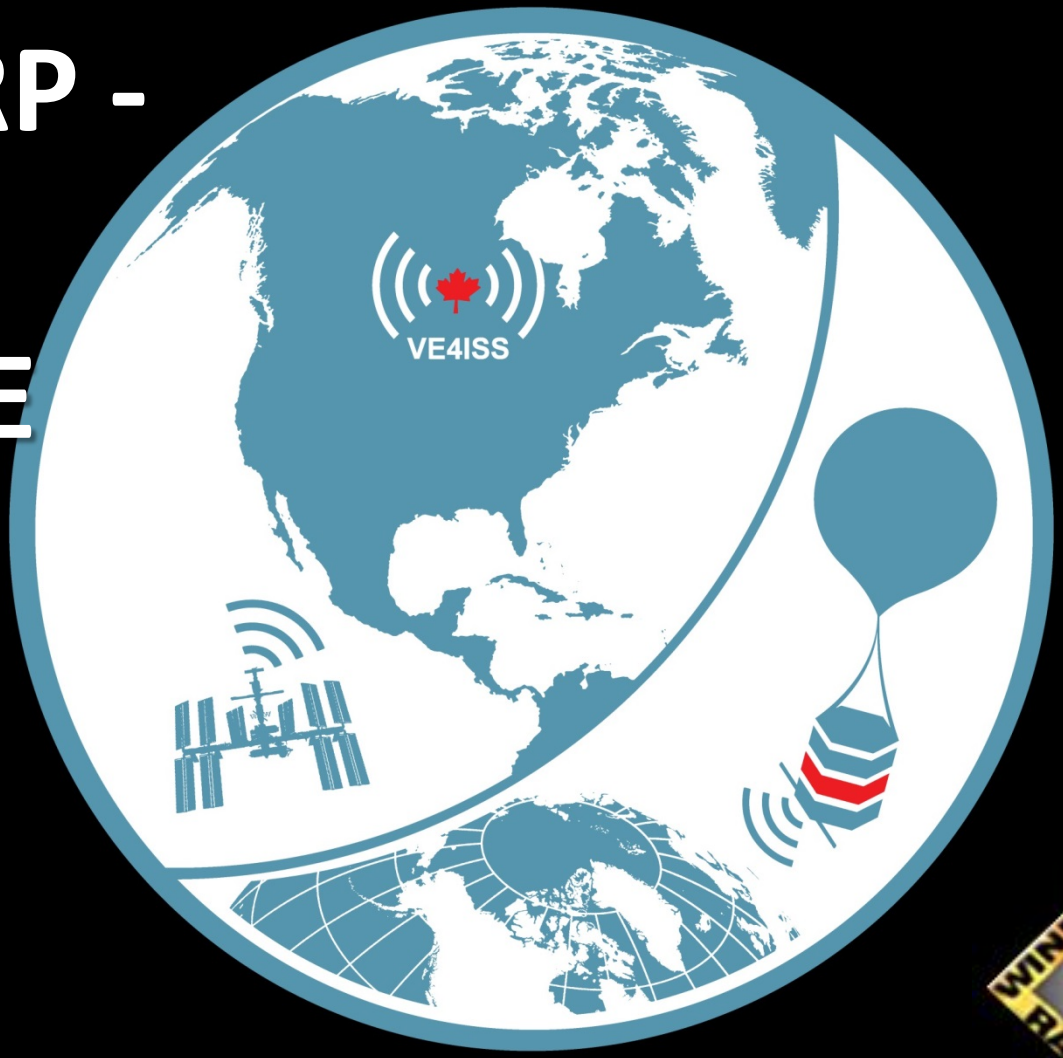
A SHARP - SATS UPDATE



SATS || SHARP

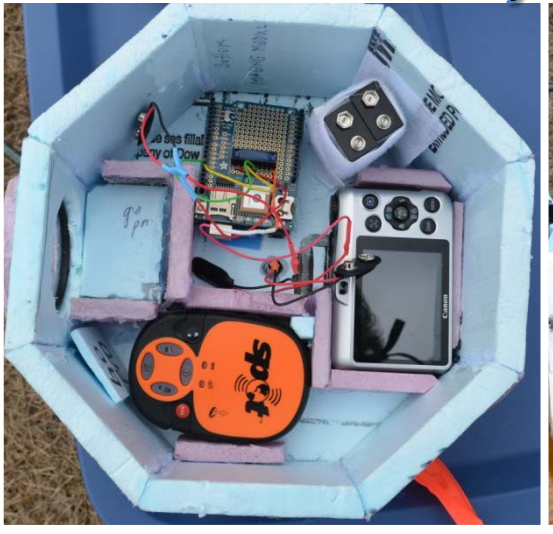
rstriemer@pembinatrails.ca
VE4SHS

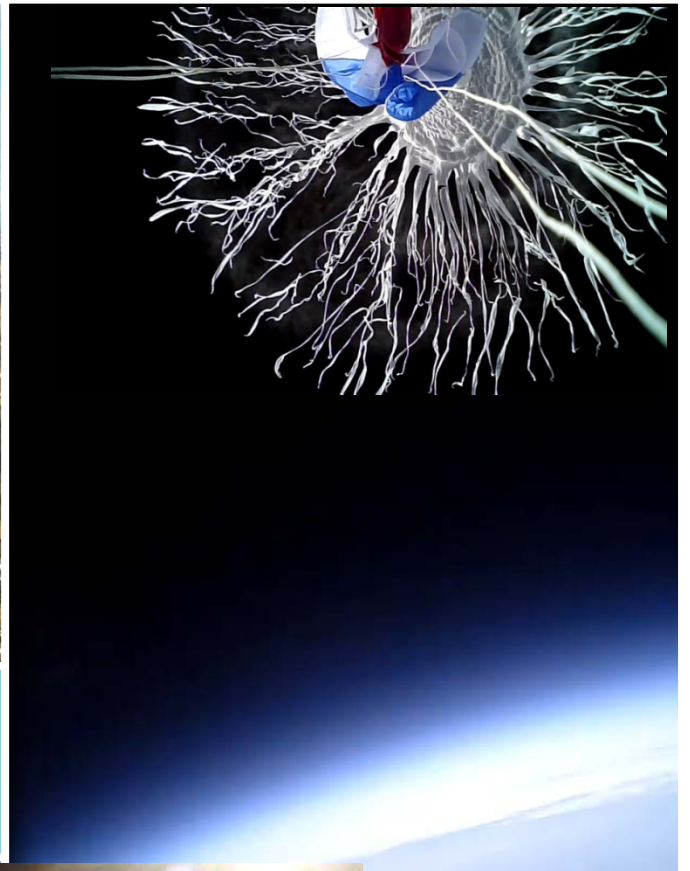
SHAFTESBURY HIGH SCHOOL
VE4ISS

adeakin@pembinatrails.ca
VA4AMD

S.H.A.R.P.

Shaftesbury High Altitude Robotics Project





Payload Photos & Videos

SHARP HAB Missions

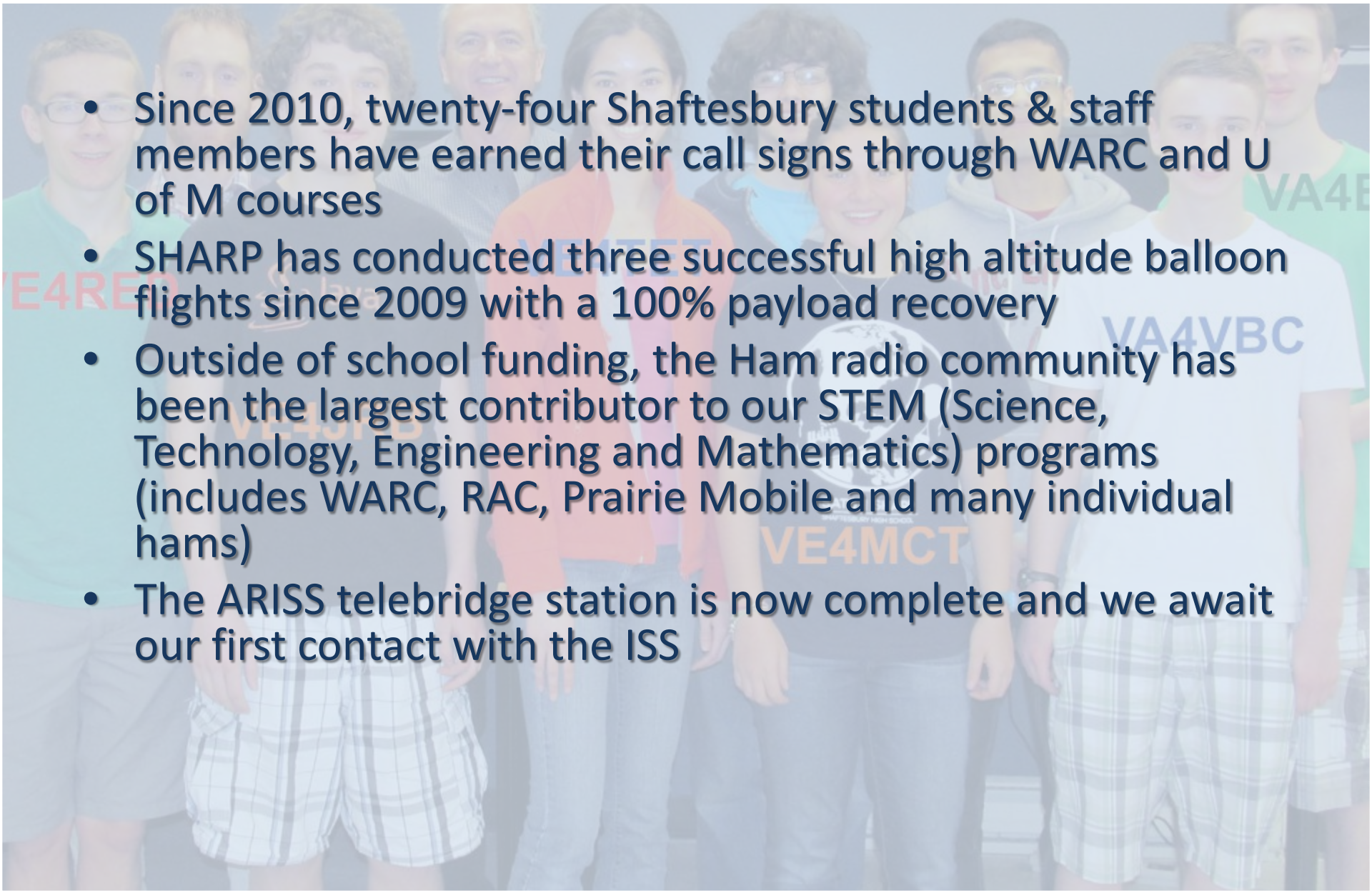
SHARP Mission	Balloon Mass	Apogee (feet)	Mission Objectives
SHARP1 10.22.2010	1500 g	107,000	Capture digital video containing curvature of the earth
SHARP2 10.28.2011	3000 g	127,000	Set altitude record, capture photos & HD video, collect radiation, temperature data, examine effects of radiation on seeds & chemicals
SHARP3.1 11.03.2013	3000 g	117,000	Improve launch procedures & quality of photo & video data collected, test Arduino sketches, log a broad range of atmospheric & telemetric data, conduct scientific investigations, incorporate an R/C aircraft drop

http://shsballoonproject.pbworks.com

SATS

Shaftesbury ARISS Telebridge Service

SHARP || SATS & Amateur Radio



- Since 2010, twenty-four Shaftesbury students & staff members have earned their call signs through WARC and U of M courses
- SHARP has conducted three successful high altitude balloon flights since 2009 with a 100% payload recovery
- Outside of school funding, the Ham radio community has been the largest contributor to our STEM (Science, Technology, Engineering and Mathematics) programs (includes WARC, RAC, Prairie Mobile and many individual hams)
- The ARISS telebridge station is now complete and we await our first contact with the ISS

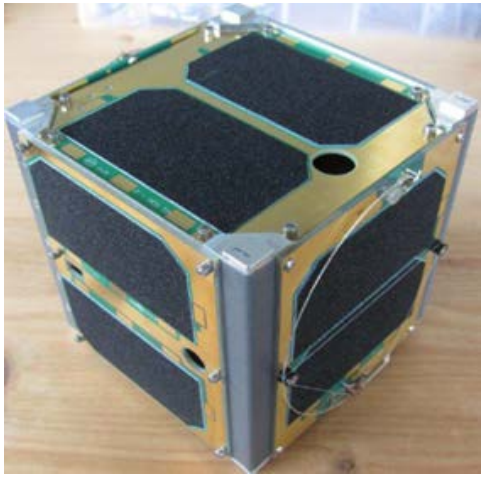
VE4ISS: Completed August 2104

VE4ISS Equipment

ARISS Primary Antennas		
	22-Element CP 2m Yagi Specs	42-Element CP 70cm Yagi Specs
Model	2MCP22	436CP42UG
Frequency Range	144 to 148 MHz	430 to 438 MHz
Gain	14.39 dBic	18.9 dBic
Front to Back	25 dB Typical	25 dB Typical
Elipticity	> 3 dB	1.5 dB Typical
Beam Width	38°	21° Circular
Feed Type	Folded Dipole	Folded Dipole
Feed Impedance	50 Ohms Unbalanced	50 Ohms Unbalanced
Max VSWR	1.4:1	1.5:1

ARISS Secondary Antennas	Rotors/Cables	Radios & Additional Antennas
• 2 Gulf Alfa Dual Band 2m/70cm satellite yagis (phased for 2m & 70cm) • RF HamDesign HamTV 1.5m dish (Kuehne LNB downconverter)	• RF HamDesign 1x Spid RAS HR, MD-01 controller • RF HamDesign 1x Spid Big RAS HR, MD-01 controller • All LMR400/600 cables to station	• Kenwood TS-2000 & TS-2000X (1° & 2° radios) • Kenwood TM-D710A Mobile • Yaesu FT-8100 • Diamond 2m/70cm vertical • 2m Tape Measure Yagi • 2x ICOM V80 Handheld • 2x Baofeng UV5R Handheld

Software		TNC
• SatPC32 • Nova for Windows • Orbitron	• UISS • DireWolf • FL-digi / FL-digi HAB	• 2 Signalink USB • 2x Kenwood PC-1A Phonepatch



AMSAT & ARISS

October 2014 - VA4AMD and VE4SHS are presenters on SHARP & SATS STEM projects at AMSAT Symposium in Baltimore.

We meet many members of the ARISS operations team.

OSCAR 1 (Orbiting Satellite Carrying Amateur Radio 1) was the first radio amateur satellite launched January 1, 1962.

German astronaut Alexander Gerst KF5ONO, conducted an ARISS contact with students of the Indianapolis Area School District, Pennsylvania via the ARISS telebridge station in Italy, IK1SLD. Bryce, VA4VMC represented the Shaftesbury telebridge, VE4ISS.

VE4ISS Mission Statements

- To provide students access to and to promote the hobby of amateur radio
- To educate and train student amateur radio operators so that they may make satellite contacts and facilitate ARISS school contacts worldwide
- To build and strengthen relationships with members of the amateur radio and satellite tracking communities (we need your help and expertise)
- To provide a centre for excellence in STEM (Science, Technology, Engineering & Mathematics) education

Our Fantastic Supporters

A High Altitude Partnership

Shaftesbury High School
Winnipeg, Manitoba, Canada

WHARP – **W**innipeg **H**igh **A**ltitude **R**epeater **P**roject

WARC builds the Repeater System and Promotes the Flight.
SHARP helps integrate the payload, launches and retrieves the HAB payload.

Manitoba Repeater Society

AMATEUR RADIO EMERGENCY SERVICE RAC

SATS || SHARP
SHAFTESBURY HIGH SCHOOL

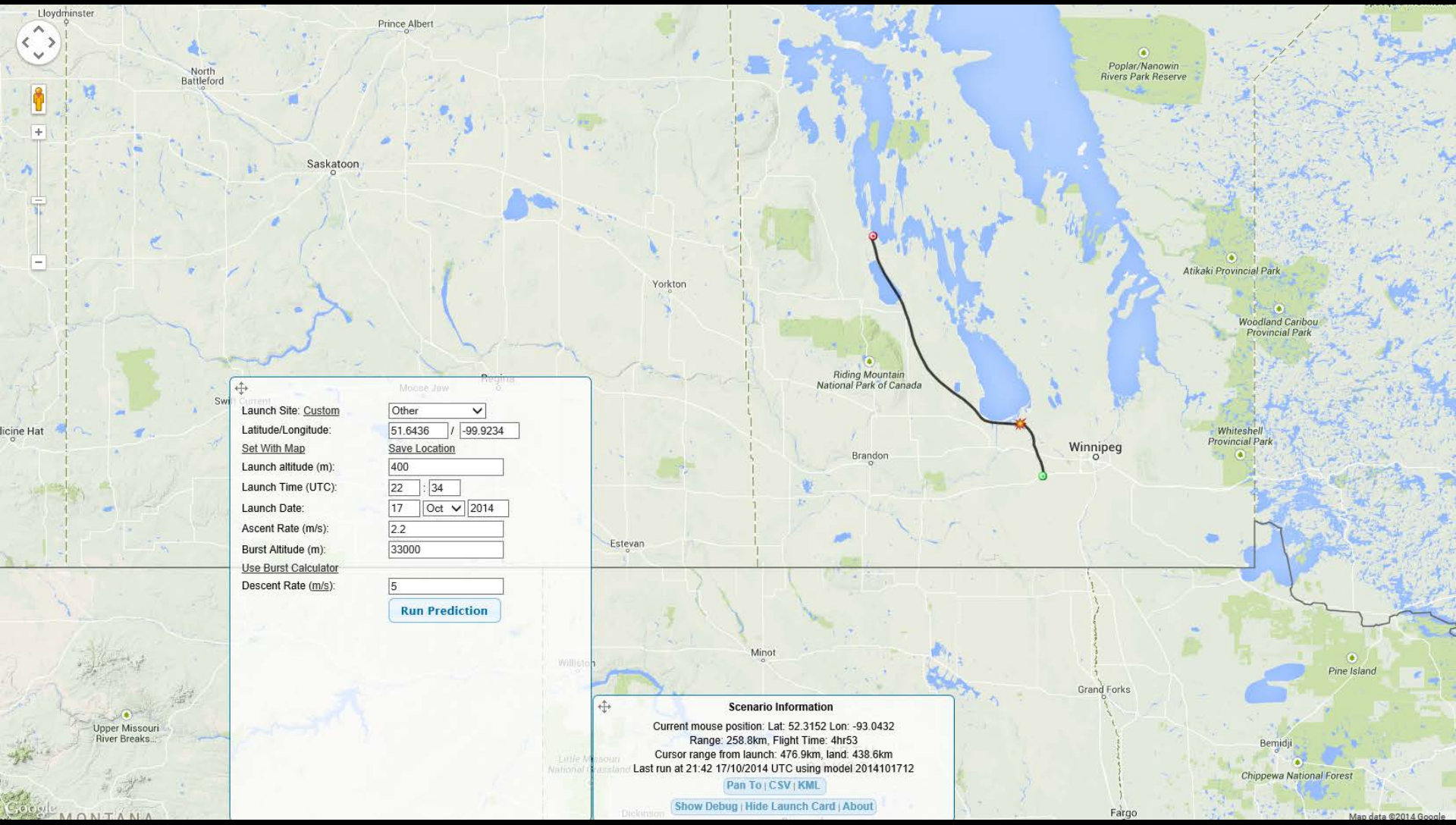
http://shsballoonproject.pbworks.com
VE4ISS

Context: BEAR - Balloon Experiments with *Amateur Radio*

BEAR-2 (Alberta hams fly a repeater)

- The balloon was launched from Sherwood Park, Alberta, on August 5, 2000.
- It reached 30,322 meters (99,481 feet).
- The payload contained a highly modified Icom IC-24AT handheld configured for crossband repeating.
- The radio was configured to receive on 446.100 MHz in the UHF band, and repeat the audio automatically on 146.520 MHz in the VHF band.
- Contacts were made with stations from Cold Lake, AB to Swift Current, SK as well as numerous contacts in the Edmonton, Red Deer, Calgary corridor in Alberta.

Example WHARP Flight Path



Manitoba Association of Physics Teachers

Manitoba Repeater Society

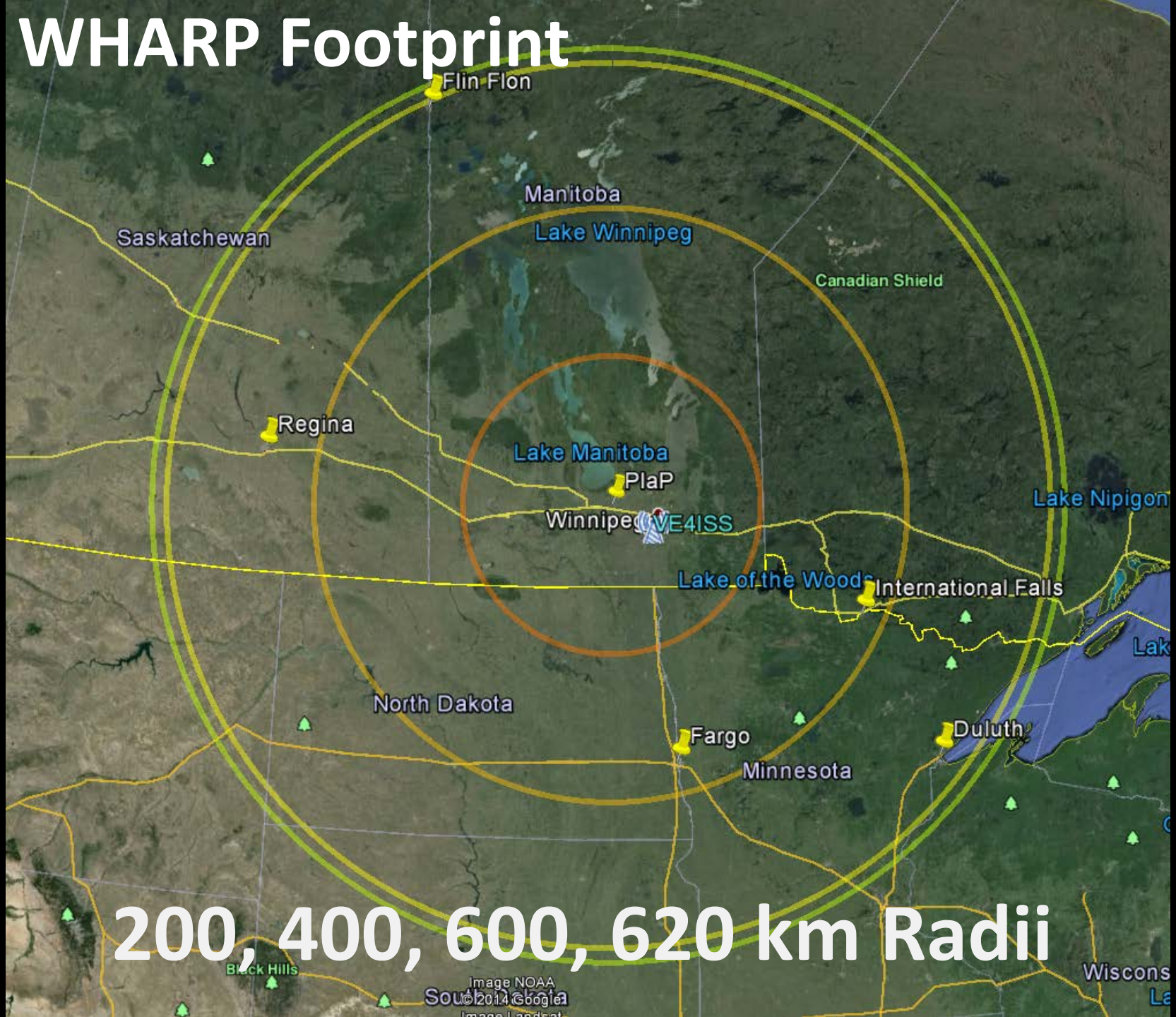
COMMUNICATIONS RANGE vs. PAYLOAD ALTITUDE and DISTANCE - Ralph Wallio, WØRPK

Distance [miles] = 1.23 * SQRT(Altitude [feet])

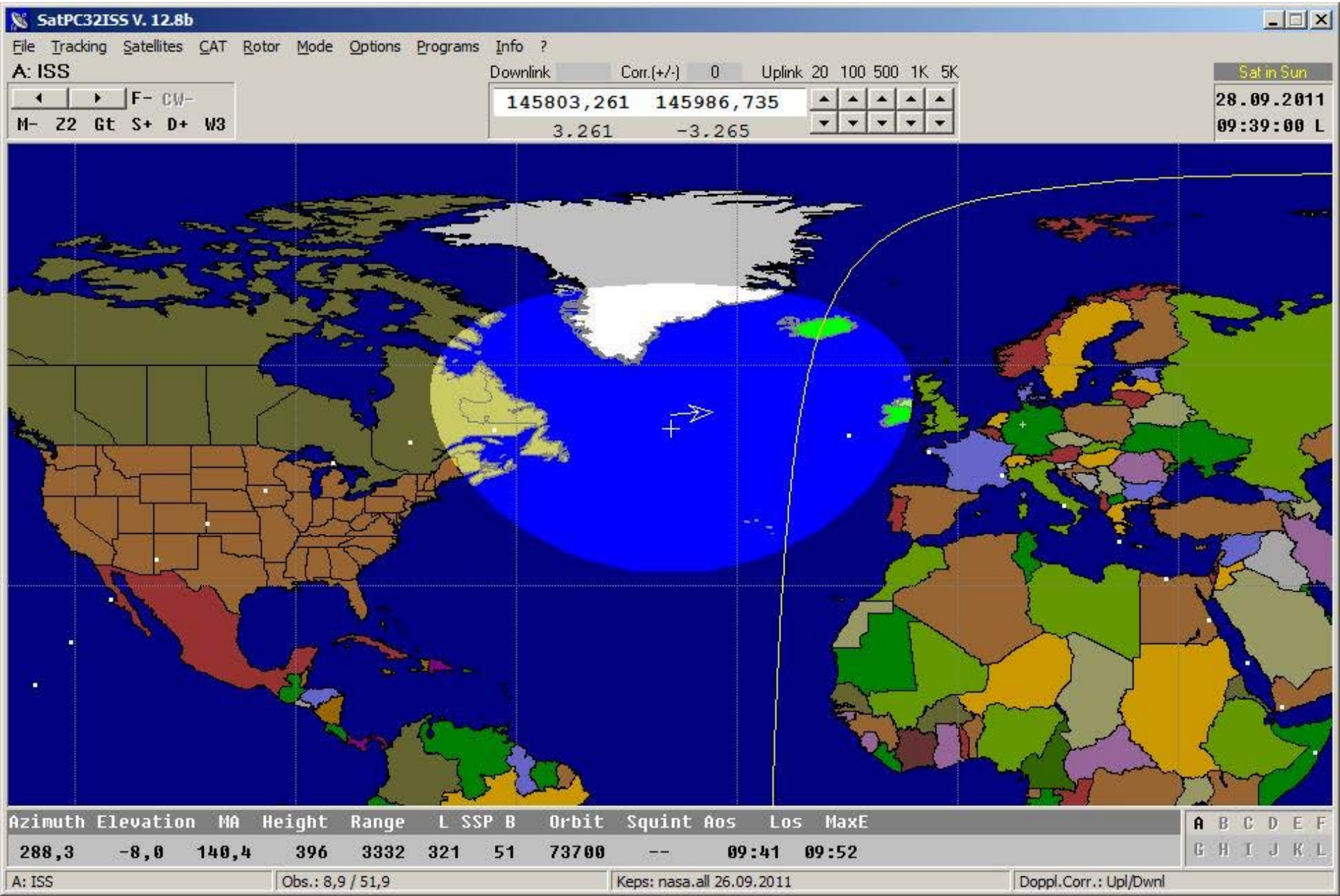
39 miles at 1,000ft
123 miles at 10,000ft
389 miles at 100,000ft

ALTITUDE [feet]	DISTANCE [miles]	[km]
20,000	174mi	280km
40,000	246mi	396km
60,000	301mi	484km
80,000	348mi	560km
90,000	369mi	594km
100,000	389mi	626km

As a high altitude balloon/payload gradually ascends,
its horizon gradually extends in all directions.
This increasing distance to the horizon
defines the payload's line-of-sight VHF/UHF
radio communication footprint.
A ground station within this footprint
will perceive the payload to be above
its horizon and radio communication is possible.


WHARP Footprint
Flin Flon
Manitoba
Lake Winnipeg
Saskatchewan
Canadian Shield
Regina
Lake Manitoba
PlaP
Winnipeg
VE4ISS
Lake Nipigon
Lake of the Woods
International Falls
North Dakota
Fargo
Duluth
Minnesota
200, 400, 600, 620 km Radii
Black Hills
Image NOAA
© 2014 Google

The ISS Radio Footprint is over 4000 km



BEAR-2 (August 2000)

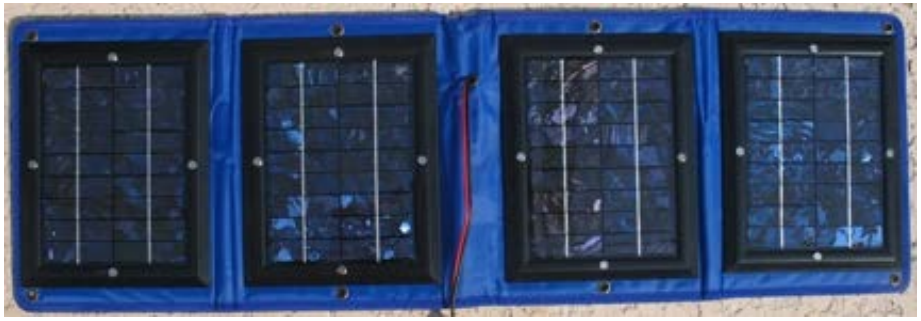
- Duration: only 2h 48’
- Max. Altitude: 99,481 feet
- Balloon Size: 1200 grams
- Total Payload: 1.564 kg, 3.45 lbs
- Distance Travelled: 120 km

Proposed WHARP (April 2015)

- Duration: 4h – 5h
- Max. Altitude: 105,000 feet, 33 km
- Balloon Size: 1500 grams
- Total Payload: 1.5 kg, 3.3 lbs
- Distance Travelled: 200 – 300 km

Many Questions…

Transceiver Frequencies, Antenna, Power, Tracking, and Internal Temperature Limitations, etc. Will Determine Payload Design



- Rugged folding 10.4W solar panel.
- 18 to 20VDC open circuit voltage. Current 0.75A. Cigarette socket connector.
- 10.25" X 7.5" folded; 10.25" X 32" unfolded.
- 1 pound 15 oz weight. Eyelets at each corner and at panel middle to allow mounting or suspension with rope or bungee cords. Very durable and rugged. Ripstop blue nylon enclosure. Take this panel anywhere. No glass. $189.95

The world record altitude for a amateur radio repeater is held by CNSP-10 which reached 136,545 feet, or 25.86 miles, AGL on Oct. 23, 2011.

The SHARP || SATS MISSION

To challenge students to design, construct, test and fly, high altitude robots **using amateur radio for communications** and carrying scientific payloads, so that students may explore their potential. (STEM teaching – Science, Technology, Engineering and Mathematics).

The SHARP VISION

'Surely the sky lies open, let us go that way'

the words of Daedalus in Ovid's Metamorphoses

Amateur Radio & 21st Century Education