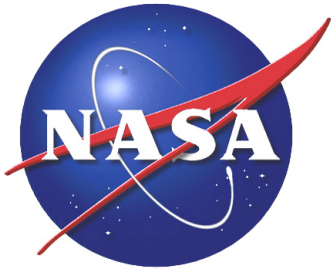
NASA Satellite Laser Ranging Program
GNSS Tracking Best Practices



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MOBLAS 4, MOBLAS 5, MOBLAS 7

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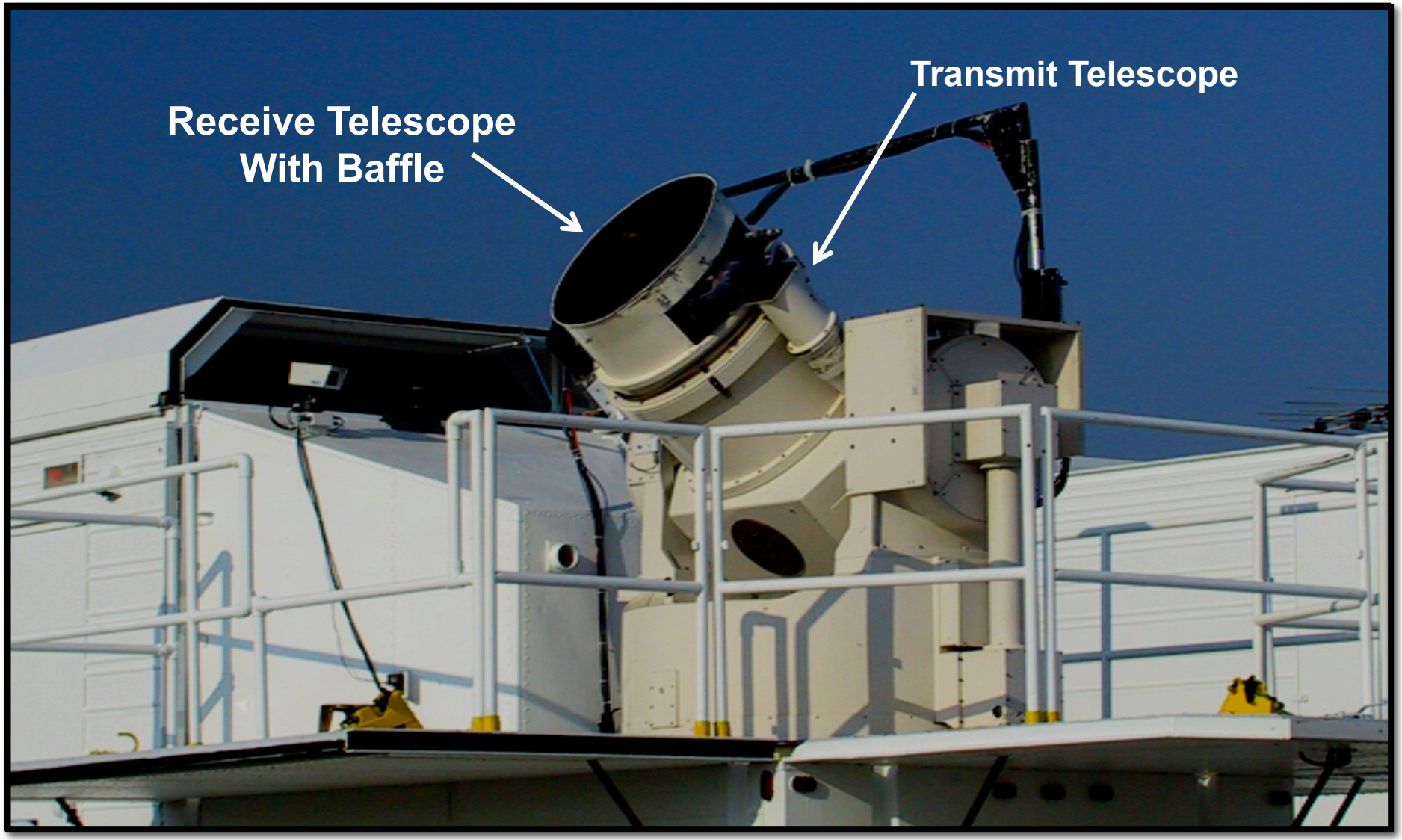
MOBLAS Transmit/Receive Telescopes



- System Optics
  - Precision coelostat alignment
  - Precision co-alignment alignment of laser pointing with coelostat
  - Precision co-alignment of transmit and receive optics (boresight)
    - Perform periodic boresight alignments, sometimes weekly or more often to compensate for temperature effects
  - Transmit and receive optics stability
    - Mirror mounting is stable
    - Mirror mounts are stable
    - Mirror mounts are free of mechanical wear
  - Transmit and receive optics are clean
    - Optical coatings correct for particular use
    - Optical coatings are in good shape
- Laser
  - Laser divergence is nominal
  - Laser output power is maximum sustainable and stable

- Use of intensified camera allowing visual viewing of sunlit GNSS satellite
  - Precision co-alignment of intensified optics with the transmitted laser beam
  - Precise identification mark on intensified camera readout (mark on CRT) of transmit and receive optics co-alignment point
- Precision mount model (star calibration)
  - Use of intensified camera for mount model
  - Precise alignment of star image with the intensified camera identification mark (mark on CRT)
  - Understand daytime/nighttime stability of optical system and compensate as necessary
  - Perform mount models often, sometimes weekly
- Maintain record of pointing biases with respect to gimbal azimuth and elevation direction during passes

MOBLAS Control Console

- Spatial and temporal filters are precision aligned verified periodically
  - Minimize opening of spatial filter during high noise conditions
  - Maximize temporal filter throughput
  - Use of temperature stable temporal filter
- Use of receive signal amplifier and co-aligned constant fraction discriminator (High Sensitivity Laser Receiver - HSLR)
- Minimize electronic gate widths to reduce noise and chance of noise returns
  - PMT Gate
  - Constant Fraction Discriminator
    - Double gating
    - Minimal gate widths
- Use of a telescope baffle to minimize off-axis light, glare
- Use of low signal loss, temperature stabile receive cable for MCP output
- Use most up-to-date satellite predictions
- Gimbal servo loop is highly tuned to ensure tightest possible tracking at GNSS orbits