

UI - GridDefender Capstone Project 2016

Abstract:

The Grid Defender Utility Pole Protection System is a patented concept intended to reduce the high costs and risks associated with natural disasters that result in downed power lines (Fig. 1). Grid Defender is a unique electromechanical device that shuts off power and enables the lines to be lowered to a predetermined height. The purpose of this Capstone project is to take the existing Grid Defender designs and patent information, and develop engineering specifications for the full-scale system and produce a working small-scale prototype.

System Overview:

The GridDefender is an electromechanical system composed of: 1) a mechanical system of cross arms suspended by cables and pulleys for lowering and raising the power lines (see Fig. 2), and 2) an electrical system of sensing and communication components for monitoring environmental and structural conditions that control the state of the local power system in the event of hazardous conditions.

Mechanical Project Objectives:

- a. Develop dock and dock yoke with release mechanism (see Fig. 3).
 - b. Integrate NC (Normally Closed) switch with communication system (SEE: b. under Communication System).
 - c. Design winch, centrifugal brake, and release mechanism.
 - d. Design and fabricate tool(s) for setting and resetting release means at variable release thresholds.
- a. Fabricate apparatus and generate protocols for control and operation of mechanical system.
 - b. Design and fabricate breakaway for transformer and meter drops (and tool for resetting breakaway drops).
 - c. Redesign transformer hangers which accommodate the Grid Defender apparatus.
 - d. Develop a slip joint for suspended insulators and conductor placement and optimum equilibrium (for both symmetrical and asymmetrical conductor configurations).



Figure 1. Weather-induced power line damage.

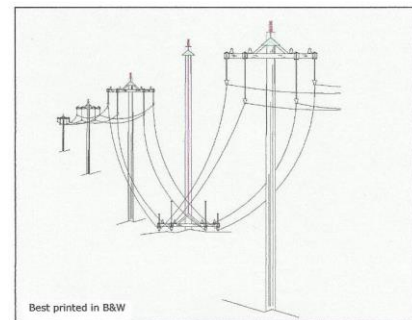


Figure 2. Grid Defender concept lowers lines to prevent damage.

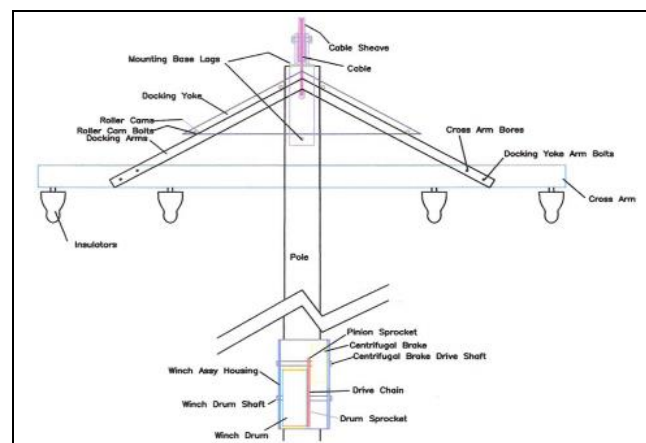


Figure 3. Sketch of cable-supported cross arm and docking yoke concept with winch assembly.

- e. Take into consideration other pole-mounted services such as telephone and TV cables.
- f. Design and fabricate a novel "quick clamp" for attaching conductor to crossarms.

Electrical and Electromechanical Project Objectives:

- a. Design and fabricate an anti-arc breaker with dielectric flap and incorporate an integral electromagnetic sear (part of a triggering provision which holds back a striker until a threshold of pressure is applied to trigger release or disengagement) Note: the sear component in the breaker sketch (see Fig. 4).
- b. Design and fabricate a breaker reset tool.
- c. Integrate tilt switch, GPS, current sensor (Hall type, etc), and line tension sensing.
- d. Integrate a DC power source and solar recharging unit.
- e. Integrate a communication cable and method of attachment.
- f. Consider EMI AND RFI (Electromagnetic and Radio frequency interference) in determining spacing and potential of interference with communication system, shielding, etc.

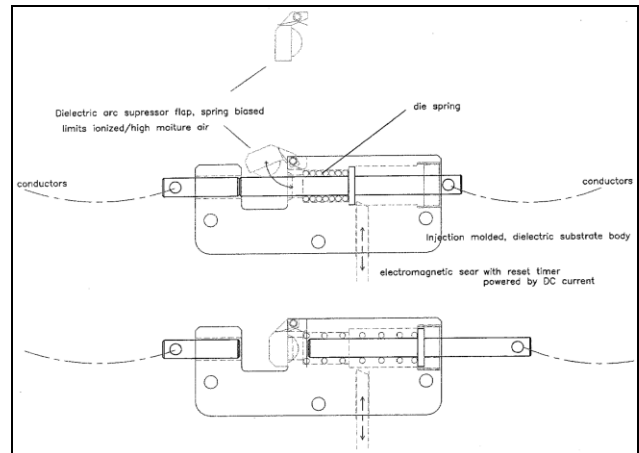


Figure 4. Anti-arc breaker with manual reset concept.

This team will work closely with the inventor of the Grid Defender system and representatives of the UI Business School to produce initial system specifications and a working prototype. The goal of the prototype is to support business and entrepreneurial students in demonstrating system capabilities at competitions toward acquiring additional funding for later full-scale system development (Fig. 5).

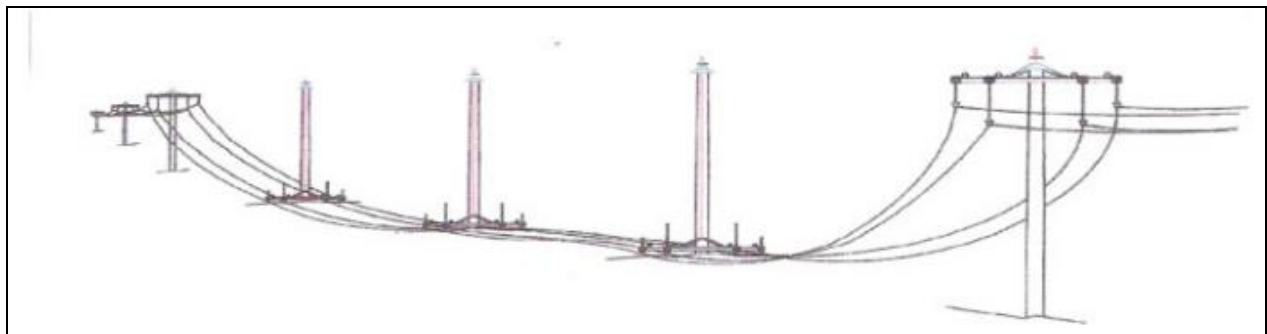


Figure 5. Grid Defender system with 3 sections lowered in the event of an impending weather storm or environmental hazard.