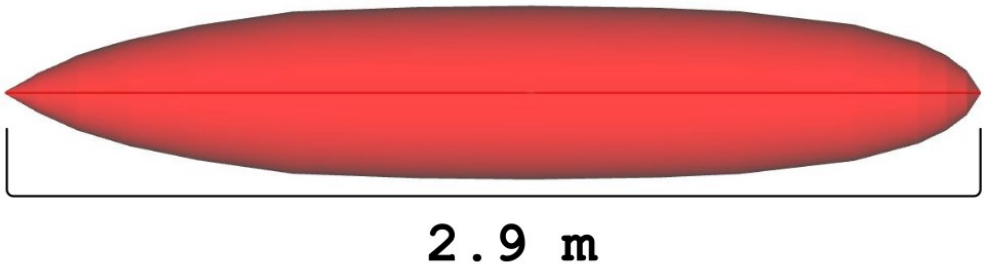
Long Term Outdoor Tests of a Model Airship Envelope

The future of lighter than air technology definetely happens outdoors. So, an interesting test is the durability of envelope material in continuous outdoor use. Factors like halestorms, wind and UV radiation can harm sensitive ultra light foils as used in small modell airships.

As the Windreiter team is now capable of mass producing envelopes, we used one of those in a long term exposure experiment, presented in detail in the following:

The Envelope:

A standard RACEBASE envelope (360 L, 2.9 m length, 210 g) from the running production was used without any improvements or changes. Manufactured from PE/PA foil, colored red. Weblink: https://windreiter.jimdosite.com/shop/racebase-envelope-red/



The Setup:

In the back of our private garden, the envelope was inflated to pressure, the nozzle folded and firmly closed with a sealing clip. The envelope was then tied with ropes to a stack of pallets. The position was chosen in order to be not too affected by playing children, but still fully exposed to sun, wind and any other weather conditions. The envelopes state was checked every few days and was inflated again if pressure loss was significant. A detailed log of the observations was prepared.

Date	Note
2020-01-11*	Started experiment. Filled some air to account for the low night temperature 4 °C
2020-01-13	Everything good
2020-01-15	Everything good
2020-01-16*	Ice on top of the envelope. Filled some air as temperature is low 0 °C
2020-01-17	Good pressure, very windy conditions
2020-01-25	Good pressure
2020-01-28	Good pressure, heavy winds, halestorm
2020-01-31	Super strong pressure, temperature about 11 °C
2020-02-02	Everything good
2020-02-06	Ice in the envelope, pressure is a bit reduced
2020-02-07*	low pressure, fille some air, temperature 0 °C
2020-02-10	Heavy Storm, everything good
2020-02-14	Very high pressure do to raising temperature
2020-02-20	Survived another heavy storm
2020-02-21	Suriveved heavy halestorm
2020-03-02	Everything good
2020-03-14	Still fine, slightly reduced pressure
2020-03-23	Ship escaped during night with low pressure and wind, was found in the neighbour garden. However at noon pressure was super strong again.
2020-03-25	Ship escaped again and was destroyed by thorns. End of experiment.

**grey fields indicate refilling of air*

Results:

The airship envelope was constantly outside for about 3 month, in total 74 days until it was destroyed mechanically by thorns of a nearby bush, as the envelope escaped from its mooring. During this period the envelope was filled with air and kept under pressure by periodically refilling. We found two factors mainly driving how much air is lost. The goodness of the sealing of the filling tube is a major factor and was almost perfect on 2020-02-07 as after this refilling no additional air was needed to keep the envelope under pressure for an amazing 49 days. The second factor is the change of atmospheric pressure and even worse temperature. Especially the spring days end of march showed temperature gradients from about 0 °C during night up to 20 °C air temperature measured in sunlit areas. This lead to strong pressure changes inside the envelope allowing it to eventually escape from its ties and slip with the wind to the neighbour garden. After the envelope was destroyed, we compared it directly to another one, not exposed to halestorm, heavy winds, rain, ice and UV radiation. Neither a change in color, nor in material feeling or toughness could be noticed.

Conclusions:

Even though we currently use the present envelope material for indoor models, it seems to be perfectly suitable for outdoor applications. However a better tethering of the envelope would allow longer tests. The main driver of the envelope tightness was actually the closing of the filling tube.

Pictures:






1) Setup in winter 2) Envelope with low pressure, 3) Envelope in sunlight under high pressure 4) Ice on the envelope 5) The escaped envelope, still fine 6) The cut in the envelope after the second escape