DEPARTMENT OF MECHANICAL ENGINEERING



Problem Definition

Motivation

- As wildfires become more frequent and intense due to climate change early detection is critical to preventing the spread of fire
- Wildfires can significantly damage infrastructure and people who live in wildfire prone areas are at a higher risk for health problems, displacement, injury, or even death
- Uncontrolled wildfires can devastate ecosystems and reduce air quality
- Current fire fighting methods can be costly and dangerous

Design Constraints

- Fully-mechanical water balloon rupturing device
- Built-in timer that is adjustable for 1-5 seconds
- Timer precision of at least 25 milliseconds
- Weight and size restrictions: under 250g and 100 cm³
- Design that can hold and rupture a 10kg water balloon
- Comprised of environmentally friendly materials

<u>Goal</u>

- Compete in the XPrize Ignite Change Competition to improve current wildfire response methods
- Partner with UMD's Crossfire Team to:
 - Develop an autonomous wildfire detection system
 - Produce a one-time use product that can be deployed by firefighters to identify and extinguish fires
 - Design a fire suppression system that can be dropped from a drone and, after a predetermined number of seconds, rupture a water balloon to douse an early stage fire

-	Prototyp	e & Test Results
	Drop height (10-100 m)	 Material Selection Carrier: mesh, nylon, or cotton Cotton has the best water of and is biodegradable Tension component: spring or Rubber bands are more en friendly and had a lower spring value than springs
¢,	Burst height (~ 5 m)	 Prototype Testing Timer mechanism validation Timer-rupture integration testion Puncture location (top, side, b) Water dispersion

TEAM C1 Balloon Bursting Legends Seamus Carmody, Aakash Maurya, Joshua Ogunmola, Sander Schulman, Nicole Uhl, and Klaus Wood



Adjustments for Final Design

- Improved calibration of gear teeth for smaller time increments
- Reduce size and weight
- Replace metal screws and nail with a biodegradable alternative
- Reduce complexity of assembly

- Faster response time for early-stage wildfires
- Protects lives, property, and reduces damage costs

dispersion

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ing bottom)



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<u>Carrier</u>

- Lightweight wooden box (6" x 4" x 2.5")
- Open cotton netting design maximizes water dispersion
- Adaptable to various drones and balloon sizes

Sustainability & Benefits

- Biodegradable design: wood PLA, basswood box, cotton netting, rubber band, and wood glue
- Benefits of drone delivery:
 - Can reach remote areas
 - Reduces habitat disruption
 - Minimal manpower
 - Increases firefighter safety
- Low-cost, simple build with no complex machinery







