

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

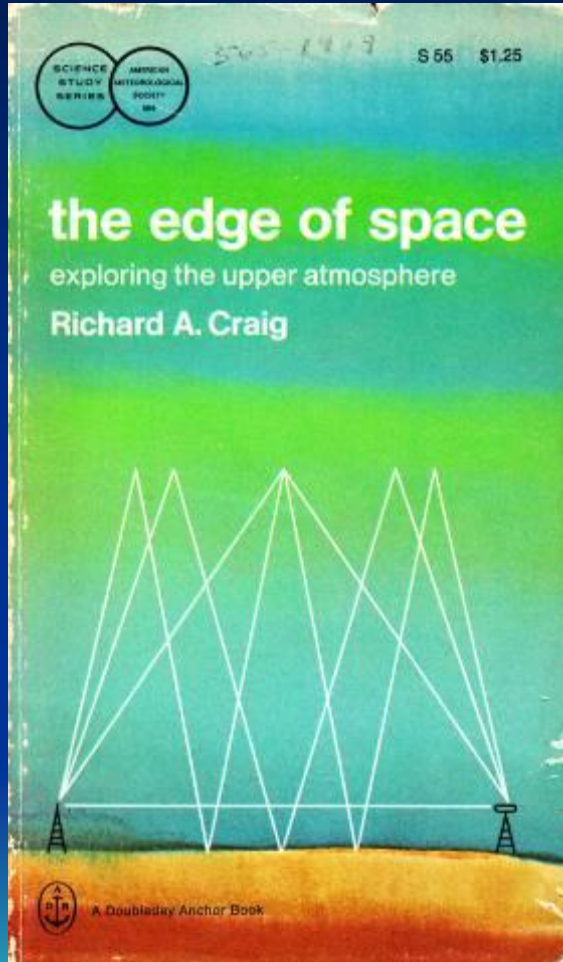
- Amateur Radio

- 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?

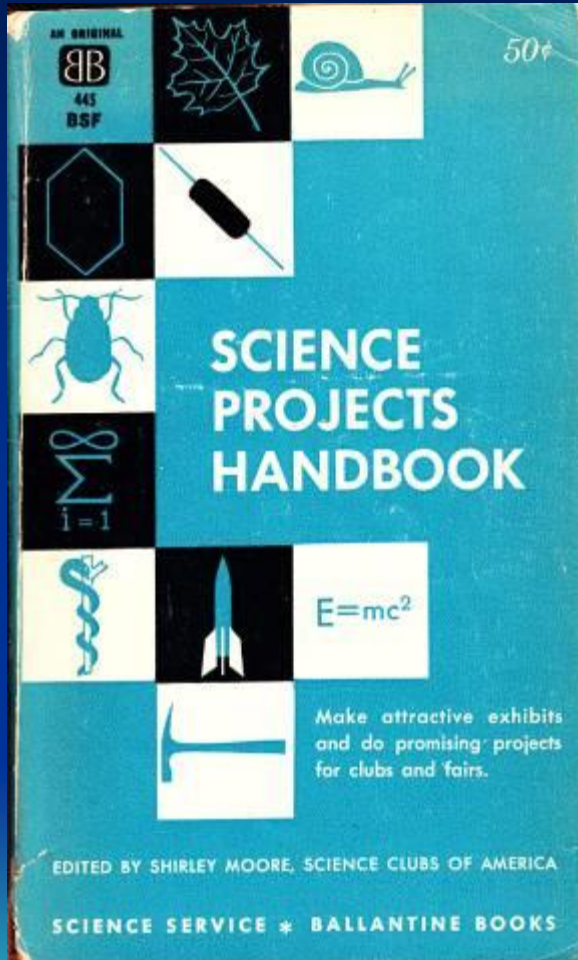


Ideas for HAB Science



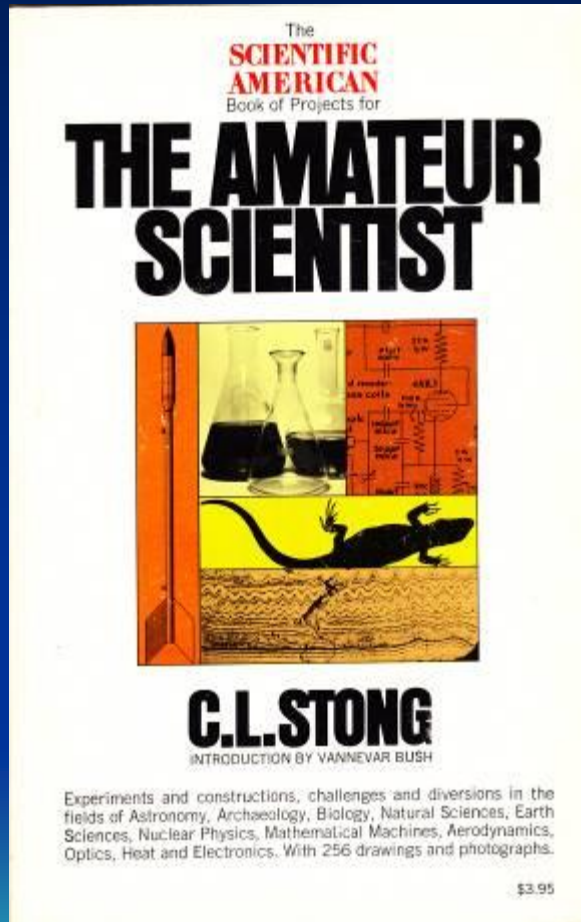
- The Edge of Space

Ideas for HAB Science



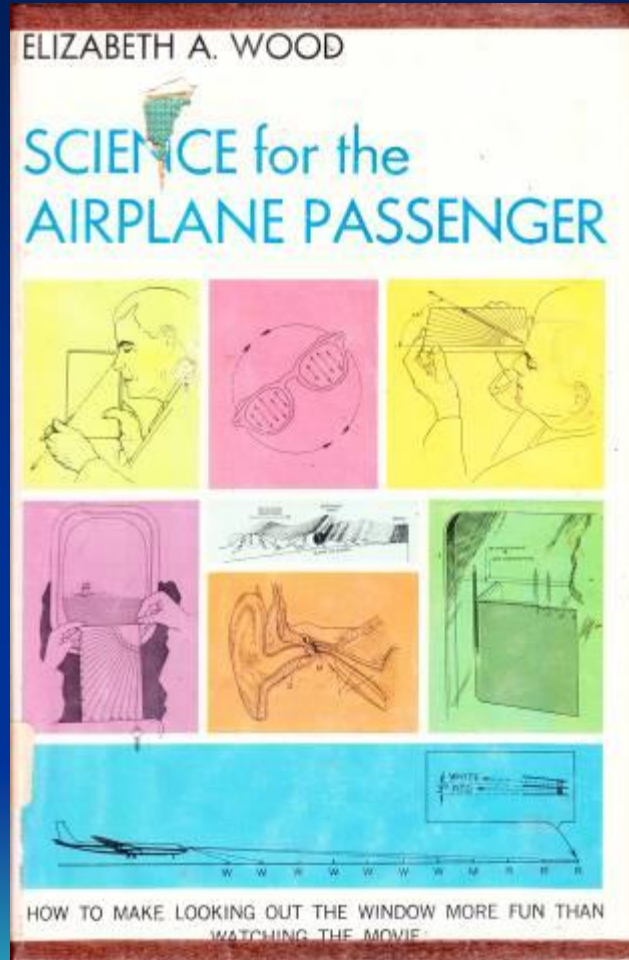
- Science Projects Handbook

Ideas for HAB Science



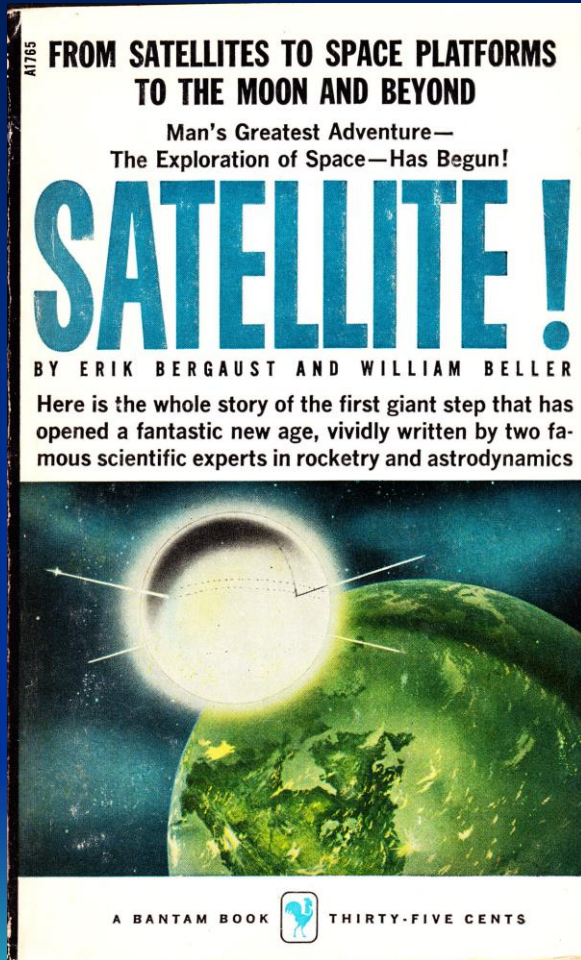
- The Amateur Scientist

Ideas for HAB Science



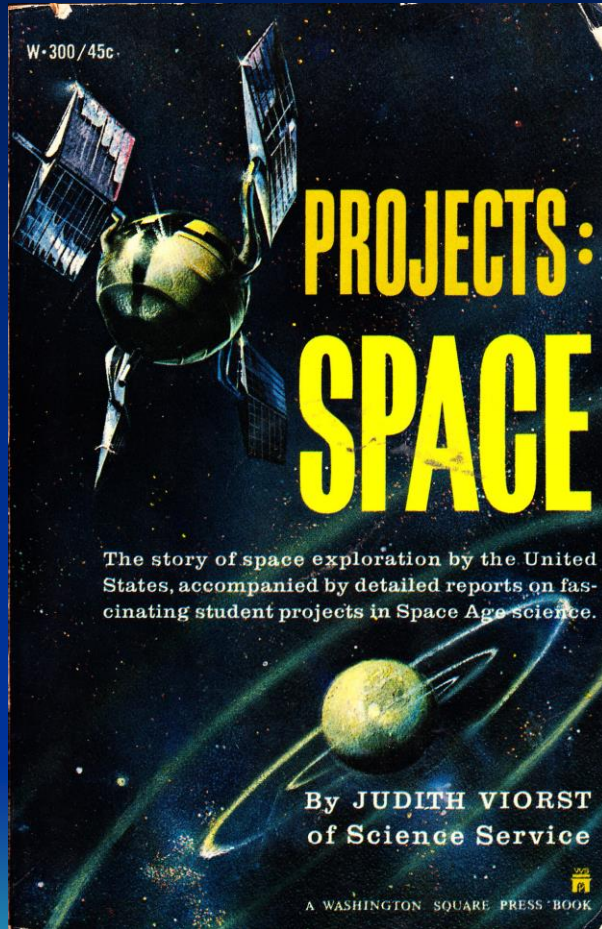
- Science for the Airplane Passenger

Ideas for HAB Science



- Satellite!

Ideas for HAB Science



- Projects: Space