Science using Airships

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Advantages of Airships

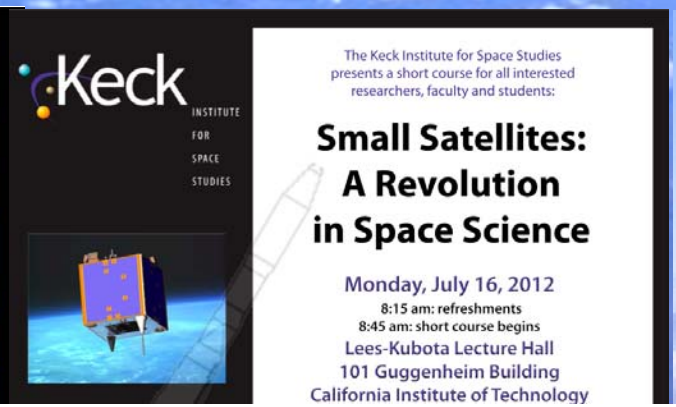
1) Maneuverable allowing for possible station-keeping
2) Offer continuous night and day operations
3) Wide latitude range; not limited to polar regions
4) Simple line-of-sight communications

Disadvantages of Airships

1) Atmospheric density limits altitude to around 90,000 ft and hence no UV or X-ray flux from space
2) Practical payload masses are well below that of NASA high-altitude balloons
3) May not be able to station-keep at any given location throughout an entire year

Why hold a workshop on airships now?

- There has been lots of experience and lessons learned from a number of recent DoD airship programs.
- The science community has begun to realize that good science can be done without large instrumentation weighing many tons (i.e., the advent of cubesats and nanosats).
- There has been several successful high-altitude, solar powered propeller vehicles (e.g., Pathfinder, Helios, Zephyr) similar to the propulsion systems airships would employ.



US Military Airship Budgets

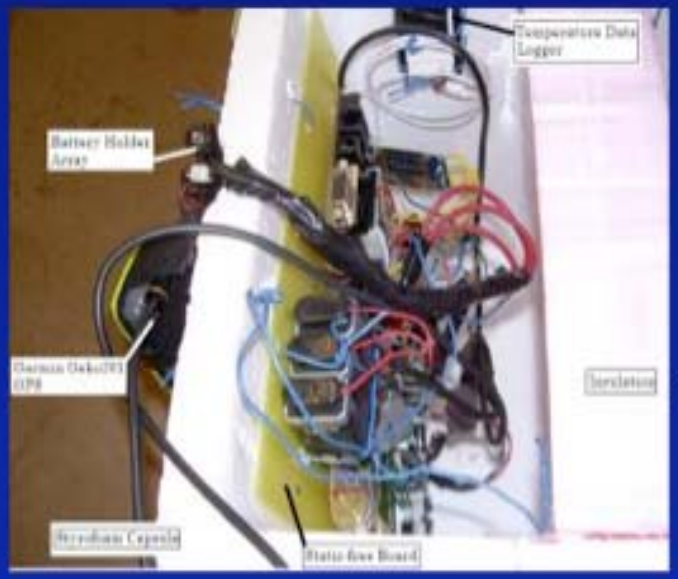
Name	Prime Contractor	# of units	Operational altitude	FY07--FY14 .
Blue Devil	MAV6	1	20,000 ft	$243.6 million
HALE-D	Lockheed Martin	1	60,000 ft	$36.3 million
ISIS	Lockheed Martin	1	65,000 ft	$506.7 million
LEM-V	Northrup Grumman	1	20,000 ft	$356.2 million
Pelican	Aeros	1	tech demo	$42.4 million
StarLight	Global Near Space	1	65,000-85,000 ft	$2.1 million
HiSentinel	SwRI	2	66,000 ft	$11.2 million
PGSS	Aerostar & TCOM	59	6,000-9,000 ft	$2,108 million
PTDS	Lockheed Martin	66	8,000 ft	$3,170 million

Bridging the Gap: Science Airships

Hand Launch

Heavy Equipment

No Man's Land (almost)



5000 lbs

5 - 12 lbs

Mike Smith, Aerostar

Bridging The Gap To Space

Lightweight Science Payloads on High Altitude Long Duration Balloons and Airships

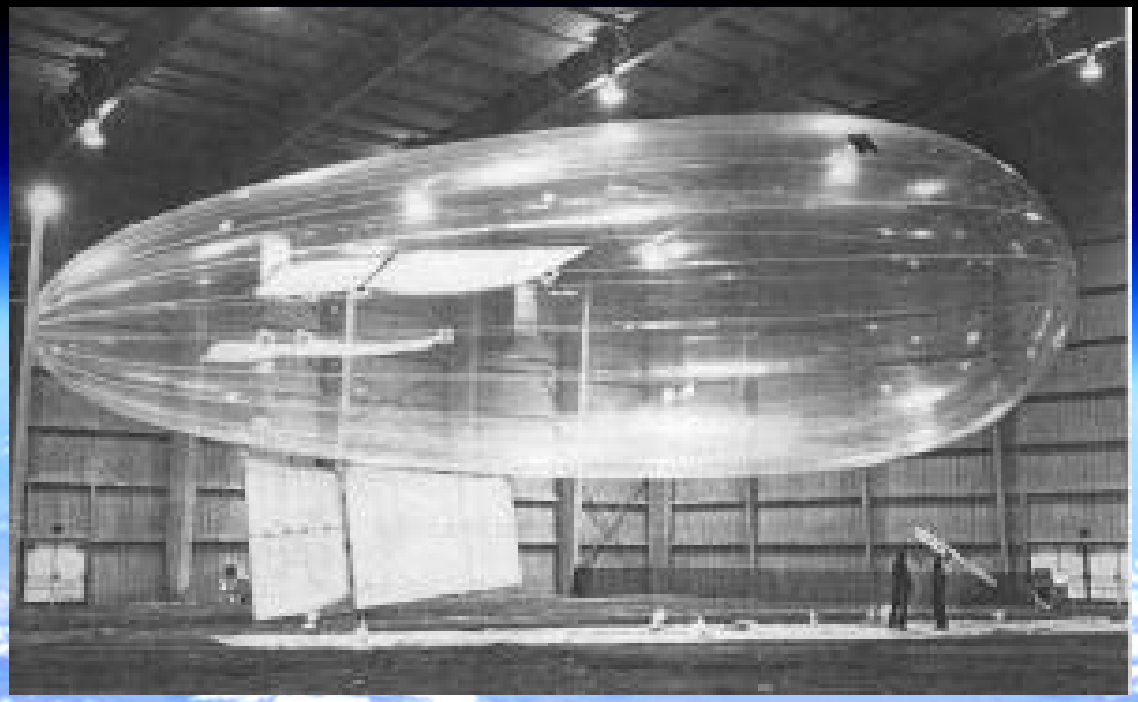
2009 October 26 – 28
NCAR Mesa Lab Boulder, Colorado

Balloon-borne missions can provide space-like quality data with high science per dollar return with rapid development, deployment and re-deployment cycles. Recent developments in high altitude super-pressure balloons and airships are on the verge of making long duration, near-space science missions across the globe a reality. This workshop will address a variety of potential high altitude science missions using lightweight payloads and associated enabling technologies.

Sponsored by:
National Center for Atmospheric Research
and Southwest Research Institute, Boulder

For more information:
http://www.boulder.swri.edu/LCANS09

The concept of a buoyant stratospheric vehicle which can hover over one geographic location for long periods of time has been the “Holy Grail” in the LTA community for decades.



In the late 1960’s, Raven built the High Platform II vehicle which has a 5 pound payload and flew for 2 hours at 67,000 ft.

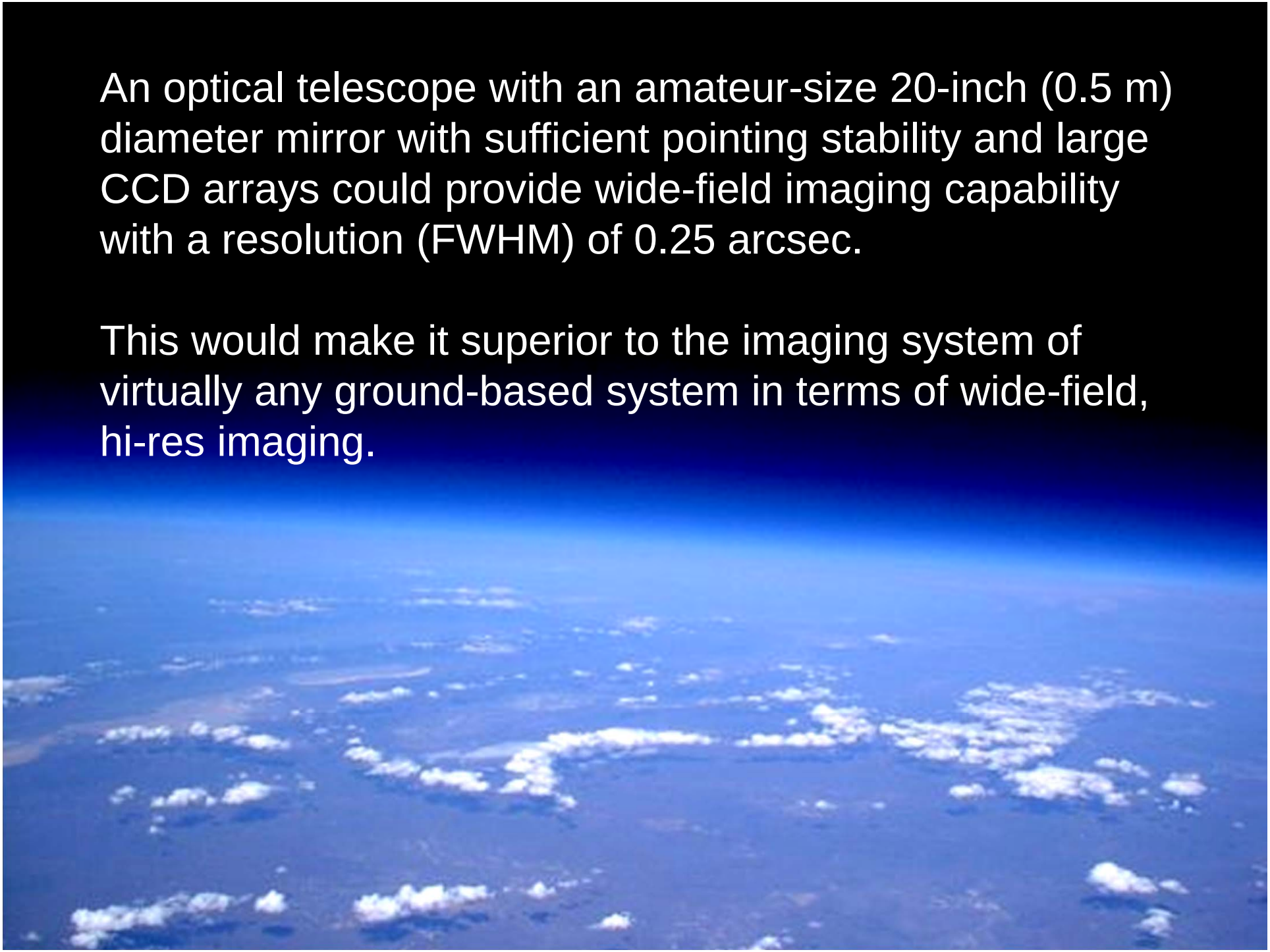
For astronomical observations, high altitude airships are an especially attractive option for obtaining high quality science data such as high-resolution imaging.

Just how high up do you have to go to avoid all clouds and stormy weather and start having space-like, high-resolution imaging conditions?

A photo taken from the window of a TR-1 (U2) aircraft from an altitude of around 70,000 ft.

At an altitude of 65,000 ft (20 km), one is above all but 5.5% of the atmosphere. At 85,000 ft (26 km) just 2.3% of the atmosphere lies overhead.

An airship perched at such altitudes would offer the possibility of near-space like astronomical imaging and much better Earth reconnaissance imaging than LEO satellites.



An optical telescope with an amateur-size 20-inch (0.5 m) diameter mirror with sufficient pointing stability and large CCD arrays could provide wide-field imaging capability with a resolution (FWHM) of 0.25 arcsec.

This would make it superior to the imaging system of virtually any ground-based system in terms of wide-field, hi-res imaging.

The value of keeping a LTA platform cost down cannot be overstated.

This lesson can be seen in high-altitude aircraft development.

The U2 reconnaissance aircraft developed back in the 1950's has survived the advent of the 80,000+ ft Mach 3 SR-71 and the 65,000 ft ceiling plus 35 hour loiter time of the Global Hawk.

Mostly due to much lower cost.

SR-71

Global Hawk

Highlights from the April 2007 LCANS Workshop

Eliot F. Young
Southwest Research Institute

NASA Balloon Community Workshop, 7 AUG 2007

OPPORTUNITIES FOR AIRSHIPS

as Unique Science Platforms

Sarah H. Miller
Oxford/Caltech