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Interactive comment on "Return glider radiosonde for in-situ upper-air research measurements" *by* Andreas Kräuchi and Rolf Philipona

Anonymous Referee #1

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This paper presents novel concepts, has substantive conclusions that are supported by the methods and results, and presents science relevant to AMT. The language and presentation could use some improvement. There are also a number of typographical errors. Specific suggestions for improving the presentation appear below.

The most significant suggestion I have for this manuscript is to put greater separation between the engineering measurements and the atmospheric measurements. A good example of this is Section 7.2.4 where temperature measurements of "vital electronic components" and "ambient" air are confusingly lumped together. Division of these two "themes" would permit more relevant discussions of the atmospheric measurements that have already been made and those that could be made from this glider.

Most readers are going to want to know if this glider could be used to carry their instru-

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Discussion paper

ment or an air core. A bit more of the manuscript should be devoted to describing the payload capabilities (i.e., space available, weight limitations) rather than just mentioning a couple of possible instruments near the end of the paper.

I think the advantages of using this glider for atmospheric measurements should be clearly stated in general terms, not just for the radiation measurements that have been made. First and foremost is the potential cost savings of having expensive instruments easily recovered. Second is that repeated vertical profile measurements can be made with the same instruments over multi-hour time scales when the payload recovery time is short (this is stated, but not strongly enough).

The number of Figures can be reduced and the value of some figures greatly enhanced. Figures 1 and 2 can be easily combined to show the successful return of the glider to the launch site, including the final 100 m descent by parachute, as well as the emergency descent by parachute at a distance from the launch site. Figures 3, 4 and 5 would benefit from the addition of dimensions or a length scale. Figure 3 should more clearly show the T and RH sensors of the radiosonde. Would an actual photograph be better? I don't see the need for both Figures 6 and 7, as Figure 7 (for 1 flight) can show everything shown in Figure 6. Figure is cluttered with too many flight trajectories to show what's important. These types of Figures would also benefit from a length scale. I also don't see the need for both Figures 8 and 9 because they show the same thing except for the height of glider release. In printed form Figure 10 is so small that it is unreadable. Please consider increasing the size of each panel.

Figures 8 and 9 are interesting but are also somewhat confusing. If one assumes that the released glider is always heading straight for the launch site (is this valid?) then the "RGR horizontal speed" is always with respect to the landing site and easily translated to "distance from landing site". "Wind speed" is the confusing part. Is this the wind speed (projection vector) opposing the glider's direction of travel (direct to base), or the total wind speed regardless of direction? If the former then it is meaningful, as the glider's progress back to base is very much a function of the opposing wind speed. If

the latter, I don't get the connection between wind speed and RGR horizontal speed (or distance to base). Regardless, the Caption needs to explain this clearly or the Figure has little value.

The word "control" is used many times and in several contexts throughout the manuscript. On page 2 Line 27 I believe "controlled descent" means "not descending with only a parachute". On P3 L16 there is "Controlling a payload", while on P4 L12 there is "controlled landing", something completely different. On P5 L28 there is "well-controlled horizontal position". P9 L3 has "controlling the electric current". There are also mentions of "attitude control", "control surfaces" and "flight controller". I think in many cases you should be able to substitute a more meaningful word for "control" rather than over-use this word.

Specific Comments:

P2 L29: "free fall" implies there is nothing impeding descent, for example a parachute. Is this the case?

P3 L22: Is an entire section on parafoil systems necessary when this is not part of the RGR?

P4 L1: I thought radiosondes went up on balloons and down on parachutes, and dropsondes were "dropped" from aircraft or helicopters.

P4 L17: There is a wide range of UAVs that can carry payloads weighing from several hundred grams up to several thousand kilograms.

P5 L4: I do not understand the statement that "slow progress from low towards higher altitudes is required to analyze the aircraft's performance."

P5 L19: "benefit since a vertical stabilizer would obstruct the radiation instruments on the glider."

P5 L21: What are the payload limitations of a balloon-borne sounding?

P5 L24: How exactly could an electric motor propel the flying wing?

P6 L22: Explain that elevons are moveable parts of the trailing edge of a delta wing and label them in Figure 3.

P6 L30: I assume “all cables and connectors” refers to electrical parts, not the tethering strings that hold the RGR in a horizontal position during balloon ascent? This description is somewhat confusing.

P7 L1: Why aren’t the T and RH measurements made at the back of the RGR perturbed by the glider body? It seems that the air rushing over the RGR surface before reaching the sensors would somehow be perturbed. Can you cite evidence that there are no perturbations of T or RH?

P7 L7: What are the “limits of standard balloon-borne payloads”? It would also be useful to know the dimensions of the payload sections and the approximate weights that could be carried by the RGR. This is information that could be used to decide if the RGR is suitable for other instrument payloads.

P8 L5: Do “wind components” include vertical winds? I don’t see how that is possible.

P9 L24: I believe the second occurrence of “one” should instead be “own”

P10 L2: What does “properly tuned and adjusted” refer to? Is this a physical adjustment of the airframe? An adjustment of software?

P10 L7: If the parameters are “permanently stored” can you never change them?

P10 L24: GPS has already been mentioned several times before this point (P2, P8, P9). Define the acronym at the first occurrence.

P10 L29: I believe the Swiss company name is “ublox”

P11 L14: What is a safety “barrier”? Do you mean “feature” instead?

P11 L22: What kinds of “special attention needs” are there for balloon preparation?

P12 L25 (and L27): I thought the RGR was released from the balloon, not the opposite.

P13 L11: Why would the RGR want to fly back to the release point? Do you mean balloon launch site?

P13 L17: I don't see the need for so much detail about the winds above the launch site in this paragraph. Why do we need to know the progression of winds from west to south to east?

P15 L14: A glide ratio is a unitless number (e.g., 4.7) and does not need ":1".

P15 L24: This is a confusing sentence because "theoretical distance from a single direction" is not well explained. I think you are describing the situation that would arise if the balloon is carried in only direction before the RGR is released. Please re-word this.

P15 L28: How is this timing achieved so that the RGR is pointing in the correct direction when released from the balloon? This is critical information.

P16 L11: How can "the humidity measured on board" distinguish between passage through a cloud or a region with high water content?

P16 L27: What is the "special flight path" that helps the parachute eject?

P17 L28: How will a dew point sensor work in the UTLS? The air core is not a "sensor", it is an air sampling device that is analyzed after recovery to produce vertical profiles of gases. I'm curious how these larger and heavier payloads could be deployed on the RGR? Is there unused space in the payload sections?

P18 L12: Doesn't the RGR always "maintain a forward flight path"? It always points in the "forward" direction, since forward is defined relative to the nose of the glider.

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