Light Weight

Mirrors for Space

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Drivers to light weight
Space optics

The primary mirror in a space camera is a major cost driver in a satellite's budget,

- weight of the primary and the mirror support system.
- design constraints on keeping the optical components aligned (structure needs to be stiff-- higher mass)

Routes to light weight optics (1)

Passive Mirror

Passive mirror made from light weight rigid material.

- low complexity
- variety of light weight materials that can be used (each with its own pros and cons)
- low CTE needed
- low tolerances on alignment
- can't correct for in orbit aberrations

Routes to light weight optics (2)
Active Optics

Use a thin meniscus mirror that is actively support.

- possible large weight reduction (esp with relaxation of design specs).
- higher imaging performance.
- potential use in extreme temperature environment.
- more complex system with higher power requirements

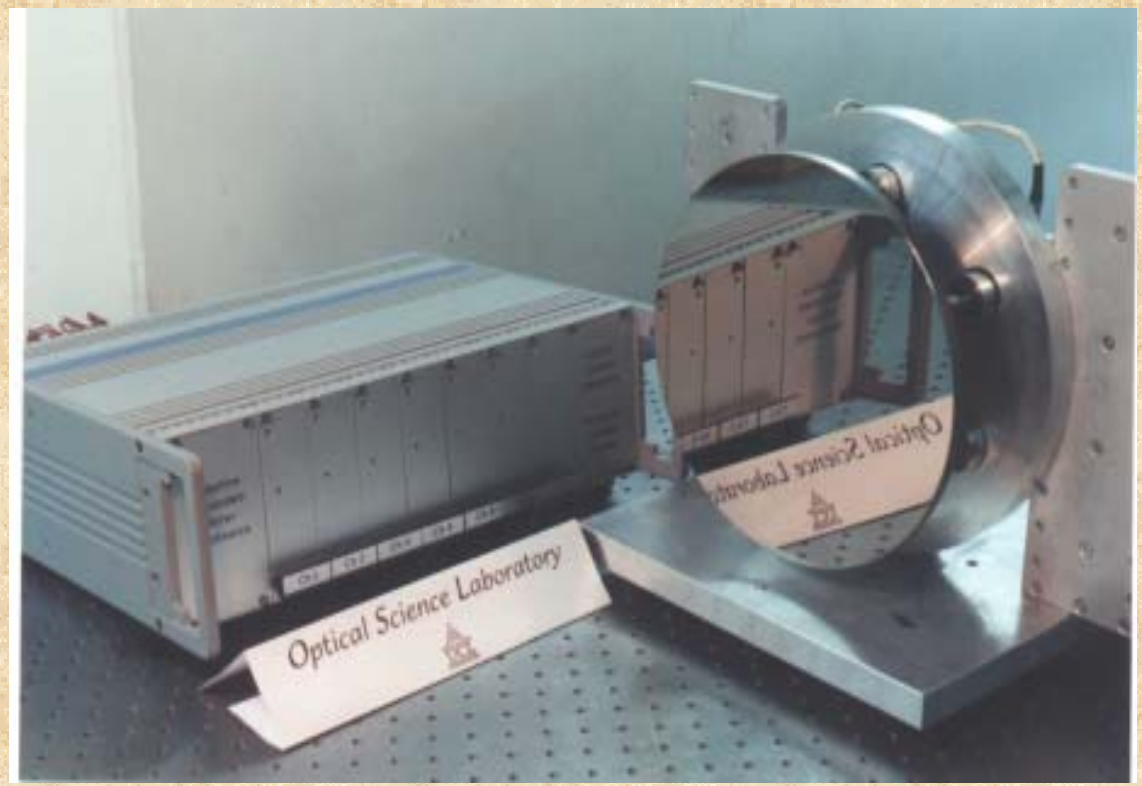
Possible weight saving using lightweight material

- Current zerodur mirror 24x26cm, 4.6kg mirror and 1.2kg mount
- If scaled to 55cm would be 20Kg mirror and 7Kg mount. **Total 27Kg**
- Active mirror 1-2kg mirror, 2-6kg actuators, 4kg electronics. **Total 7-12Kg**

Competing Mirror Substrate Materials

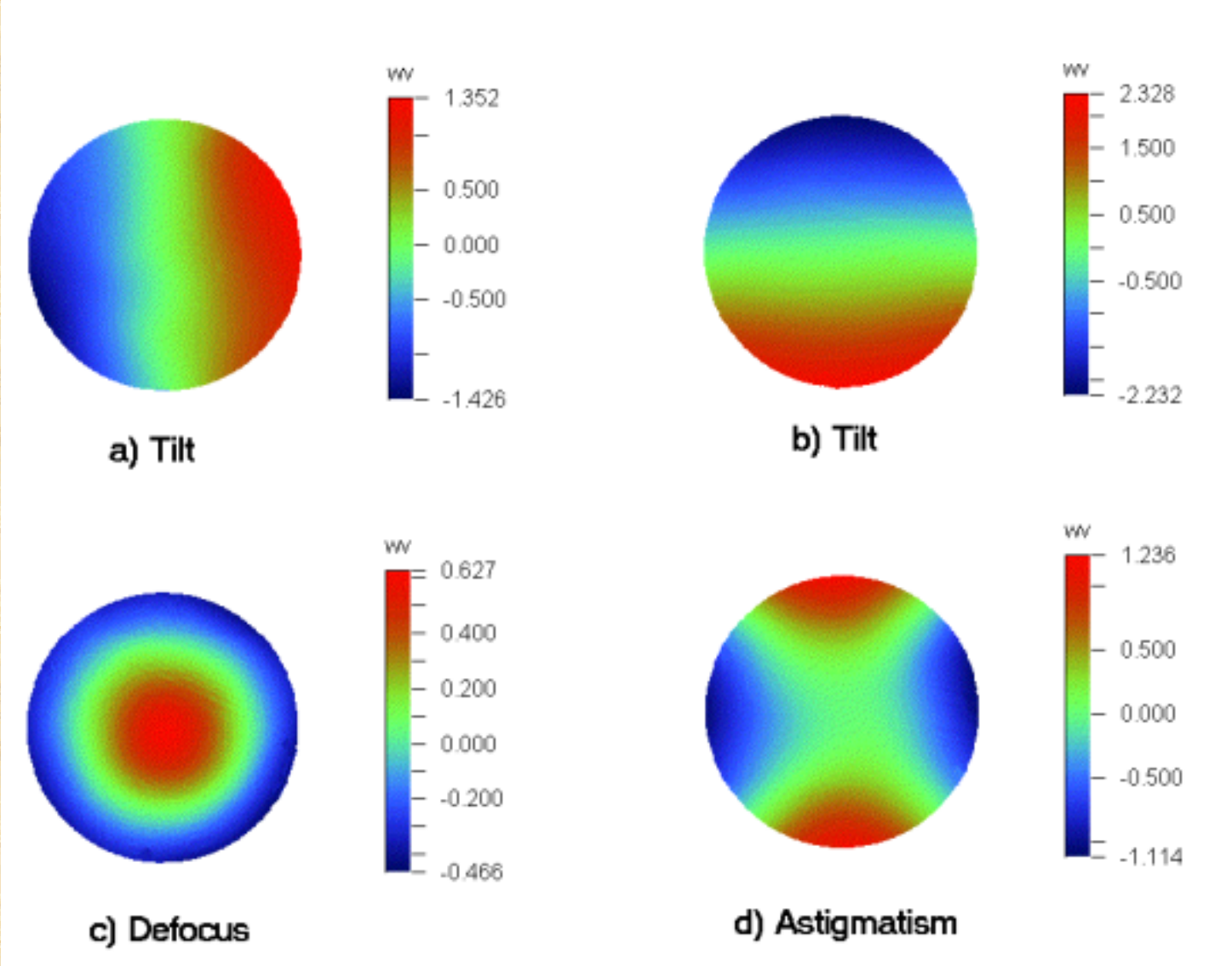
Densityg/cm^{-3}ThermCon(WmK)CTE10^{-6}/^{o}CYoung'sModGPaZ_{ϵ}

Adaptive Aluminium Mirror Technology Demonstrator



- Ni-coated Aluminium
- 1cm thick faceplate
- Magnetostrictive actuation
- 30cm diameter F/11

Measured Zenike forms



Actuator Technology

Advantages **Potential Drawbacks**

Piezo-electric

Low power dissipation

Reliabilit

Current work at OSL

- Development of polishing techniques for new materials.
- Thin mirror optical fabrication.
- Development of active mirrors.
- Development of athermal camera designs
- Computerized optical production - to lower timescales esp. for aspherics.

Zeeko polishing machine