DES and the Curtis-Schmidt

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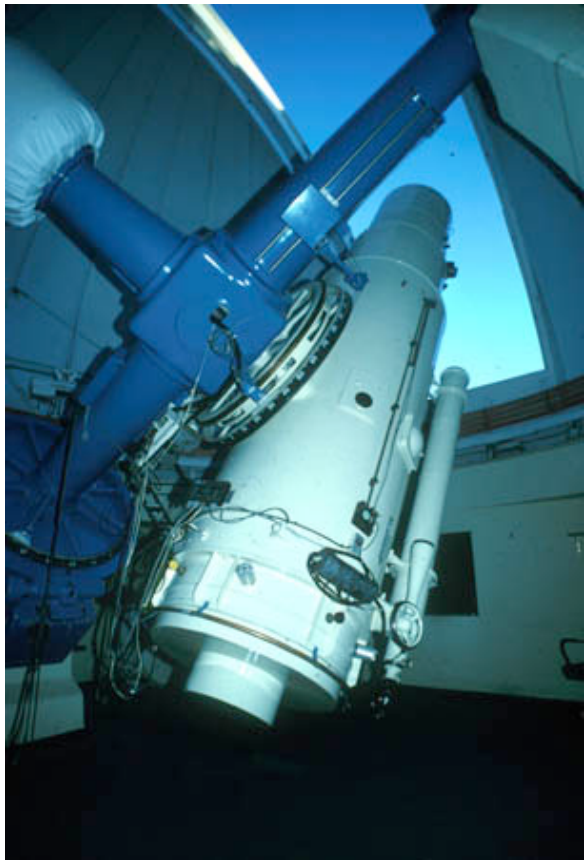
Current Curtis-Schmidt operations funded by:
NASA Orbital Debris Program Office
Johnson Space Center
Houston, Texas

University of Michigan Curtis-Schmidt Telescope

Cerro Tololo Inter-American Observatory, Chile

0.61/0.91-m Schmidt telescope



Optical Studies of Space Debris

- **MODEST** - **M**ichigan **O**rbital **DE**bris **S**urvey **T**elescope
- 100% dedicated to NASA program of optical studies of artificial space debris.
- NASA funds *all (100%)* of everything - mountain share costs, operating costs, capital improvements, travel, etc.
- > $300,000 in capital improvements in last 4 years.
- Principal areas of interest are GEO regime and navigation satellite regime (near mean motion 2 rev/day)
- 3 times/year - Schmidt and CTIO 0.9-m run simultaneously
  - for survey and chase – handoff to 0.9-m after discovery on Schmidt.
  - Simultaneous photometry: B on 0.9-m, R on Schmidt

DES Use?

- No interference with debris project
- Continued access to telescope for debris project if need arises
- Simplicity
- Flexibility

Curtis-Schmidt Time

- Schmidt now scheduled on demand for debris observations.
- International observing campaigns defined every year in March/April at annual IADC meeting.
- Light use of Schmidt during periods when anti-solar point crosses Galactic Plane – July/August and December/January.
- DES –
  - Limited number of instrument changes.
  - Instrument changes done during week by CTO staff.
  - Start after first quarter, end before last quarter.

Requirements for DES Use

1. Debris program access to Curtis-Schmidt during DES time if need arise.
2. DES pays all expenses resulting from DES use of the facility.
3. 10% of time to Chilean astronomers - service observing .
4. DES contributes hardware upgrades to telescope.

Requirements (1)

1. Debris program access to Curtis-Schmidt during DES time if need arise.
    1. Must have access to facility if need arises – witness Chinese ASAT test (2007) and Iridium-Cosmos collision (2009).
    2. Observations with PreCam and SDSS filters on a few occasions – we will provide tracking software.
    3. If major event happens on orbit, then finish night with PreCam taking debris data, switch to NASA camera the next day.
    4. Time made up to DES as soon as possible or next year.

Requirements (3)

3. 10% time to Chilean astronomers (*all NASA debris grants have 10% Chilean time as part of the program.)*

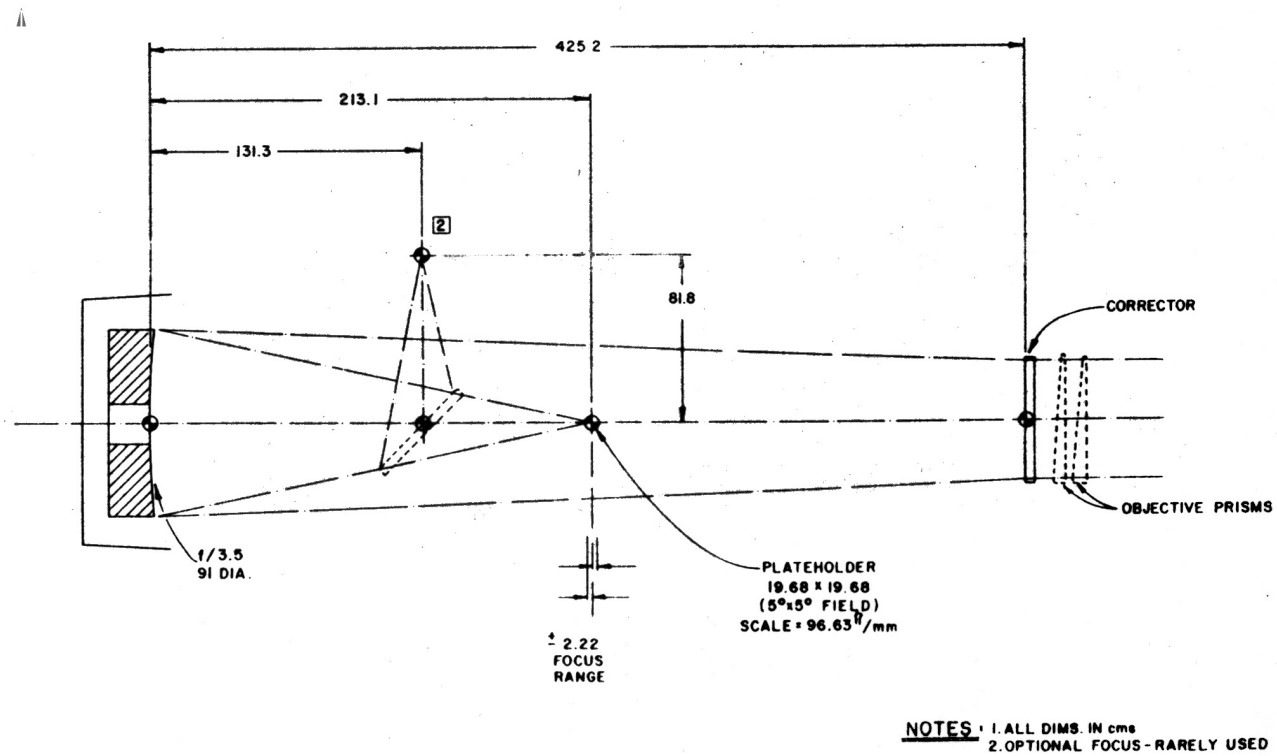
    1. 10% applies to scheduled observations for science, not engineering time.
    2. DES 100 nights
        - Assume 20% engineering time since this is a new instrument
        - 80 nights for science
        - 8 nights for Chile
    3. Approved proposals will be received from CNTAC through CTIO.
    4. Service observing with PreCam and SDSS filters only.
    5. Suggest two 4 night runs scheduled in advance
        1. 4 nights July/August/Sept
        2. 4 nights December/January

Requirements (4)

4. Hardware upgrades as part of facility improvement (*DES will benefit from significant NASA upgrades)*

    1. New secondary flat for unvignetted field – current flat may have 0 deg fov!
    2. New secondary flat support structure (spider)
    3. Flat field screen

Optical Layout



NOTES: 1. ALL DIMS. IN cms
2. OPTIONAL FOCUS - RARELY USED

Technical Details

- 90-mm Uniblitz iris shutter
- Computer controlled filter bolt with five 4x4-inch square filters
- Computer controlled focus
- Dedicated GPS network timeserver at Schmidt.
- Internal net for command and control.
- March 2005 telescope drives modernized using NASA funds
  - DFM Engineering
  - Everything now computer controlled via TCP/IP connection
    - Dome open/close
    - Dome rotation
    - Telescope positioning and tracking
    - Maximum slew rate tested at 1.8 deg/sec; could go faster.
    - Telescope status (position and rates) readback
    - TCS control scriptable

DES to provide

1. Camera.
2. Data acquisition computers
3. Data reduction computers
4. Observers.

Anything else?

1. UM Astronomy access to PreCam data for science.

2. NASA has need for calibration strip approx 1 deg tall in declination.
   1. Approx declination = -2 deg
   2. Around whole sky
   3. Single pass in gri
   4. 2-3% photometry
   5. Catalog of stellar positions (UCAC3?) and reduced magnitudes/colors.

3. Access to DECam on Blanco for debris program – a very interesting instrument for debris observations at GEO.

Summary of Requirements

1. Debris program access to Curtis-Schmidt during DES time if need arise.

2. DES pays all expenses resulting from DES use of the facility.

3. 10% of time to Chilean astronomers - service observing .

4. DES contributes hardware upgrades to telescope.

100 total nights possible in July/August/September 2010 and December 2010/January 2011