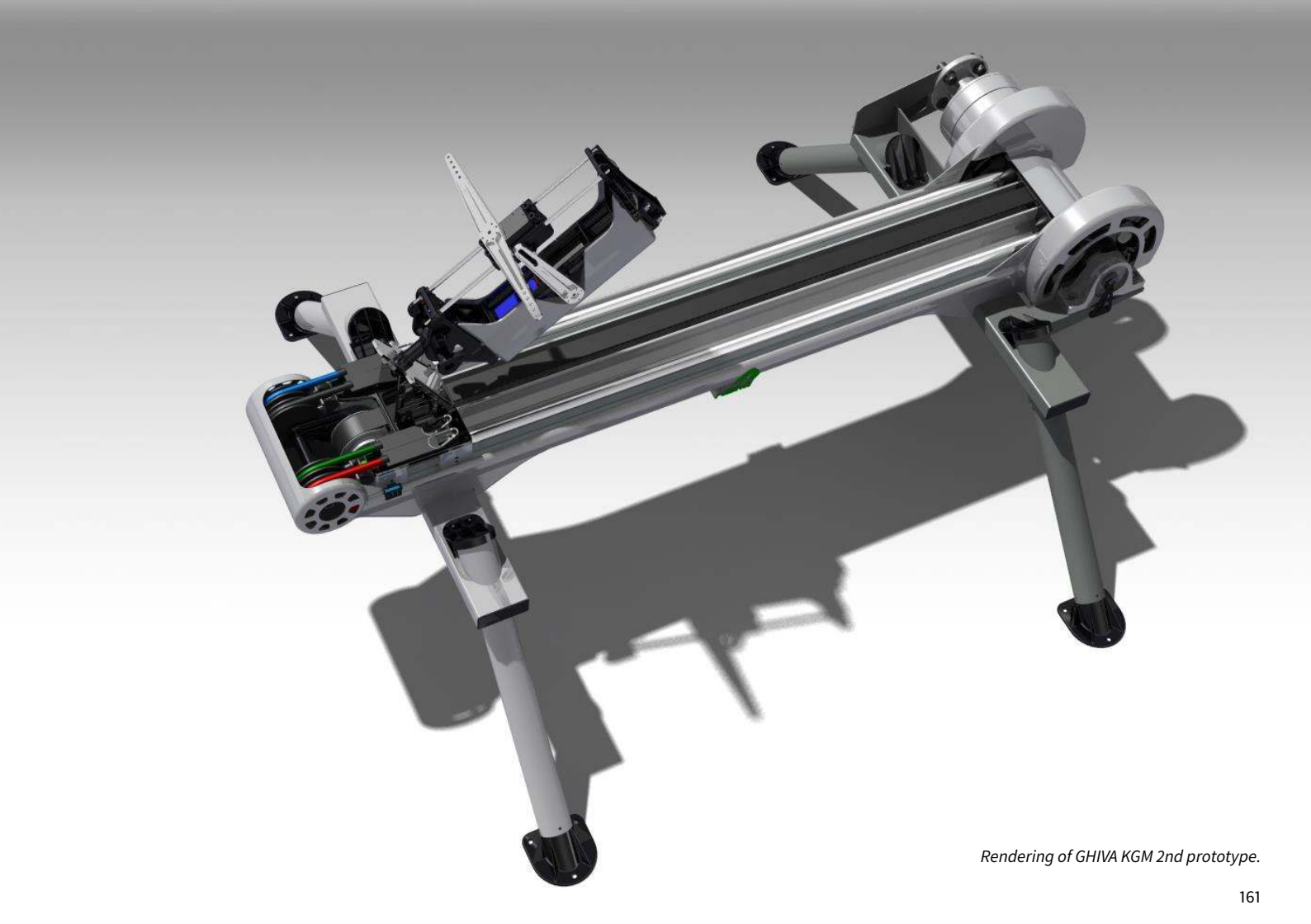

Rendering of GHIVA KGM 2nd prototype.

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KGM1 – A Different Approach to the Airborne Wind Energy Technology

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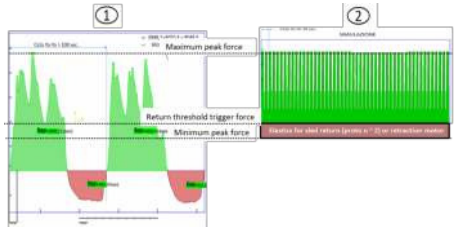
This is a research project in the sector of "Airborne Wind Energy" (AWE), belonging to the type "ground-gen" and operating through a personal type of "yo-yo" cycle. The KGM1 initiative aims to draw a new path in the AWE sector, with a first small size generator (5-20 kW, modular sizes), working off-grid, customized on the needs of "Inuit" and worldwide off-grid populations.

KGM1 have identified and patented a linear generator based on simple solutions, chasing what is called "robust design", while trying to steering clear of the "hyper-technology syndrome", which leads to frequent maintenance intervals, difficult insurability and an exponential increase of the "complexity" (represented below).

This first prototype - developed on the "Inuit" needs - is now lacking of azimuth tracking and will have a simplified flight control, now foreseen without any kind of automatic take-off. The research has originated two variants of the project (the first studied in the Master's degree thesis [1], the second actually in test) as well as a third described in the EU patent. The second prototype still features a linear motion of the KSU pulled by a kite that supplies at least one generator connected via a toothed belt. It no longer works using the "pull peaks" of the ropes, but on the "pull variations" of the ropes themselves. These variations are created by the different positions and speeds of the kite as it flies within the "flight window".

KGM1 compensates for the lower power produced through an increase in the frequency of active cycles with a super short slide stroke, synchronized on the flight path, as shown in the plots below. Moreover, it also compensates with more constant kinetic energy impressed on both the kite and the generators, as well as "low cost depower". These characteristics allow to keep dimensions and weights contained and a probable simplification of the automatic flight control SW, with consequent savings on the total cost of the generator.



Left: typical power course of a conventional AWE system. Right: simulated power course of KGM1.

References:

[1] Federico Montanari, Modeling, control and optimization of an airborne wind energy system with translating ground unit, Politecnico di Milano, MSc thesis, 2018. [Available online]