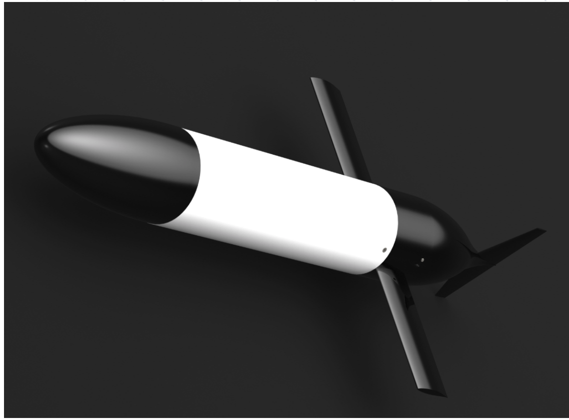
.8TH EGO MEETING - 23 MAY 2019

Low-drag glider development



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Gliders are slow – so it is best to have many

- If you are going to have many:
  - Each glider cannot be too expensive
  - The operational costs have to be reasonable
- If each glider is to be less expensive, they have to be smaller
  - Production cost is roughly proportional to the square of the diameter
- If gliders are going to be smaller than they have to be spending less power. Or you cannot fit the batteries required to go as far as you want.

The power budget has three main elements

- Power to sensors and electronics
  - Something we know how to deal with (ADCPs are hungry beasts)
  - Generally solved by turning things on and off in a hurry
- Efficiency of pump system that drives buoyancy engine
  - Needs to be focused on solving the mission parameters and designed for volume production.
- The drag (resistance) of the glider needs to be as small as possible
  - Defines the volume that need to be pumped (for a given speed)
  - (It helps that the glider is smaller)

The numbers (popular science version)

- To get down to a weight of about 25 kg, we need to reduce the power consumption by a factor of 2.
- Has to come from all three elements of the power budget – first working on the drag.
- The drag of gliders is partly defined by the shape, but it is also very much defined by the angle between the glide path and the glide body (angle of attack).
- Problem is solved with airplanes by making asymmetric wings that give lift even at 0 degree angle of attack
- Gliders (and acrobatic airplanes) fly both up/down so wings and body are typical symmetric – which means that you can generate a lift only by having angle of attack <> 0.

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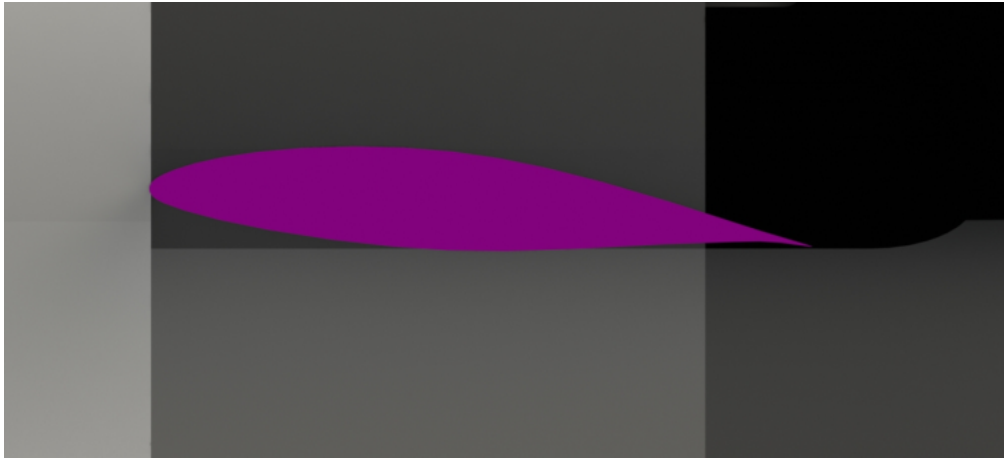
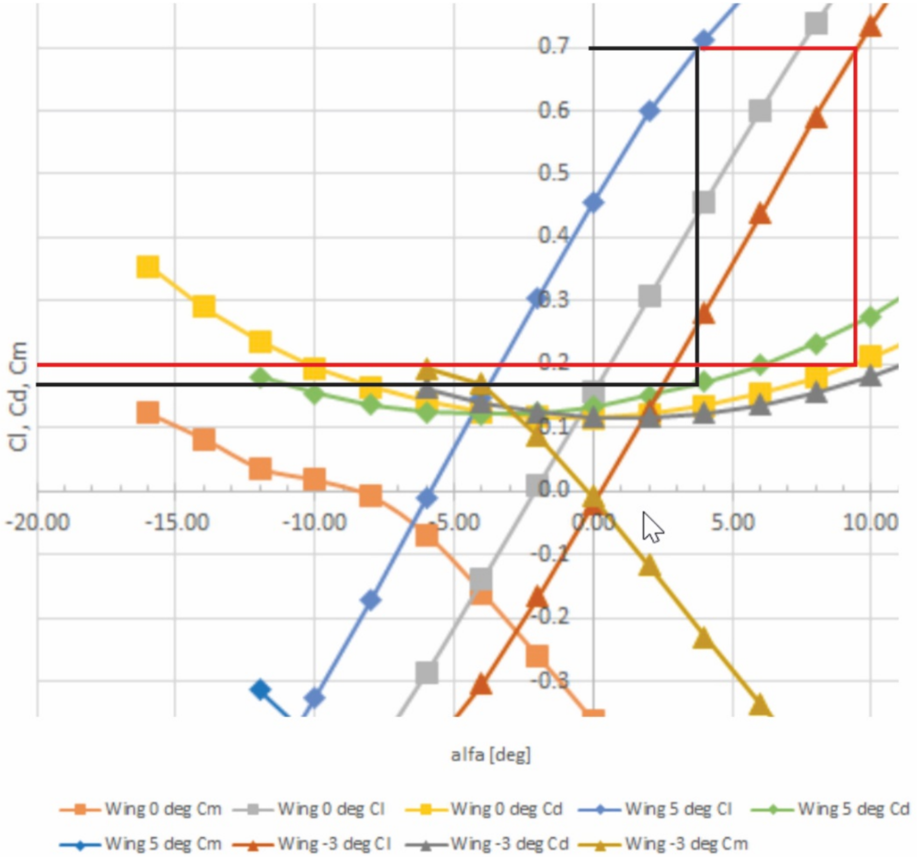
What if we used asymmetric wings

- Built a scaled glider model – with a standard wing shape
- But how do we solve the problem of getting lift both during descent and ascent?
- We roll: https://vimeo.com/336584904



Numerical modelling

- Still has about 3 degree angle of attack
- Give us about 25% drag reduction when compared with symmetric wings.
- Body still significant contribution to lift. Need larger wing



Next steps

- Continue optimization of wing size and location
- Determine the key design parameters. At this point:
  - CTD surveys only (need to agree on accuracy specifications)
  - Aim for 2*1000 km x 200 m with 25 kg vehicle on alkaline (or Li-Io)
    - Models says we are close
  - Not a «bus» – this will be a mission specific design
- Building a new organization for this project. Now hiring mechanical, electrical, software, system, robotics, test engineers and scientists – offices in DC ☺