Concept Generation

## Concept Generation

Before we began our morphological chart, we decided on the most important criteria that would have the biggest effect on our aircraft. First, we have the fuselage with 3 types: the guppy, the dolphin, and the whale. These three fuselage types were designed in CAD specifically for the task of carrying the payload and mounting the landing gear, without much consideration for aerodynamic effects. Next is the section that our team is primarily concerned about since it involves the wing design of the airplane. Based on our research we chose two candidate airfoils for our morphological chart, the Eppler 423 or S1223, and its placement on the aircraft (low, medium, or high). The next 3 sections are subcomponents of the plane that are essential to its design, yet that didn't have as much importance as the previous sections. These are the landing gear (tricycle or taildragger), the rear tail design, (conventional, medium, or T-tail), and winglets to help with drag (None, Hoerner or Swept).

The next section of our concept generation is Biomimicry where we looked at animals to try and get some insight into how they achieved flight. The first few concepts are based on birds with long wingspans, the next few are those with a similar body style to our guppy designs that have a large circular cross section that would imitate us carrying our payload and the last selection of birds were those that migrate large distances. Further, we went beyond birds and looked at any animal that was able to fly through flows of either water or air to make us think critically about ways to achieve flight.

Next, our concept generation chart looks at preexisting full-scale airplanes that are available. This allows us to scale down an airplane with desirable aerodynamic characteristics without needing to change many parameters. In terms of optimization design, this can be seen as an initial “guess” configuration that we can optimize iteratively for our project requirements. Some of the aircraft selected would not fit our project but were still worth considering in the ideation process.

Finally, the last section of our concept generation looks at model aircraft. Since we are building a model aircraft, many of these concepts are more obviously feasible. They are also designed to use similar components.

The SAE aero design competition states that we must use an original design, so the preexisting aircraft are listed to exemplify the overall configuration, rather than specifics of the design. Any concept used from these two categories will be heavily modified to suit our needs.

### Medium Fidelity Concepts:

### Concept 1.

E-flite UMX Radian scaled up

### Concept 2.

Skyhunter 1800

### Concept 3.

E-flite Air Tractor scaled up

### Concept 4.

Cessna 208B scaled down

### High Fidelity Concepts:

**Concept 1.**

Dolphin

E423

Low wing

Conventional tail

Taildragger

Hoerner wing tips

**Concept 2.**

Guppy

E423

High wing

Tail Dragger

Conventional tail

No wing tips

**Concept 3.**

Whale

E423

Low wing

Tricycle Gear

Conventional Tail

Hoerner wing tip