

## Conceptual and Preliminary Design of Landmine Searching UAS at Extreme Environmental Condition

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**Abstract :** Landmines and ammunitions have been creating a significant threat to the people and animals, after the war, the landmines remain in the land and it plays a vital role in civilian's security. Especially the Children are at the highest risk because they are curious. After all, an unexploded bomb can look like a tempting toy to an inquisitive child. The initial step of designing the UAS (Unmanned Aircraft Systems) for landmine detection is to choose an appropriate and effective sensor to locate the landmines and other unexploded ammunitions. The sensor weight and other components related to the sensor supporting device's weight are taken as a payload weight. The mission requirement is to find the landmines in a particular area by making a proper path that will cover all the vicinity in the desired area. The weight estimation of the UAV (Unmanned Aerial Vehicle) can be estimated by various techniques discovered previously with good accuracy at the first phase of the design. The next crucial part of the design is to calculate the power requirement and the wing loading calculations. The matching plot techniques are used to determine the thrust-to-weight ratio, and this technique makes this process not only easiest but also precisely. The wing loading can be calculated easily from the stall equation. After these calculations, the wing area is determined from the wing loading equation and the required power is calculated from the thrust to weight ratio calculations. According to the power requirement, an appropriate engine can be selected from the available engine from the market. And the wing geometric parameter is chosen based on the conceptual sketch. The important steps in the wing design to choose proper aerofoil and which will ensure to create sufficient lift coefficient to satisfy the requirements. The next component is the tail; the tail area and other related parameters can be estimated or calculated to counteract the effect of the wing pitching moment. As the vertical tail design depends on many parameters, the initial sizing only can be done in this phase. The fuselage is another major component, which is selected based on the slenderness ratio, and also the shape is determined on the sensor size to fit it under the fuselage. The landing gear is one of the important components which is selected based on the controllability and stability requirements. The minimum and maximum wheel track and wheelbase can be determined based on the crosswind and overturn angle requirements. The minor components of the landing gear design and estimation are not the focus of this project. Another important task is to calculate the weight of the major components and it is going to be estimated using empirical relations and also the mass is added to each such component. The CG and moment of inertia are also determined to each component separately. The sensitivity of the weight calculation is taken into consideration to avoid extra material requirements and also reduce the cost of the design. Finally, the aircraft performance is calculated, especially the V-n (velocity and load factor) diagram for different flight conditions such as not disturbed and with gust velocity.

**Keywords :** landmine, UAS, matching plot, optimization

**Conference Title :** ICUASR 2022 : International Conference on Unmanned Aircraft Systems and Robotics

**Conference Location :** Dubai, United Arab Emirates

**Conference Dates :** January 28-29, 2022