

SHAFTESBURY ROBOT REACHES THE STRATOSPHERE

November 5th: Flight Approved

A Special Flight Operations Certificate was granted by the Minister of Transport for the flight of a “Large Unmanned High Altitude Balloon” on Tuesday, November 5th around 3 PM. SHARP 3.1 would finally get its chance to fly. SHARP team members received the highly anticipated news just before the 3:30 bell. Final packing-up for the trip to the launch site was completed by 6 PM.

November 6th: A Launch Site in Treherne

At 7 AM on Wednesday, November 6th, the SHARP high altitude balloon (HAB) launch team assembled in Shaftesbury’s satellite tracking station. There were 28 students and 7 adults in all. The cars were loaded and at 8 AM we were on the road headed to Treherne via highway 2. Treherne was selected after running many flight simulations. Based on the predicted winds aloft and balloon ascent and descent rates, a launch from Treherne was expected to produce a landing on the flood plain south of Winnipeg; our preferred landing area.

We arrived at Treherne Collegiate Institute at 9:30 and the students immediately started to set up on the track infield behind the school. By 10 AM our experienced team was filling the 190 cubic foot balloon with helium from a large cylinder of compressed gas. SHARP had been given use of one of Treherne Collegiate’s science labs for the morning. Shaftesbury students quickly set up shop in the lab and they began to check the four cameras and ready their science and engineering experiments.

Outside, the radio controlled (RC) aircraft group took the plane up for a final flight check. The plane would hitch a ride to about 500 feet then drop away and fly back to the launch site. SHARP’s radio amateurs completed their radio checks. Students and adults started taking photos and video of the team preparing for the launch. By 11:30 the balloon was filled. In fact it was slightly over-filled as its measured lift was too great for the desired ascent rate of 1000 feet per minute. The launch crew vented helium for about 5 minutes to bring the lift down to the desired amount.



3.1 Ready for Launch

As the noon launch time approached, students began to turn on video recording and experiment data logging equipment including the very important Arduino data logger and sensors for temperature, luminosity, pressure/altitude, acceleration, magnetic field and radiation. The students stacked the imaging, science and communications modules together to form a single octagon shaped payload. The APRS tracking beacon was turned on and checked using the mobile amateur radio system in a chase car.

Lift Off and the First Sign of Trouble

By 11:50 the balloon and the payload and the attached RC aircraft was fully assembled. Parachute lines were connected to swivel hooks at the top of the payload. The balloon, parachute and payload including the RC aircraft were allowed to rise slowly from the ground using a control line that ran from a cinder block on the ground, to the balloon and back down to the students who would launch the HAB. A ten second count-down began as 12 PM

approached. At precisely 12:00:00 the control line was cut and SHARP 3.1 left the Earth as per flight plan. It was a textbook launch.

Shortly afterwards the small RC aircraft was to be automatically released from the payload by a well tested Arduino/GPS cutdown circuit. However, after one minute, it was clear that the auto-release had failed and that the RC would likely continue up with the payload to a considerable height – probably as high as the programmed payload cut-down altitude of 36.9 km. Just as the balloon reached cloud height, Brandon Dennis, our RC pilot, attempted to use the engine to shake the plane lose but without effect. It's possible that the GPS sensor lost satellite lock when the circuit was sealed into the payload box.

Despite this glitch the team was in very good spirits. We assembled for some traditional post-launch photos including “the point” photo where the team points upwards at the balloon as it heads for outer space. We also got some photos with our new friends from Treherne Collegiate and Treherne Elementary.



The SHARP 3.1 Point

Chasing the High Altitude Balloon

Packing up was completed in a hurry. The position of the balloon was checked using the chase car's GPS navigator and by now students and teachers with smartphones were seeing SHARP 3.1 live on the internet at <http://aprs.fi>. The balloon was moving due east as predicted.

The team decided to retrace our route back towards Winnipeg on Highway 2 to Elm Creek where we would stop and reevaluate. By 1 PM we were in Elm Creek. According to the APRS tracking information, the balloon should be almost directly above us and sure enough, after exiting the cars we were able to see the balloon far above the clouds at a height of about 60,000 feet. As we had caught up to the balloon and it would be about an hour before it started back down to earth, we decided to have lunch.

By 2 PM we were back on the road headed south for Carmen on highway 13. Just before arriving in Carmen, we realized that the APRS beacon was no longer transmitting. We had a similar problem on SHARP 2 in 2011. After the balloon burst, the APRS beacon stopped transmitting position and altitude. We believed that the explosion of the SHARP 2 balloon or the chaotic descent through the near vacuum of the stratosphere had knocked the transmitter offline. Contact was lost for 19 minutes. This could be a repeat of that SHARP 2 experience. Many questions arose. Had the balloon burst? If so why did it burst over a kilometer lower than anticipated? Would the very important tracking radio return to life before the payload reached the ground? If the APRS beacon didn't restart, the job of finding our payload would become much more difficult.



The Unexpected Burst at 35.8 km

We continued to drive to the last reported position. In Carmen we turned east on highway 3. About 20 minutes after losing contact, the beacon started transmitting packets again and we now felt confident that we would recover the payload soon. Excitement began to build as the

payload descended and we closed in. Soon the altitude data showed that the payload was no longer descending. At 2:32 PM, SHARP 3.1 was back on the ground at almost the exact time and place predicted. The ground now blocked the radio signal from the APRS transmitter in the payload so there would be no more position reports until the chase team was within line-of-sight of the payload.

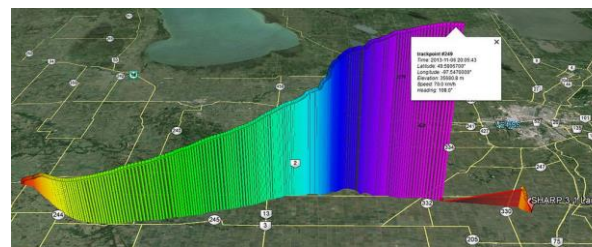
At Sperling the chase team left highway 2 and continued east on a gravel road (205). After reaching Rosenort we were back on pavement for a bit before turning north on a gravel road (330) for 5 miles. Then we turned east again on a section road. After travelling about 3 miles, we again picked up the SHARP 3.1 beacon with the mobile radio in the chase car. The GPS navigator indicated that the payload was directly north and less than a mile away.



Solo Flight

We continued however for another two miles east to link up with the lead vehicle. Then we turned north for a mile then west for two miles. We were in direct radio contact with the payload and getting very close. Finally we turned south scanning the fields ahead. In less than a minute we saw the payload and parachute against the black Red River valley topsoil. We stopped the cars and got out. Students immediately ran to be the first to reach the payload. It wasn't until then that most of us realized that three chase cars were missing. As it turned out, they had stopped in Rosenort. The chase team had split into two groups.

Getting everyone back together at the landing site would be difficult now and time consuming. We decided to do a quick inspection of the payload and take some photos. Everything looked good but there was no sign of the radio controlled aircraft that had been attached to the payload. It had dropped away at some point during the flight. Maybe the video would tell the story (it does). In all likelihood the little airplane is still within a couple of miles of the payload landing site. The school's phone number is written on the fuselage.



The SHARP 3.1 Flight Path

We left the farm and proceeded to highway 75 to link up with the other chase cars at St. Agathe. By 4 PM we were back in Winnipeg. As with previous SHARP HAB flights; it had been a busy day and a wonderful climax to more than a year of hard work. For our grade nine students, it must have been an exciting introduction to the Shaftesbury High Altitude Robotics Project.

Data Analysis and the Manitoba Schools Science Symposium (MSSS)

Now that the flight is over, students are examining the videos and processing the data. Work on SHARP 3.1 will continue for months. Some of our students will enter their work in the provincial science fair known as M-triple-S in the spring of 2014. Some students will likely be asked to do presentations on the SHARP 3.1 mission. All of us will be preoccupied by the many small triumphs and setbacks as well as the possibilities for the next high altitude balloon flight.

For more information and pictures please visit the SHARP web site at <http://shsballoonproject.pbworks.com> and click the SHARP 3.1 link in the side bar.

73

Mr. Striemer