MARTZ-KOHL OBSERVATORY · FREWSBURG, NY

MKO Astronomy Dashboard

A guide to what's on the screen and where the data comes from

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The dashboard is an always-on information screen for the observatory, in the spirit of a ham-radio HamClock: the time, the sky tonight, space weather, the weather at the dome, and what's coming up. It runs as a web page at **martzobservatory.org/mko-dashboard** and is designed for a 1920 × 1080 display (such as a Raspberry Pi in kiosk mode), but works in any browser. A **Night Mode** button turns everything red-on-black to protect dark-adapted eyes.

Ten panels

Three columns: the clock, tonight's targets and satellites on the left; events, the AllSky camera, the Sun and the Moon in the middle; weather, radar and the clear-sky forecast on the right.

Fresh and honest

Every panel shows how old its data is. If something goes stale, that panel's header turns orange; if the whole system stops, a warning appears where the date is.

Look, don't touch

The dashboard only reads and displays. It never sends commands to the telescope, dome or cameras, and visitors' browsers never contact NASA, NOAA or the other sources directly.

How the data reaches the screen

Outside sources
NOAA, NASA, CelesTrak, cleardarksky.com, Helioviewer, Night Sky Network, plus MKO's own sensor and cameras

→

Small scripts
On the web server, run by a timer every 1 to 10 minutes. They fetch, check, and calculate (sky positions are worked out here)

→

One data file
dashboard.json, plus saved copies of the pictures, so visitors never hit the original sources

→

The page
Your browser re-reads the data file every 30 seconds and redraws each panel

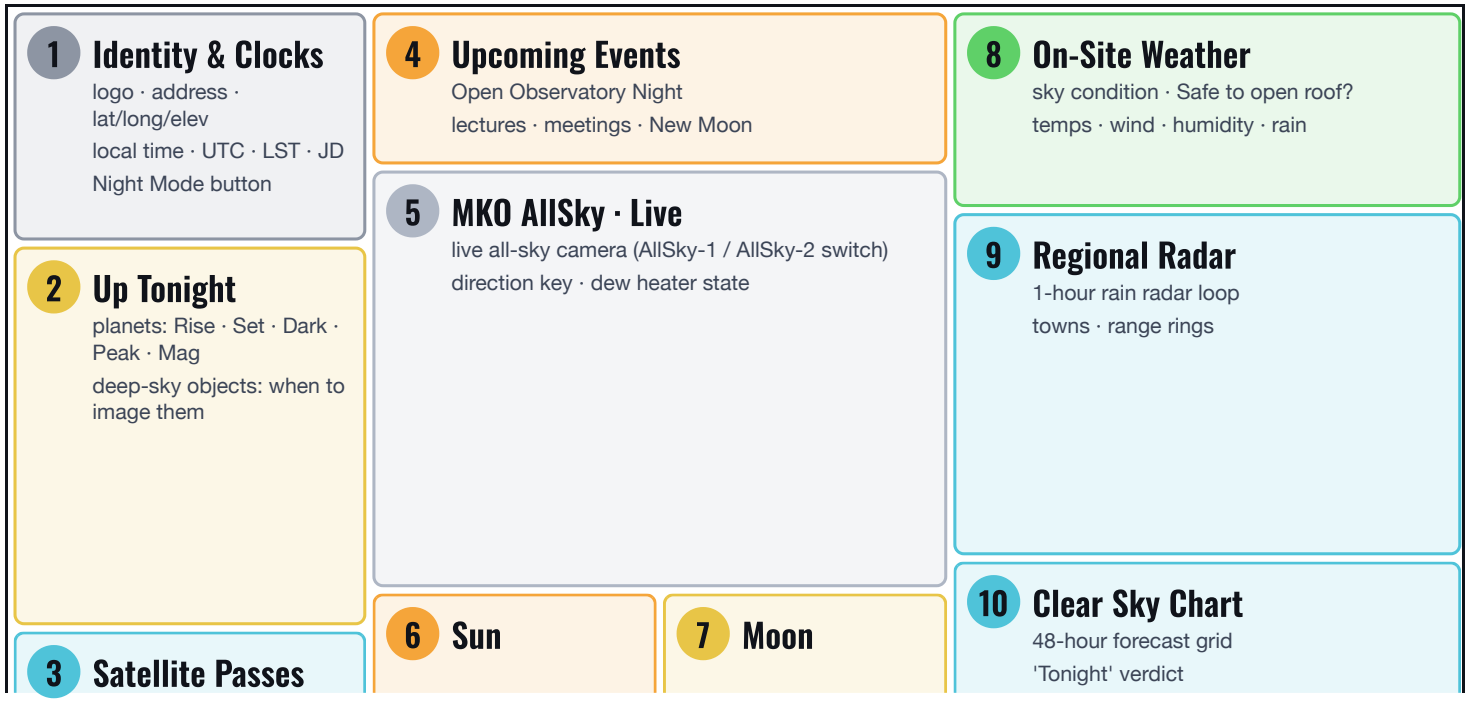
Inside this guide

2 The screen layout
3 The real screen, panels numbered
4–6 The ten panels, one by one
7 Where the data comes from, and terms
8 Using the dashboard; reading its signals
9 What it's built with

Online version, with a clickable screen picture and a short FAQ: **martzobservatory.org/mko-dashboard/guide**

The screen layout

Panels are numbered by column, left to right. The following pages explain each one.



Left column

Time, and tonight's targets: 1 Identity & Clocks, 2 Up Tonight, 3 Satellite Passes

Middle column

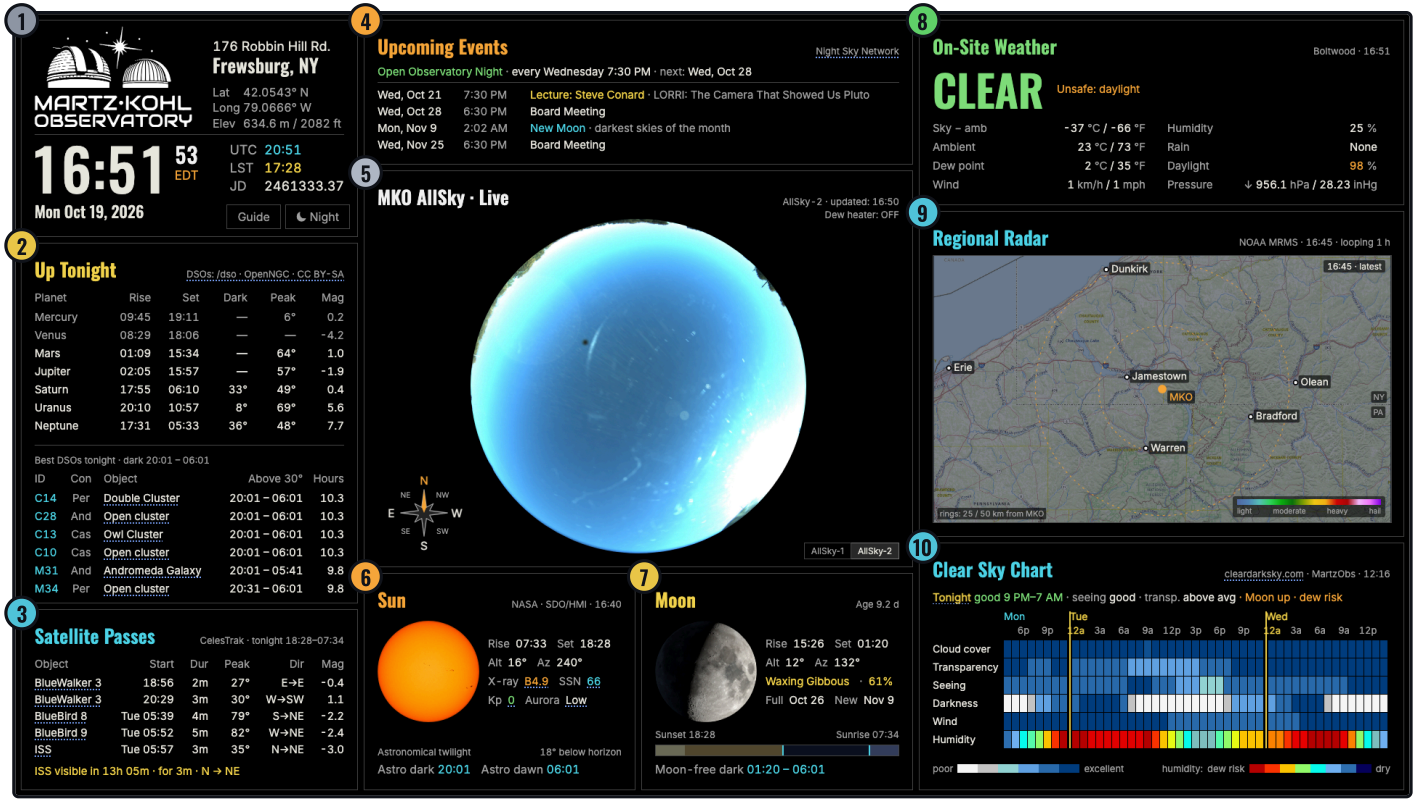
What's on and the sky itself: 4 Upcoming Events, 5 AllSky, 6 Sun, 7 Moon

Right column

Weather and forecasts: 8 On-Site Weather, 9 Regional Radar, 10 Clear Sky Chart

The real screen (day view)

A capture of the live dashboard at 1920 × 1080, with the panel numbers added.



The panels (1 of 3)

1 Identity & Clocks

Who and where we are, and what time it is.

WHAT IT SHOWS

- MKO logo, street address, town, and the site's latitude, longitude and elevation (634.6 m / 2082 ft).
- Local time with seconds, UTC, LST (local sidereal time: the sky's own clock, the right ascension crossing the meridian now) and JD (Julian Date).
- The date, and the Night Mode button.

WHERE THE DATA COMES FROM

- Calculated in your browser from its own clock; the site constants come from the project's config file. Nothing is fetched.
- If the data behind the page stops updating, or the server can't be reached, a warning replaces the date line.

HOW OFTEN

Every second.

2 Up Tonight

What to point at tonight.

WHAT IT SHOWS

- Planets (Mercury to Neptune): Rise and Set; Dark = height an hour after full darkness begins (Now = height right now, once it is dark); Peak = the highest it gets tonight; Mag = brightness. A dash means below the horizon. A bright row means the planet is viewable tonight (at least 10° up at some time from now until sunrise, twilight counts as night); a dim row is not. Hover a row for the viewing window.
- Best deep-sky objects (DSOs), planned for imaging: the six easiest objects (Easiest or Easy in the /dso catalog) that spend the most hours above 30° during tonight's dark hours, or from now on once it is dark. The caption gives the dark hours. Columns: ID (catalog number: M = Messier, C = Caldwell), Con (constellation), Object (name), Above 30° (first and last time it is that high) and Hours (how long). An object next to a listed one (inside 2°, such as M32 beside M31) is skipped.

WHERE THE DATA COMES FROM

- Planet and DSO positions and times: calculated on the server with Skyfield and NASA/JPL's DE421 ephemeris.
- DSOs: MKO's own /dso catalog (martzobservatory.org/dso), copied weekly, with coordinates from the OpenNGC database (credited in the panel header, CC BY-SA 4.0).

HOW OFTEN

Planets and DSOs recalculated every minute; the catalog is refreshed weekly.

3 Satellite Passes

Bright satellites you can see tonight.

WHAT IT SHOWS

- ISS, Tiangong, Hubble, BlueWalker 3 and the BlueBird phone satellites: start time, duration, Peak (the highest point of the pass), direction (where it appears to where it disappears) and brightness.
- A yellow line counts down to the next ISS pass. A pass is listed when the satellite is above 10°, in sunlight, and the Sun is at least 6° below the horizon (peak at least 20°, except Hubble).

WHERE THE DATA COMES FROM

- Orbits from CelesTrak (NORAD data), refreshed every 12 hours; passes calculated on the server with Skyfield.

HOW OFTEN

Passes recalculated every 5 minutes.

4 Upcoming Events

What's coming up at the observatory.

WHAT IT SHOWS

- A standing line for Open Observatory Night (every Wednesday 7:30 PM, next date), then the next lectures and meetings, and the next New Moon.

WHERE THE DATA COMES FROM

- MKO's NASA Night Sky Network calendar (club 333), plus a small file of MKO corrections for cancelled or changed events. New Moon is calculated with Skyfield.

HOW OFTEN

Checked every 10 minutes; the Night Sky Network is read hourly.

The panels (2 of 3)

5 MKO AllSky · Live

The live sky over MKO.

WHAT IT SHOWS

- Pictures from two all-sky cameras inside the lens circle: AllSky-1 and AllSky-2 (switch with the buttons at the lower right, or the A key). The header says when the picture was taken.
- The direction key (lower left) shows N, NE, E ... as they lie in the picture: north up, east on the left, as when looking up.
- AllSky-2 also shows Dew heater ON/OFF under the header.

WHERE THE DATA COMES FROM

- The cameras upload to martzobservatory.org; the dashboard copies each picture, checks it is complete and the right size, and keeps the last good one if not.
- AllSky-2's Raspberry Pi runs its dew heater from sunset minus 30 minutes until sunrise and reports its state.

HOW OFTEN

Pictures every few minutes; heater state every 2 minutes.

6 Sun

The Sun today, and space weather.

WHAT IT SHOWS

- Picture of the Sun in visible light (SDO/HMI); the header names who supplied it. Rise, Set, Alt, Az.
- X-ray = solar flare class; SSN = sunspot number; Kp = geomagnetic activity (0-9); Aurora = chance of seeing it from MKO. Astro dark / Astro dawn = start and end of full darkness.

WHERE THE DATA COMES FROM

- Picture: the SOHO or SDO mirrors, or Helioviewer when they are stale, whichever has the newest.
- X-ray, SSN, Kp and aurora: NOAA Space Weather Prediction Center. Rise/set/alt/az: Skyfield.

HOW OFTEN

Picture and space weather every 5 minutes; positions every minute.

7 Moon

The Moon tonight.

WHAT IT SHOWS

- Moon picture for this hour, phase name, percent illuminated, age in days, rise, set, alt/az, next Full and New Moon.
- The night bar runs from sunset to sunrise: darker shading = full darkness, yellow tint = Moon above the horizon, cyan ticks = the Moon-free dark window, white tick = now.

WHERE THE DATA COMES FROM

- Picture: NASA Scientific Visualization Studio, 'Moon Phase and Libration' (one frame per hour). Everything else: calculated with Skyfield.

HOW OFTEN

Picture hourly; numbers every minute.

8 On-Site Weather

Is it safe to open the roof?

WHAT IT SHOWS

- A big sky word (Clear / Cloudy / Very cloudy, or Rain), then 'Safe to open roof' or 'Unsafe: reasons', with the readings behind them: sky minus ambient temperature, ambient, dew point, wind, humidity, rain, daylight and pressure (in hPa and inHg, with an arrow for the 3-hour trend: rising, steady or falling; orange for a rapid fall).
- If the sensor stops answering for 15 minutes the panel says OFFLINE instead of showing old values.

WHERE THE DATA COMES FROM

- MKO's Boltwood Cloud Sensor III, read-only over its own web interface. 'Safe' is worked out from its readings and its own limits; it is advice for people, not a control.

HOW OFTEN

Every minute.

The panels (3 of 3)

9 Regional Radar

Rain and storms near MKO.

WHAT IT SHOWS

- A map centred on MKO with a looping radar picture of the last hour (frames 5 minutes apart), range rings at 25 and 50 km, and nearby towns.

WHERE THE DATA COMES FROM

- NOAA MRMS quality-controlled radar (clutter such as wind farms removed); base map from the USGS National Map, lakes and state line from Natural Earth.

HOW OFTEN

Every 5 minutes.

10 Clear Sky Chart

Will the sky be good?

WHAT IT SHOWS

- A 48-hour grid for cloud cover, transparency, seeing, darkness, wind, humidity (and smoke when there is some). Colours run poor to good; hover a square for its value.
- The 'Tonight' line names the longest run of good hours and warns about Moon, dew or smoke.

WHERE THE DATA COMES FROM

- Forecast numbers from cleardarksky.com for the MartzObs chart (Attilla Danko; forecast by A. Rahill, Environment Canada), redrawn by the dashboard.

HOW OFTEN

Rechecked every 10 minutes; a new forecast is downloaded when one is published.

Where the data comes from

Source	What we take from it	Panel	Refreshed
NOAA Space Weather Prediction Center	X-ray flares, sunspot number, Kp, aurora	6	5 min
NASA SOHO / SDO mirrors, Helioviewer.org	Picture of the Sun	6	5 min
NASA Scientific Visualization Studio	Moon phase and libration pictures	7	hourly
NASA/JPL DE421 ephemeris (via Skyfield)	Positions of Sun, Moon, planets; twilight; rise/set; LST	2, 3, 6, 7	every minute
CelesTrak	Satellite orbits	3	12 hours
NASA Night Sky Network	MKO events calendar	4	hourly
MKO /dso catalog + OpenNGC	Deep-sky objects and their coordinates	2	weekly
MKO AllSky cameras (AllSky-1, AllSky-2)	Live pictures; AllSky-2 dew heater state	5	minutes
Boltwood Cloud Sensor III at MKO	Sky, wind, rain, humidity, pressure readings	8	1 min
NOAA MRMS radar; USGS; Natural Earth	Radar frames and base map	9	5 min
cleardarksky.com (A. Danko; Environment Canada)	Observing forecast	10	10 min

All of it is public data used read-only. Credits are shown where required: Helioviewer.org is named in the Sun panel header; cleardarksky.com and its authors in the Clear Sky Chart; NOAA MRMS, USGS and Natural Earth in the Radar panel's hover tip; OpenNGC in Up Tonight.

A few terms

Alt / Az Height above the horizon / compass direction (0° = north, 90° = east).

LST Local sidereal time: which part of the sky is crossing the meridian (the north-zenith-south line) right now.

JD Julian Date: a running day count astronomers use for timing.

Mag Brightness: smaller numbers are brighter; Venus is about -4, the faintest naked-eye stars about +6.

Dark / Peak In Up Tonight and Satellite Passes: Dark = height an hour after astronomical dark begins (Now once it is dark); Peak = the highest height reached (planets: tonight; a satellite: during the pass).

Con The constellation an object lies in, as a three-letter abbreviation: Per = Perseus, Cas = Cassiopeia, And = Andromeda, Tau = Taurus, Lac = Lacerta.

DSO Deep-sky object: a galaxy, nebula or star cluster.

Kp Geomagnetic activity from 0 to 9; 5 or more is a storm.

SSN Sunspot number.

X-ray class Solar flare strength: A, B, C, M, X (each ten times stronger than the one before).

Transparency / seeing How clear the air is / how steady it is (sharpness of star images).

Astro dark When the Sun is 18° or more below the horizon: full darkness.

Dew heater Warms the AllSky-2 dome so dew and frost don't form on it.

Using the dashboard, and reading its signals

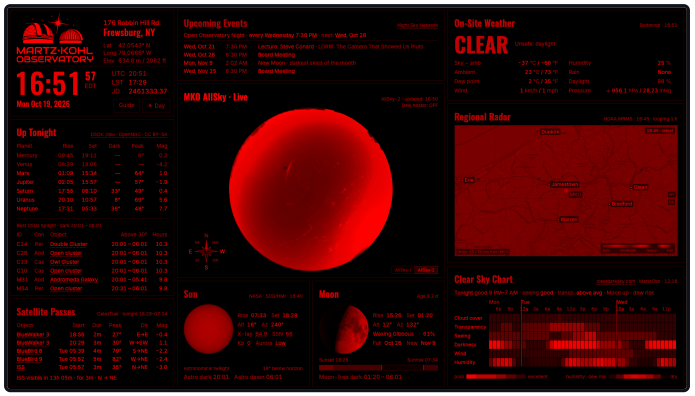
Controls

- **Night Mode:** the Night button, the N key, or *?night=1* at the end of the address. Everything turns red-on-black; the choice is remembered.
- **AllSky camera:** the AllSky-1 / AllSky-2 buttons at the lower right of the picture, or the A key (*?allsky=1* or *?allsky=2* picks one). It opens on AllSky-2.
- **Guide link:** the Guide link beside the Night button (shown when a mouse or touch screen is present) opens the online version of this guide in a new tab: *martzobservatory.org/mko-dashboard/guide*.
- **Hover tips:** with a mouse, items with a dotted underline (and the planet rows) explain themselves. The kiosk has no mouse, so nothing depends on them.
- **Daily refresh:** the page reloads itself at 4 AM so a kiosk always runs the latest version.

What the colours and warnings mean

- **Orange header text:** that panel's data is old (for example 'Boltwood · 25 min old', or 'AllSky-2 · updated: 25 min ago').
- **Red warning where the date is:** the whole system stopped updating, or the server can't be reached.
- **Dimmed rows or values:** not current or not viewable: a planet that is not up tonight, or a space-weather value whose feed went quiet.
- **On-Site Weather:** 'Safe to open roof' (green) or 'Unsafe: reasons' (orange, with the readings behind each reason highlighted). A gray OFFLINE means no reading for 15 minutes. It is advice only.
- **Dew heater line:** ON in yellow, OFF in gray; orange 'no update' if the AllSky-2 Pi stops reporting.

Night Mode



Night Mode keeps every picture and chart in shades of red only.

What it's built with, and where to find it

Component	What it does here	Licence	Where to find it
The page (in your browser)			
Plain HTML, CSS, JavaScript	The whole page; no framework, no build step.	Written here	web/ folder of the project
Inter and Oswald fonts	Text and headings, kept on the MKO server (none loaded from Google).	SIL OFL	rsms.me/inter fonts.google.com/specimen/Oswald
The calculations (on the server)			
Skyfield	Sun, Moon, planets, rise/set, twilight, sidereal time, satellite passes.	MIT	rhodesmill.org/skyfield
NumPy, jplephem, sgp4	Array maths, planet data, satellite orbits (all used by Skyfield).	BSD / MIT	numpy.org pypi.org/project/jplephem pypi.org/project/sgp4
JPL DE421 ephemeris	NASA/JPL table of planet and Moon positions.	Public	ssd.jpl.nasa.gov/planets/eph_export.html
The server			
Ubuntu Linux and Apache HTTP Server	Serves the page and decides what is public; cron runs the scripts. Shares the server with the WordPress site but does not use it.	Open source	ubuntu.com httpd.apache.org
rsync and OpenSSH	Copy new versions to the server; the Pi sends its heater state with scp.	Open source	www.openssh.com
Open data and maps			
OpenNGC	Positions of deep-sky objects.	CC BY-SA 4.0	github.com/mattiaverga/OpenNGC
Natural Earth; USGS The National Map	Lakes and state line; the topographic radar base map.	Public domain	www.naturalearthdata.com www.usgs.gov (The National Map)
Helioviewer	Fallback picture of the Sun.	Free public service	helioviewer.org
MKO's own AllSky cameras (local)			
Allsky (AllskyTeam)	Software that runs MKO's own cameras, takes and uploads the pictures, and runs the dew heater script on AllSky-2's Raspberry Pi.	Open source	github.com/AllskyTeam/allsky
ZWO ASI678MC and ASI676MC	MKO's two all-sky cameras (AllSky-1 and AllSky-2).	Hardware	www.zwoastro.com
sunwait; pinctrl	Sunrise/sunset for the heater; switches the Pi's GPIO pin.	Open source	github.com/risacher/sunwait github.com/raspberrypi/utils
MKO's weather sensor			
Boltwood Cloud Sensor III	MKO's own sensor: sky, wind, rain, humidity and pressure readings, read-only.	Hardware	diffractionlimited.com/cloud-sensor

The dashboard's own code: the scripts (fetch/), the web page (web/) and the install scripts (deploy/); notes in CLAUDE.md and docs/. All of the above is free or open source except the hardware.