Orbiting Wide-angle Light-collectors (OWL)

ISAL Study Overview
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Science Summary

- High energy cosmic ray particles have been observed leaving fluorescent tracks in the Earth's atmosphere
- The calculated energies $E \sim 10^{20}$ eV are enormous and imply that they are relativistic protons

- Where do these protons come from?
- What is the means of accelerating them?

How best to measure them?

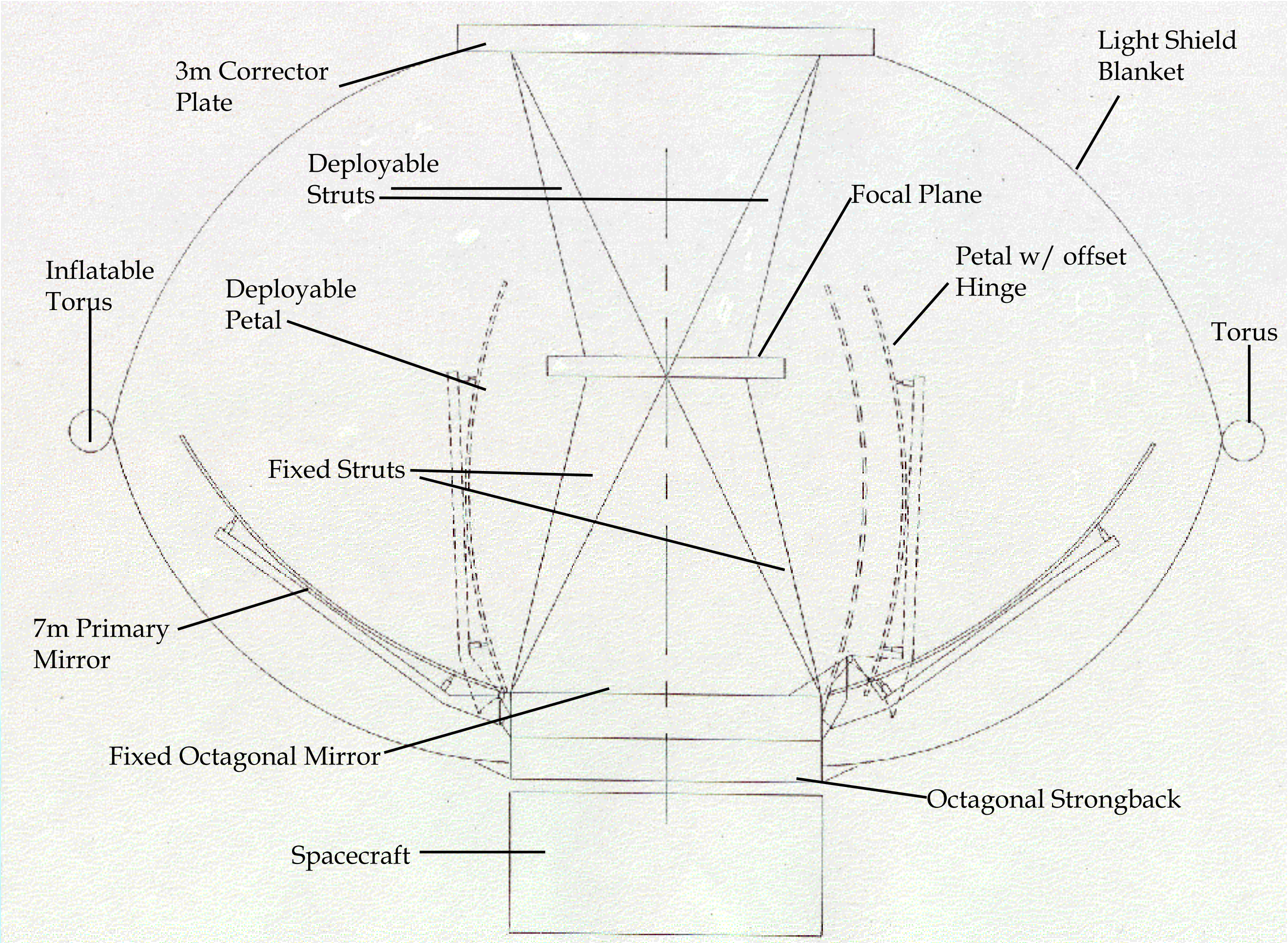
- The tracks are airshowers of collision products which cause the atmosphere to fluoresce in the blue spectral band 300 – 400 nm
- Ground-based light collector systems have observed a few of these extreme events - dual systems provide 3D track information
- But twin wide-angle cameras in space can provide as many as ~ 4000 events per year with $E > 10^{20}$ eV: more than a factor 100 that of present or contemplated future ground-based systems
- The stereo cameras enable 3D track location and isolation of external influences from background and atmosphere

ISAL Solution

- A number of fast wide-angle optical systems were studied
- By Thursday of the first week, the team had settled on a 3m/7m classic Schmidt camera with 8 deployable petals (and a fixed octagonal central component) for the primary mirror
- The focal plane is populated with composite bi-alkali photocathode photomultiplier tubes behind Schott BG-1 glass filters
- The optical quality of the telescope need not be high: spot size between 0.6 – 2.1 mm
- On-board processing reduces the amount of data transmitted to the ground to about 1 to 10%
- The focal plane is fixed with respect to the octagonal strong back in the center of the spherical primary mirror
- The corrector plate deploys forward from a position stowed near the focal plane carrying the folded inflatable light shield into position for inflation

OWL Telescope

Instrument Synthesis and Analysis Laboratory



Other Disciplines

- Mechanisms enable folding of the 7m diameter spherical primary mirror - alternate petals have "virtual" hinges so they offset when folded
- A full-aperture door is required to protect the focal plane PMTs
- The light shield blanket is deployed by the upward motion of the deploying corrector plate and the inflation of the torus
- Heat from the focal plane electronics is brought down to the spacecraft by heat pipes for radiation to space
- Orbits are 1000 and 400 km at zero inclination
- The 1000 km orbit is a concern for the high level of cosmic-ray protons – 30 krad total dose
- The 400 km orbit is not a concern for radiation dose
- The high orbit has a higher risk for orbital debris impact than the lower orbit

Composite Optics, Inc. Estimate

- Composite Optics of San Diego estimated $XX M for building the 16 petals and two central octagons of the two primary mirrors
- This ROM estimate includes coating with aluminum plus MgF coating and building the steel mandrel for all parts in-house
- COI would test all parts on the shop floor and correct or replace all parts with out-of-spec figures
- The hinges and mechanisms for deployment and solid body petal motion would be the responsibility of Goddard
- The estimate does not include the A-frame support for each petal

Goddard MICM-TRL Cost

One OWL Instrument

- Mass = 1800 kg
- Peak Power = 749 watts
- Data Rate (Peak) = 5.7 Kbits/sec
- Duration to delivery = 36 months
- Launch Year = 2008
- Instrument Family = Photometer
- Mission Class = Normal
- TRL = 4.75

- Cost = $XXX M (FY 2002 $M)