Mt. Olympus, Greece

# Olympus

What do astronomers want?

A mountain in the stratosphere.

Can a new concept be like a ground based observatory at the top of the atmosphere?

LIGHTER THAN AIR!

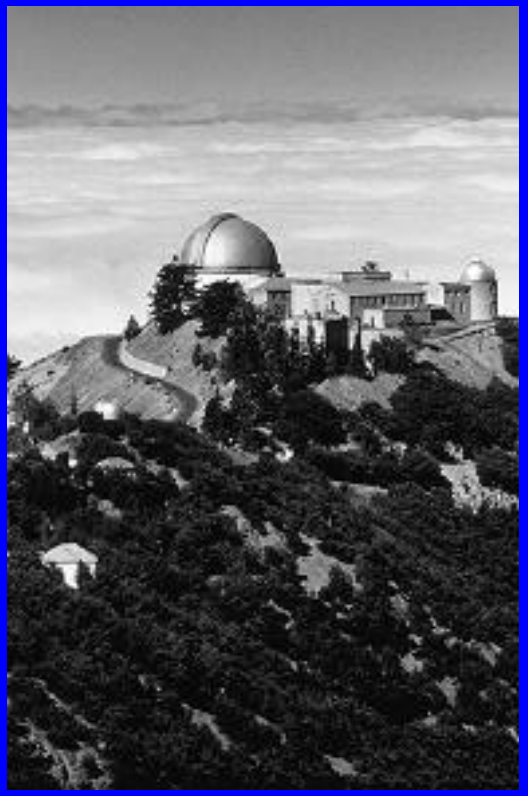
Olympus Mons, Mars

# Olympus

Observatory Facility

at the top of the atmosphere

- Needs cheap, reliable, and routine launch and recovery
- Needs large structures w/o deployables
- Needs fine pointing control
- Should avoid strong shaking of rockets



Lick Observatory
Univ. of California

# Olympus

Advanced Mission Scenarios

- Polar Night Flights
- All Sky Surveys w latitude control
- Routine Facility Operations

an observatory at the top
of the atmosphere

UCB HIREGS in Antarctica

# Olympus

## Polar Zone Flights

- ~90 days of continuous night or day
  must stay near the poles

- needs crude trajectory control
- needs nighttime power source
- needs polar communications

# Olympus

Sensitive All-Sky Surveys

- CMB and hard x-ray/gamma ray

- needs long flights (>100 days)
- needs robust latitude control to traverse to opposite hemisphere
- gamma-ray surveys require heavy lift

# Olympus

AAS Special Session

Austin, TX - January 1999

| | |
|---|---|
| large infrared telescope | Giovanni Fazio |
| extrasolar planet finder | Holland Ford |
| hard x-ray survey | Josh Grindlay |
| cosmic microwave bkg survey | Bob Silverberg |
| large solar telescope | Alan Title |

# Olympus

Terrestial & Planetary Aerobots

- Aerobots have robust trajectory and altitude control for downward looking payloads
- Earth aerobot technology applies to other planets with atmospheres
- Earth proves low cost proving ground

http://robotics.jpl.nasa.gov/tasks/aerobot/homepage.html

Mars Aerobot

# Olympus

Crosscutting Technology

- applies Origins, SEU, SEC themes
- applies to Mission to Planet Earth
  in-situ stratospheric chemistry
- applies to Aeronautics
  remotely piloted vehicles
- also to space inflatibles

# Olympus

Stratospheric Chemistry

- ozone hole and climate change
  in-situ measurements

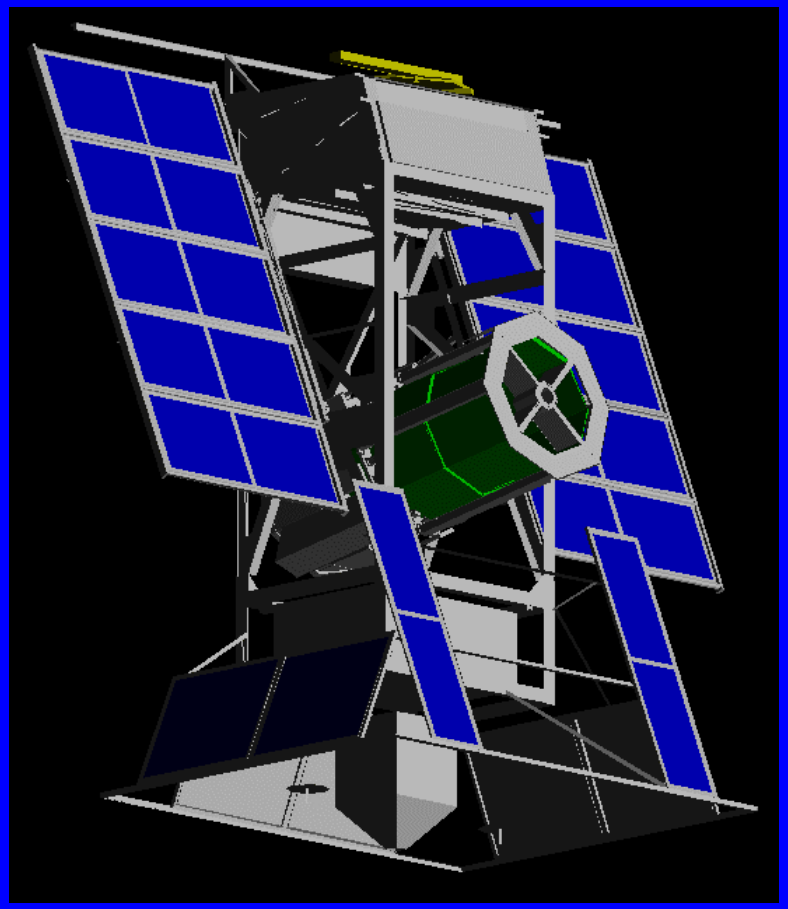
- needs robust altitude control
- special out-gassing requirements

# Olympus

Solar Telescopes

- millisec time resolution
- <1 arcsec spatial resolution
- fine spectroscopy

- needs lots of data
  on-board recording
- polar day flights desired
- needs fine pointing



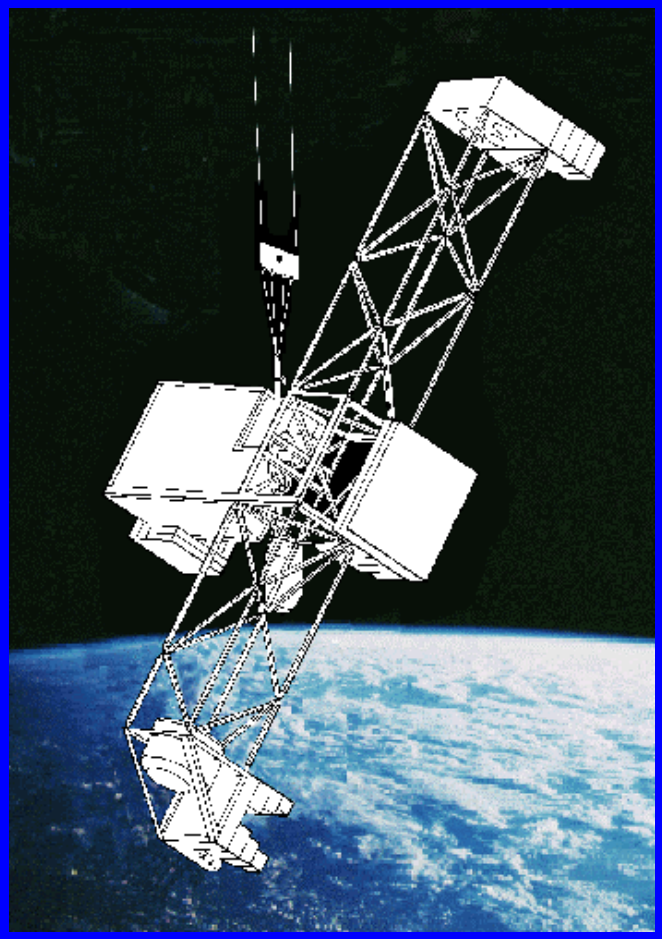
Flare Genesis Experiment
Dave Rust/APL

# Olympus

## Hard X-ray Focusing Optics

- X 10-100 improvements in
  spatial and energy resolution
- true imaging

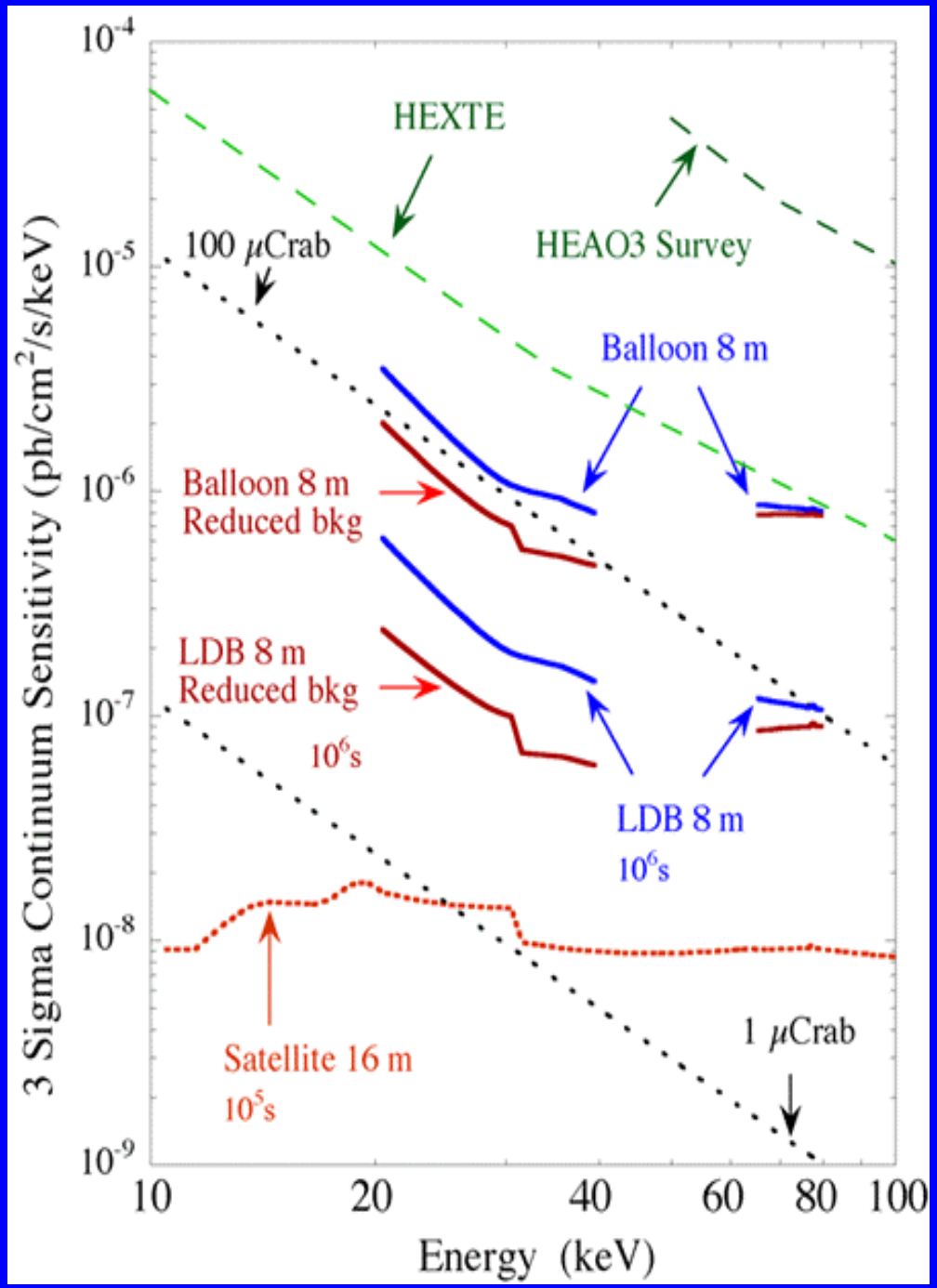
- needs >8 m focal lengths
- long observations with low bkg.
  low latitudes desired
- needs arcsec pointing of gondola
  due to small FOV



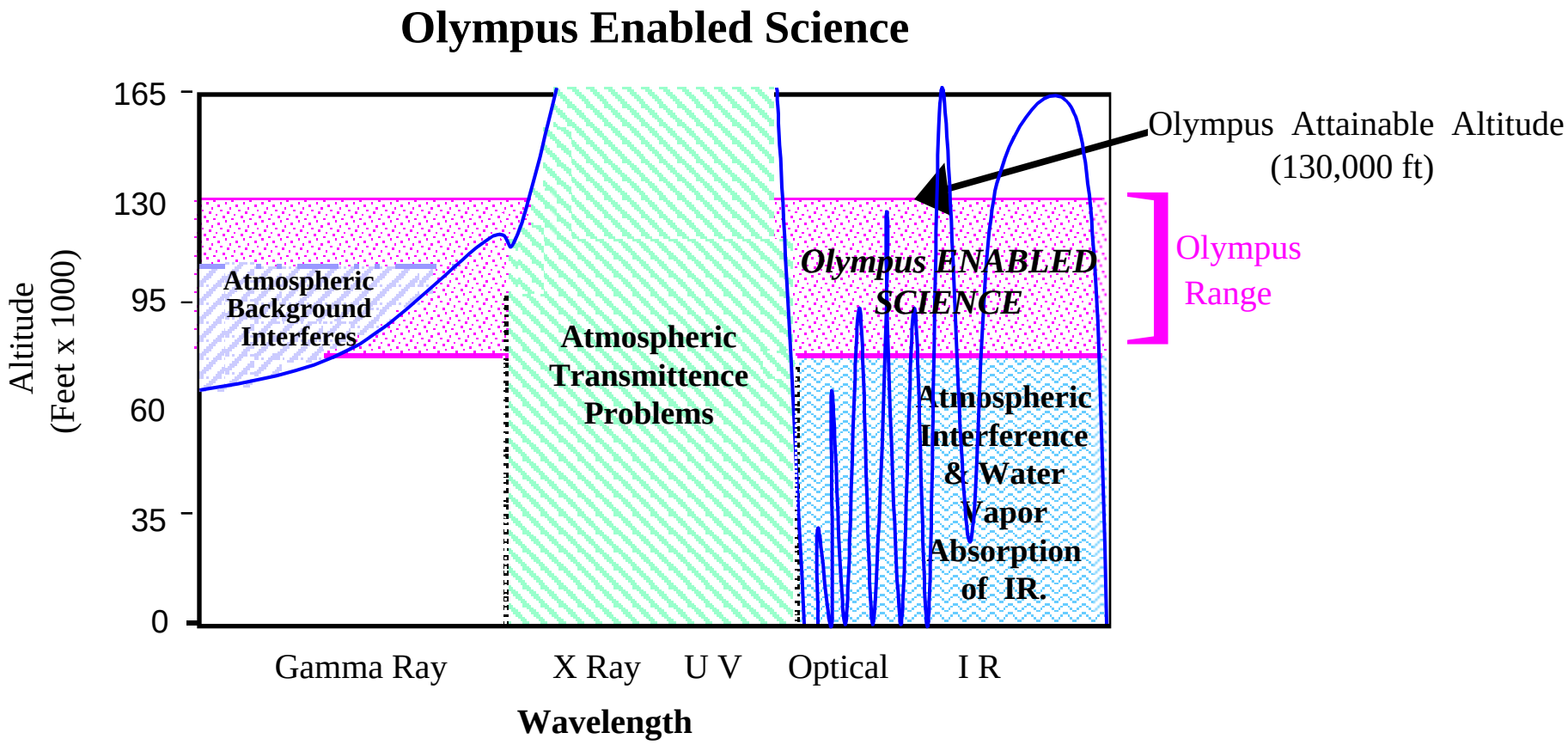
InFOCμS telescope
Jack Tueller/GSFC

# InFOCμS Sensitivity

- Very low background implies not systematics limited for long integrations.
- Longer focal lengths yield higher sensitivity.
- Hard x-ray data needed to understand non-thermal astrophysics.



# Science Enabled at Olympus Altitudes




Prepared by O. Bruegman & G. Cashin/ITMI

# Olympus

## Large Optical/IR Telescopes

- milliarcsecond seeing
- ~90 days of eclipse

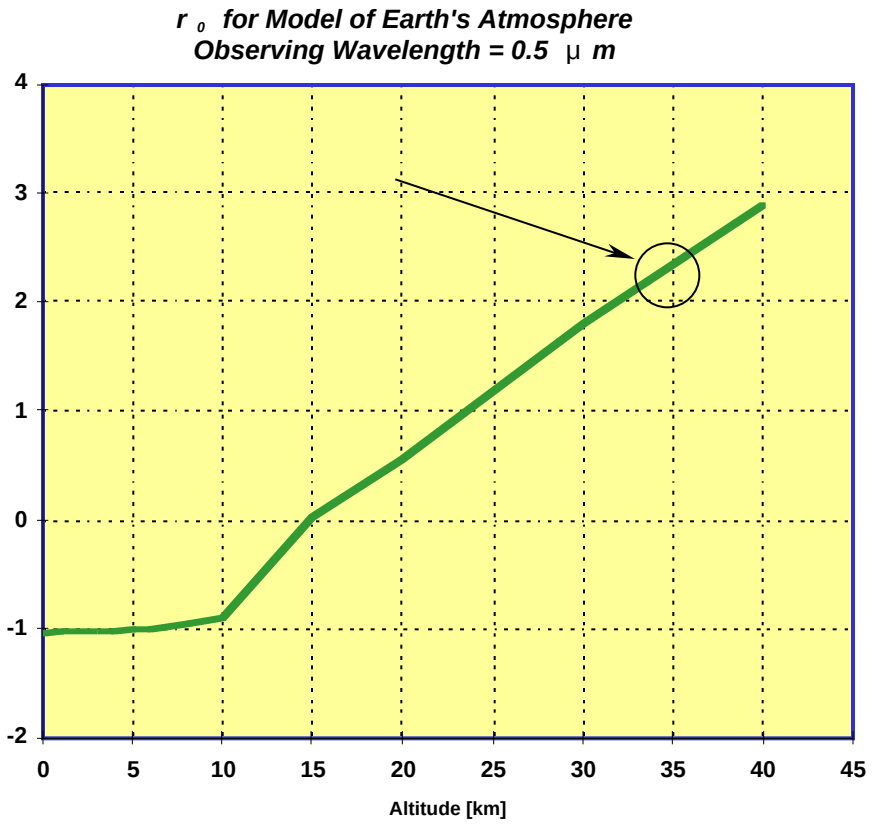
- could use polar night flights
- needs very large structures to avoid deployables
- needs ~0.1 arcsec pointing of gondola and moving secondaries


NGST concept
Ball Brothers

# Superior Imaging from Olympus

The superb 35-km environment for high-contrast and high-resolution

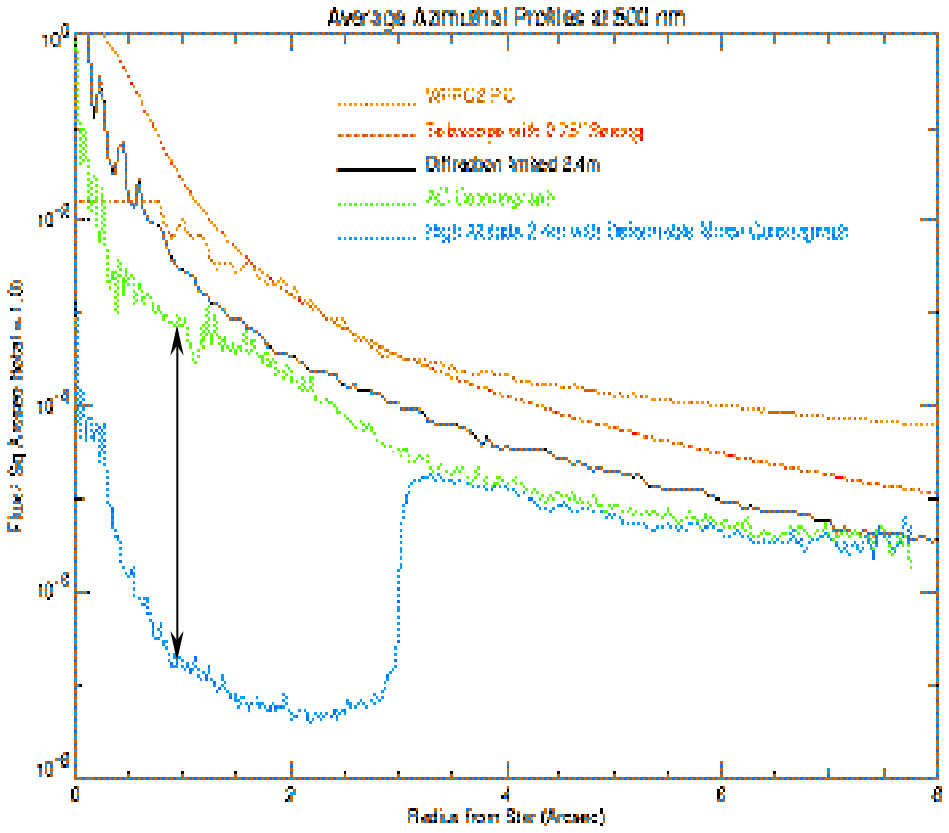
- residual atmosphere is 0.01%
- $r_0$ much greater than 10 m
- diffraction-limited optics
- no need for high-speed, atmospheric adaptive optics
- long thermal time scales are superior to low Earth orbit environment
- in situ environment of free-drifting aerobots changes slowly




Holland Ford & Larry Petro/JHU

# Olympus Planet-Finder Payload

- Large aperture telescope
  - 2.5-m diameter (approx. diameter of Hubble Space Telescope)
  - Ultrasmooth optical surfaces
  - Tip-tilt mirror image control
- Coronagraph
  - Stellar glare reduced by $10^4$ compared to HST Advanced Camera
  - Adaptive mirror for wave front error correction of telescope
- Observations in 0.5 μm waveband
  - Enables imaging close to parent star (1 - 10 AU)
  - Modest CCD ($512^2$, 10” FOV, 20 milliarcsecond pixels)




Holland Ford & Larry Petro/JHU

# Olympus

What Do We Keep?

- low launch cost
- routine payload recovery
- flexible operations schedules
- heavy lift capability
- large structures without deployables

# Olympus

What Do We Add for
New Ambitious Missions ?

- new long duration aerobots
  (100 days)
- trajectory control
- improved recovery systems
- advanced pointing systems

French PRONAOS
IR Telescope