Overview and Goal
The goal of the first assignment is to determine the specifications and requirements for a fixed-wing UAV. These requirements will provide the basis for the subsequent modeling, control, simulation and flight testing steps.
To be realistic for the type of aircraft that will be used in the course experiments, the mission is constrained to the general characteristics of the Ultrastick airframe (size and weight, etc. see table 1).

I. Mission Definition: Requirement Analysis
   1. Provide general description of the mission
   2. Flight conditions

II. System Analysis: Requirements of mission profile
Describe:
   1. Task elements and mission profile
   2. Automation in the task elements
   3. Operation

III. Payload Analysis
Describe:
   1. Payload functionalities needed for task
   2. Operation of the payloads (human, automated, hybrid)
   3. How the payload is coupled with the mission profile

V. Airframe Design Reference
To have a reference for the analysis based on the Ultrastick determine the general specifications for an ideal design by relaxing the constraints imposed by the Ultrastick.
Figure 1: University of Minnesota Ultra Stick 25e UAV.

Table 1: Physical properties of the Ultra Stick 25e airframe.

<table>
<thead>
<tr>
<th>Property</th>
<th>Symbol</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>$m$</td>
<td>1.959</td>
<td>kg</td>
</tr>
<tr>
<td>Wing Span</td>
<td>$b$</td>
<td>1.27</td>
<td>m</td>
</tr>
<tr>
<td>Wing Area</td>
<td>$S$</td>
<td>0.31</td>
<td>$m^2$</td>
</tr>
<tr>
<td>Mean Aerodynamic Chord</td>
<td>$c$</td>
<td>0.25</td>
<td>m</td>
</tr>
<tr>
<td>Lift Coefficient</td>
<td>$C_{L,\alpha}$</td>
<td>4.58</td>
<td>–</td>
</tr>
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