

MOBLAS-6 technical and operational overview

Johan Bernhardt
(HartRAO, MOB6 Manager)

2nd Space Geodesy Workshop
Matjiesfontein
12-15 November 2007



HartRAO MOBBLAS-6



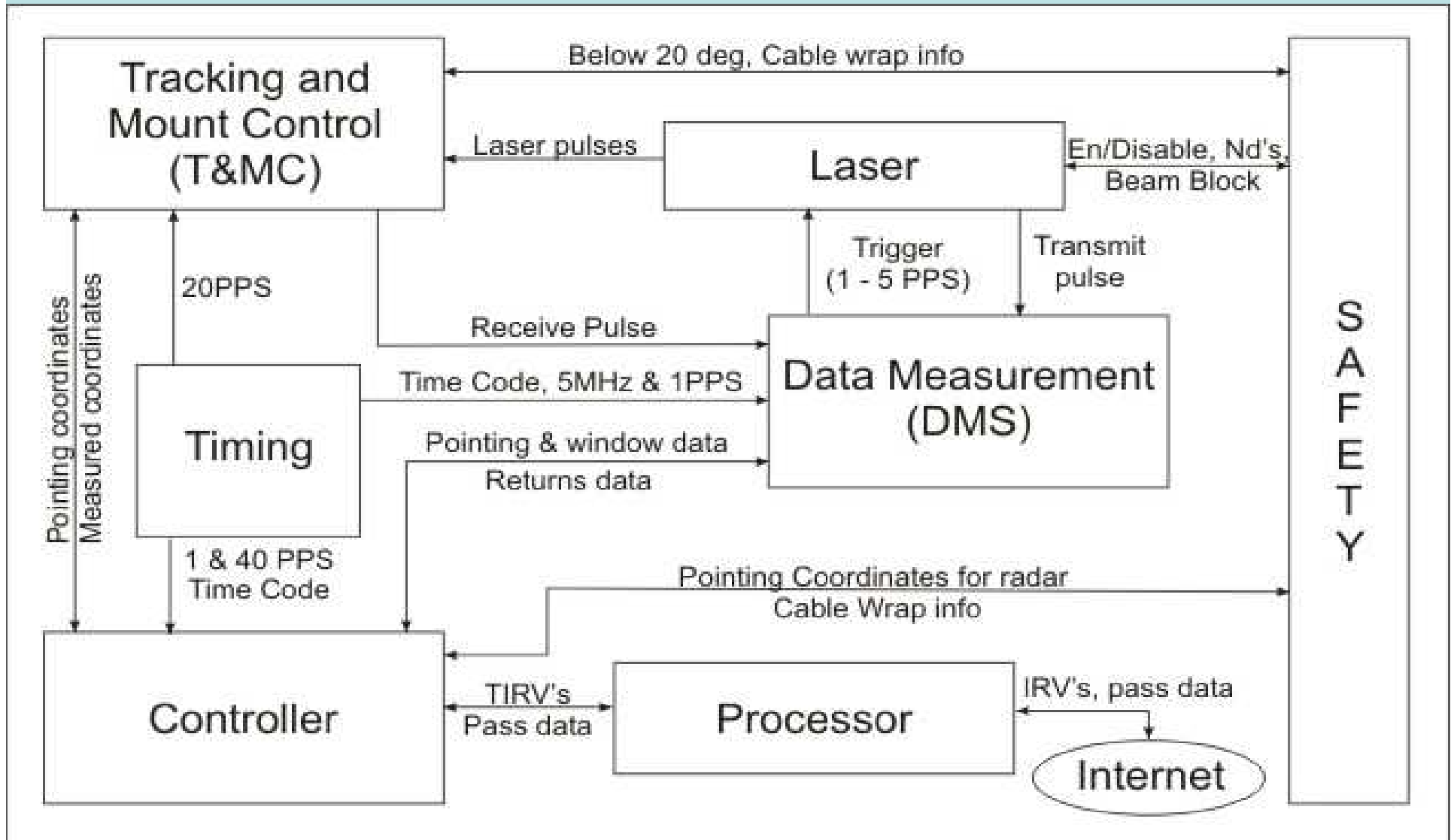
Overview

MOBLAS-6 SLR Since September 2000

MOBLAS-6 is a NASA Satellite Laser Ranging System located at HartRAO, it forms part of a global network of 40 stations.

MOBLAS 6 have produced high quality data since September 2000 on more than 22 thousand Satellite Passes

MOBLAS-6 Functional Block Diagram



MOBLAS-6 Technical set up

- **Laser System**
- **Receive System**
- **Timing System**
- **Telescope Control System**

Laser System

- ND: YAG
- Primary wavelength 1064 nm
- Maximum energy 250 mJ
- Secondary wavelength 532 nm
- Amplification stages 1
- Maximum energy 120 mJ (Adj)
- Repetition rate 1 to 20 Hz (4 / 5 pps)
- Pulse width 200 ps
- Final exit beam diameter 0.093 M

SLR Receive System

Mount:

- AZ – EL
- Integral torque drive motors

Telescope:

- Cassegrain
- Aperture: 76.2 CM

Detector:

- Photek PMT - 318
- Primary Gain 532 nm
- Rise Time 350 ps
- Jitter: 100 ps

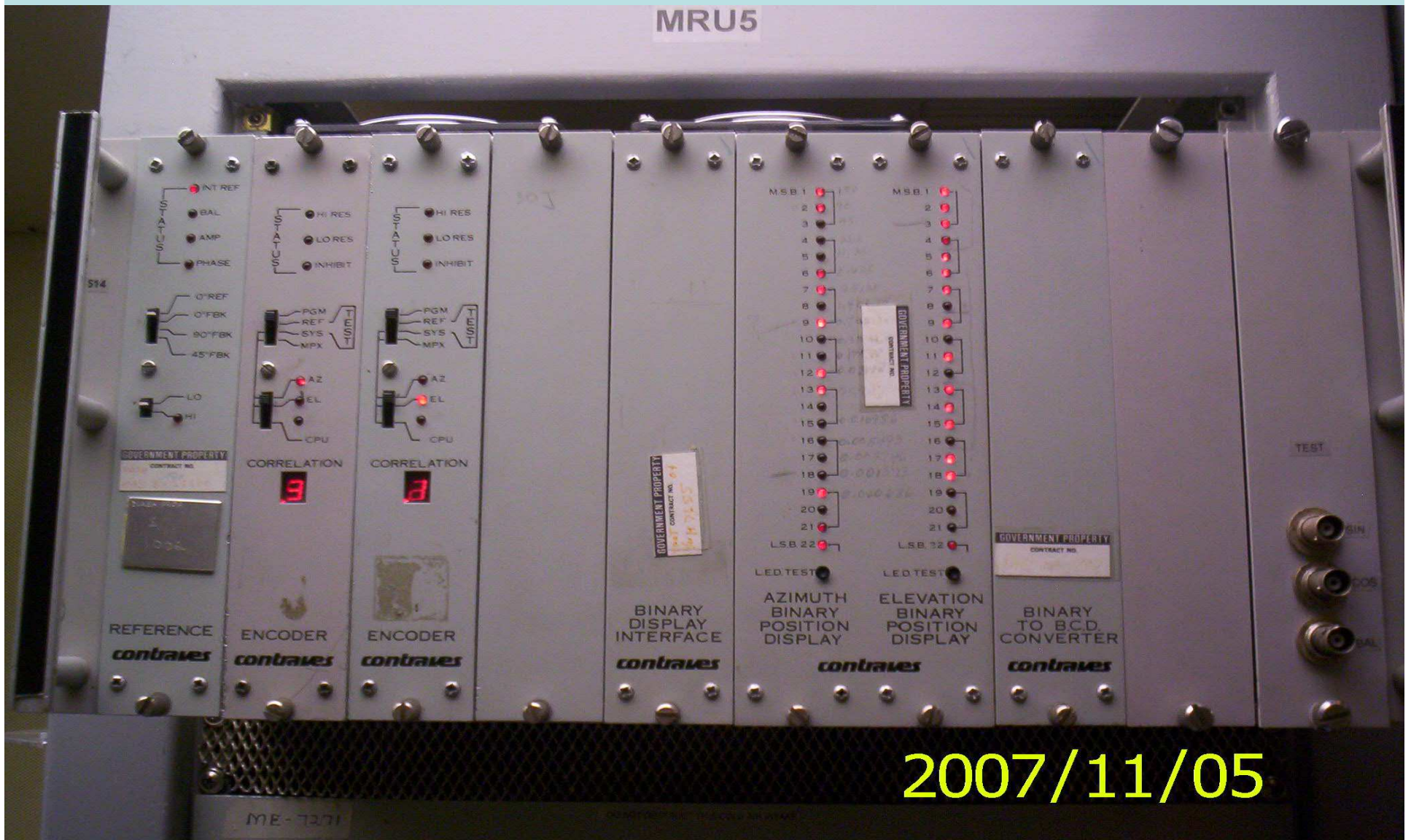
Timing System

- GPS Steered Rubidium Clock



Telescope Control System

MRU5



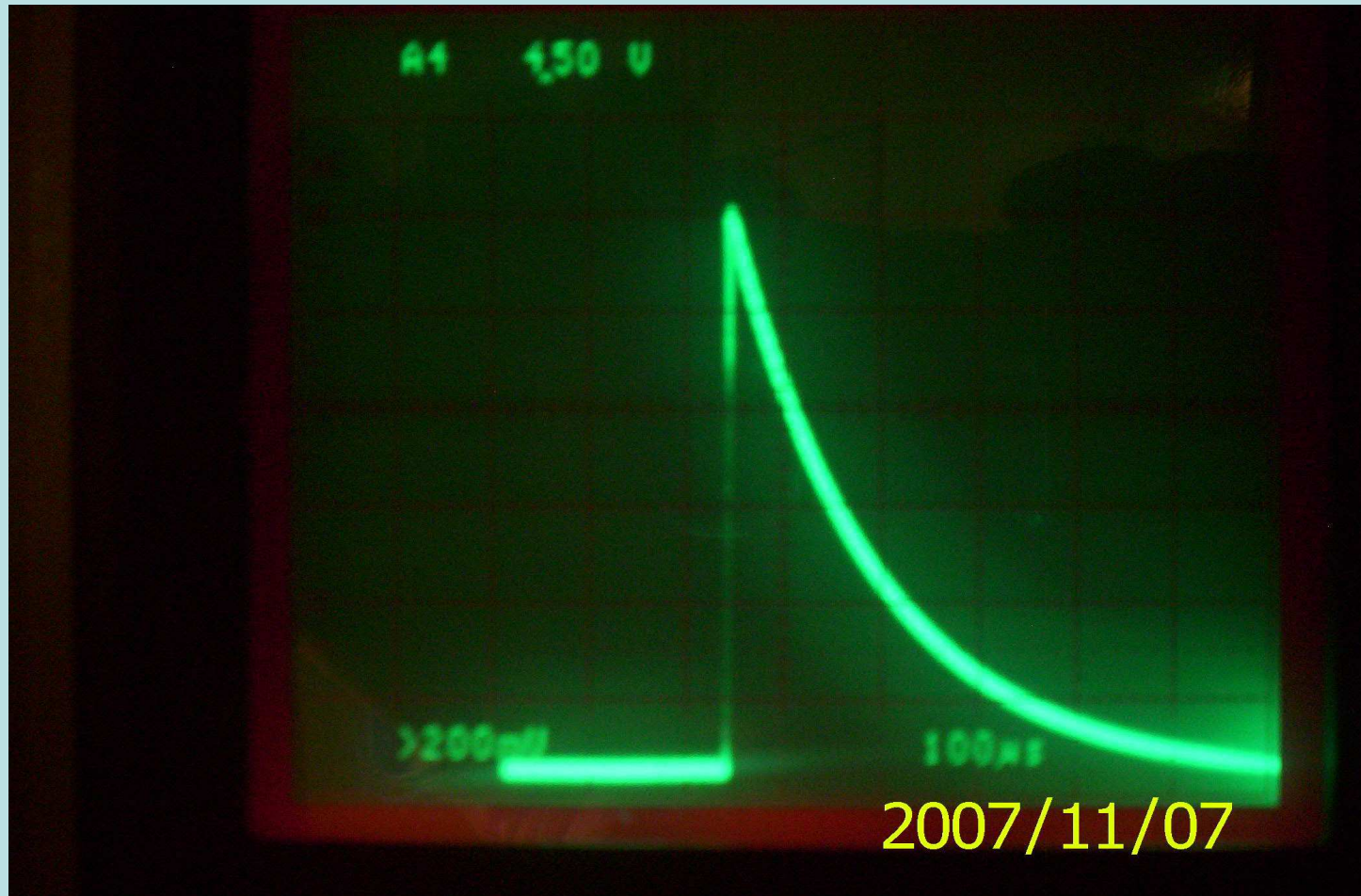
MOBLAS-6 Logistics

- Laser Maintenance
- Tracking Schedules and operator shifts
- Laser Rod installation
- Mechanical repairs and design
- Electronic repairs

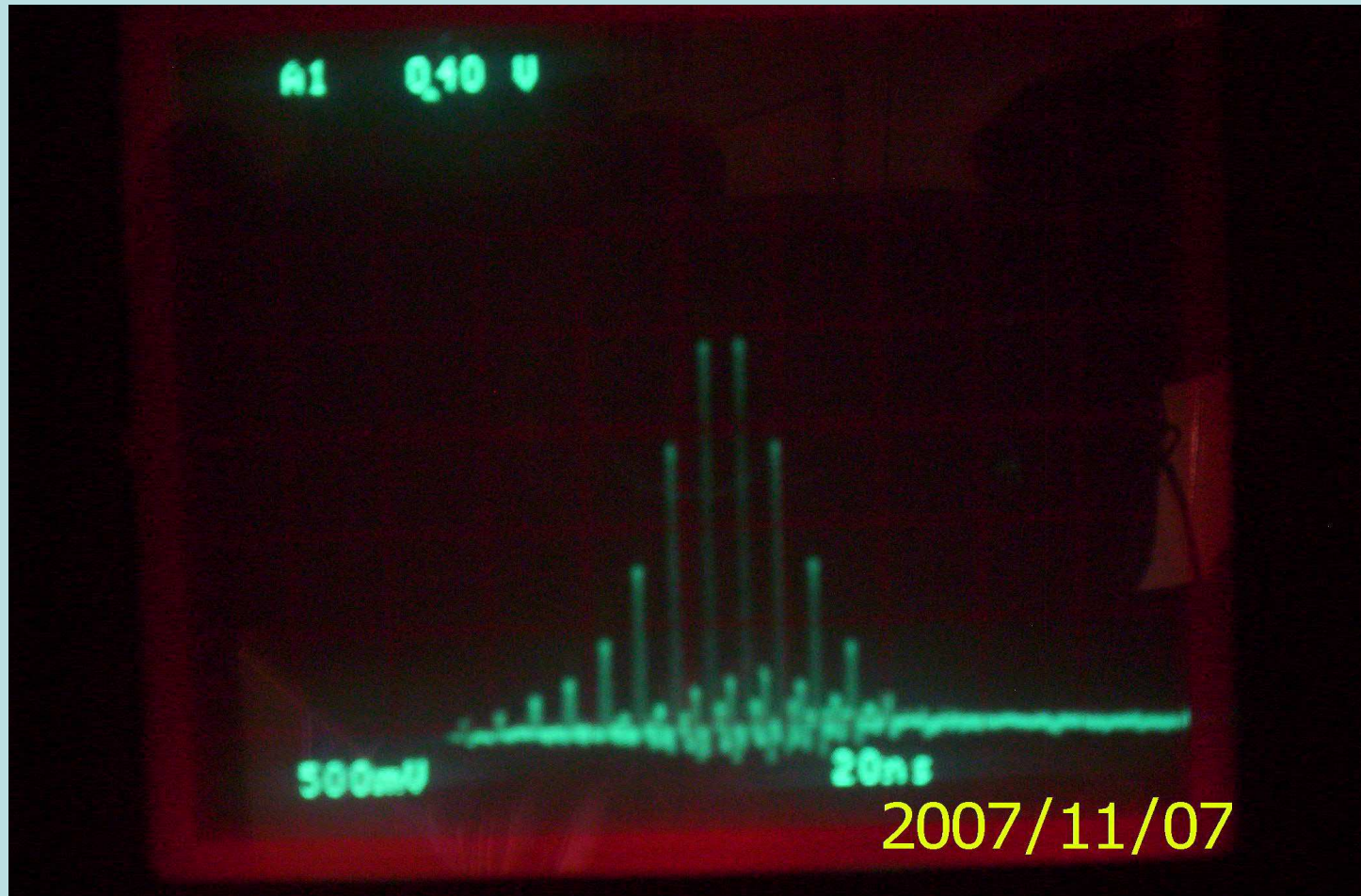
Typical Laser Maintenance Tasks

- **Room is environmentally controlled**
- **Optics to be kept clean**
- **Dye kept to specified concentration**
- **Cooling system monitored (chiller)**
- **System maintenance and alignment**

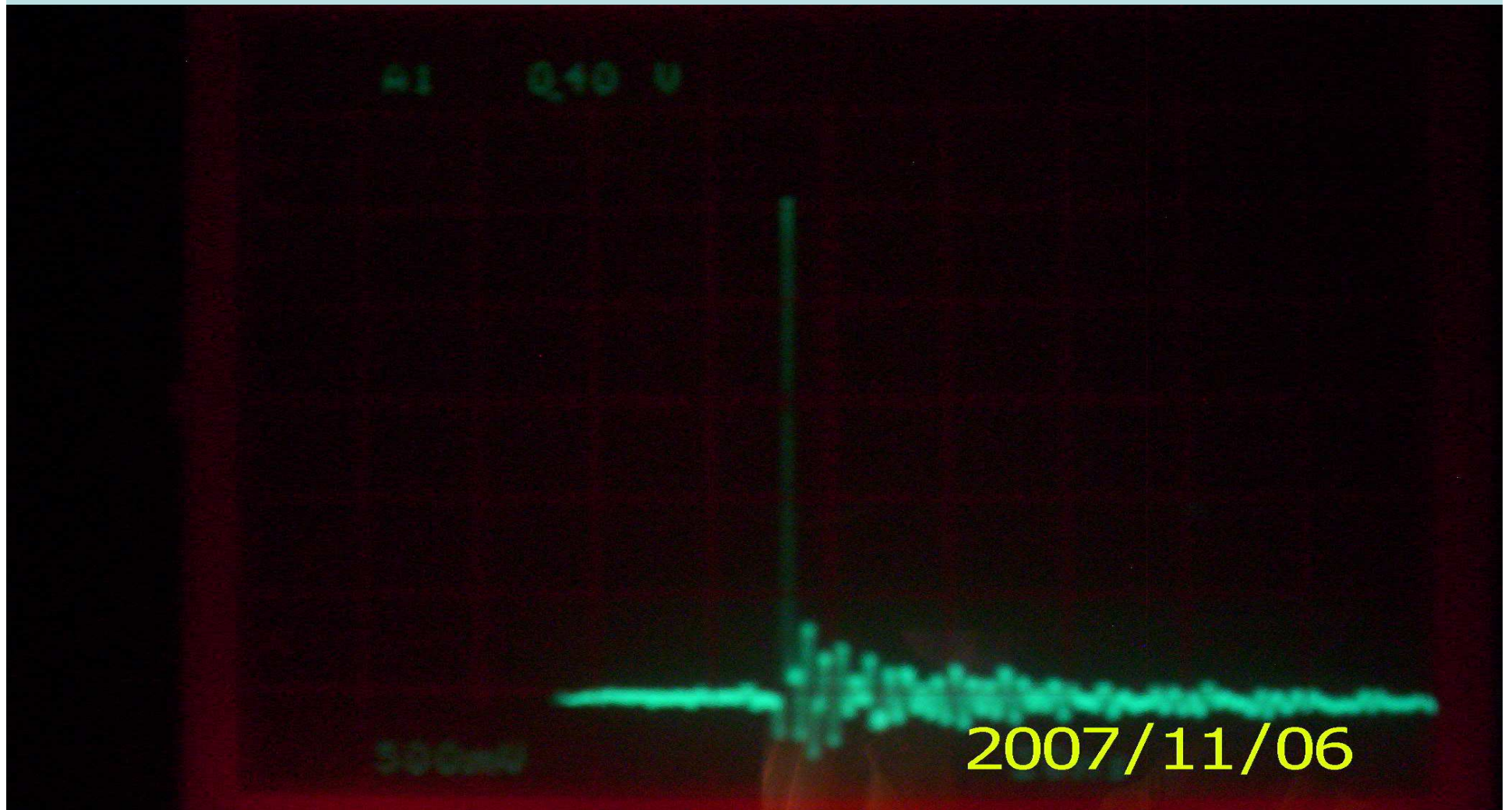
Laser Oscillator free running



Laser Oscillator Mode Locked



Laser Oscillator output pulse



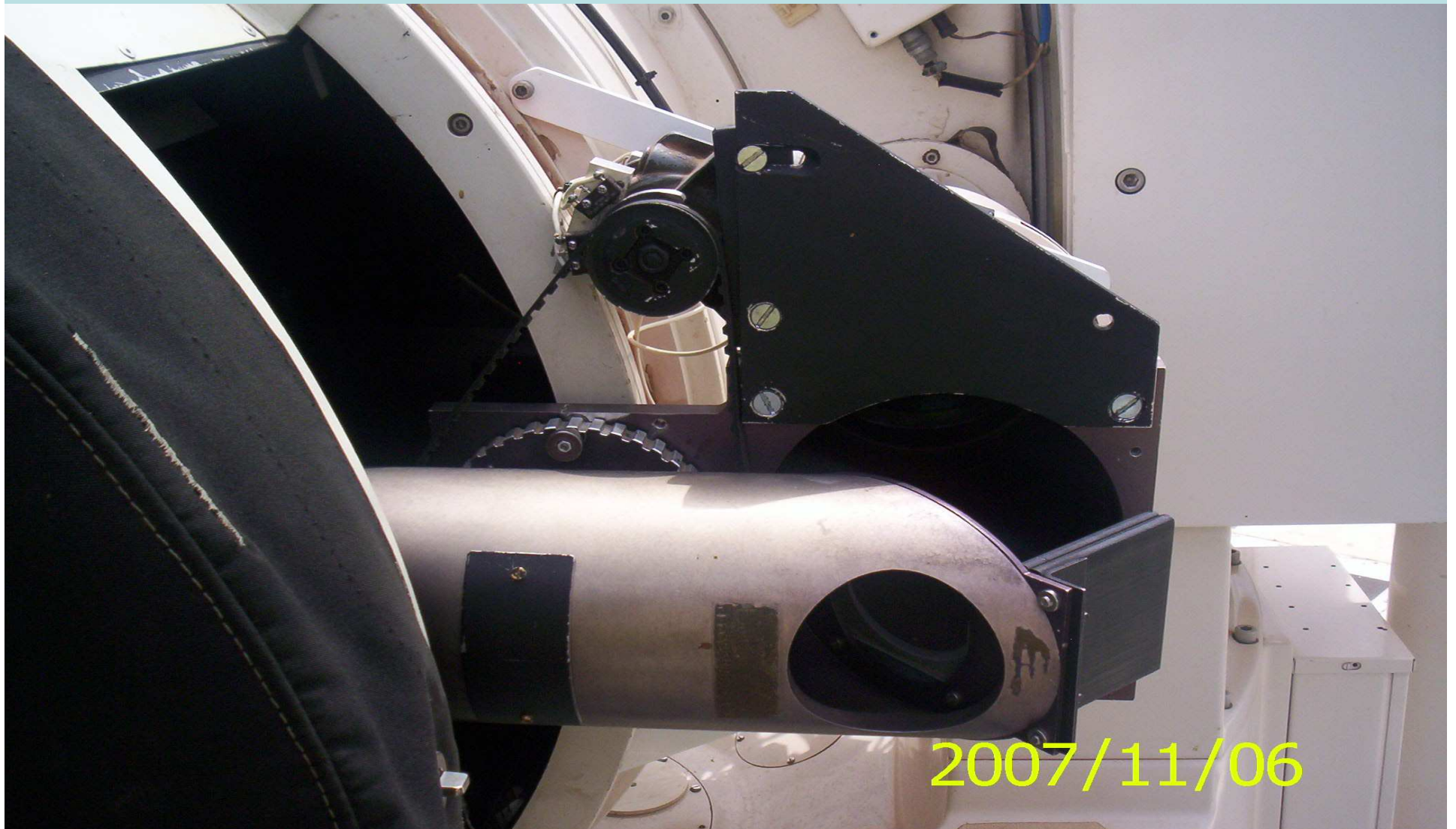
MOBLAS-6 Upgrades

- Telescope Cable Boom
- Calibration Translator
- Fixed Target De-mister
- Air-Conditioning Units
- Return Rate Monitoring

Motorized Cable Boom



Motorized Translator



2007/11/06

Calibration Pier De-mister



2007/11/06

New Air-Conditioners



Return Rate Monitor

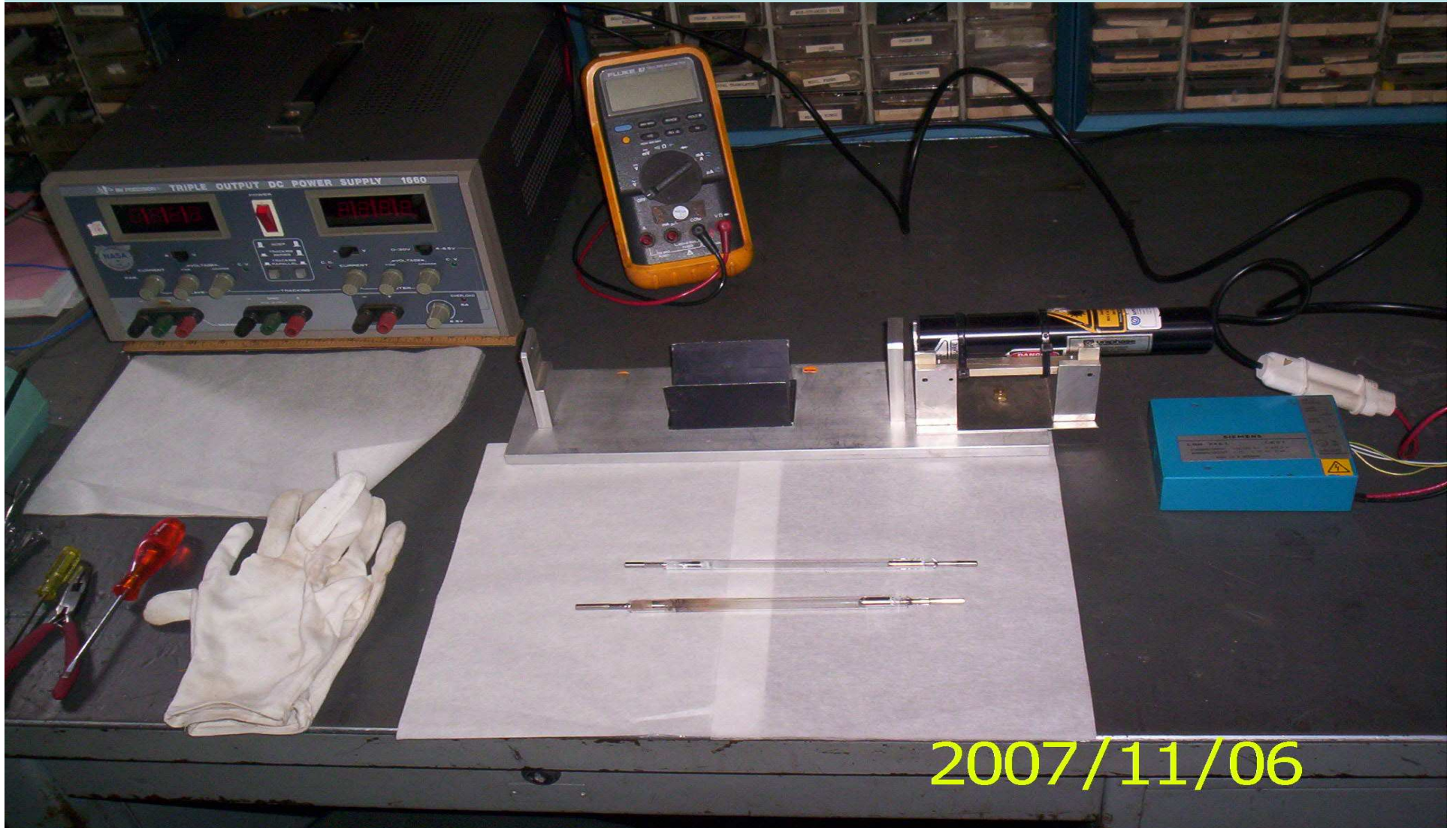


2007/11/06

MOBLAS-6 Repairs

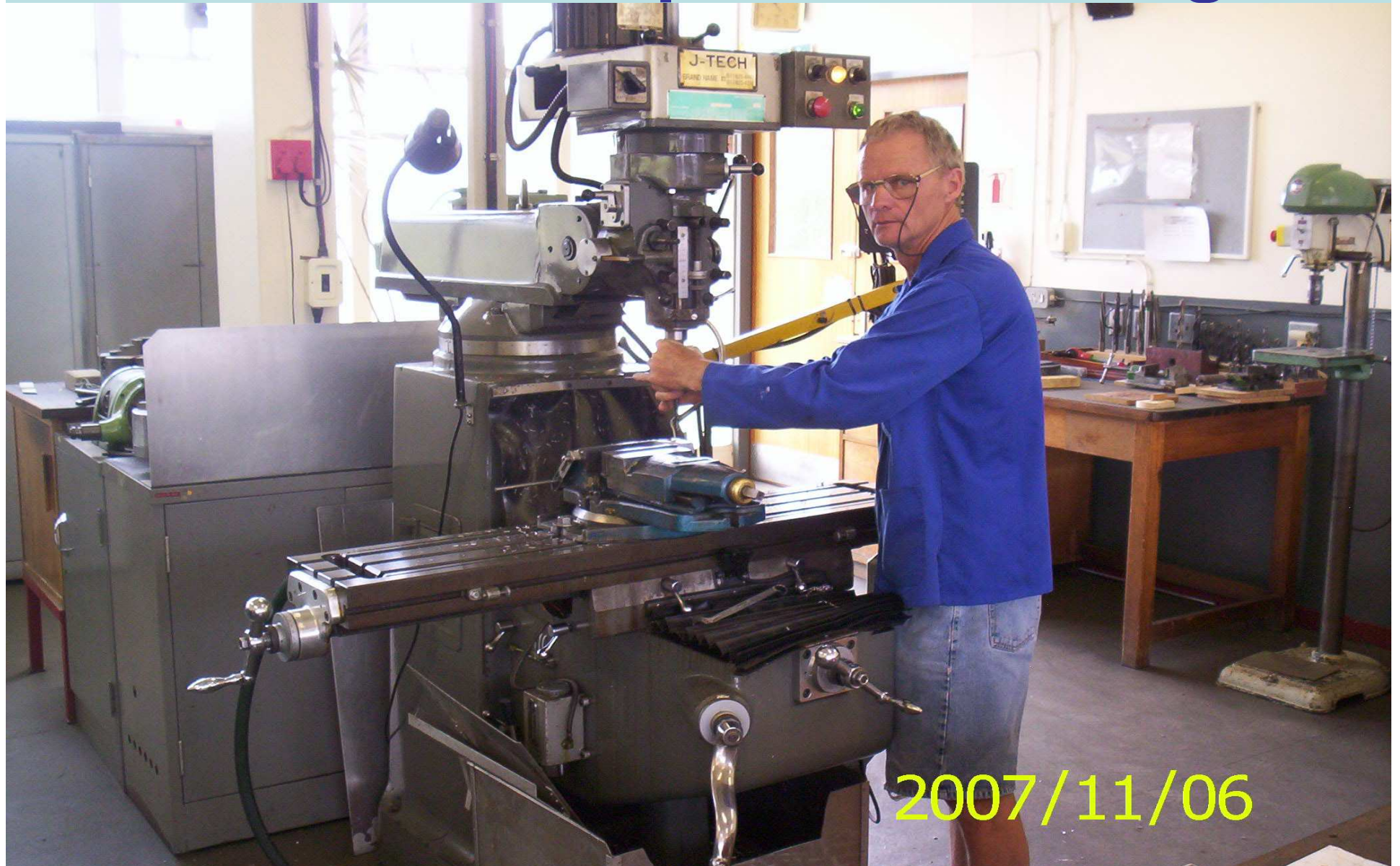
- Laser Optics repair/replacement
- Mechanical repairs and design
- Electronic repairs

Laser optics



2007/11/06

Mechanical Repairs and Design

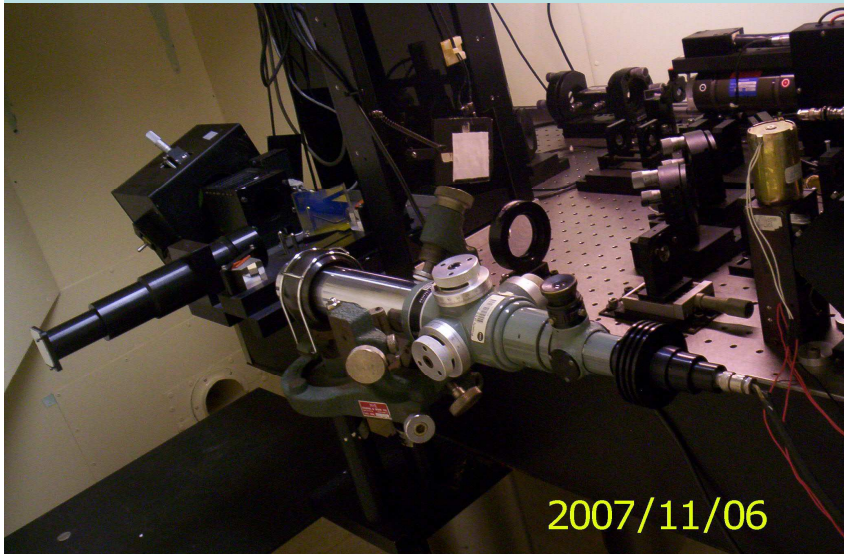


Electronic Repairs



MOBLAS-6 Calibration

- Bore Sight Alignment
- Star Calibration



MOBLAS-6 Safety

- Full Power Tracking (120mJ)
- Laser Room access and Alignment
- Telescope access monitor and laser disable
- Aircraft safety
- Telescope Pointing Error
- Laser safety when ranging to fixed targets on site

Laser full power after 20 degree elevation



Laser Room Access



Laser disable stairwell switches



Aircraft Safety (Radar)



2007/11/05

Full power tracking only above 20 degree elevation



Laser eye safe when ranging to fixed targets on site



2007/11/06

Telescope pointing Error

Software laser fire keyhole: disables laser when telescope computer command position and actual position delta is greater than 5 degrees

SLR Mission Support

- **Geodetic Missions**
- **Earth Sensing Missions**
- **Radio Navigation Missions**
- **Experimental Missions**
- **Future Missions (LRO)**

SLR Geodetic Missions

To determine by observations and measurements the exact positions of points on the earth's surface; the shape and size of the earth; and the variations of the terrestrial gravity and magnetic fields.

SLR Earth Sensing Missions

The earth sensing satellites carry experiments designed to sense the earth to acquire data on worldwide environmental changes such as the green house effect, ozone layer depletion, tropical rain forest deforestation, and abnormal climatic conditions, in order to contribute to international global environmental monitoring.

SLR Radio Navigation Missions

The radio navigation satellite constellations are now commonly used throughout the World

SLR Experimental Missions

The experimental satellites carry diverse experiments that do not fit into one of the other mission classifications (i.e. geodetic, earth sensing, positioning). These satellites are irregularly shaped objects in relatively low altitude orbits.

Lunar Reconnaissance Orbiter (LRO)

- **LRO** is the first in a series of missions to the moon , planned for launch in late 2008 and will orbit the Moon for at least one year.
- **LRO** mission will not only enable future human exploration but also provide excellent opportunities for future science missions.
- **LRO** will spend at least one year in low polar orbit around the Moon, collecting detailed information about the Lunar environment.

MOBLAS-6 Staff

- Johan Bernhardt – Station Manager
- Gert Agenbag – SLR BSC Student
- Sammy Tshefu – SLR Operator
- William Moralo – SLR Operator
- Cristina Langa – SLR Trainee and post MSC Student

MOBLAS 6 Personnel



2007/11/07

END



2007/11/06

MOBLAS-6 Contact Details

Johan Bernhardt

Manager: HartRAO MOBLAS 6

Tel +27 (0) 12 326 0752

Fax +27 (0) 12 326 0756

Mobile 076 796 1539

johan@hartrao.ac.za

P O Box 443

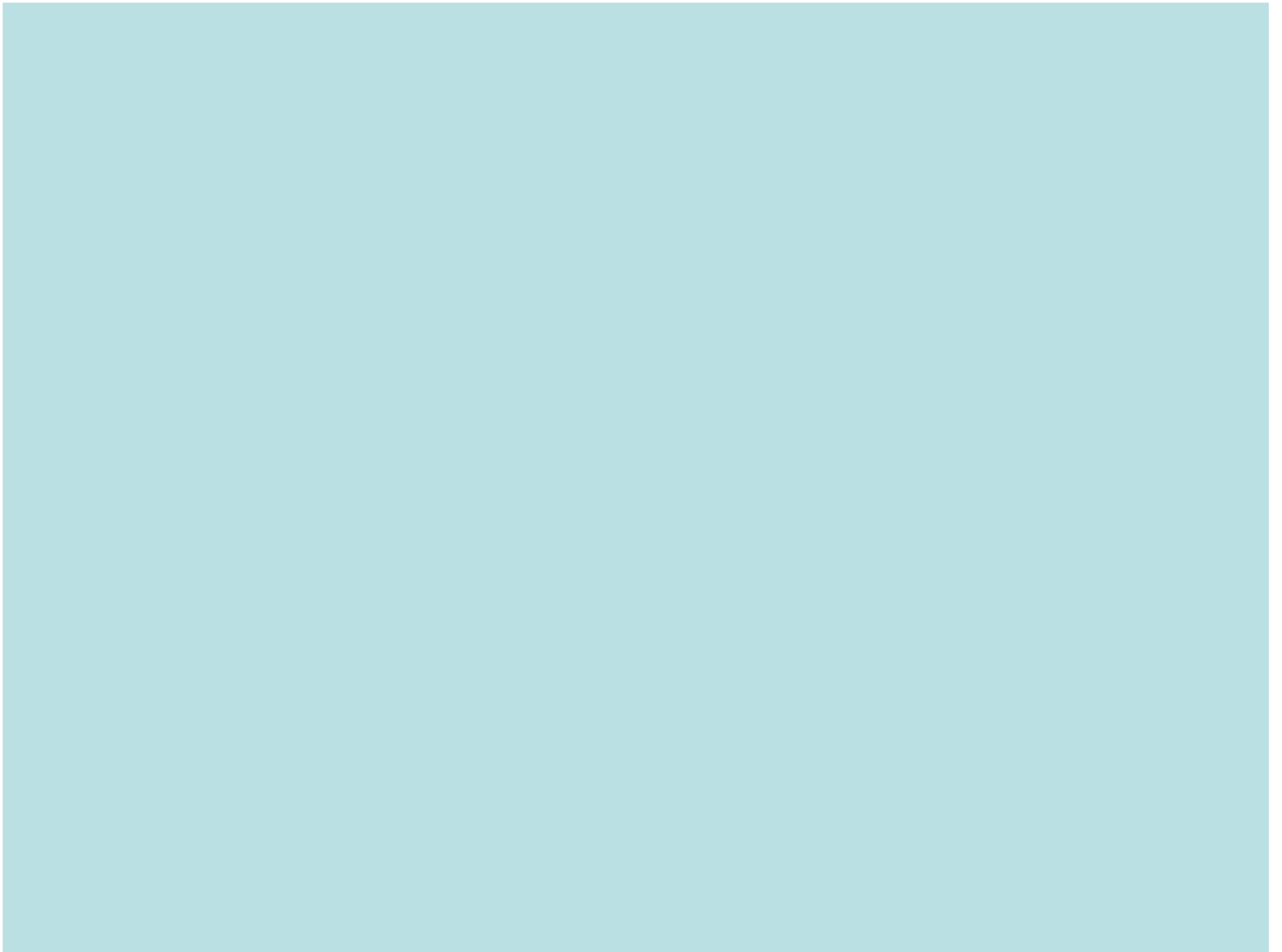
Krugersdorp

1740

Gauteng

South Africa









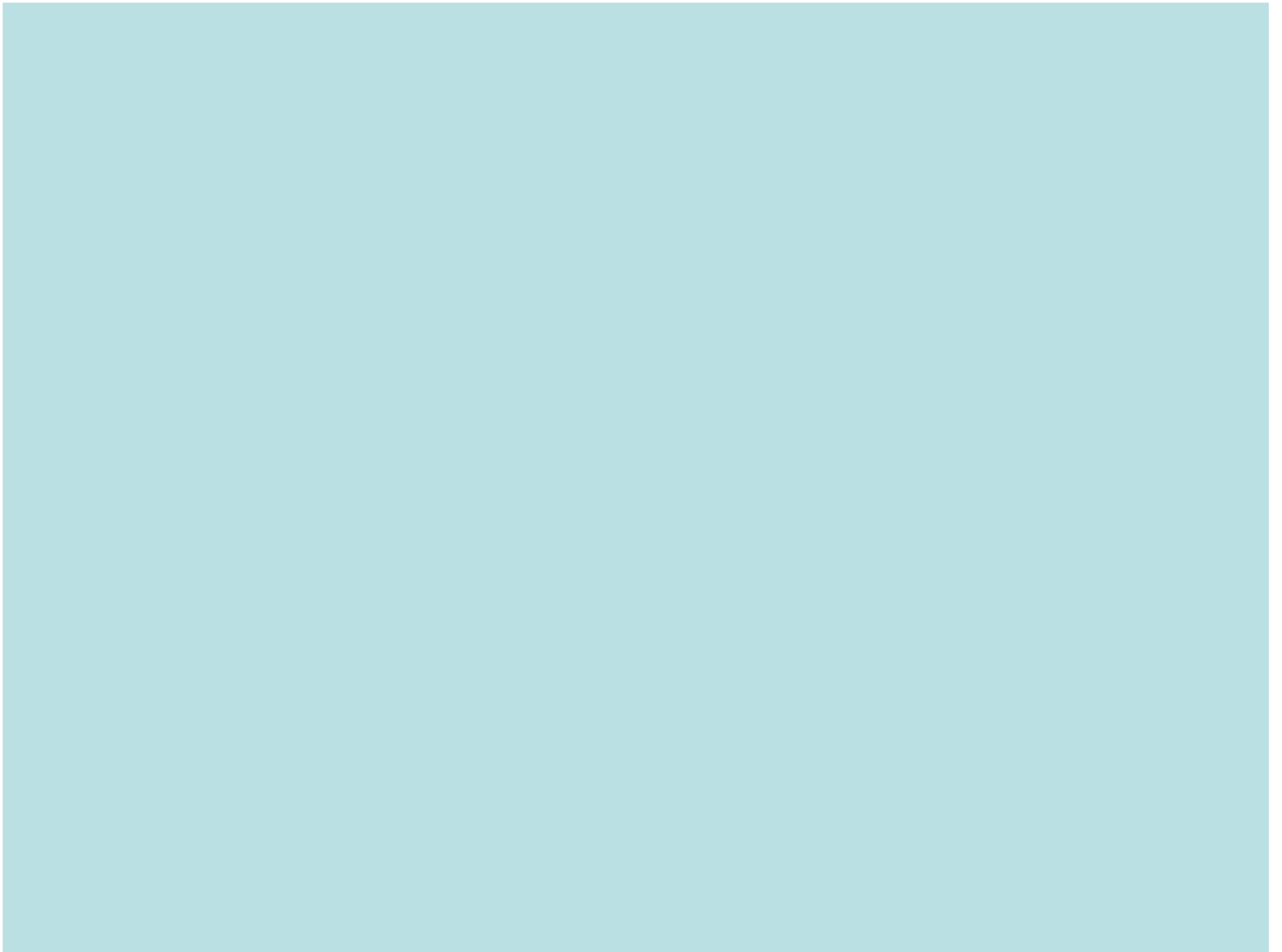
















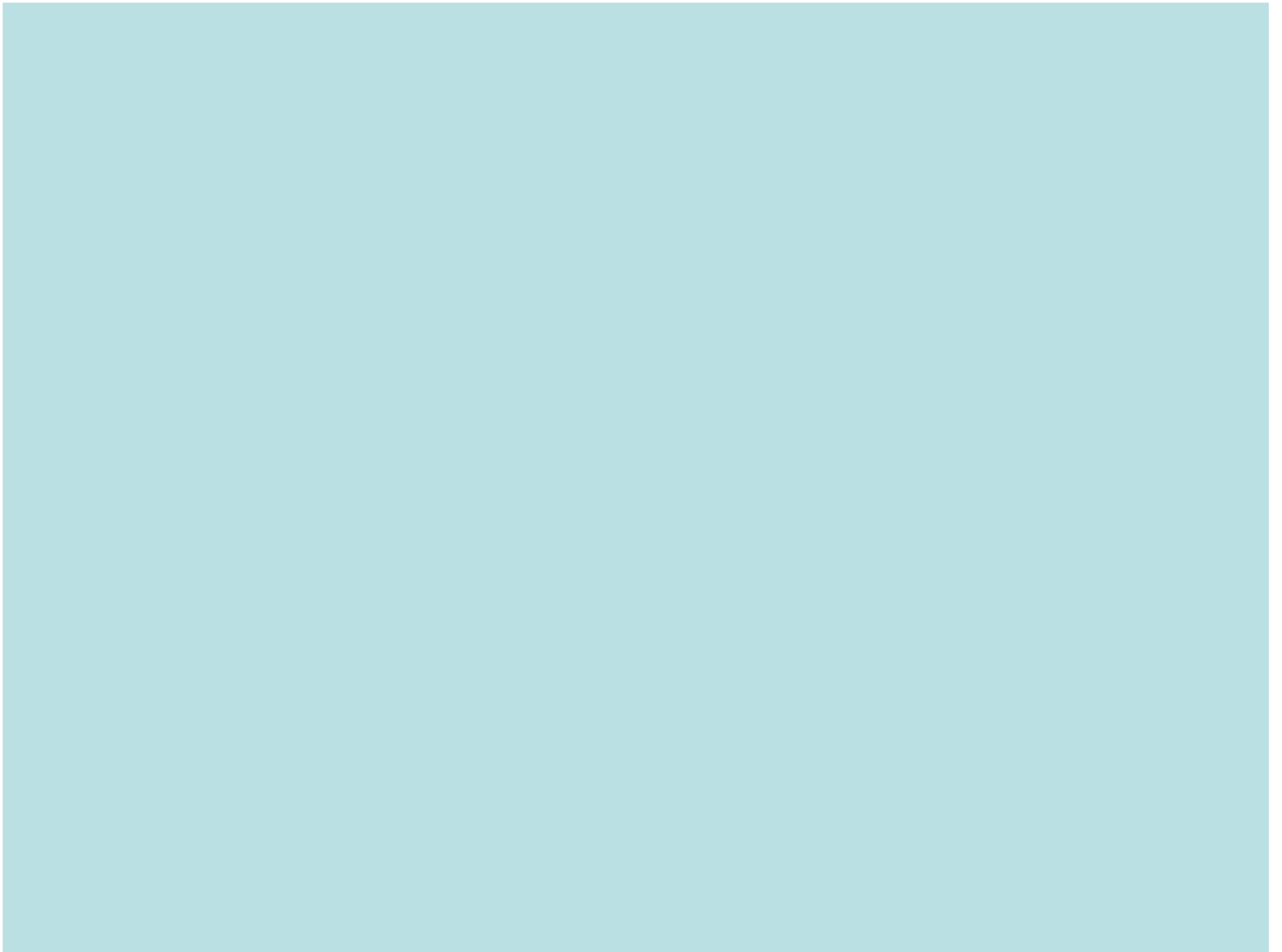
















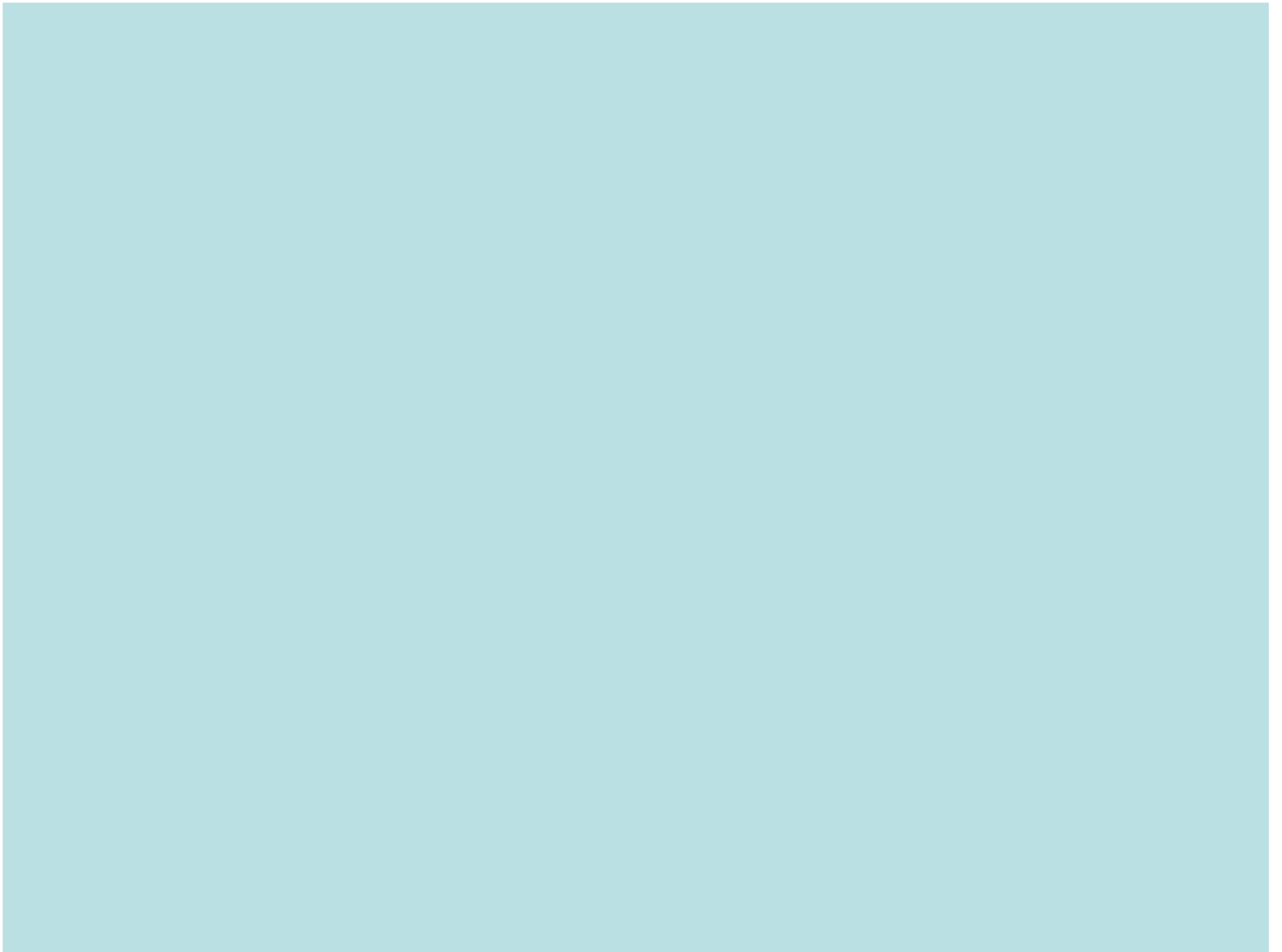
















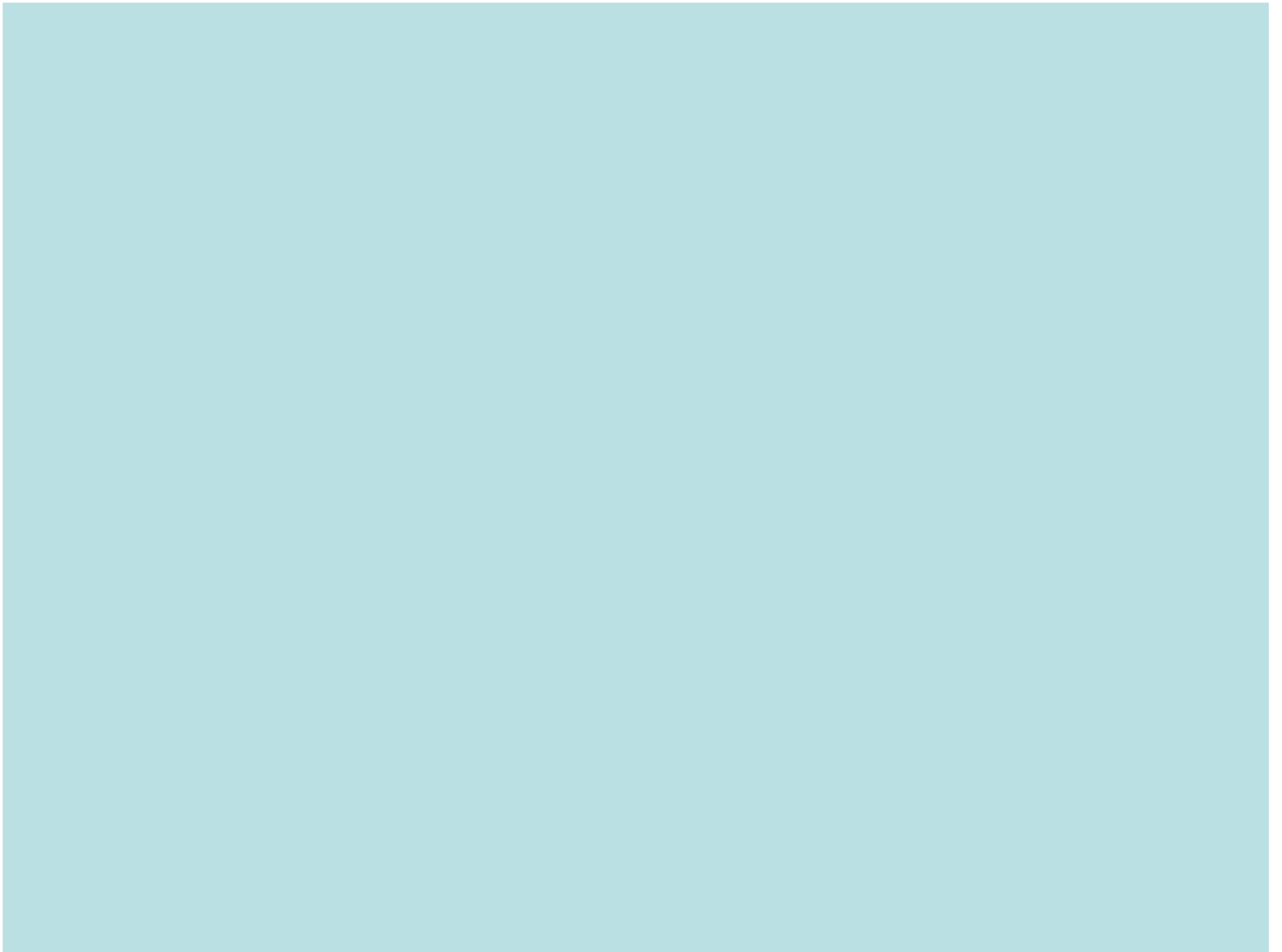
















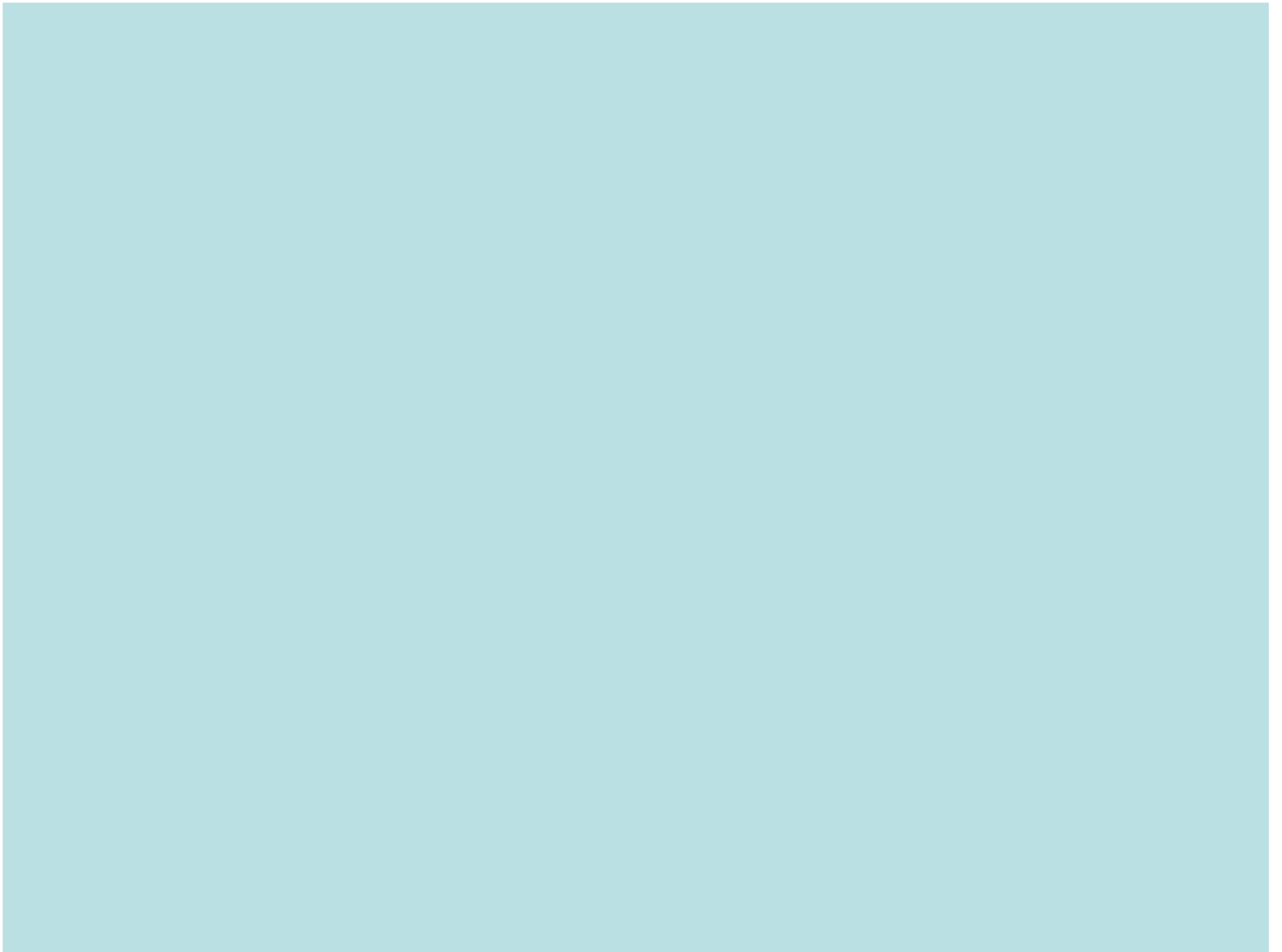
























MOBLAS-6 Repairs

- Failure Analysis and Prevention
- Special to Type Jigs (Laser Rod)

Data Transmission

Data Archive

MOBLAS-6 Upgrades

- Telescope Cable Boom
- Translator
- Calibration Targets
- Return rate Monitoring

Telescope Cable Boom

Monorized

Translator

Calibration Targets

- Nelson Pier De misters

MOBLAS-6 Calibration

- Laser Alignment and Pulse Slicing
- Laser Q
- Coedaypath and Bore sight Alignment
- Star Calibration
- Monument Seasonal Drift (Sinusoidal)

MOBLAS-6 Laser Safety

- Minimum Elevation Tracking
- Laser Alignment and access
- On Site Target Ranging (10ND)
- Telescope Access
- Aircraft Safety
- Telescope Incorrect Pointing Angle

Special to type jigs

MOBLAS-6 Upgrades

- Air-conditioning
- Cable Boom Automation
- Translator Automation
- Calibration Pier De-misters

Air-conditioning

Cable Boom Automation

Translator Automation

Calibration Pier De-misters

- Picture

