

GSBC 2015 Highest Altitude Prize Submission

This document describes the XABEN87 & 88 high altitude balloon flights which are presented for the GSBC 2015 Highest Altitude prize. The XABEN87 height of 42895m (140,732ft) is submitted as the record.

XABEN87 23/04/2015 – technical description.

This flight used a sub 50g payload on a 1600g Hwoyee balloon filled with circa 2cu m (cubic meters) of Hydrogen. In essence the design was to use the lightest radio tracker and camera combination and carry it on the balloon that had previously taken most of the altitude records. The payload comprised a small radio tracker and single micro camera held in a extruded polystyrene foam structure (see supporting pictures section in the appendix).

A UKHAS style radio tracker was used containing a uBlox GPS and weighing just 14g. The tracker transmitted GPS position using 10mW UKHAS format FSK in the EU licence exempt 434Mhz band. The circuit board comprises: chip GPS antenna, uBlox7C GPS module, PIC 18F26K80 microchip, RFM22B transmitter module and 1.8V boost power supply. The tracker was powered from a single 1.5V AAA Energizer ultimate lithium battery which can run it continuously for 24hours. Four thin wire radial elements were added underneath the XPS housing to create an inverted groundplane antenna. The elements were held rigid using thin plastic drinking straws.

The camera was a modified “808” #18 keyring camera – weight 13g. As standard this camera is only capable of running continuously for about 45mins – so the camera was modified to take photos approximately every 30 seconds and powered down in between. This allowed the camera's 350mAh battery to last the full duration of the flight. The modification was achieved using a 8 pin PIC microchip (12F683) which faked operation of the camera's power and shutter buttons. The PIC chip consumed about 500uA during the power-down between camera shots. The camera was covered in thin aluminium foil to stop interference with the GPS (808 cameras are notorious for GPS jamming). This modification allowed the camera and tracker GPS to be run in close proximity (saving size and weight).

The radio tracker and camera were mounted in a machined extruded polystyrene (XPS) foam structure – which in turn was mounted into the balloon neck using a PVC plug. The plug provided the gas seal and payload mount – which in turn allowed the antenna elements to be held away from the balloon once inflated. The intention of the “payload in neck” design was to gain a further 20m altitude which would normally be lost by it hanging under the balloon. A parachute and line were attached under the balloon.

Supporting Evidence

A notable event during the flight – the clear skys and flight path allowed the balloon to be photographed as it passed over the launch site – see pictures section.

The launch and recovery was live streamed on YouTube:

https://www.youtube.com/watch?v=JQMufWF_GNAo

Radio transmissions were received by 30 separate receiving stations during the flight and uploaded to the UKHAS HabHub database and tracker.

Position data from the flight is recorded in the HabHub database and can be found here:

http://habitat.habhub.org/habitat/_design/ept/_list/csv/payload_telemetry/flight_payload_time?

[include_docs=true&startkey=\[%2224158dd7879ff13dd1f850f5b338f05b%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22\]&endkey=\[%2224158dd7879ff13dd1f850f5b338f05b%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22,\[\]\]&fields=_sentence](https://www.google.com/search?q=include_docs=true&startkey=[%2224158dd7879ff13dd1f850f5b338f05b%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22]&endkey=[%2224158dd7879ff13dd1f850f5b338f05b%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22,[]]&fields=_sentence)

Key Flight Data:

Launch at 14:57 GMT Lat/Lon 52.25174,-0.09276

Burst at 17:32:54 GMT Lat/Lon 52.18357,-0.54457 at **42895m (140,732ft)**

Landing: Lat/Lon 52.17007,-0.48971

All pictures from the flight can be found here:

<https://drive.google.com/folderview?id=0B2sJ6cUJZiFTzJ1U2pyUnN4NWs&usp=sharing>

XABEN88 25/04/2015 – technical description.

This flight again used the same type of 1600g balloon, hydrogen and the same tracker and camera. The same payload housing was used but an extra layer of insulation was added to the top. Building on the experience of the 1st flight it was decided not to use the neck mounting arrangement – for fear the antenna elements might touch the balloon during the early phases of the flight. The payload was strung 20m below the balloon using a conventional inline parachute arrangement, the balloon neck was conventionally closed with cable ties.

This balloon was given slightly more fill than XABEN87 which resulted in a slightly faster ascent rate and a correspondingly lower burst altitude.

Supporting Evidence

The launch and recovery were live streamed on youtube:

<https://www.youtube.com/watch?v=IFEt087xoHs&t=23m46s>

<https://www.youtube.com/watch?v=H-pGFhd0MZw>

Radio transmissions were received by 26 separate receiving stations during the flight and uploaded to the UKHAS HabHub database and tracker.

Position data from the flight is recorded in the HabHub database and can be found here:

[http://habitat.habhub.org/habitat/_design/ept/_list/csv/payload_telemetry/flight_payload_time?include_docs=true&startkey=\[%22f686fab6b91c7a9fe2ccc62b09063b28%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22\]&endkey=\[%22f686fab6b91c7a9fe2ccc62b09063b28%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22,\[\]\]&fields=_sentence](http://habitat.habhub.org/habitat/_design/ept/_list/csv/payload_telemetry/flight_payload_time?include_docs=true&startkey=[%22f686fab6b91c7a9fe2ccc62b09063b28%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22]&endkey=[%22f686fab6b91c7a9fe2ccc62b09063b28%22,%22b6dc0b63fe8e9bcb1dd866d22031bad9%22,[]]&fields=_sentence)

Key Flight Data:

Launch at 11:13 GMT, Lat/Lon 52.25246,-0.08948

Burst at 13:32:30 GMT, Lat/Lon 52.54604,0.24170 at **42318m (138839ft)**

Landing: Lat/Lon 52.66941,0.51913

Photos from the flight can be found here:

<https://drive.google.com/folderview?id=0B2sJ6cUJZiFLTzQaDRiU3VZZGM&usp=sharing>

The camera stopped taking photos part way through the flight due (it's believed) to a battery failure.

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Appendix

Supporting Photographs

Radio Tracker and battery on the gram scales (both flights):

<https://drive.google.com/file/d/0B2sJ6cUJZlIFdmpHRFQ3VEwwYWs/view?usp=sharing>

Modified 808 Camera on gram scales (both flights):

<https://drive.google.com/file/d/0B2sJ6cUJZlIFRU4WC1IMWE5OFE/view?usp=sharing>

<https://drive.google.com/file/d/0B2sJ6cUJZlIFaW1fcVZnZzJBNms/view?usp=sharing>

Radio tracker (camera underneath) mounted in XPS payload housing (both flights):

<https://drive.google.com/file/d/0B2sJ6cUJZlIFeGt5STIZOGIyVmc/view?usp=sharing>

Payload XPS Body (both flights):

<https://drive.google.com/file/d/0B2sJ6cUJZlIFbzQ0bHQzb3pQX1U/view?usp=sharing>

XABEN87 passing overhead of launch site at 100,000ft+ (camera Canon 550D with 250mm lens):

<https://drive.google.com/file/d/0B2sJ6cUJZlIFXzVlcEpoTFVGeG8/view?usp=sharing>

<https://drive.google.com/file/d/0B2sJ6cUJZlIFaEFFQkh3WW1aR00/view?usp=sharing>

XABEN87 flight path:

<https://drive.google.com/file/d/0B2sJ6cUJZlIFMS1pSWd2N2hTWmc/view?usp=sharing>

XABEN86 parachute on gram scales:

<https://drive.google.com/file/d/0B2sJ6cUJZlIFSE1XVW1LNG9nUnc/view?usp=sharing>

XABEN88 flight path (also MM4):

<https://drive.google.com/file/d/0B2sJ6cUJZlIFcDI4Q180Q3NNck0/view?usp=sharing>

XABEN87 – receiving station pie chart:

<https://drive.google.com/file/d/0B2sJ6cUJZlIFXy02UUV5NmVsaXM/view?usp=sharing>

XABEN88 – receiving station pie chart:

<https://drive.google.com/file/d/0B2sJ6cUJZlIFbUpBckVWSIYwOGs/view?usp=sharing>

Launch Site:

Both flights were launched from New Farm, Elsworth, Cambridgeshire, England UK.

UK CAA Permits and NOTAMS were in place and the CAA procedures for launching from the site were followed on both occasions.

The RandomAerospace Team

Members (both flights):

Steve Randall

Darren Bannister

Team Track Record

Steve Randall holds 3rd, 5th and 8th place ARHAB (<http://www.arhab.org/>) highest altitude records:

XABEN-25 - 43721m (143442 ft) set 20/05/2012

XABEN-26 - 43412m (142,428ft) set 26/05/2012

XABEN-24 – 42687m (140,049ft) set 14/04/2012