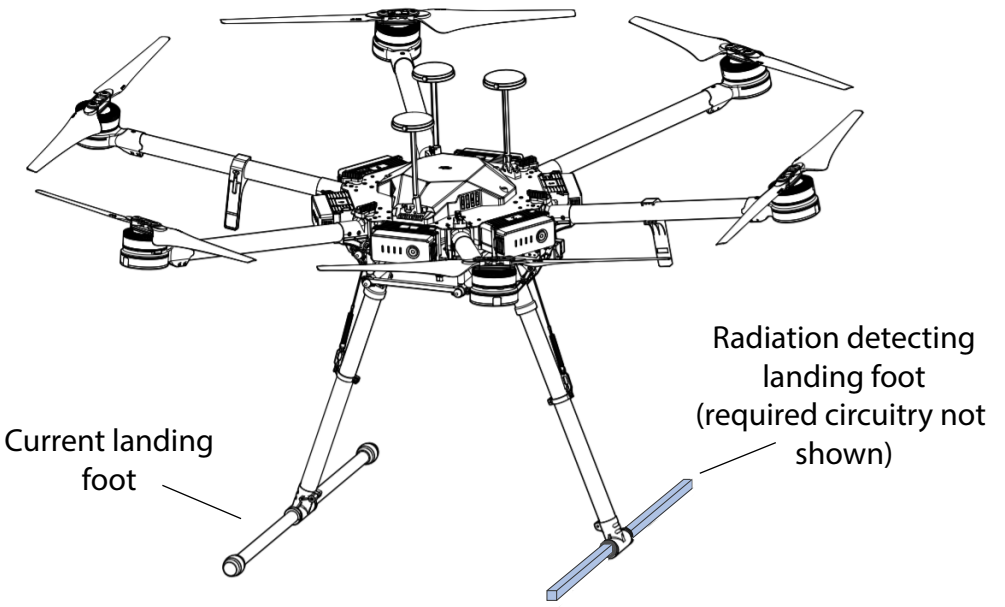
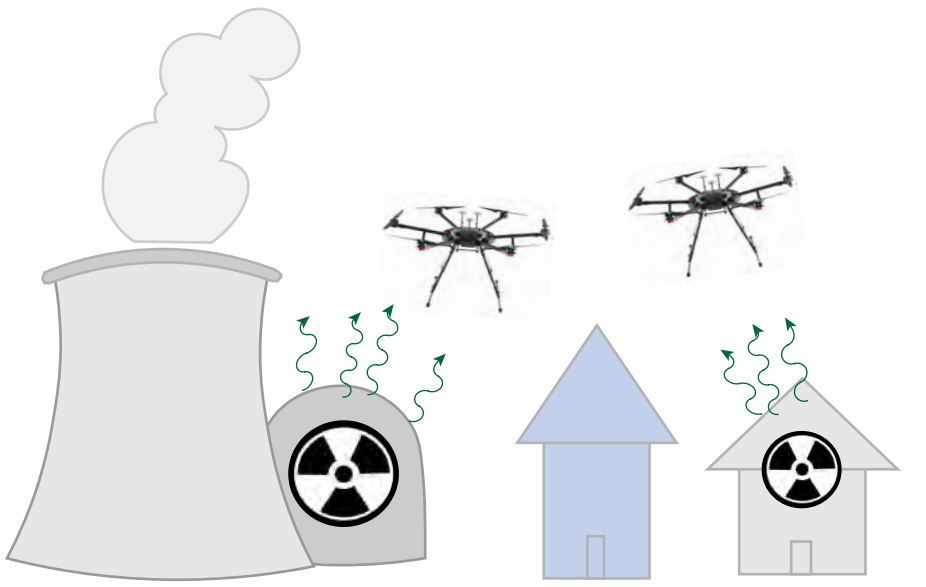
BUILDING RADIATION DETECTING DRONES USING SCINTILLATING MATERIAL

JESSICA ELDER MARK MA SHUBHAM MANDOT
ADVISED BY: DR. KAI VETTER

Reliable methods of radiation detection are crucial for many applications, including nuclear emergency response, proliferation detection and environmental assessment. However, measurements taken in person yield the potential risk of radiological damage from hazardous sources. By eliminating the need for in-person survey, we can therefore remove the additional risk from conducting measurements. Our team has designed a radiation detection systen that will be incorporated into an unmanned aerial vehicle (UAV), allowing users to measure areas of interest from a safe distance. Our system will use a new plastic scintillator material, which will enable the UAV to distinguish between neutrons and gamma-rays, while maintaining its light weight and structural integrity.

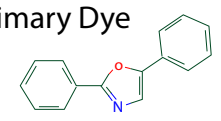




Our detection system will **replace the landing feet** of a Matrice 600 drone, enabling users to take measurements from a **safe distance**. This project proved the feasibility of using a novel plastic scintillator material **simutaneously as a radiation detector and a UAV structural component**.

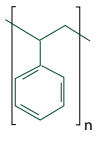
Major Chemical Components of PSD Plastics

Primary Dye

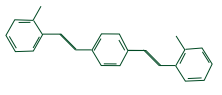


2,5- Diphenyloxazole (PPO)

Loading Matrix

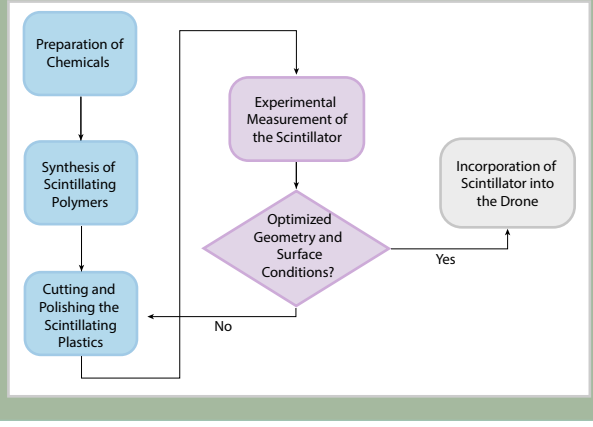


Secondary Dye

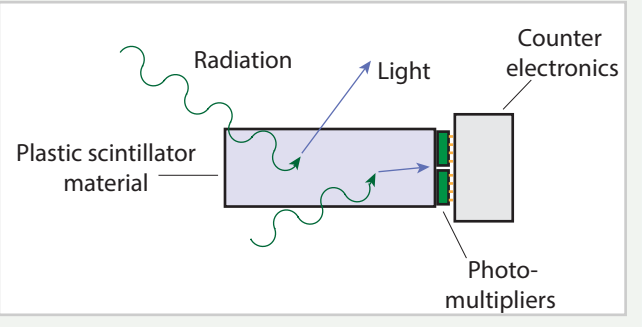


1,4-bis[2-(2-methylphenyl)ethenyl]benzene (Bis-MSB)

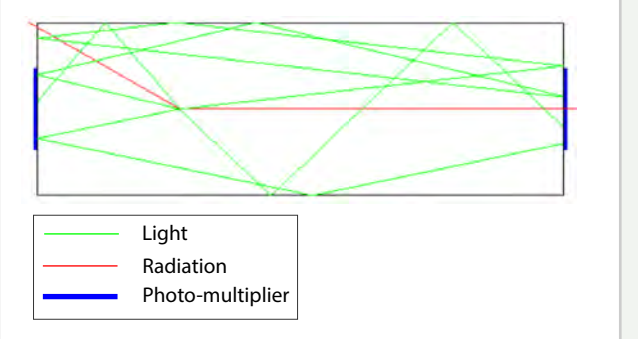
Scintillator Synthesis and Processing



Radiation Detection System

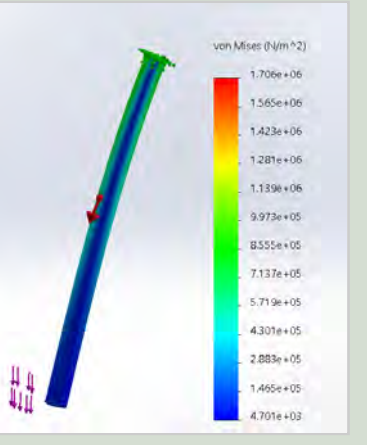


Light Transport Modelling Using Particle Simulation Software (GEANT4)



GEANT4 simulations were performed to obtain **optimum scitillator size** for our detection system.

Structural Design and Analysis Using SOLIDWORKS



SOLIDWORKS simulations were created to ensure that our UAV would **maintain structual integrity.** Stresses and bending were examined for both the drone leg (right) and the detection system (below).