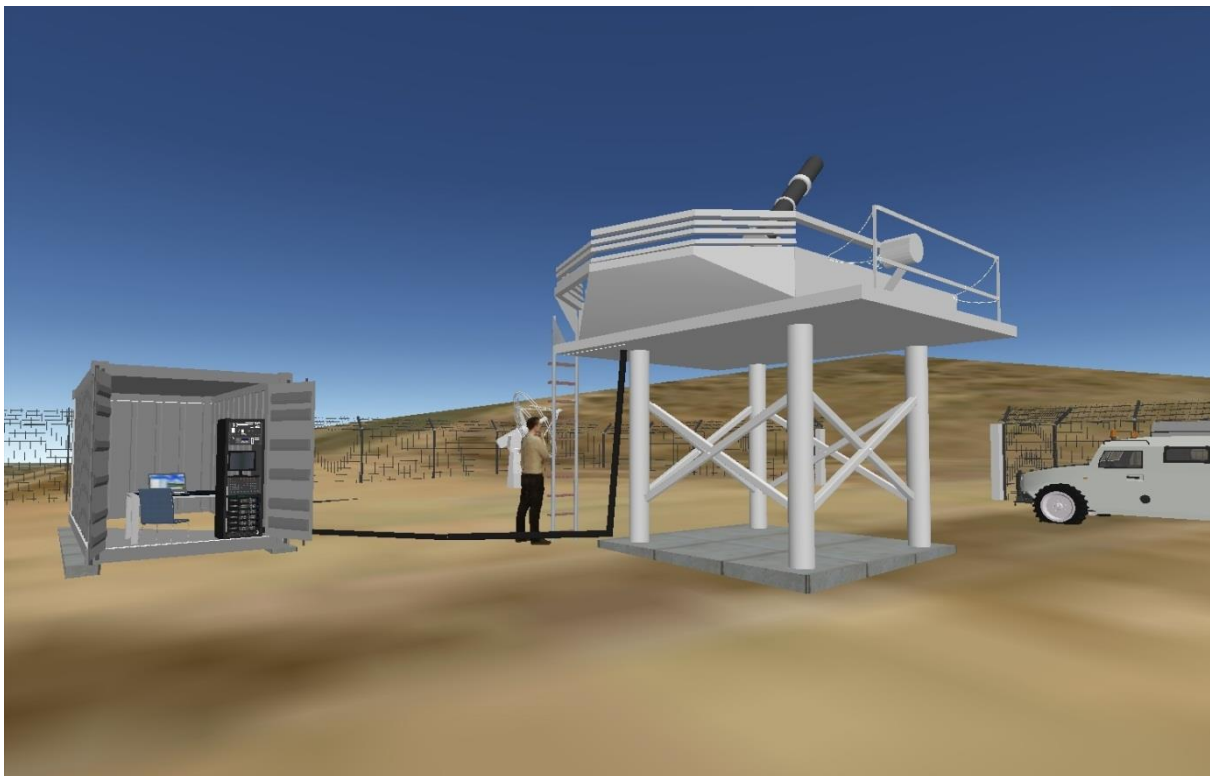
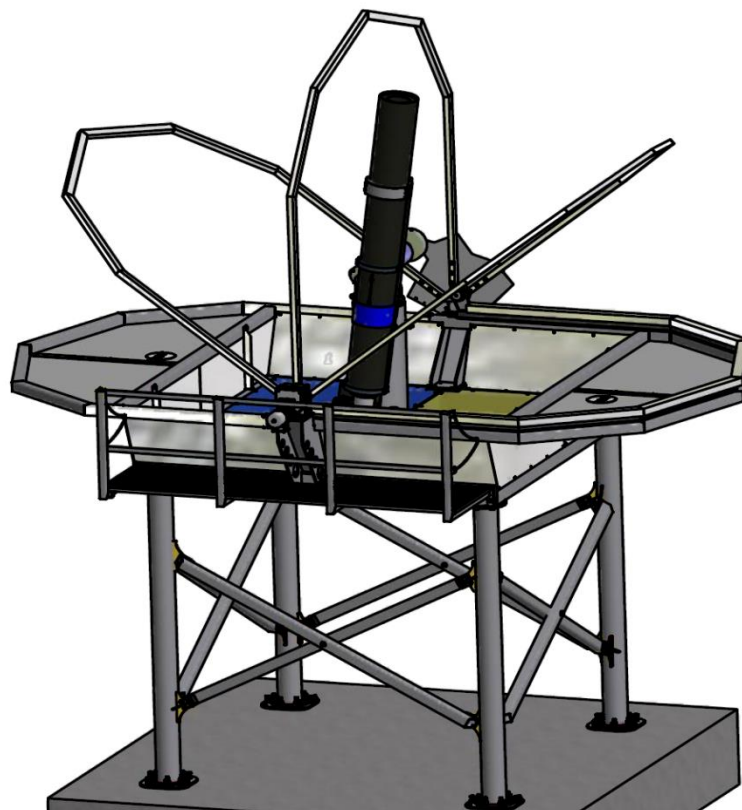


ASTELCO Remote Telescope Station **ARTS**



Exemplary configuration for the ASTELCO Remote Telescope Station

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1. Introduction

The ASTELCO Remote Telescope Station consists of a remote/robotic mount system (ASTELCO NTM-500), a completely retractable enclosure (dust sealed when closed), steel tower, professional weather station, 180° HD AllSky camera and solar power station (some of these are options).

The standard NTM-500 mount can be exchanged for a larger mount, like the NTM-1000, for larger / heavier telescopes.

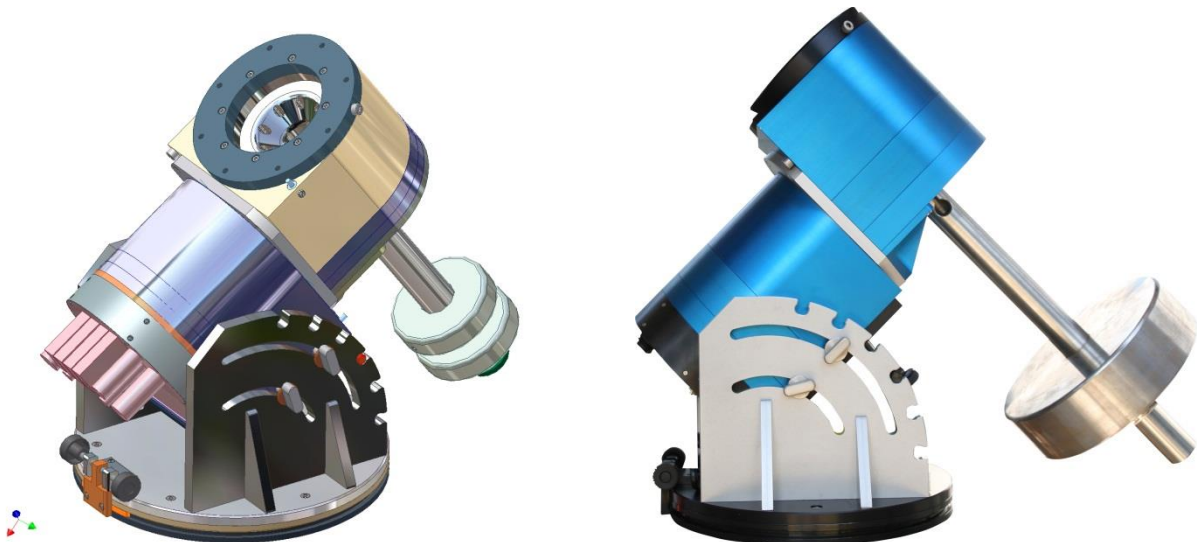
The steel tower interface is included to be connected to a (customer provided) concrete base foundation of approximately 2m x 2m.

2. Technical Specifications

2.1 Telescope

No telescope is supplied. The system is ready to accept telescopes of various sizes and weights. Please contact ASTELCO.

2.2 NTM-500 Mount



NTM-500-A – Drawing shown for illustration purposes only. Patent pending.

Please refer to the separate spec sheet for the ASTELCO NTM-500 mount.

2.3 ARTS Enclosure

2.3.1 Mechanics

The enclosure design is similar to the ESO VLT test siderostat enclosure. The enclosure is a one-part completely retractable structure with a base frame size of approximately 3x5m. The main parts are the base steel frame which will be connected to the enclosure base frame, the enclosure with the UV resistant plastic fabric, the motors and the gears.

The main specifications:

- Approximate inner dimensions of the enclosure:
2.5m (height in the center of the dome-shaped enclosure; measured from the steel base frame); 3m (width); 5m (length)
- Opening and closing possible at any telescope position
- Special plastic fabric, 900g/m², 10 year UV resistance guarantee, glossy coated surface, PVC with canvas reinforcement.
- Completely retractable one-part enclosure
- Two motors with self arresting worm gears
- Rubber seals with safety sensors for maximum safety during opening and closing
- Dust sealed design to avoid dust to enter the closed enclosure
- Opening/closing position accuracy of the enclosure is 10deg.
- Opening and closing possible at max. wind speed of 25m/sec
- Survival wind speed around 50m/sec
- Total weight of enclosure: Approx. 500kg
- All welded pieces are manufactured according to DIN 18800 welding certificate and ISO 9001.
- Operable in the temperature range of -15°C to +65°C
- Limit switches, emergency stops and emergency close function
- Power consumption of enclosure: approx. 700W
- Total power consumption for enclosure control:
Approx. 1000W / 230V (50Hz)
- Total power consumption including NTM-500 mount:
Peak: Approx. 2500W / 230V (50Hz)
Mean: Approx. 1000W / 230V (50Hz)
- 230V 50Hz power supply on site is required

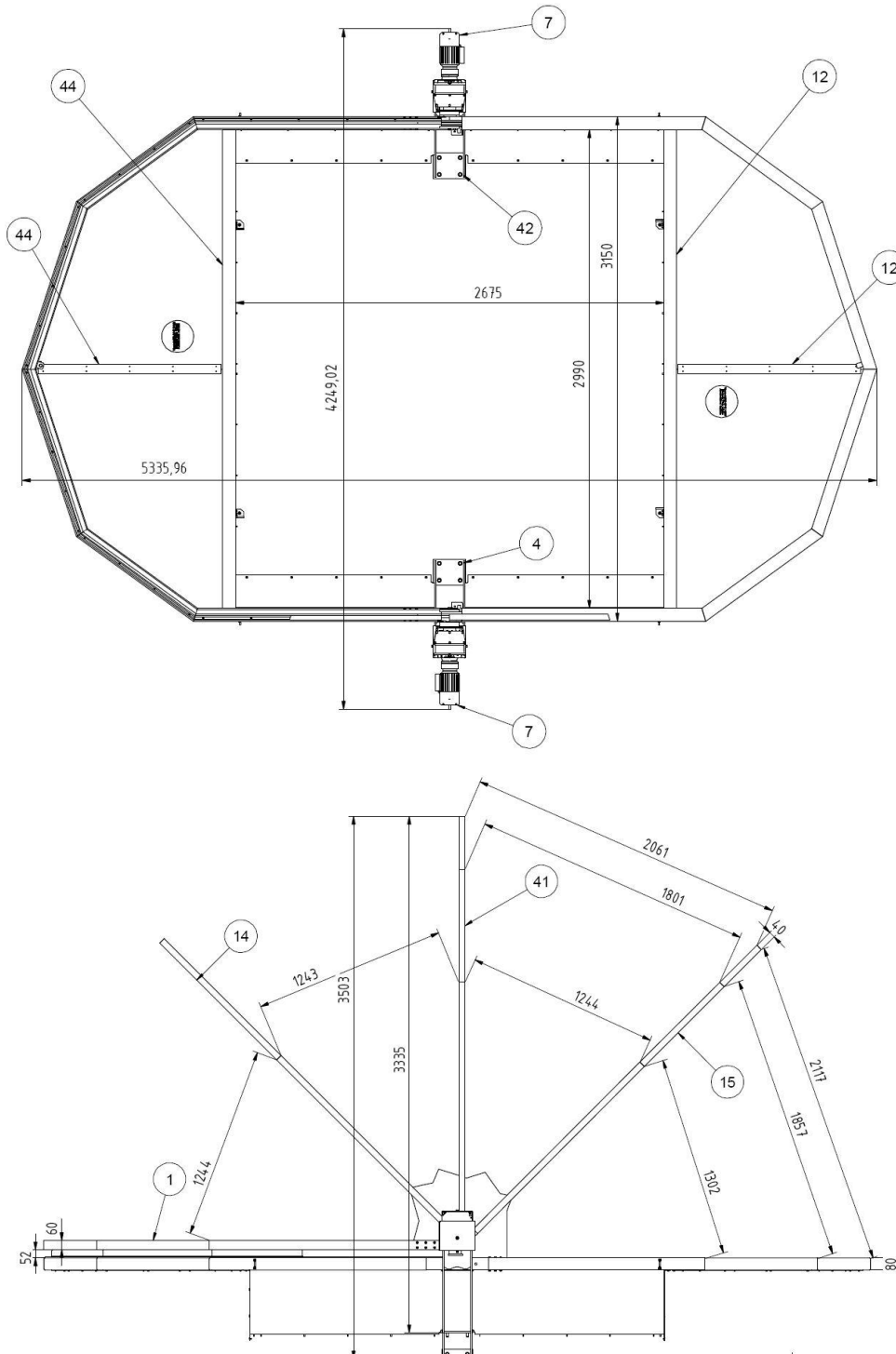
2.3.2 Control Cabinet

For control of the ARTS, a weather proof and ventilated control cabinet is provided. It can be put at a maximum distance (cable length) of 12m from the top of the steel tower. This control cabinet provides enough space to accommodate

the control unit of the NTM-500 mount, the enclosure control unit, the weather station control and all sky control PC.

2.3.3 Drawings and dimensions

In the following figure, the mechanical dimensions of the ARTS Enclosure are shown. The enclosure must be mounted on the ARTS Steel Tower (see 2.4).

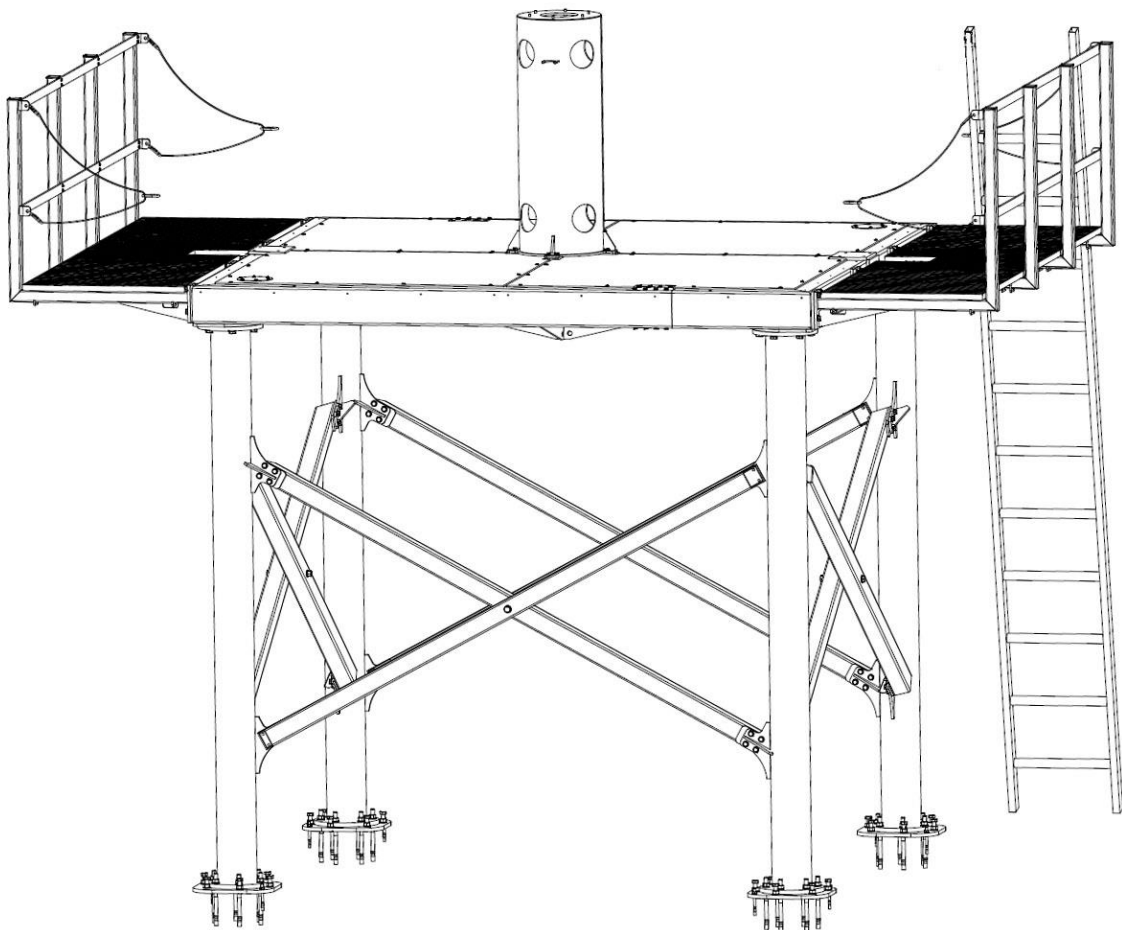


2.4 ARTS Steel Tower

The steel tower delivered with the ARTS telescope system has a height of 2m and allows the equipment to be enough above ground to avoid ground-based seeing turbulences.

The tower is designed stiff and rigid to guarantee high resolution imaging even at high wind speeds.

The steel tower is connected to the frame of the enclosure with a platform, which allows standing and walking around safely.



2.5 Stand Alone Solar Power Module (optional)

The solar power module consists of the appropriate numbers of modules with a steel container to guarantee the KVA values below. The container is used for housing the batteries and other electrical components.

- Power: 6 kVA max. energy output, 3 kVA continuous energy output. These are the calculated numbers for all subsystems of the ARTS: enclosure, mount, cameras, computer/server/control cabinet, ac unit, AllSky Camera and weather station.
- Battery bank 48V, ~6000 Ah in total with converters and controllers to guarantee 48h continuous power supply of 3 kVA.
- Steel container for the batteries : approx. 210 cm x 200 cm x 114 cm
- Tilted solar panel support system
- Temperature Range: -15°C to +65°C

2.6 Weather Station (optional)

The ARTS weather station is attached to either the supplied (optional) container or to a separate (customer-provided) post. The weather station provides the safety signals to the telescope system for opening and closing the enclosure.

- Temperature
- Air Pressure
- Wind speed
- Wind direction
- Rain / snow sensor
- Humidity

2.7 20ft Transport Container/AC unit (optional)

For transportation of all ARTS parts an insulated standard 20ft container will be used. After installation of the telescope system, the container will be used for storage of the station computers and control cabinets/racks and maintenance.

The insulated container is equipped with an AC unit converter to keep the average temperature at around 20°C level. The maximum power consumption of this unit is at 2.2 kVA, the continuous power consumption is around the half of this value.

2.8 HD AllSky Camera (optional)

2.8.1 Introduction

The design goal of ASTELCO's HD AllSky Camera was a high resolution monitoring system with a field of view of 180° in every direction on sky. This

system allows for real-time sky monitoring, meteorite capturing, satellite or airplane trails monitoring, zodiacal light monitoring and many more.

Together with easy-to-use software, the camera can either deliver real time live images as a video feed or be put into a scripting mode, which allows for capturing individual sequences with a very high timing accuracy.

The system is capable of both daytime and night-time observations. The housing of the HD AllSky Camera is designed to protect the camera and lens against the environment.

2.8.2 Specifications

In the following table, the mechanical, electrical and optical specifications are given.

Description	Specification
Dimensions	240 x 330 x 328mm (width x length x height)
Weight	Approx. 15kg
Material	Anodized aluminium
Field of view (FOV)	180° in every direction Focal length 8mm Lens tilt is adjusted during assembly
Sensor	36mm x 24mm 5616 x 3744 Pixel (22 Megapixel) Color CMOS Sensor
Exposure times	1/8000 sec – 30 sec Internal auto-dark subtraction possible
Focal ratio	f/3.5 – f/16 (manual setting)
Video format	Full-HD 1080p video recording
Image files	JPG or Camera RAW (14 bit)
Internal memory	8GB Flash Card in camera 80GB HDD in embedded PC
Data interface	USB 2.0 to camera 10/100/1000 Mbit/sec Ethernet for embedded PC
Power requirements	240V / 3A
Power consumption	Approx. 30W for camera unit

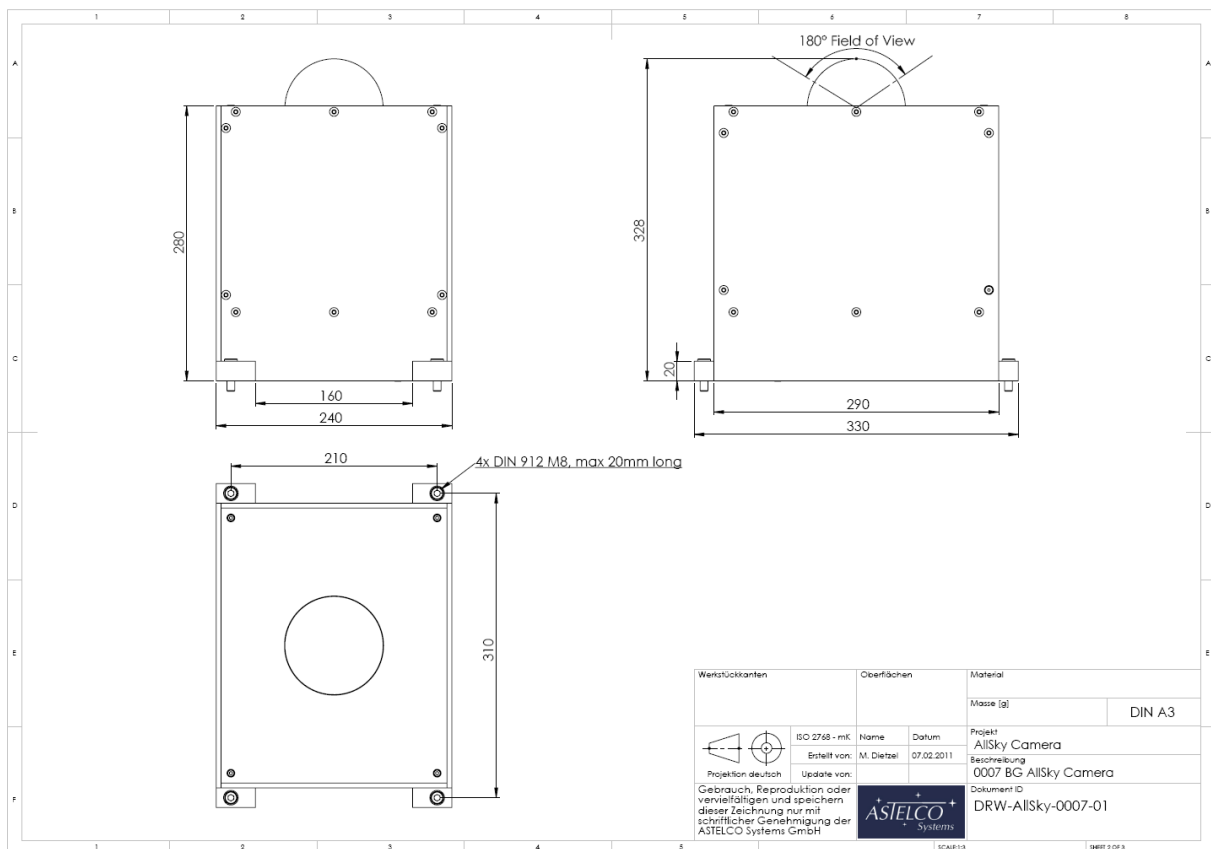
2.8.3 Control software

The HD AllSky Camera comes with two software packages: the original camera control software by the camera manufacturer, which among others allows for fast image downloading, changing of internal camera settings and live video mode.

The second software package provides an accurate scripting interface, in which individual image settings, intervals and iterations can be set for each exposure. The most important camera settings like exposure time, gain and image quality can be defined for each image.

2.8.4 Drawings and dimensions

In the following figure, the mechanical dimensions of the HD AllSky Camera are shown. The fixation to the support structure is realized by 4x M8 DIN 912 screws, as indicated below. Make sure that the support structure is strong enough to securely hold the HD AllSky Camera, also taking into account additional forces caused by strong winds.



The glass dome on top of the camera houses the fisheye lens with the 180° field of view.

The connector section is inside the housing at the bottom of the HD AllSky Camera. They can be accessed from the bottom of the camera. When the camera

is mounted, no cables are passing out at the side of the system. Therefore, the power and data plugs are protected against the environment.

2.8.5 Sample image

The following image was taken with an exposure time of 30 seconds at f/3.5. The limiting magnitude at zenith is approx. 9 mag. On the right, the zodiacal light is visible.



2.8.6 Documentation

Technical documentation of the HD AllSky Camera, its functions and of the delivered software is part of the supply. All documentation is provided in English language in PDF format.

3. Software (optional)

- Software package for automatic and remote control of the telescope
- Pointing, tracking, focusing, image capturing, baffle and shutter control

- ASCOM robotic interface
- Robotic/remote/scripting software package

The list of features which are part of the delivered robotic SW package is shown below:



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Every Image Centered™	Self-learning Pointing Corrector	Imager Rotator Control
Adaptive Auto-Guiding	Adaptive & Periodic Auto-Focus	Filter Focus Offsets
Dome and Roof Control	Weather Safety	Automatic Sky Flats
Auto-Calibration	Auto-Flip During Repeat-Sets	Image Stacking of Repeat-Sets
Solar System Ephemerides	NEOCP Ephemerides	Orbital Tracking
Starfield Simulator	User Script Hook-Points	70,000+ Deep Sky Objects
Observing Plans	Plan Repeats (sets)	Chaining Plans
Browser & FTP Access	Auto-Astrometry	Limiting Mag & Airmass

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4. Data Server Industrial PC (optional)

- 4-core system
- Industrial system
- 16-24 GB RAM
- Linux operating system
- SSD/CG based, (if possible read only)

- Hard disc as RAID 1 (mirror) and possible to change during operation
- 3 pairs of hard discs
- Central router included
- Cabinet with ventilation or AC available

5. Transport and Installation

After transportation of the 20ft container to the observing site, the ASTELCO team will assemble and install the entire system.

6. List of Deliverables

- NTM-500 Mount
- Retractable enclosure
- Steel tower
- Weather station (optional)
- HD AllSky Camera (optional)
- Solar power modules (optional)
- Software (optional)
- Data Server (optional)
- 20ft container (optional)

7. Warranty

The warranty period is 1 year from the date of the delivery.

8. Images





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