

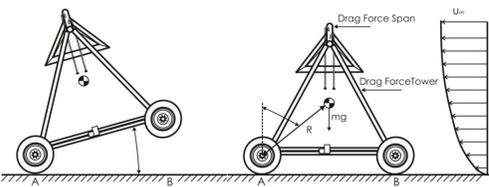
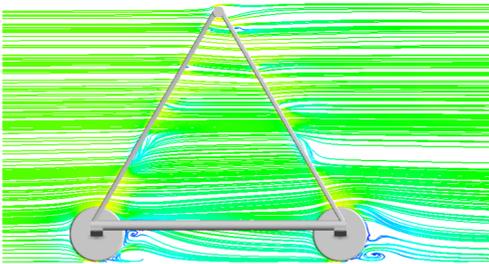


Background



- Wind storms of 2013 led to 800 irrigators reportedly toppling in Canterbury region.
- Major damage to irrigation systems in place.
- Loss of production for farmers.
- High cost of repair/replacement
- Clients of Foundation for Arable Research (FAR) request a solution.
- FAR request help from University of Canterbury (UC) Mechanical Engineering Department.
- FAR patent the solution developed by UC project group and license to Carrfields Irrigation for further development and commercialisation.

Academic Research

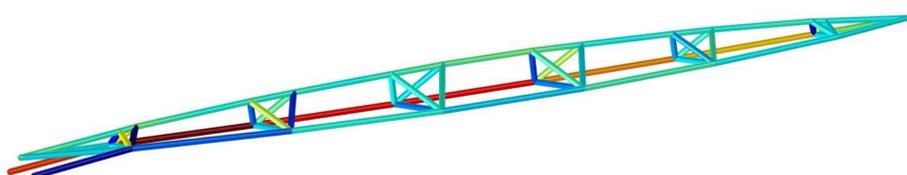
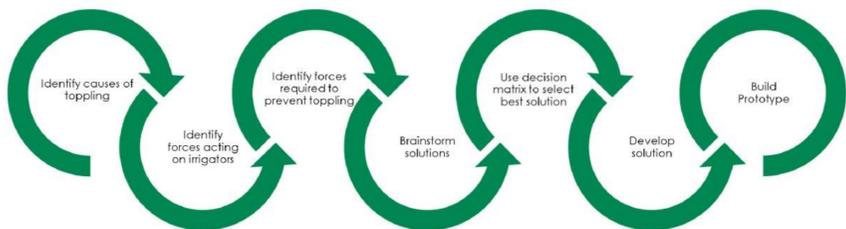


$$\begin{aligned}
 &I^2 \ddot{\theta} + mgR \sin(\alpha - \theta) = 0 \quad \text{for } \theta > 0 \\
 &I^2 \ddot{\theta} - mgR \sin(\alpha + \theta) = 0 \quad \text{for } \theta < 0
 \end{aligned}
 \quad \left. \vphantom{\begin{aligned} &I^2 \ddot{\theta} + mgR \sin(\alpha - \theta) = 0 \quad \text{for } \theta > 0 \\ &I^2 \ddot{\theta} - mgR \sin(\alpha + \theta) = 0 \quad \text{for } \theta < 0 \end{aligned}} \right\} \text{Dynamic Response Model}$$

$$\begin{cases}
 M_f = F_{tower} \left(\frac{w}{2} \sin(\theta) + T_{span} \cos(\theta) \right) + F_{span} \left(\frac{w}{2} \sin(\theta) + S_{span} \cos(\theta) \right) \\
 M_r = m_{tower} g \left(\frac{w}{2} \cos(\theta) - T_{span} \sin(\theta) \right) + m_{span} g \left(\frac{w}{2} \cos(\theta) - S_{span} \sin(\theta) \right)
 \end{cases}$$

w = Wheel Span T = Tower S = Span

- Research performed into different failure modes and current prevention methods.
- Wind loading analysis performed using CFD (Computational Fluid Dynamic) software and verified using 3D printed model in the wind tunnel.
- Static and dynamic mathematical models formulated to approximate the effects of a severe wind storm.
- In depth design process looking at various methods of reducing the drag or anchoring irrigators in high winds.
- Solution chosen and validated in FEA (Finite Element Analysis) software to ensure spans would not be damaged in operation.



HydroFix Irrigator Stability System

The HydroFix Irrigator Stability System consists of a series of inflatable water tanks connected to pulley and counterweight systems along the length of an irrigator. On arrival of a major wind event, the turn of a tap fills the tanks with water and lowers them to the ground to secure the irrigator at the centre of each span.

When the wind danger has passed, the water tanks can simply be drained and after this they will raise themselves to a 'ready to activate' storage position in two stages, requiring minimal effort from the operator.



- **Prevent your valuable irrigation system from toppling** – stable in all wind directions
- **Initiate the system with the turn of a tap** – no more relocating farm machinery or driving in ground anchors
- **Simple pulley and counterweight system, weather resistant tanks** – minimal maintenance required
- **One size fits all** – install the system on any brand or size of centre pivot or lateral irrigator

Field Trial / Commercial Release

- Carrfields Irrigation are releasing the HydroFix Irrigator Stability System for purchase as part of an open field trial at a special introductory price of \$1500 per secured span tailored to the farmer's specific requirements.
- Considerable interest expressed leading to target of 50 units to be released around the country in the first half of 2016.
- Commercial release will follow the field trial with two versions of the system (DIY kit and fully installed option)