

## **The Manitoba Association of Physics Teachers High Altitude Balloon Report**

Langruth, a small town on the west side of Lake Manitoba, was the perfect launch site for MAPT's High Altitude Balloon Flight Day 2017. This is the third year that the Manitoba Association of Physics Teachers has organized HAB flights that launch from rural schools. Eight teams launched HABs this year and other schools sent observers. Students from the HAB schools work on their payloads all year long. Each payload includes science and engineering experiments as well as a 2-metre band Automatic Packet Reporting System (APRS) transmitter. The HAB's APRS beacon transmits a call sign, as well as latitude, longitude, altitude and airspeed provided by the attached GPS receiver. Most teams include students and teachers who are certified amateur radio operators.

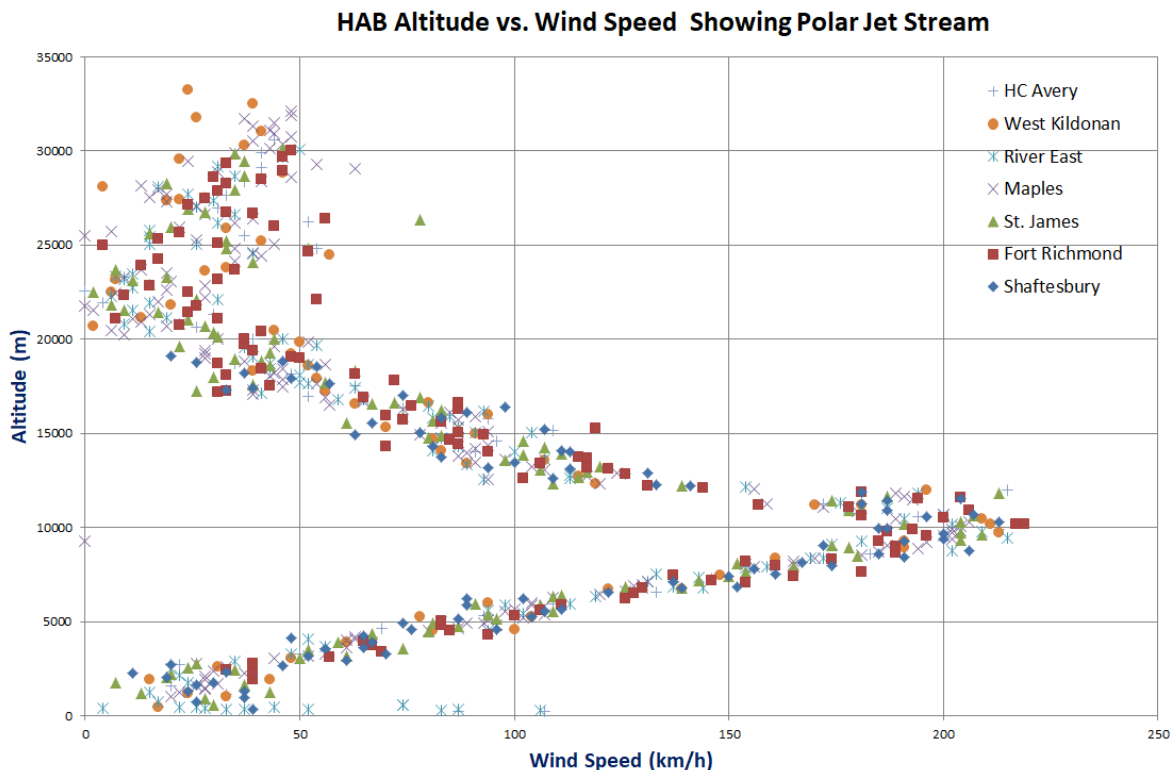
Shaftesbury High School's team (SHARP) launched their HAB using teacher Adrian Deakin's call sign VA4AMD-8 first. All HABs were in the air by noon. The weather was warm and sunny. Surface winds were light. The children of Langruth Elementary School watched with great interest from the edge of the field. Launches are always fun and exciting events for our growing community of young scientists and engineers.



**SHARP 71r is launched from Langruth Elementary School. St. James Collegiate and Maples Collegiate HABs are ready to go.**

After the launches, all the HABs drifted out over Lake Manitoba. The teams quickly cleaned up the launch site and got into their vehicles and proceeded to chase their high flying experiments. At an altitude of about 10 km, near the city of Portage la Prairie, the HABs entered the polar jet stream. The balloons were now travelling at over 200 km/h. These speeds were faster than our model had

predicted and concern was growing among some teams that their payloads could land in the United States.



**The Polar Jet Stream May 4th, 2017 is 10 km above Portage la Prairie (HAB data via APRS).**

A half hour later, the Shaftesbury High School HAB was at an altitude of almost 20 km (65 000 feet) and about 40 km to the southeast of the chase team. The crew had stopped at a gas station on the outskirts of Portage la Prairie to consider the speed and range problem. The HAB was now above the jet stream but it was much farther south than predicted. The team decided that an engineering experiment called the Iridium Satellite Transceiver Circuit in the Shaftesbury payload should be activated right away. Student Bryce Jenkins sent a command from his cell phone, through the Iridium satellite system, to the SHARP HAB at 12:37 to “cut” the Dacron line between the parachute and the balloon. The Iridium transceiver-Arduino circuit worked perfectly. This turned out to be the right decision. Although the Shaftesbury payload did not reach its desired 30 km altitude in a region of the atmosphere called near space, it did stay in Canada. Otherwise the Shaftesbury payload would have joined another team, landing just across the border in Minnesota. Thank you Tom Tessier (VE4TRT), president of [Solara Remote Data Delivery](#) for mentoring students Bryce Jenkins (VA4VBC) and Matthew Hewlett (VE4MRH) on this project! Tom and MAPT will encourage the guys to develop the device further.

The SHARP payload, free of the balloon, descended to Earth hanging from its parachute. It landed within a few hundred metres of a farmhouse three miles northeast of Plum Coulee, Manitoba. The farmer who owned the land, discovered the payload. Mr. Nickel happily gave it to students Bowen LeMay and Bryce Jenkins. A good discussion about the HABs and the technology in the payload was had with the Nickel family. Bryce had earlier decided to not trigger the cold smoke

dispenser in the payload, just before the landing, because the team would not be near enough to see the coloured smoke trail. Now with the payload on the ground, Bryce sent the command, through the Iridium satellite system, to trigger the smoke. Unfortunately the smoke dispenser was damaged when the payload landed and it did not start properly. All we saw was a puff of smoke from the fuse. Our new friends gave Bryce a propane torch and lots of orange smoke was quickly produced.



The Shaftesbury High School payload is recovered on the Nickel farm Near Plum Coulee. Peter Toth (VE4TTH), Winnipeg Amateur Radio Club president and RAC assistant director is third from the left. Bryce Jenkins (VA4VBC) is third from the right.

All teams had adventures which makes these science and engineering field trips really special and unique events. MAPT looks forward to the annual MB HAB Schools Symposium where students will present papers on what they learned from the May 2017 flights and relive their successes and failures and discuss plans for future flights.

### ***“The Cockroaches Did Not Survive” and Other Short Stories From Near Space***

- The jet stream encountered by the school HABs on May 4<sup>th</sup> was part of the infamous omega block which resulted in a stalled cyclone over eastern Canada. This resulted in days of rain followed by severe flooding in Gatineau and Montreal. Weather, including atmospheric circulation patterns and the jet stream are studied by Canadian science students in grade 10. School HABs built by students, return data revealing the structure of Earth’s atmosphere.
- More than 400 illegal migrants have crossed into Manitoba from the USA since January 1<sup>st</sup>. The following storey comes from Fort Richmond Collegiate (FRC) physics teacher Jennifer Piaseck (VE4JPI) whose students receive live TV from their HABs.

FRC managed to retrieve our payload. It was 3 km from Emerson and just 0.5 km north of the US border! The APRS transmitter’s battery conked out at 7000 m on the descent. We predicted the area where the payload might be and then began grid searching. We had two false alarms, where we ran

into the field but were disappointed. A school bus driving by saw us running in the field, a kid called his mom to say there were 20 black people in the field and she called the Canadian border patrol. We talked to the patrol twice before they figured out that the illegals they were looking for were us! Maybe the student on the bus was referring to FRC's black T-shirts.

As we were about to give up the search and drive home, a farmer caught up to us and said he had found our payload and had it back on the corner of his property. He had also talked to the border patrol so he knew we were driving around searching. Lots of excitement and even some crying ensued! We arrived back in Winnipeg at 7:45pm.

Quote from student; "Best field trip ever!"



**The Garden City Collegiate GopherSpace mascot (GopherSpace mascot) soars over Lake Manitoba.**

- Garden City Collegiate teachers Barbara Gajda (VE4PAZ) and Gabe Kraljevic (VE4GMK) report that their students used a device incorporating an electronic force sensor to measure the neck lift of their balloon before launch with great success. Grade 10 student Nik Riechert (VE4NJR) used sensors to measure and log UV intensity and ozone levels with an Arduino microcontroller. The GopherSpace payload carried a plasmid genetic damage experiment. Plasmids are short pieces of bacterial DNA. The DNA will now undergo gel electrophoresis at the University of Winnipeg to look for molecular fragmentation from exposure to the near space environment. GopherSpace had a CBC TV news crew follow them all day. They were featured on the Friday National News at 10PM. Thanks CBC!

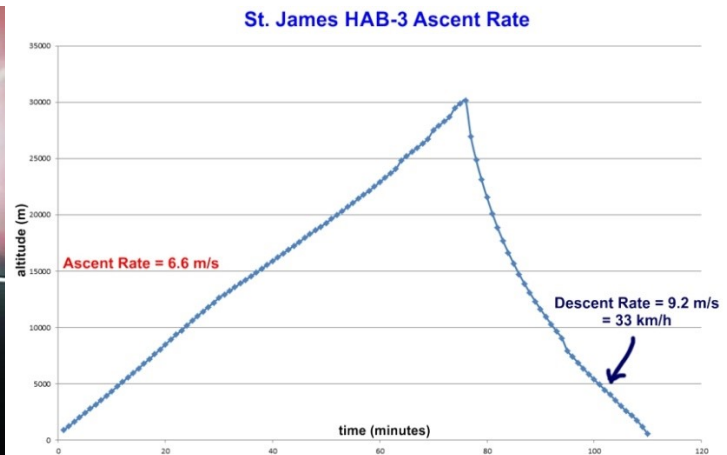


- MAPT president Heidi Werner provided the following report.

The St. James Collegiate Jimmies had a wonderful time and everything seemed to go very smoothly. Thanks to teacher Andrea Misner (VA4NGC) and the Maples Collegiate team (Maraud Air) for sharing their helium as we ran out. Our flight path was pretty much as predicted and we recovered our payload just northwest of Lowe Farm at 2:30. The cockroaches did not survive, but we are not sure if they died in nearspace or on impact. It looks like they got a bit squashed on landing as some items came loose from the velcro. We are just beginning to sort through all our footage and data, but the Jimmies reached an altitude of 30.2 km. The lowest external temperature recorded was  $-50^{\circ}\text{C}$  at 11930 m (the tropopause). The jet stream is just below the tropopause. The lowest pressure recorded was 1.3 kPa, roughly 0.01 atm, at an altitude of 99000 feet. Our radiation sensor didn't seem to work. The APRS tracking beacon and all four cameras worked great. Two cameras lasted the duration of the flight with the other two stopping just before landing. We have excellent video of the burst and all the beautiful landscape of southern Manitoba.



Left: A St. James Collegiate sunburst.



Right: Motion graphs are studied in grade 10 science and grades 11 and 12 physics.

- The highest altitude achieved this year was by a new team from West Kildonan Collegiate. The team Icarus HAB burst at 33,223 m or 109,000 feet. This Icarus flew high but landed safely.
- HC Avery Middle School reported that students and teachers had a great experience and the team is already talking about plans for next year's flight.
- River East Collegiate is another new team for 2017. Teacher Dean Hallick (VE4ADH) gives the following report.

Our team's launch and recovery was an unforgettable, positive experience. The fill went a little slow but the release was near perfect. We retrieved our payload just north of Rosenfeld, a few hundred metres from where we received our final APRS packet. We had two Möbius video cameras on board

and the footage is outstanding. We absolutely plan on launching in the future and look forward to working with everyone again.



River East Collegiate student Joshua Chornick (VE4BAZ) waits by the parachute for the rest of his team.

## Many Thanks!

- Thank you Langruth Elementary school principal Tim Klein for hosting our group. We hope your students enjoyed watching the high altitude balloon launches. Coincidentally, Langruth Elementary held their annual science fair the next day. Perfect timing! Flight is a unit of study in grade 6 science classes. Thank you to all the school administrators for supporting our STEM projects by releasing staff and students for the day. Thank you to the parents and drivers who made the day possible.
- Thanks to all the farmers across Manitoba (and now Minnesota) who keep finding and returning our payloads.
- Thank you to our local hams for their equipment donations, the Winnipeg Amateur Radio Club (WARC) for providing our students with amateur radio classes, the University of Manitoba Amateur Radio Society (UMARS) for providing Arduino workshops and tracking help on flight days, the radio amateurs in Manitoba and North Dakota who provide the APRS infrastructure that allows real time HAB tracking and provides our students with much useful data to study and finally, thank you Radio Amateurs of Canada for the community grants and scholarships and bursaries which continue to help our science and engineering minded students.

With the support of RAC and the amateur radio community, the Manitoba Association of Physics Teachers will grow the Manitoba schools HAB project and work to develop a for-credit Science, Technology, Engineering and Mathematics (STEM) program centred on amateur radio, electronics, science and aerospace that will excite and inspire the next generation of Canadian engineers and scientists.

Rob Striemer (VE4SHS)

[Manitoba Association of Physics Teachers](#)