

```

1 mcdp {
2   # We need to fly for this duration
3   provides endurance [s]
4   # While carrying this extra payload
5   provides extra_payload [kg]
6   # And providing this extra power
7   provides extra_power [W]
8
9   # Sub-design problem: choose the battery
10  sub battery = instance mcdp {
11    # A battery provides capacity
12    provides capacity [J]
13    # and requires some mass to be transported
14    requires mass [kg]
15    # requires cost [$]
16
17    specific_energy_Li_Ion = 500 Wh / kg
18
19    mass >= capacity / specific_energy_Li_Ion
20  }
21
22  # Sub-design problem: actuation
23  sub actuation = instance mcdp {
24    # actuators need to provide this lift
25    provides lift [N]
26    # and will require power
27    requires power [W]
28    # simple model: quadratic
29    c = 10.0 W/N^2
30    power >= lift * lift * c
31  }
32  # Co-design constraint: battery must be large enough
33  power = actuation.power + extra_power
34  energy = power * endurance
35  battery.capacity >= energy
36
37  # Co-design constraint: actuators must be powerful enough
38  gravity = 9.81 m/s^2
39  weight = (battery.mass + extra_payload) * gravity
40  actuation.lift >= weight
41
42  # suppose we want to optimize for size of the battery
43  requires mass for battery
44 }

```