Kenya Water Well Drill Rig – Redesign of Engine Drive Train System & Support Tower

Overview
The team was presented with the task of redesigning the engine drive train system and support structure for a water drill rig to be used in Kenya. The original engine drive train system was fabricated by a professional machinist and had many intricate components not replicable in Kenya. The original support structure also had design flaws as it failed during operation. It was imperative the new designs of the engine drive train system and support tower not only be fully functional but also relatively inexpensive, replicable in Kenya using readily available materials, and safe.

Objectives
Redesign engine drive train system and support tower for simplicity, affordability, manufacturability, and safety
- The engine drive train system and support tower must be capable of repeatedly raising and lowering a 300 pound percussion weight, cost less than $2,000.00, be manufactured using readily available materials in Kenya, and not compromise the wellbeing of the operator

Approach
- Survey questions were sent to partner Kenyan university, JKUAT, to acquire customer needs
- Determined the most important design criteria were affordability, manufacturability, and safety
- Brainstormed drive train housing and support tower designs, along with materials and dimensions
- Market research indicated no drill rigs of similar scale and price are available in Kenya
- Engine drive train system and support tower were modelled in SolidWorks
- Strength calculations done by hand and using FEA software
- 134 hours of fabrication resulted in fully functional engine drive train system and support tower
- Testing found the components capable of repeatedly raising and dropping the percussion weight

Outcomes
- The entire engine drive train system and support tower costs less than $1,300.00 to fabricate and will aid in providing the people of Kenya with the clean water they currently lack
- The new support tower is portable yet extremely strong, sturdy, and able to support the percussion weight
- The design of the engine drive train system is simple and as a result can be easily fabricated in Kenya using readily available materials
  - Eliminated gear box and selected smaller engine without compromising the performance of engine drive train system
- The engine drive train system and support tower are safe, and easy to transport and utilize
- The components can be assembled in under 40 minutes by 4 people using only 3 simple tools
- Kenyan subsistence farmers are now closer to having access to readily available clean drinking water at an affordable price