



Scientific Ballooning & Lighter-Than Atmosphere (LTA) Vehicles

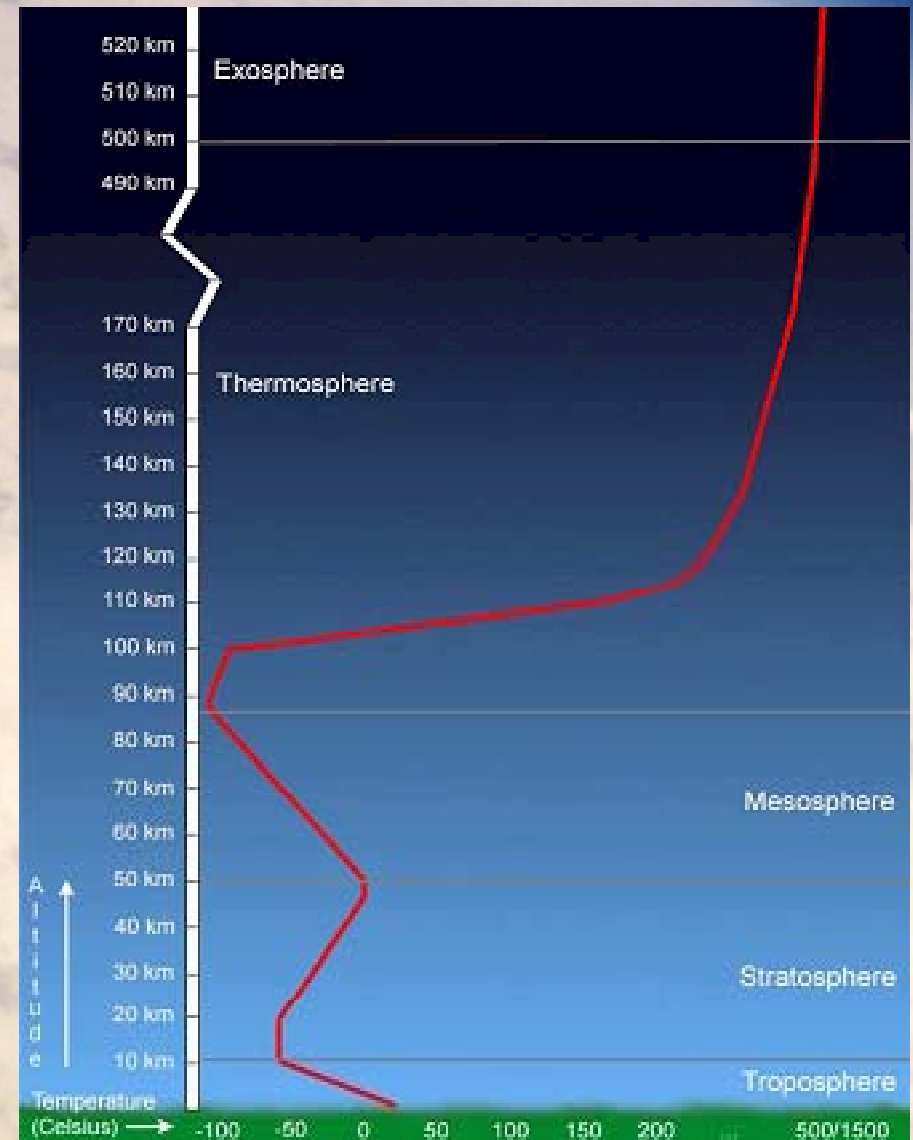
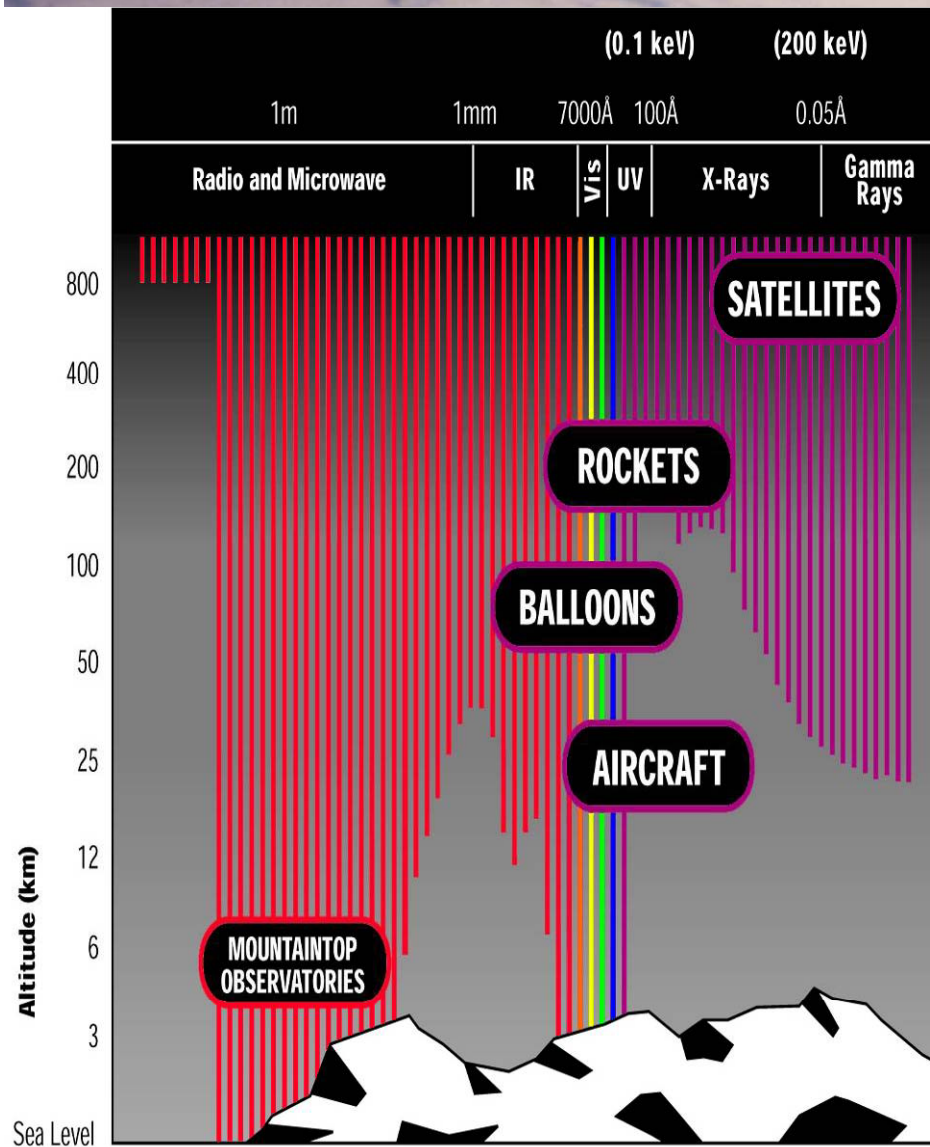
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Photo courtesy of David Gregory



What can be observed?





Stratospheric Ballooning Reality

- Stratospheric balloons have...
 - Flown >8000 lb. payloads
 - Flown large payloads to 160 k-ft.
 - Flown >700 days duration
- Stratospheric balloons **cannot**...
 - Carry 8000 lb. To 160 k-ft for over 700 days
 - Perform powered station-keeping

(Stratospheric balloons are not airships)



Balloon Payload Examples



Gamma-ray: HIREGS



Cosmic Ray : ATIC



CMB: Boomerang



Solar Physics: Flare Genesis



Infra-Red: PRONOAS



Balloon Apex Mounted Payloads

- Unobstructed view to space
- Flight 494-N (TopHat) was launched in Antarctica on January 4, 2001; duration ~26 days
- Top payload mass was 226 kgs.
- Balloon volume = $835,000 \text{ m}^3$



TOPHAT Payload Prior to Mounting on Balloon Apex



TOPHAT Payload on Balloon Apex During Inflation



Float

- Float duration varies from very short times (minutes) to hours, days, weeks, or even months depending upon flight plans and requirements
- The use and/or operational considerations determine the end of the data collection period



3 Mission Categories

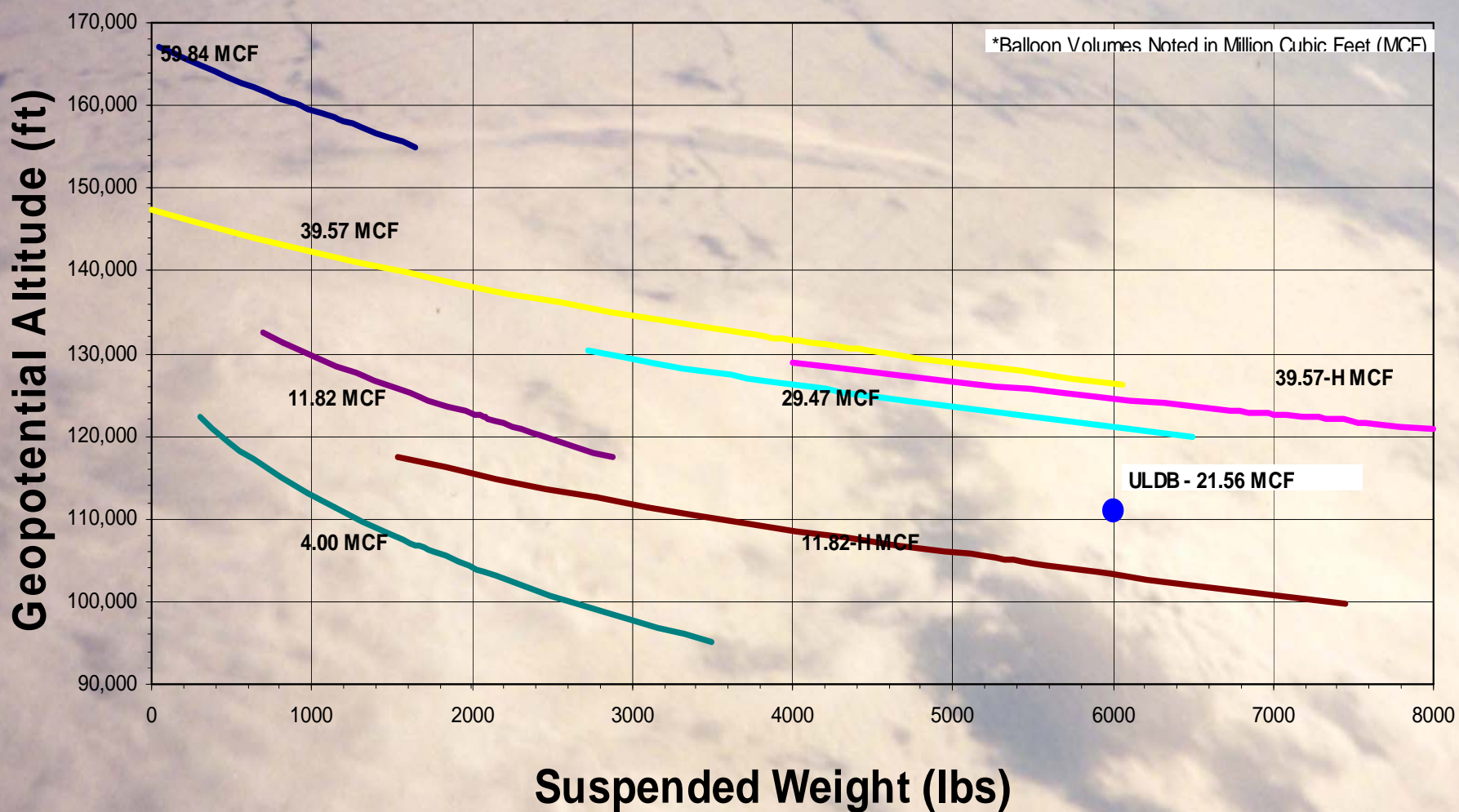
- **Conventional**
 - Zero-Pressure balloon
 - Duration hours - 2 days (local geographic regions)
 - LOS telecom
- **Long Duration Ballooning (LDB)**
 - Zero-Pressure balloon
 - Duration 3 - 32 days (global, high latitudes)
 - LOS & OTH telecom
- **Ultra-Long Duration Super-Pressure Ballooning**
 - Super-Pressure balloon
 - Duration 30 - 100 days (global)
 - LOS & OTH telecom
 - *Still in development phase*



Balloon Load Altitude Curves

Suspended Load vs. Altitude Capabilities

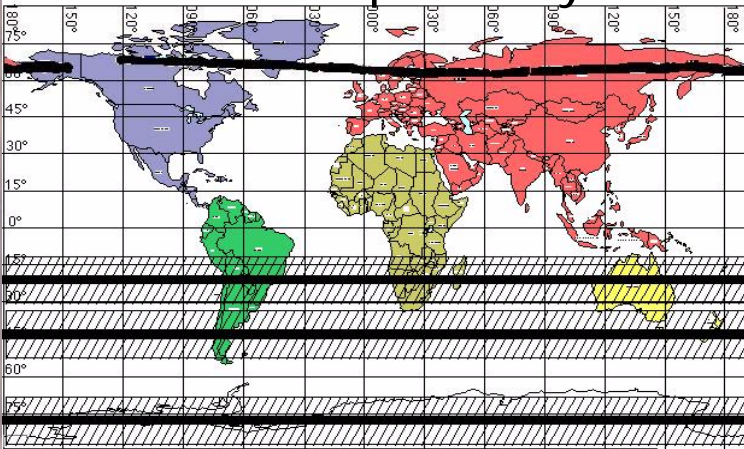
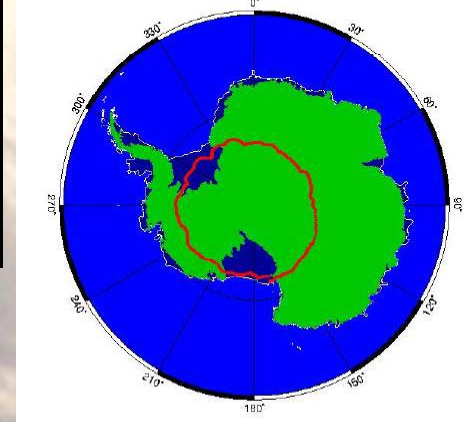
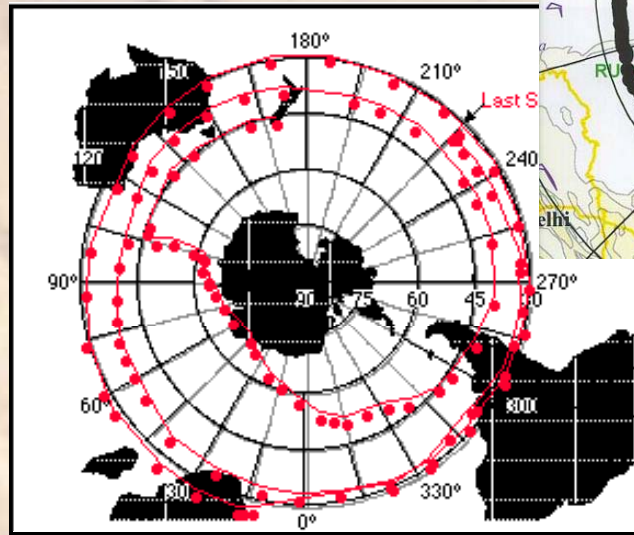
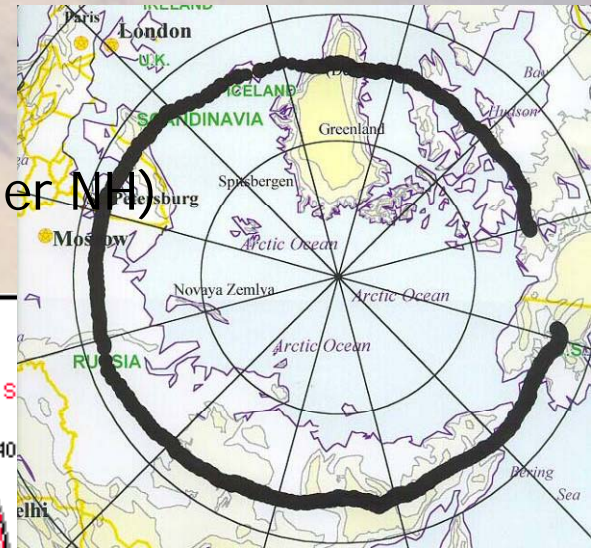
Based on 1962 Standard Atmosphere





Trajectories

- Trajectories (speed, heading, and flight duration) are a function of latitude, time of year, and altitude
- Types of flights
 - Turnaround
 - Eastbound (winter NH), Westbound (summer NH)
 - Global Circumnavigation
 - Ultra Long Duration
 - Tethered Systems
 - Propelled Systems





Who do you call for NASA Support?

NASA Balloon Program Office –Wallops

<http://sites.wff.nasa.gov/code820/>

Useful CSBF Balloon Links

<http://www.nsbf.nasa.gov/index.html>

<http://www.csbf.nasa.gov/docs.html>

<http://www.csbf.nasa.gov/convdocs.html>

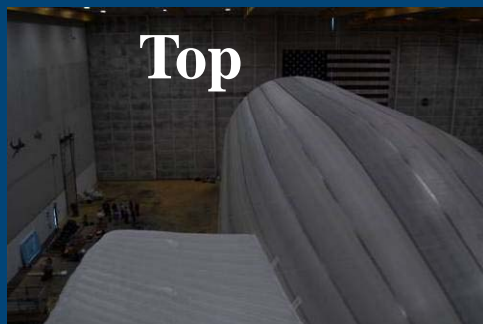


Other LTA Non-Traditional Options/Considerations

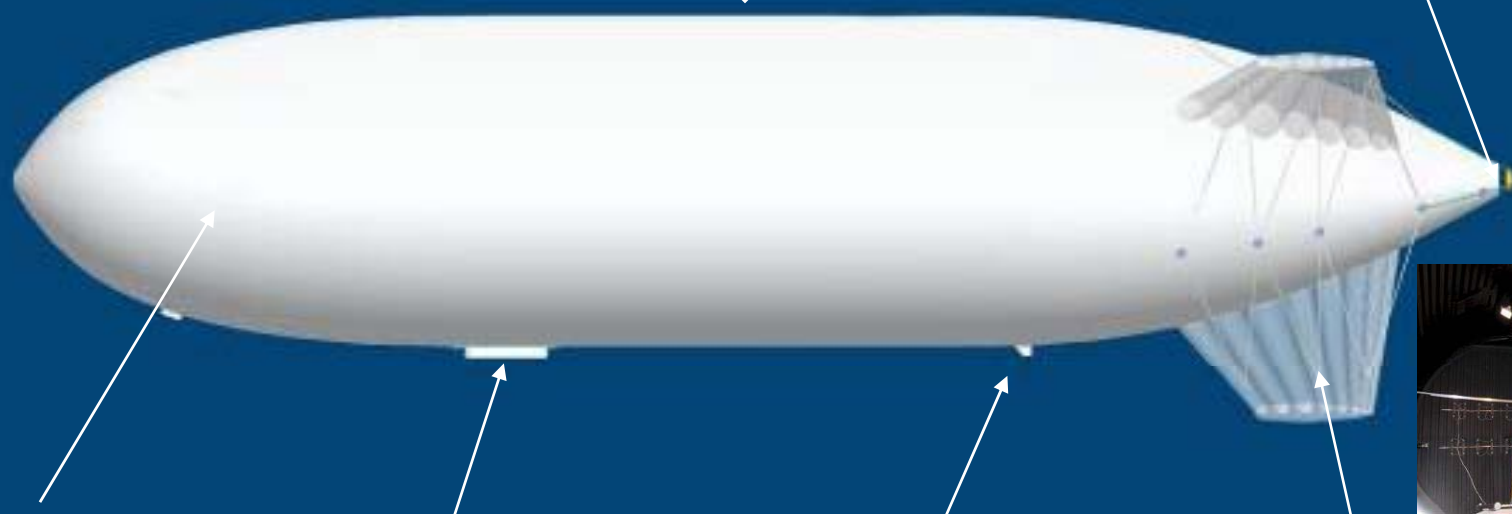
Stratospheric Airships: HiSentinel



Photograph From
Integration Test
Greenville, TX
26-29 March 2008



Propulsion Unit

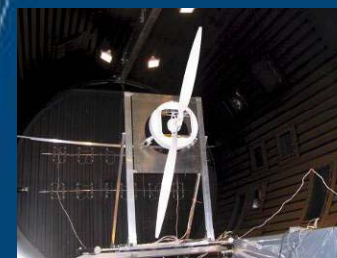


**Internal PV
Array**

Equipment Pod

Aft Ballast Pod

Inflatable Fins





Aerial Deployment & Inflation of Balloons