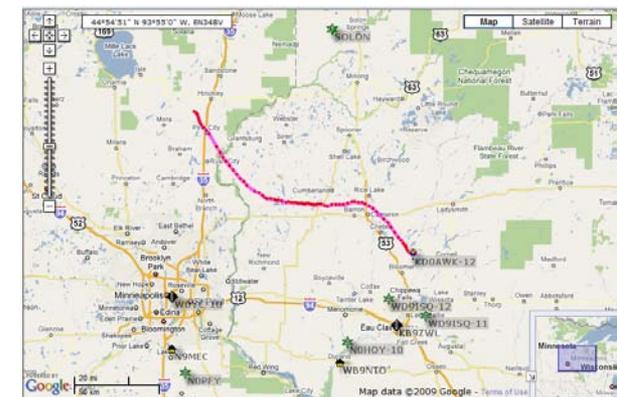




# MN Space Grant Consortium Middle School High-Altitude Ballooning Initiative “MSHABI”



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# MnSGC High-Altitude Ballooning

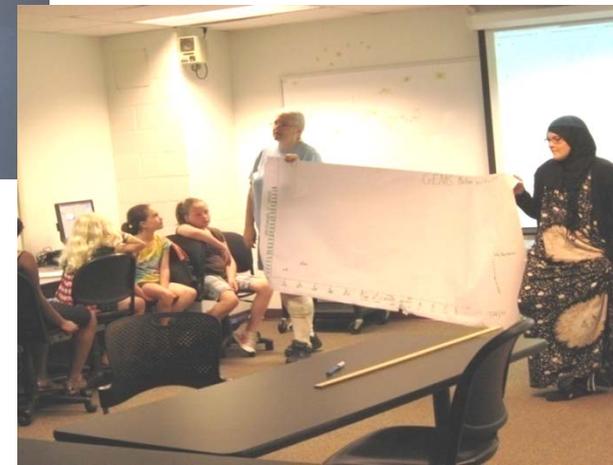
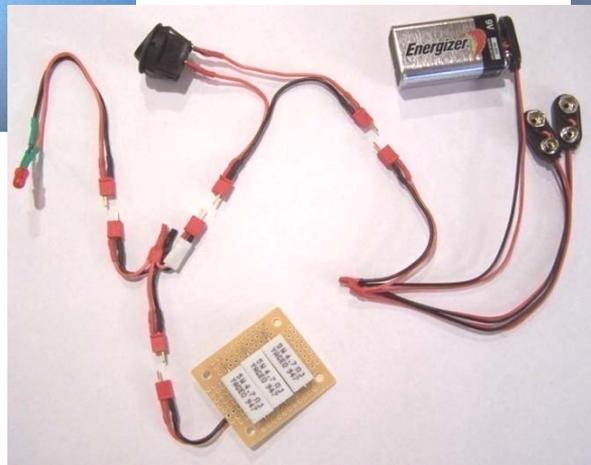
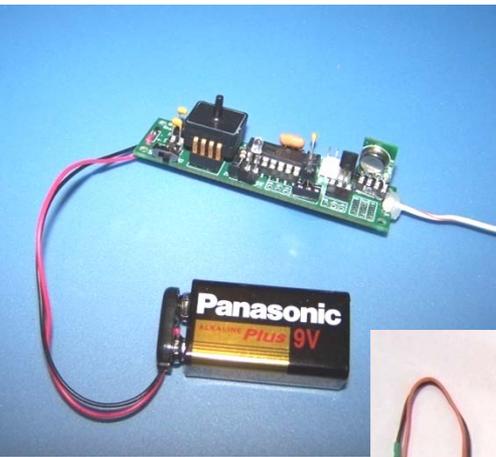
- Professor Bill Garrard and a few students (before my time)
- CO Space Grant ballooning workshop in the summer of 2006
- Summer ballooning teams since 2007 – over 40 launches so far!
- 2 Great Plains Super Launches, 2 Taylor University ballooning workshops, several ballooning conferences
- Annual freshman seminar since fall 2008
- We have inspired ballooning activity at 3 colleges (including a non-MnSGC college) and at 2 ham radio clubs; occasional payloads with local schools 😊

# The Middle School Initiative MSHABI

- Not 100% novel but our implementation has some unique features.
- Partly in response to recent RFP requests to ***“Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines.”***
- Raised some outside funding from the Pentair Foundation
- “Warm-up” workshop at White Earth Native American reservation.
- Engaged teachers from 12 mostly-middle schools in a 4-day teacher workshop with a flight and ~\$500 give-away equipment for one basic payload per school.
- Generated basic curriculum; attendees generated more to share.
- Unique implementation at the different schools.
- Teacher-led payload-build during 2010-2011; flights in May 2011.
- Teacher-led payload-build during 2011-2012; flights in 2012. 😊

# Some curricular items developed for MSHABI

- “Snap-together Anasondes” – Morse-code radios, weather sensors
- “Snap-together heaters” – learn about circuits without soldering
- “Mock boxes” – work on payload space utilization in 3-D
- “Command Center” curriculum and live video and data streaming – options for schools who elect not to send their students out to the launch (long drive) 😊



# White Earth “warm-up” workshop

- Worked with 50 students, grades 4 to 8, at White Earth reservation
- We were the kick-off 3.5-day event for the summer’s Reach for the Sky Science and Math Academy (3 weeks long)
- Snap-together Anasondes, mock boxes, snap-together heaters
- Built 8 basic payloads (with adult help)
- All students attended the launch (no remote command center)
- The ballooning team (only) did the chase/recovery and data downloading with preliminary data analysis
- Students went on to make science-fair-type posters to display for their community as their culminating activity
- Significant enthusiasm and learning gains from this activity, even among the youngest students (not yet in middle school) 😊

# Some photos from the White Earth workshop



# Middle School Teacher workshop

- 4-day teacher-only workshop, 14 teachers from 8 middle schools (plus 1 middle/high school) from the Twin Cities area – (Aside: added 3 more schools later with a “crash course”)
- Snap-together Anasondes, mock boxes, snap-together heaters, soldered heaters (exposure to soldering), programming of HOBOS and BSE flight computers
- Built 4 basic payloads (intentionally went through “flat-sat” stage)
- Also GPS tracking, flight predictions, remote command center
- Teachers attended the launch and the chase/recovery (to better understand what their students might miss) and did data analysis
- Discussed curriculum, standards-alignment, and implementation
- Each school got to keep their basic payload equipment, worth about \$500, to start payload-building with their own students
- Student mentors from the ballooning team were assigned to each school, to visit occasionally and/or answer questions remotely 😊

# List of participating schools and teachers

- Field Community School, Minneapolis – one girls team, one boys team, (Mary Hill, Mary Trandem, Dan Christiansen)
- Battle Creek Middle School, St. Paul (Sue Fournea, Jared Wenisch)
- Farnsworth Aerospace Magnet School, St. Paul (Polly Norrie)
- Stillwater Middle School, Stillwater (Jane Christopher, Tom Sabo)
- Columbia Heights Middle School, Columbia Heights (Angel Brown, Emily Christianson)
- Hastings Middle School, Hastings (Tom Wesner)
- South View Middle School, Edina (Peter Grimm – also served as master teacher)
- St. Anthony Village Middle/High School, St. Anthony Village (Paul Lulai, Kari Bodurtha)
- Calvin Christian Middle School, Edina (Susan Koppendrayer)
- Shakopee Junior High School, Shakopee (T.J. Hendrickson)
- Metcalf Junior High School, Burnsville (Sue Borne) 😊

# Payload components given to each school

- 1 resistive heater (snap-together or permanently-soldered)
- 1 HOBO data logger (plus software and programming cable) with 2 thermometers and 1 solar panel
- 1 BSE (BalloonSat Easy – Verhage design) flight computer and weather station (plus software and programming cable)
- 1 camera (either a Flip video camera or a programmable Canon digital still camera)
- Payload shell material for a new box (either styrofoam or foamcore and polyethylene insulation)
- Miscellaneous construction materials: zip ties, key rings, etc...

Also gave out door prizes (i.e. not every school got one):

- HOBO 3-axis accelerometers (with optical reader cable)
- RM-60 Geiger counters with BSM (BalloonSat Mini – Verhage design) flight computer 😊

# Some photos from the teacher workshop

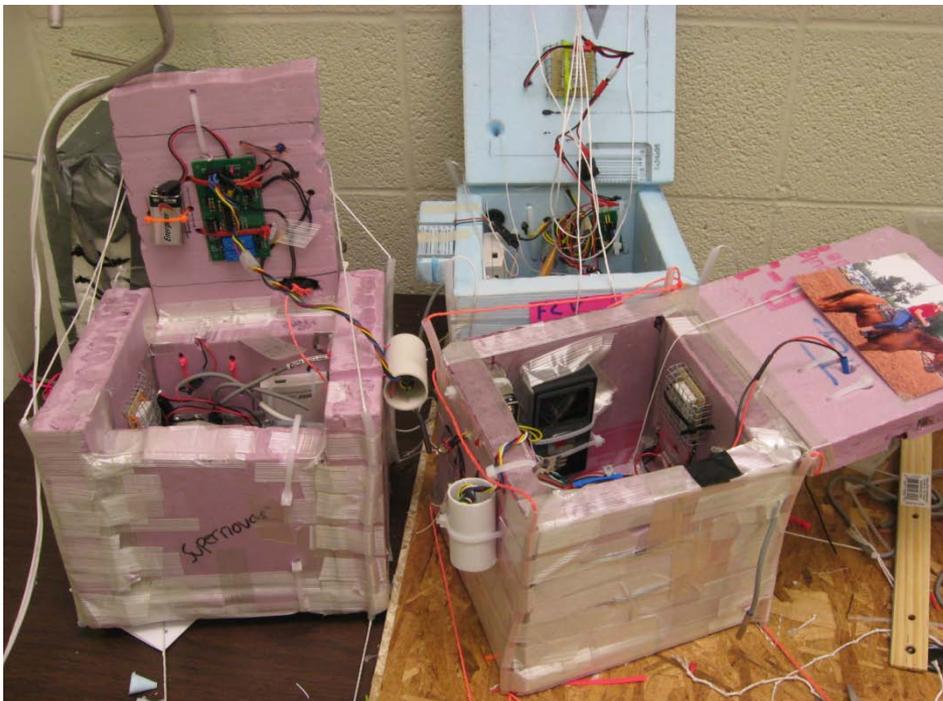


# “Year 1” implementation and flights

- All but one of the schools built a payload for our Year 1 flight
- Some schools (Columbia Heights, Burnsville, Calvin Christian, Shakopee) **engaged all students in specific classes** with activities like designing and building mock boxes, then had just a small group of students build the actual flight unit
- The other schools (Stillwater, Field (2 teams), Farnsworth, Hastings, South View, Battle Creek) **only engaged certain students**, often in an after-school club setting
- Some schools (Field, Columbia Heights, Burnsville, Shakopee, Calvin Christian) **organized their activities around a curricular theme**: layers of the atmosphere, history/space race, business, engineering design cycle, science fair projects
- Several schools (Field, Calvin Christian, Burnsville, Battle Creek) **added their own creative (low-cost) experiments to the basic box**: survivability/ behavior of materials (food, agar plates, expansion of marshmallow, exploding bag of chips, bread mold, seeds (radiation exposure)), alternative (smaller) video cameras 😊



# Some of the Year 1 completed payloads



Calvin Christian, South View, and Stillwater



Field collaborative boys/girls payload

# Some Year 1 flight day photos



# Video Clip Intermission

# Some “Year 1” feedback

- About 100 students heavily involved and over 200 more moderately involved in payload-building, flight tracking, and data analysis and data interpretation.
- Student and teacher positive STEM learning and attitude gains
- Also beneficial to ballooning team; had to teach others and be very organized when dealing simultaneous payloads.
- Teacher Quote: I was especially impressed with the graphic tables that showed the raw data from radiation, altitude and temperature at the various heights.
- Student Quote: It was a fun experience getting to build the payload and connecting with other students.
- Teacher Quote: That’s amazing! We never did anything like this when I was in school.
- Student Quote: This is so cool!
- Teacher Quote: Many students not involved in this project (also) became excited about the results. Students (who were) involved were so excited that they talked with others about the project. We even had the superintendent come to my classroom to see what we built. 😊

# Modifications/expectations for “Year 2”

- Start earlier – get data to schools more in advance of the summer
- Do more with ballooning team mentors; in-person and Skype Use of more of our curriculum and “lend units” such as classroom sets of snap-together heaters
- More sharing of teachers’ curriculum and best practice ideas
- Teachers are more confident – expect they will be more creative, involve more students, and/or involve additional colleagues
- Advise teachers wanting to continue ballooning activities 😊

# Recap of some of the main challenges

- Hard to get lots of students involved, but cannot claim to meet standards for all if you don't, when you are limited to just one payload and one flight per year per school.
- Balloning takes time, effort, and money.
- Having students not go out to the launch is a genuine let-down, especially when real-time streaming has issues.
- Working with this many schools simultaneously puts a big strain on balloon team students.
- Got Year 1 flight data back to the teachers too close to summer.
- Teacher curriculum hasn't always been very transferable.
- None of these teachers/schools are close to being able to do their own launches (yet), though we will support them if they want to learn how to do that. **Having a local (or remote) balloon-launch provider (for hire?) would be very useful.** 😊

# Other programs inspired by MSHABI (so far)

- Ballooning unit in Minneapolis summer school GEMS/GISE program with about 200 kids – summer 2011
- Several successful SOI mini-grants to MSHABI-participating teachers
- MN Teacher of the Year, Sue Fourniea, spent prize on ballooning
- BSU and UMM may offer teacher workshops on ballooning soon
- High-altitude ballooning module for teachers from Native American schools next summer, as part of an IGCCE (Innovations in Global Climate Change Education) grant with Gillian Roehrig 😊



# Acknowledgements

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- U of MN professors Stephan Carlson and Gillian Roehrig – Reach for the Sky Science and Math Academy
- Peter Grimm – master teacher for the teacher workshop
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