



**OAOG Workshop #2 (March 22<sup>nd</sup>, 2013)**

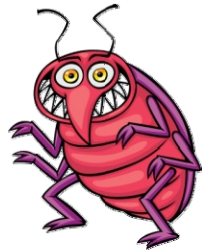
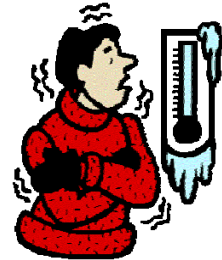
**Presented by: Jim Thompson**

# What is RCO?

- ▶ Live observing through your telescope without you being right next to it
- ▶ Requires ability to see what your scope sees, and to tell your scope where you want it to point

- ▶ Pros:

- ▶ observe during unfavorable conditions (cold, bugs)
- ▶ allow easier use of resources (books, maps, web)
- ▶ allow easier sharing with friends & family

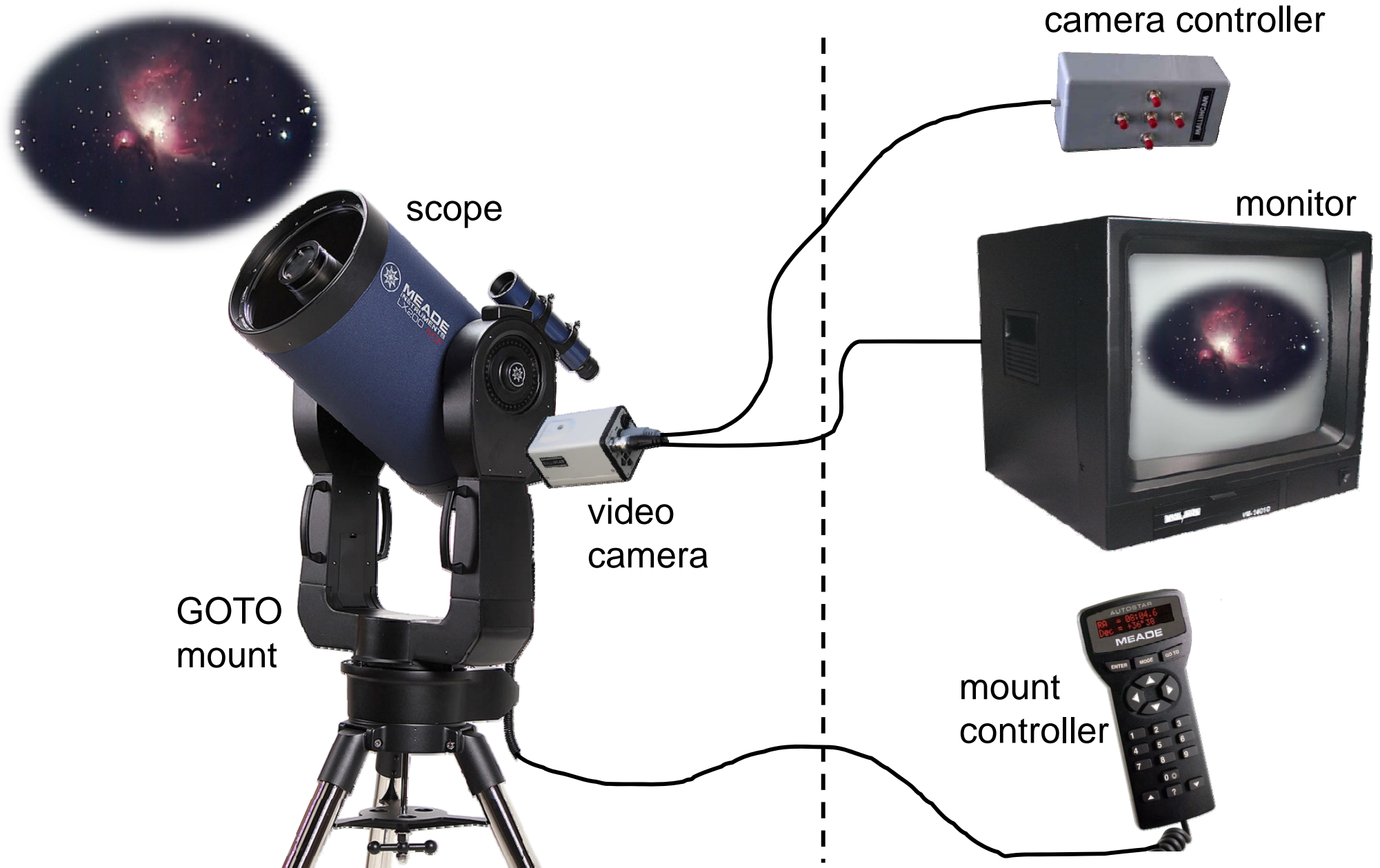


- ▶ Cons:

- ▶ more complicated & more expensive



# A Basic RCO Setup



# Hardware requirements for RCO

Must have:

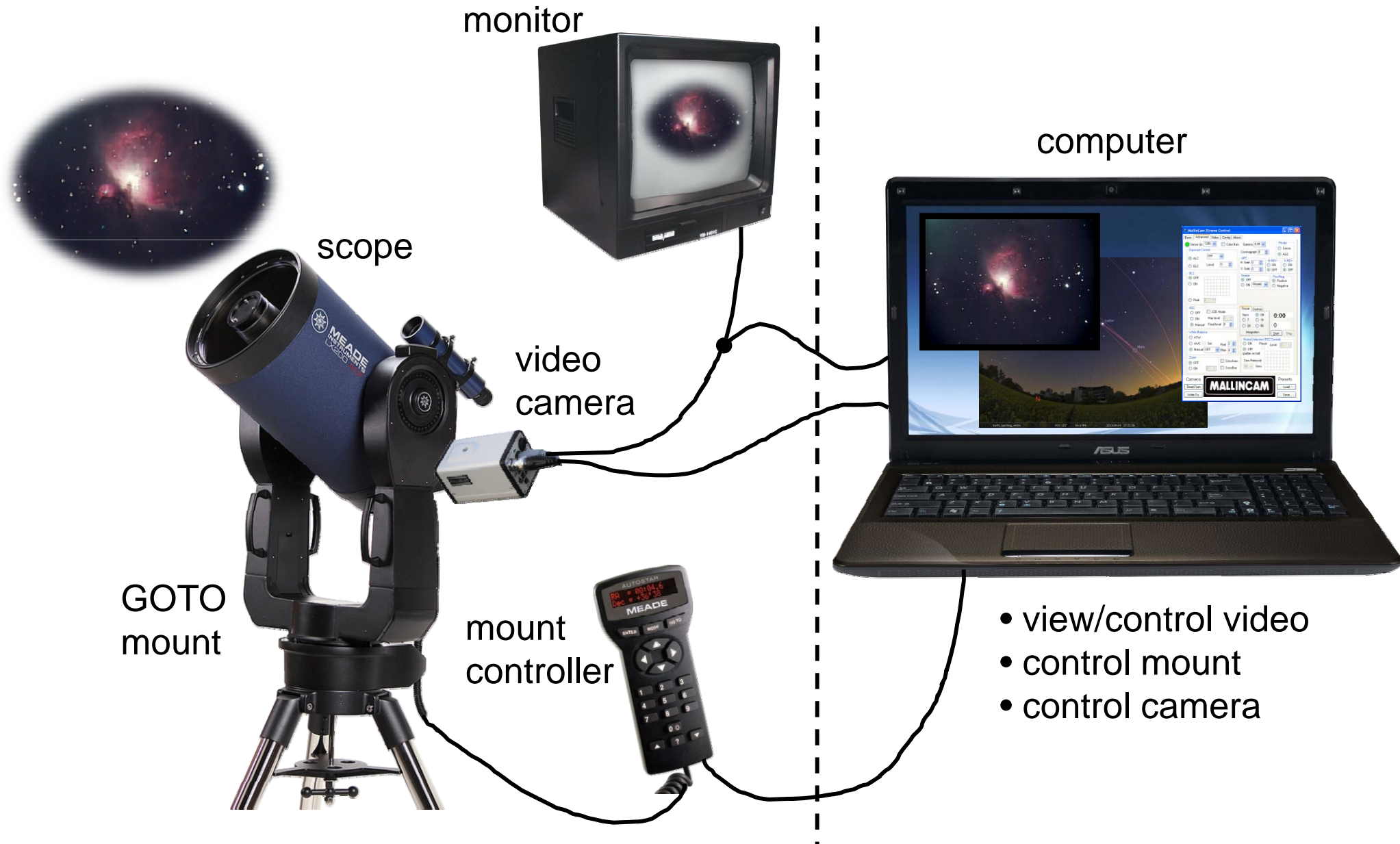
1. Remotely controllable mount (GOTO)\*
2. Remotely controllable video camera
3. Video display\*

\*Display & mount control needed remotely AND at scope (during setup)

Nice to have:

1. Computer control of mount
2. Remotely viewable finder scope
3. Remote control focuser

# A More Typical RCO Setup



# The Mount

- ▶ Need a tracking GOTO mount
  - ▶ GEM: best tracking, take time to setup, meridian flip can be a pain, cable wrap not an issue
  - ▶ ALT-AZ: good tracking but field rotation, easy setup, full sky GOTO, have to watch for camera hitting mount, cable wrap can be a problem
- ▶ Most modern GOTO mounts can link to a computer, allowing control through your planetarium software
- ▶ Mount control data usually serial link or USB
  - ▶ N.B. the hand controller can be only ~10-15' from the mount, but the PC link can normally be much more

# The Camera

- ▶ Many options depending on your budget
  - ▶ webcam: cheap, simple, limited to solar system objects
  - ▶ security cams: bit more \$, solar system and limited DSOs
  - ▶ DSLRs & CCD imagers: some have live view capabilities but not optimized for it, solar system & limited DSOs
  - ▶ astro-video cams: models available optimized for solar system and/or DSO observing
- ▶ Camera requires a remote link for the video stream and for camera control
  - ▶ USB based cameras combine data & control into single cable, but tied to using a computer
- ▶ Good to start simple/cheap, then go for the Cadillac later after you know what you're doing!

# The Display

- ▶ Choice of display driven by camera choice:
  - ▶ **Analog video** – use CRT or LCD monitor to view OR use video capture device to view on computer
  - ▶ **USB camera** – need computer to view
- ▶ Need display at scope as well for star alignment, focusing, collimation, etc. (small LCD okay)
- ▶ Analog video (S-video or Composite), with well shielded cables, can be run up to 100's of feet
  - ▶ Even more using Cat6 cable baluns
- ▶ Basic USB limited to 10-15', but booster cables available to extend to ~100' or more
  - ▶ N.B. You'll likely need a powered USB hub at scope for long "boosted" cable runs



# Computer Control

- ▶ Control of your mount & camera from a computer streamlines the process and adds capability
  - ▶ Controlling mount from planetarium software very powerful
  - ▶ Capture of video allows additional processing & archiving
- ▶ Need to manage 3 main data streams:
  - ▶ Control stream to/from mount (serial or USB)
  - ▶ Video stream from camera (analog or USB)
  - ▶ Control stream to/from camera (serial or USB)
- ▶ Adapters req'd for non-USB data streams
  - ▶ Video capture device for video
  - ▶ Serial-to-USB device for control
  - ▶ Both commercially available for low cost

# Finder Scope

- ▶ From my backyard it is too hard to do 3-star mount alignments, instead I do 1-star then “sync” my way from object to object
- ▶ Works well, but when GOTO is a big step often need finder scope to get properly sync'd
- ▶ Can do the same with RCO if have camera on finder scope as well
  - ▶ webcam will do, but only good for bright stars
  - ▶ MC Jr works excellently, showing even many DSO's in view
  - ▶ want wide field of view;  $>2^\circ$  (focal length  $<150\text{mm}$ )
  - ▶ want to be able to align finder with main scope
  - ▶ another video stream to display

# Focusing

- ▶ For me focusing done at start of session, manually at scope
- ▶ Re-focusing may be required during session
  - ▶ change in ambient temperature
  - ▶ change of filters, reducers, or Barlows
  - ▶ random mirror or focuser shift
- ▶ Several electric focusers and associated software are available, designed to serve astro-imaging community
- ▶ Remote focusing a sexy option, but adds cost

# Power Supplies

- ▶ Many many options to power your RCO setup, try to keep it as simple as possible
- ▶ Try to keep all of your components a common supply voltage, eg. 12 VDC
- ▶ Using a single common power supply with a distribution hub can greatly simplify setup and cable management
- ▶ Take care to use properly grounded and fused power supplies, and protect them from the elements (dew/frost bad, surprise thunderstorms worse!)

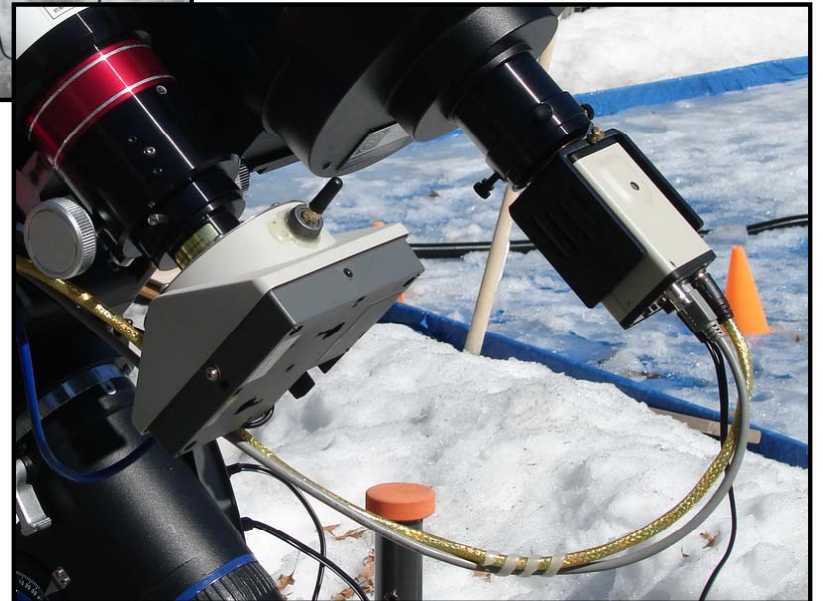
# Cables vs. Wireless

- ▶ I've tried both, and in the long run cables are far more reliable than wireless (and cheaper!)
  - ▶ Affordable wireless video transceivers prone to interference by phones, a/c motors, etc.
  - ▶ Professional grade S-video transceivers very expensive!
  - ▶ Wi-fi signal strength fluctuates with local interferences (again phones, a/c motors, etc.) and can drop links to devices
  - ▶ Wi-fi transceiver performance degrades with temperature, ceasing to work at all below  $\sim -15^{\circ}\text{C}$  (in my experience)
  - ▶ Trouble shooting and general frigging around is far less with cables
- ▶ Do take the time to get good quality cables
  - ▶ eg. commercial Cat6 cable insulation cracks below  $-20^{\circ}\text{C}$

# Demonstration

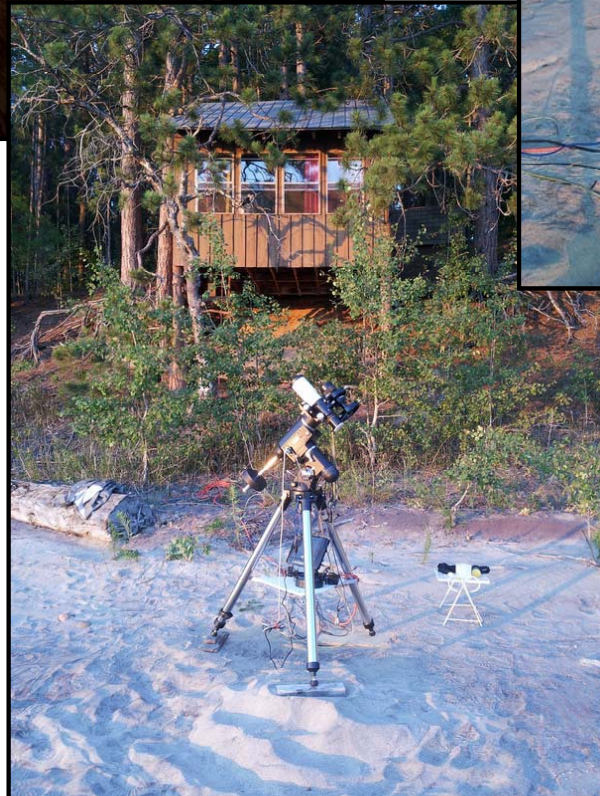
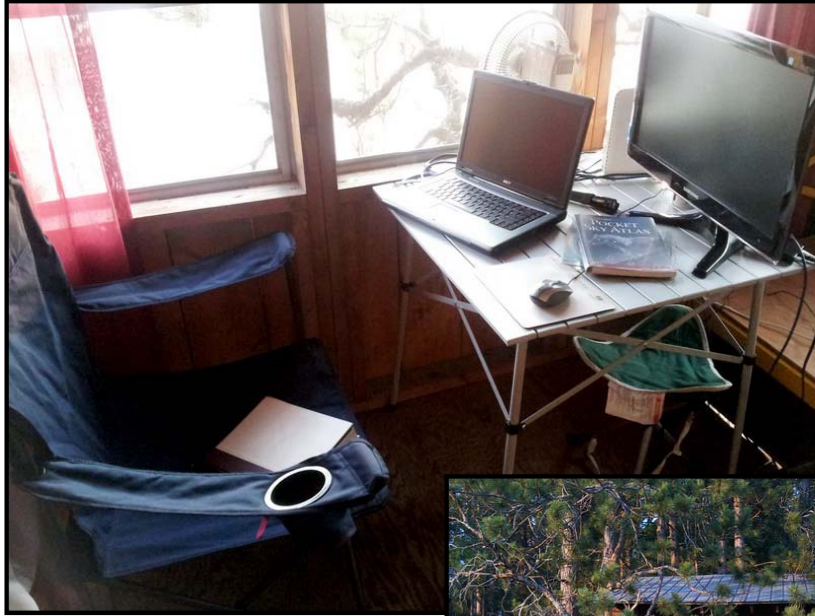


March 19<sup>th</sup>, 2011





# Demonstration



July 11<sup>th</sup>, 2012

