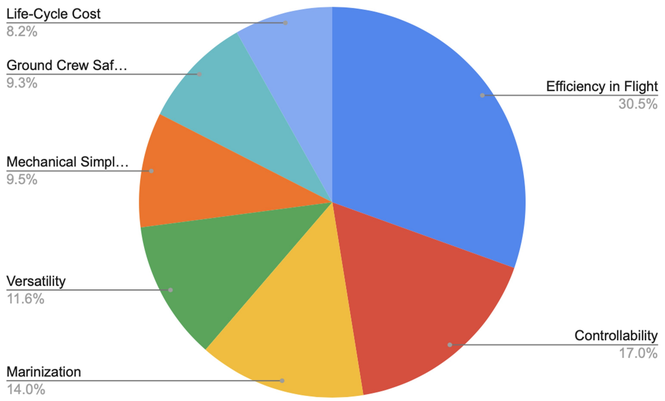
Ibis: A Multi-Mission, Modular UAS For Disaster Relief

Emma Farren, Aidan Hayes, Faith Pak, Jacques Read, Visesh Uppoor, Howard Zheng at University of Maryland, Javier Turuelo Menéndez at Universidad Carlos III de Madrid

Design Process

The process to design an unmanned, VTOL capable aircraft began with understanding the proposal. The Army Research Lab details their requirements for the two mission profiles, but reading beyond that allowed the team to decide on our design drivers. These factors acted as our priorities throughout the design process.



In certain selection stages, like the number of rotor blades for example, we used the design drivers and an analytical hierarchy process to compare the choices. They were also used to compare possible configurations for the design.

Quadrotor Bi-plane

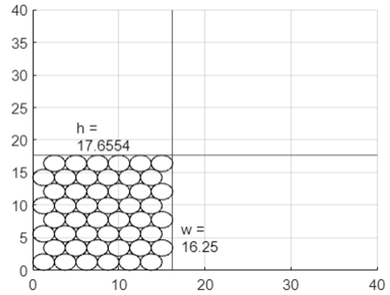
Single Main Rotor

Tilt Rotor

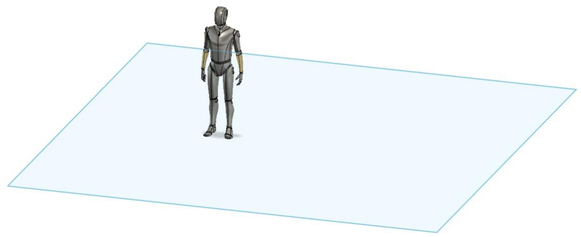
Compound SMR

Sizing and Materials Considerations

The Request For Proposals (RFP) gave specifications for the gross take-off weight (GTOW) as well as the payload masses for each mission. These specs gave us a starting point for sizing our aircraft. The supplies delivery mission has a payload of 50 kg (110.2 lbs).



In order to translate this mass into a volume, we assumed the most dense supplies that would be delivered in a disaster scenario would be tightly packed water bottles.



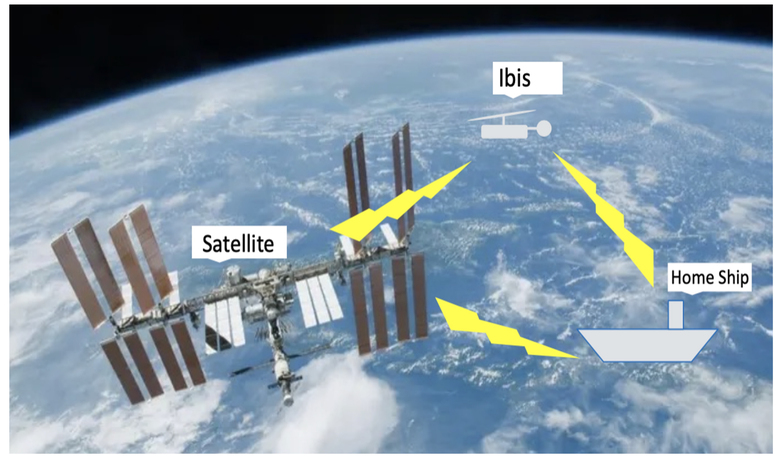
The take-off and landing footprint, a 6x6 m square, limits the possible size of our rotor diameter and overall length of the UAS. The 6 ft tall human model provides some context for how small the Ibis will be compared to the ground crew maintaining the UAV as well as loading and unloading its payload.

FAR and MILSPECs for UAVs

Ensuring our vehicle operates according to federal and military regulations was an important design aspect. Landing gear load limits, rotor hub dynamics, and fuel tank crashworthiness are a few examples of design areas *Ibis* meet these regulations. Operating on the deck of a ship, in disaster airspace, and near untrained civilians, safety and regulations becomes a major concern.

Avionics and Controls

Operating in gusty conditions, as a communications relay, and as an unmanned aircraft all come with major avionics requirements. Using satellite communication and LiDAR on board the UAS, *Ibis* is able to resist wind gusts and navigate to and from the ship deck, travelling over 370 km (230 miles).



Design Specifications

Cruise Speed	148 km/h	80 kts
Loiter Speed	118 km/h	64 kts
ETOW	93 kg	207 lbs
GTOW	160 kg	352 lbs
Bus Power	800 W	
Fuel	Jet-A	
Max Rotor Size	4 m	13.1 ft

Vertical Flight Society

IBIS