Allied Signal

OPTICAL ATTENUATION MECHANISM

UPGRADES

MOBLAS and TLRS SYSTEMS

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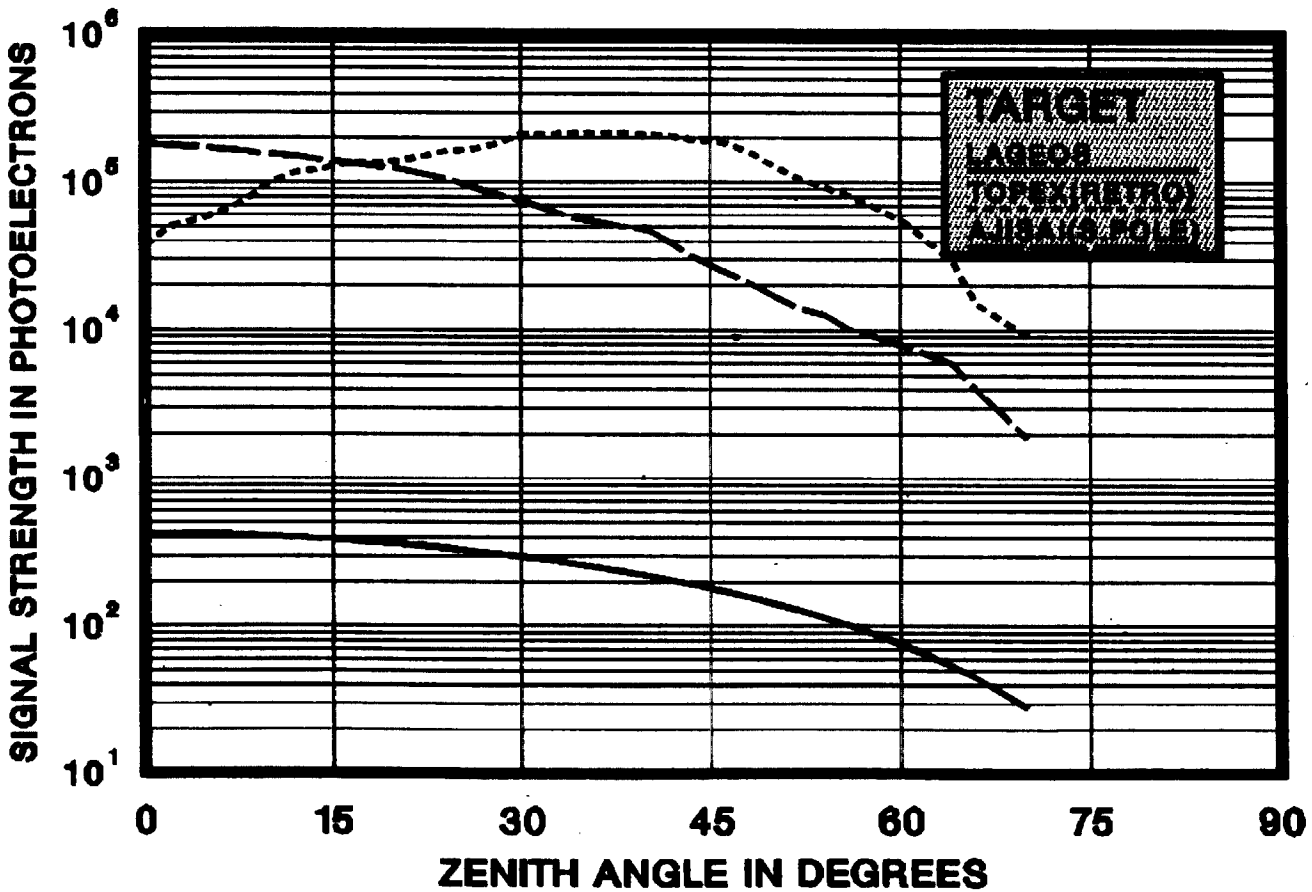
Abstract

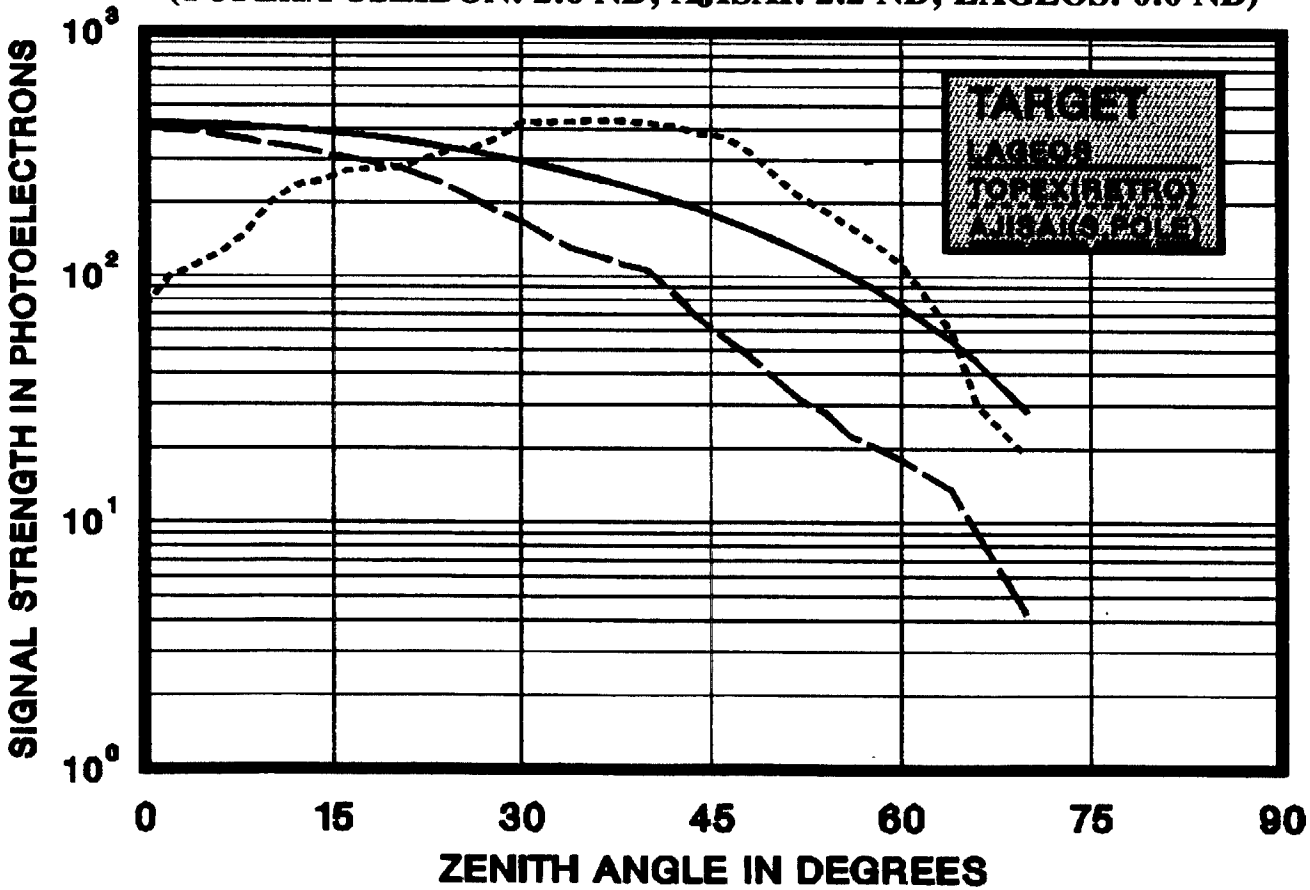
This poster presentation describes the Optical Attenuation Mechanism (OAM) Upgrades to the MOBLAS and TLRS Crustal Dynamics Satellite Laser Ranging (CDSLR) systems. The upgrades were for the purposes of preparing these systems to laser range to the TOPEX/POSEIDON spacecraft when it will be launched in the summer of 1992. The OAM permits the laser receiver to operate over the expected large signal dynamic range from TOPEX/POSEIDON and it reduces the number of pre and post calibrations for each satellite during multi-satellite tracking operations. It furthur simplifies the calibration bias corrections that had been made due to the pass-to-pass variation of the photomultiplier supply voltage and the transmit filter glass thickness. The upgrade incorporated improvements to the optical alignment capability of each CDSLR system through the addition of a CCD camera into the MOBLAS receive telescope and an alignment telescope onto the TLRS optical table.

The OAM is stepper motor and microprocessor based; and the system can be controlled either manually by a control switch panel or computer controlled via an EIA RS-232C serial interface. The OAM has a neutral density (ND) range of 0.0 to 4.0 and the positioning is absolute referenced in steps of 0.1 ND. Both the fixed transmit filter and the daylight filter are solenoid actuated with digital inputs and outputs to and from the OAM microprocessor. During automated operation, the operator has the option to overide the remote control and control the OAM system via a local control switch panel.

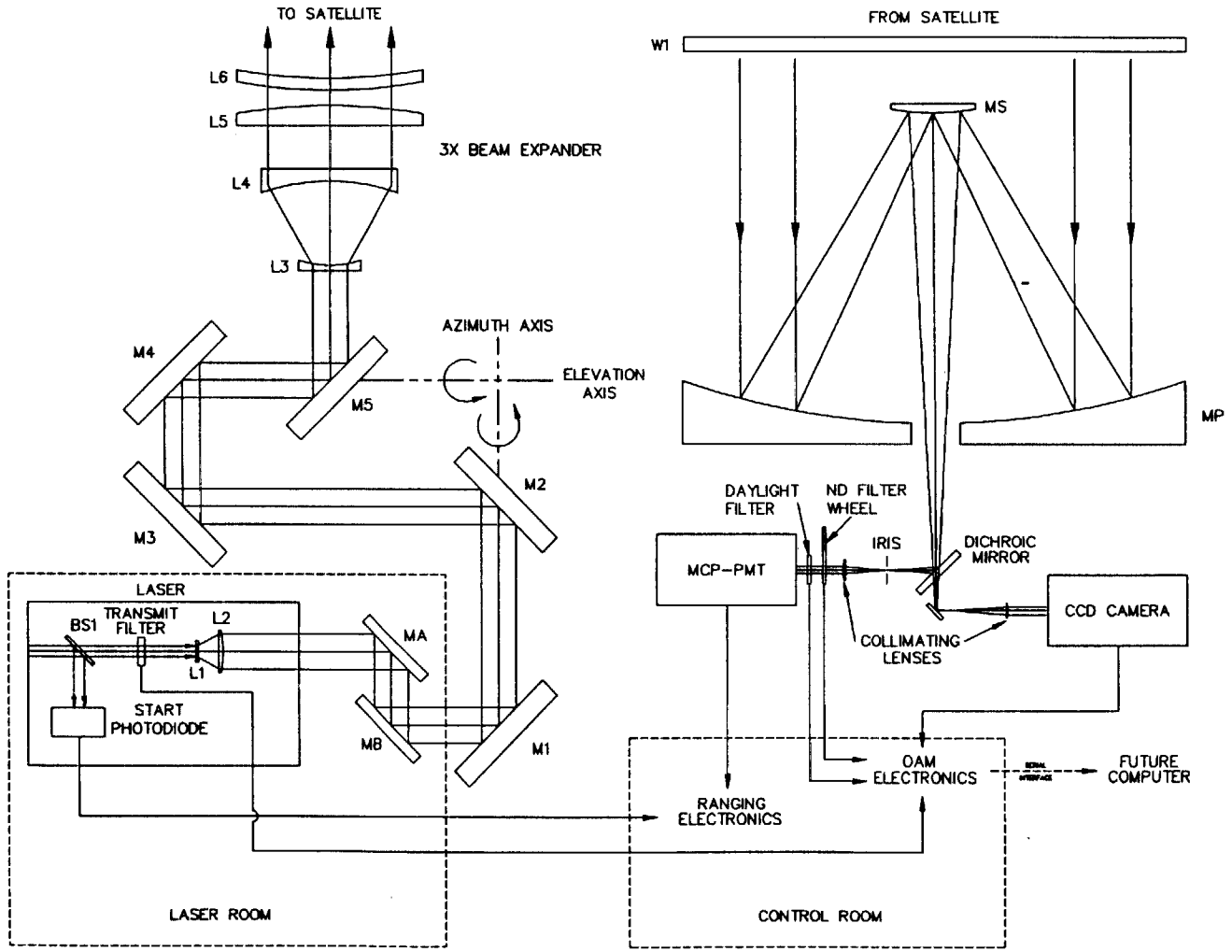
PHOTOELECTRONS RETURNED BY VARIOUS SATELLITES



PHOTOELECTRONS RETURNED BY VARIOUS SATELLITES WITH OAM
(TOPEX/POSEIDON: 2.6 ND; AJISAI: 2.2 ND; LAGEOS: 0.0 ND)



MOBLAS OAM UPGRADE SUBSYSTEM



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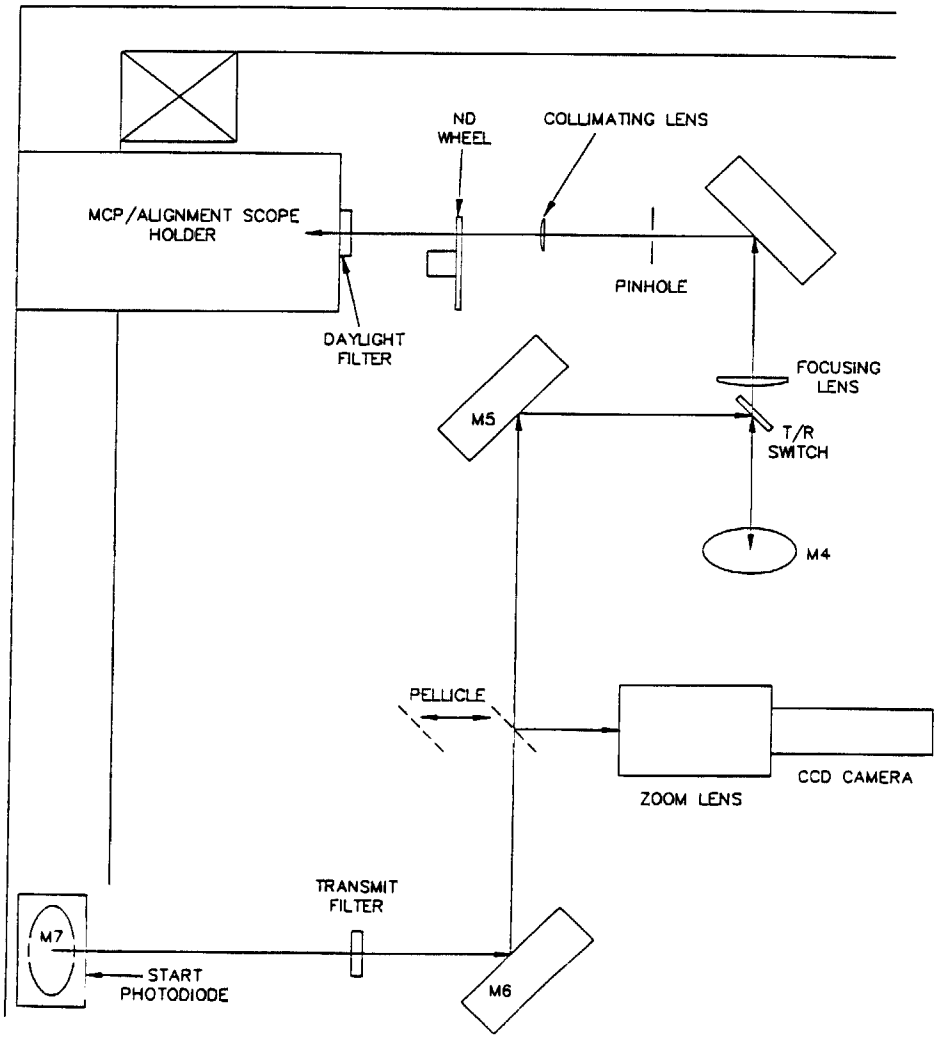
TLRS OAM UPGRADE SUBSYSTEM



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OAM UPGRADE SPECIFICATIONS

Stepper Motor and Control Electronics:
- Indexer/Controller: Compumotor model 500
  - Max. speed: 40 rps
  - Steps per revolution: 25,000
  - Digital I/O: 13 inputs, 8 outputs
  - Computer interface: EIA RS-232C
  - Software:
    - High level X-language
    - Variable assignments
    - Math functions
    - Conditional branching
    - Max. program locations: 99
    - Memory: 8k RAM
- Motor Drive: Compumotor model CT
- Miniature Stepper Motor: Compumotor model CT25-30

Neutral Density Wheel: Reynard part 522
- 0.0593 to 3.94 ND: 0 to 270 degrees, 7 mm dia. beam
- linearity of density: +/- 5%
- ar (532 nm, normal incidence, both sides): 0.1 % reflective
- substrate: 100 mm dia., BK-7, < 3 arcmin wedge

Dichroic Beam Splitter: Melles Griot substrate, coated by Omega
- 99 % reflective, 532 nm, unpolarized, 45 degree incidence
- approx. 85 nm FWHM relective about 532 nm
- 400 to 800 nm blocking
  - > 532 nm: 80-95 % transmitive
  - < 532 nm: 20-70 % transmitive
- ar (MgF) coating on one side
- substrate: BK-7, lambda/10, 1 arcmin wedge

Daylight Filters:
- Original MOBLAS: 10A @ 532 nm, Oriel
  approx. 40 % trans. (GSFC meas.)
  unknown blocking
- Original TLRS, new MOBLAS: 10A @ 532 nm, Omega
  60-65 % trans.
  uv to 900 nm blocking
- New TLRS: 3A @ 532 nm, Omega
  45 % trans.
  400 to 700 nm blocking

TLRS Pellicle:
- Uncoated: 8 % refl.
- Flatness: 2 lambda per 25 mm

OAM UPGRADE SPECIFICATIONS (continued)

Lenses:

MOBLAS Collimating lens: 36 mm fl, BK-7, ar (MgF)
Field lens: 1000 mm fl, BK-7, ar (MgF)
Achromat lens: 80 mm fl, ar (MgF)
TLRS Focussing lens: 150 mm fl, BK-7, ar (MgF)
Collimating lens: 60 mm fl, BK-7, ar (MgF)

Mirrors:

MOBLAS turning mirror: Edmund Scientific
lambda/8
enhanced aluminum
TLRS turning mirror: CVI
lambda/10
> 99.5 % refl.
BK-7 substrate
< 5 arcmin wedge

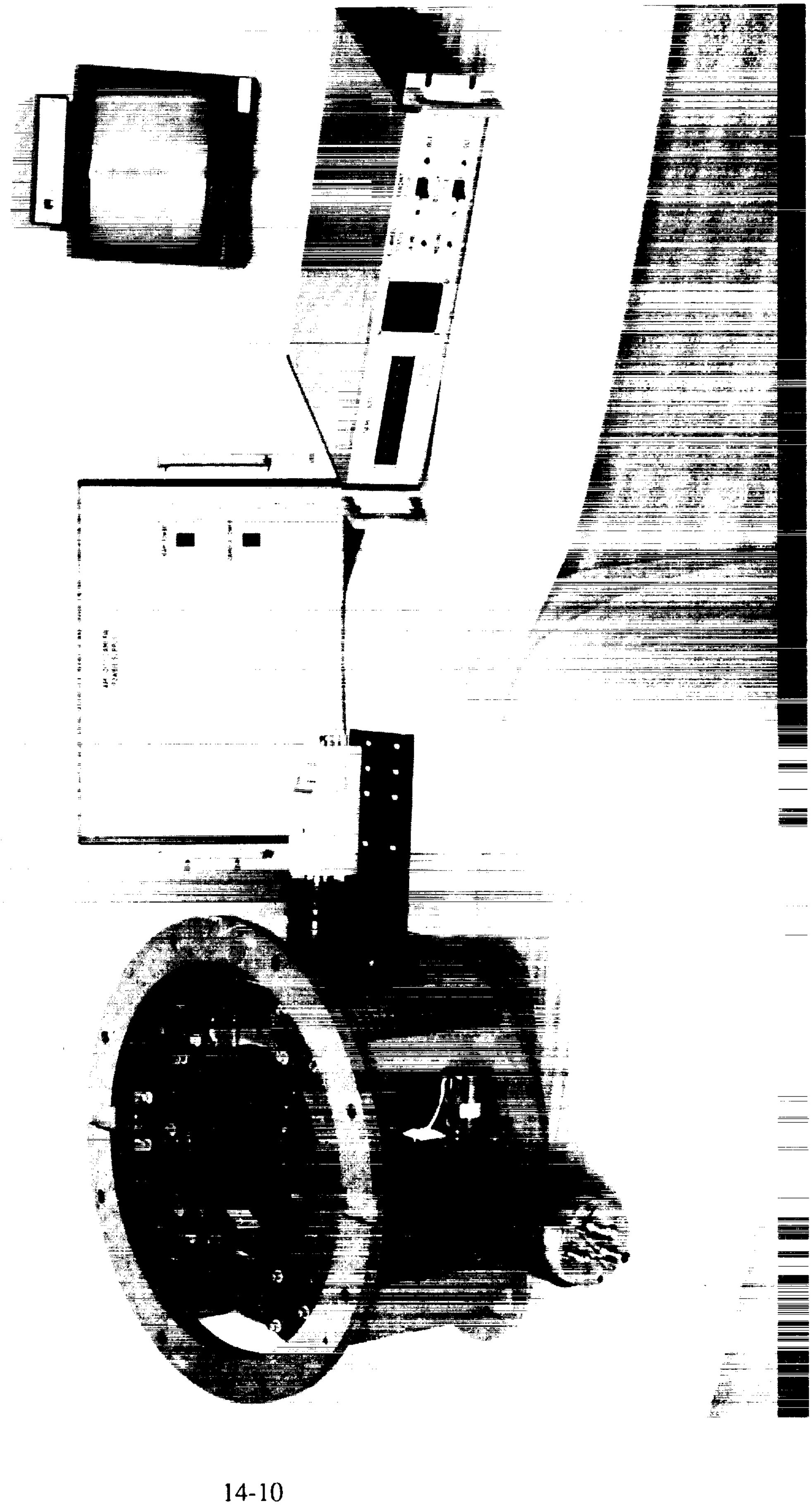
Alignment Telescopes, K&E Electro-Optical Products, Cubic Precision

Original MOBLAS: Model 71 2030 Bright Line Alignment Telescope
Magnification: 4x @ zero to 46x @ infinity
Resolving Power: 3.4 arcsec
Field of View: 42 mm @ zero, 37 min @ infinity focus
Effective Aperature: 42 mm
New TLRS: Model 71 2062 Line of Sight Telescope
Magnification: 23x @ 7 in. to 35x @ infinity
Resolving Power: 3.5 arcsec
Field of View: 7.4 mm @ 7 in., 47 min @ infinity focus
Effective Aperature: 38 mm

CCD Camera Systems:

MOBLAS CCD camera: Burle model TC652EA
510 (H) x 492 (V) pixels, EIA RS-170
Horizontal resolution: 383 TVL
Signal-to-noise: 50dB
Lens: 75 mm fl, F/1.4
Lens mount: Standard "C" or "CS"
Video Line Generator: Oracle model 1000
Video Monitor: Panasonic model TR-930B
TLRS CCD Camera: Pulnix model TM840
767 (H) x 483 (V) pixels, NTSC
TV resolution: 580 lines (H), 350 lines (V)
Signal-to-noise: 50 dB
Lens: 11-110 mm zoom
Lens mount: Standard "C"
Video Monitor: Panasonic model TR-930

MOBLAS OAM UPGRADE



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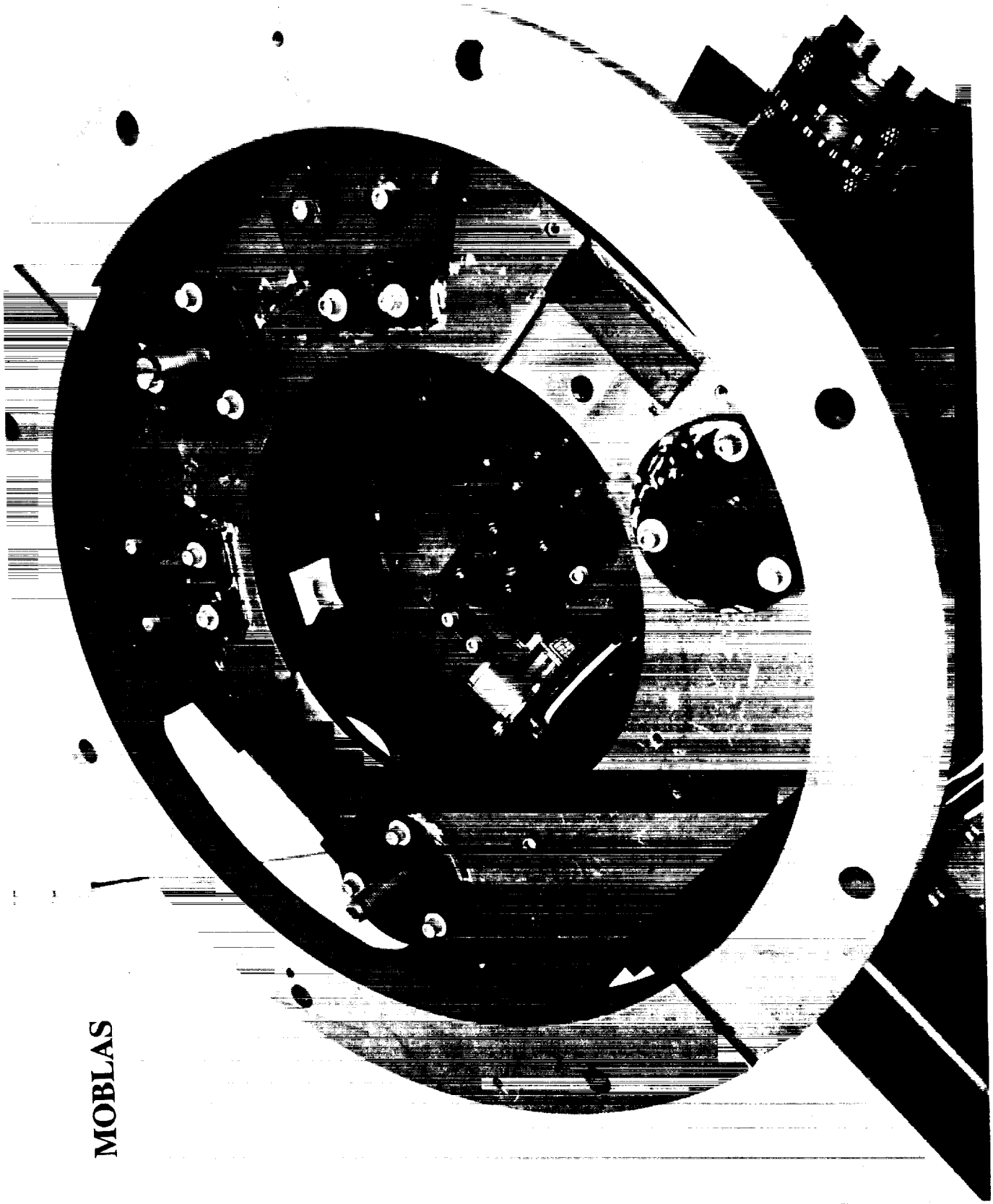
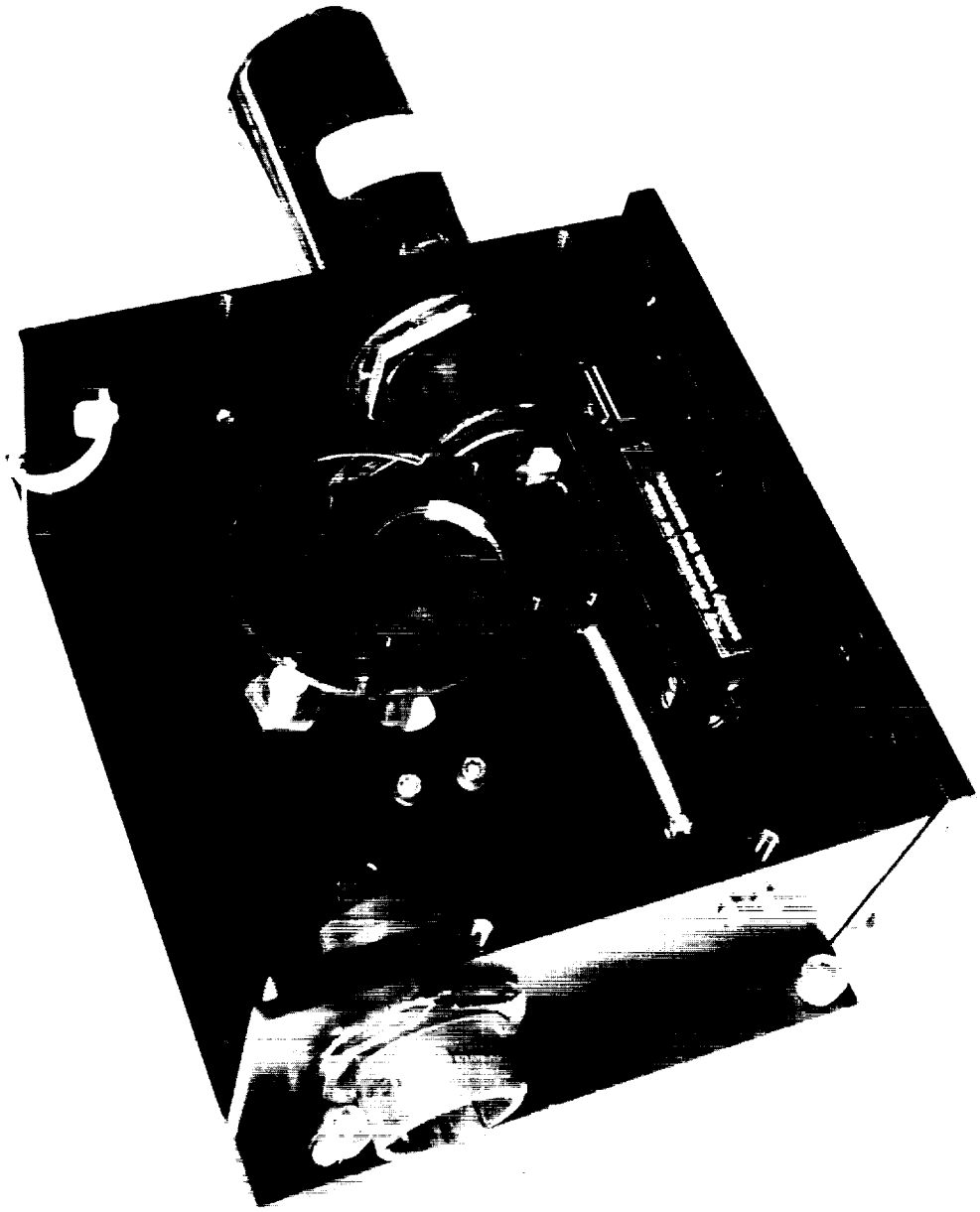
BLACK AND WHITE PHOTOGRAPH



MOBLAS



MOBLAS OAM

TLRS OAM UPGRADE