High Altitude Balloon Science

Some Proposals / Ideas
Ideas for HAB Science

• Get people thinking of science that can be done from a High Altitude Balloon platform
• Various Categories
  – Biology
  – Physics
  – Earth Science
  – Aeronautics
  – Materials Science
  – Equipment Development
  – Amateur Radio
Ideas for HAB Science

• Biology
  – Living Stuff at Altitude?
    • Expose nutrient Agar plates to atmosphere at various altitudes,
    • Grow plate in incubator on return
    • see what kinds of mold / bacteria exist at various altitudes
  – Effect of high altitude on Seedlings
    • Good for elementary schools. Learn the scientific method (controls, single variable, etc.)
Ideas for HAB Science

- Biology (cont.)
  - Effect of Altitude on Living Bacteria
    - Have known good bacteria on Agar plates
    - Expose to atmosphere, recover, look at effect. Compare with control kept on ground.
Ideas for HAB Science

- **Physics**
  - “Volts-per-meter”
    - Measure at various altitudes
    - Long insulated trailing wire, detect voltage difference
    - Possibly launch during electrical storm
  - **Speed of Sound**
    - See what effect altitude has on the speed of sound
    - Use ultrasonic module to time pulses over fixed distance
  - **Ionizing Radiation**
    - Detecting radiation vs altitude, Day vs Night, Season,
      Radiation spectroscopy (energy levels)
Ideas for HAB Science

• **Physics (cont.)**
  – Ionization Potential
    • Measure the ionization potential of the atmosphere at altitude
    • High voltage / Low current
  – Boiling Water
    • At what temperature does exposed water “boil” at altitude
  – Infra Sound
    • Detection of low frequency sounds from cities, forest fires, etc.
Ideas for HAB Science

• **Earth Science**
  – Earth Albedo
    • Measure amount of IR energy received from space vs amount of energy reflected back to space
    • May require a night flight, to eliminate effects of sun?
  – Ultraviolet Exposure
    • Measure the effectiveness of the atmosphere in reducing UVA / UVB rays
  – CO / CO2 Concentration
    • Check concentration of CO / CO2 at various altitudes
    • Jet Aircraft exhaust at various altitudes?
    • Use repurposed CO detector?
Ideas for HAB Science

• Earth Science (cont.)
  – Atmospheric Effects on Perceived Color
    • Use a sensitive camera looking at a standard color chart
    • Compare the “color of light” at various altitudes and its effect on the perceived color of paint samples
  – Ozone
    • Measure Ozone concentration at various altitudes. Compare day vs night profiles (requires night launch) Ozone layer is 63k ft to 100k ft. Sensors are available.
  – Dust / Particulate Concentration
    • Measure dust type & concentration at various altitudes
    • Use “clear tape” method, expose tapes at different altitudes
Ideas for HAB Science

• Earth Science (cont.)
  – VLF Radio Waves
    • Use time-coordinated recordings of VLF radio between balloon and ground station. “Howlers” and “Whistlers”
    • Association with storm clouds?
  – Sprites
    • Launch when Cum. Nimb. Clouds are present
    • Get a “top-down” view of the clouds
    • Night launch, long exposure to try to capture “blue sprites” at tops of storm clouds
  – Drop a “Water Sonde”
    • Small plastic/cardboard container with fins
    • Has water that comes out as it drops
    • Freezes on way down, leaving visible trail
    • Photograph change in trail from straight line to get winds
Ideas for HAB Science

• Aeronautics
  – Model Rocket Altitude
    • See how high a model rocket can fly if launched from a High Altitude Balloon
  – Strobe Locationing
    • Incorporate a bright strobe light and 2 (or more) fixed ground location cameras to triangulate on HAB location via strobe light
    • Reduce raw data to provide 3D location of HAB vs time.
Ideas for HAB Science

- Materials Science
  - UV Exposure
    - Effect of short term high intensity UV exposure on thin plastics or fabrics (fading, mechanical properties)
Ideas for HAB Science

- **Equipment Development & Testing**
  - **Horizon Scanner**
    - Develop a sensor that can provide feedback on the location of the horizon.
    - Can be useful for future stabilized platforms
  - **Autonomous Return Vehicle**
    - Develop a payload that can autonomously return its cargo to a fixed location using active aero controls and GPS coordinates. Aeroshell, Ballute.
  - **Solar Cells**
    - Effectiveness of solar cells at high altitude
    - Effects of increased solar radiation, low temperatures
    - Ability to use for powering equipment
Ideas for HAB Science

• Equipment Development & Testing (cont.)
  – Cell Phone
    • Investigate the use of cell phones for sensor platform and data communications
  – Tethered Balloon
    • How high can a balloon go that is tethered to the ground for recovery?
    • Need ultra light & strong tether
    • Need to launch in middle of nowhere
  – Active Buoyancy Control
    • Develop equipment that allows a balloon to reach target altitude and stay there
    • Good for ultra long duration / distance
Ideas for HAB Science

• **Equipment Development & Testing (cont.)**
  – Laser Communications
    • Install laser receiver on balloon
    • Use telescope to transmit modulated laser light to balloon
    • 2-way communications?
Ideas for HAB Science

- Amateur Radio
  - Dual Balloon Radio Relay
    - Launch two HABs, 150 miles or > apart (beyond horizon for each ground location)
    - Balloons will link to each other, relay messages
    - Field Day Project?
Ideas for HAB Science

- The Edge of Space
Ideas for HAB Science

- Science Projects Handbook
Ideas for HAB Science

- The Amateur Scientist
Ideas for HAB Science

- Science for the Airplane Passenger
Ideas for HAB Science

• Satellite!
Ideas for HAB Science

- Projects: Space