OAOG Workshop #2 (March 22nd, 2013)

# REMOTE CONTROL OBSERVING

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)
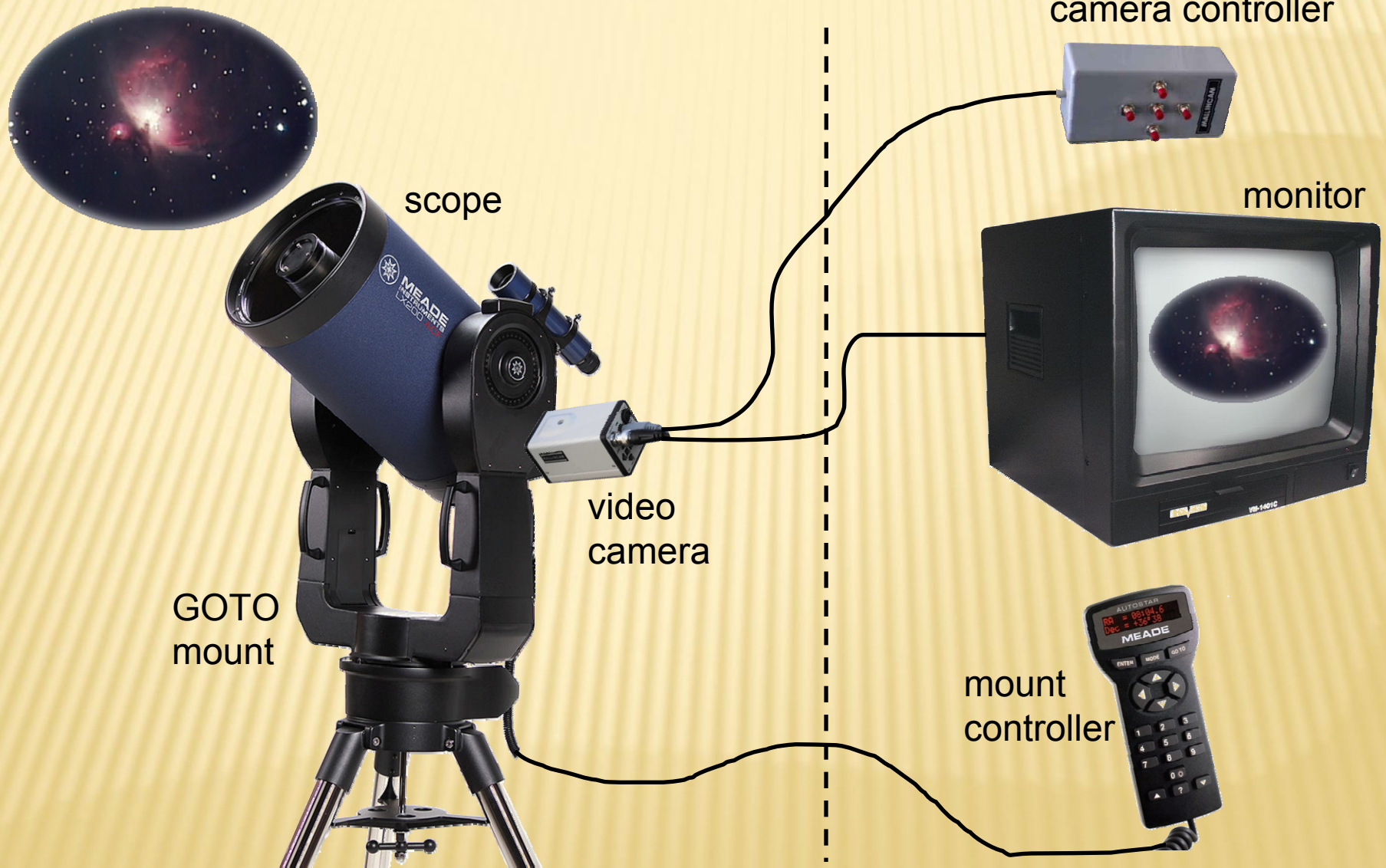 ► allow easier sharing with friends & family

► Cons:
  ► more complicated & more expensive

A BASIC RCO SETUP

camera controller

scope

monitor

GOTO
mount
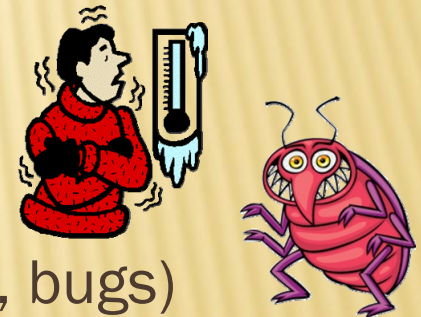
video
camera

mount
controller

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

monitor

computer

scope

video camera

GOTO mount

mount controller

- view/control video
- control mount
- control camera

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° (focal length <150mm)

  ► 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!)
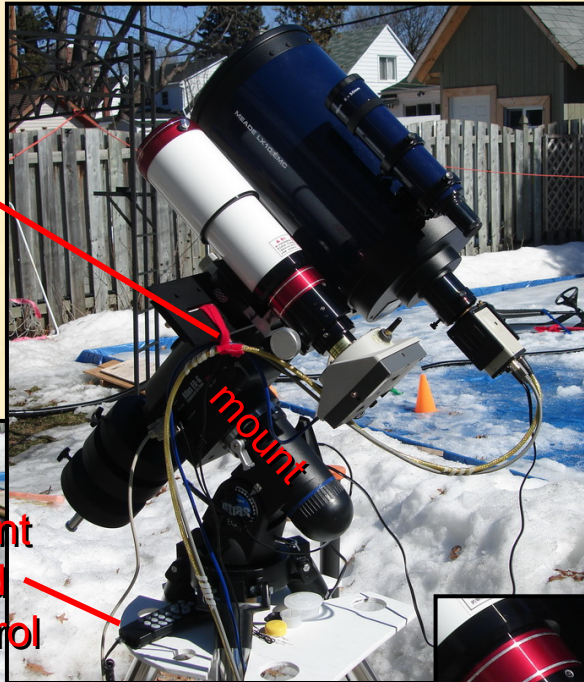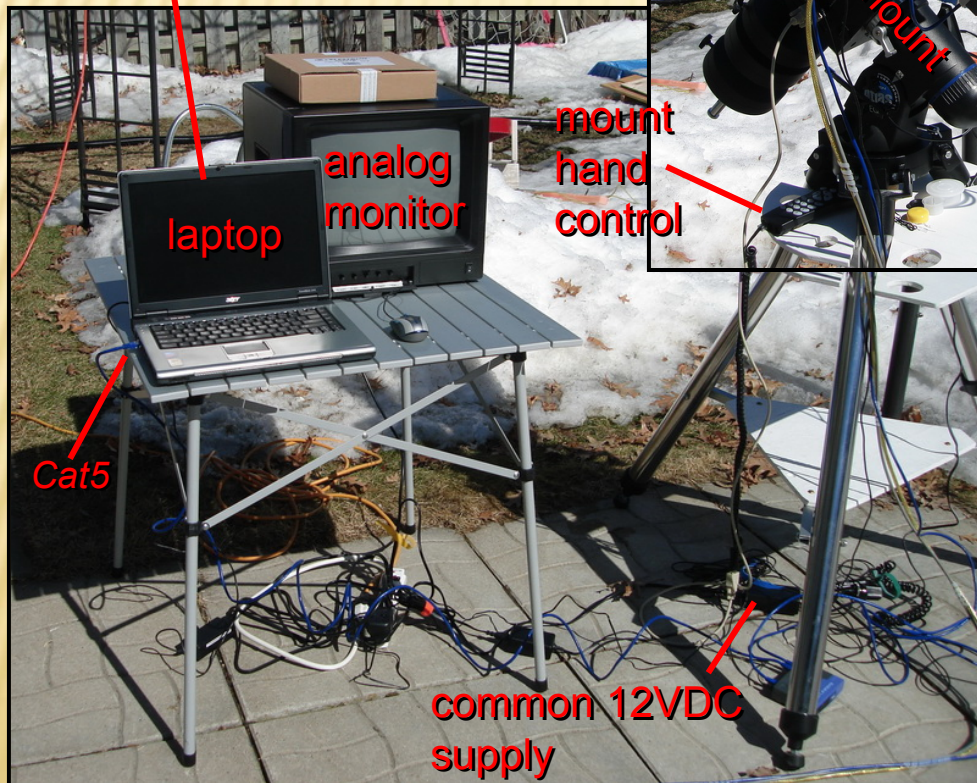
CABLES VS. WIRELESS

► 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 ~ -15°C (in my experience)
- ► Trouble shooting and general frigging around is far less with cables

► Do take the time to get good quality cables

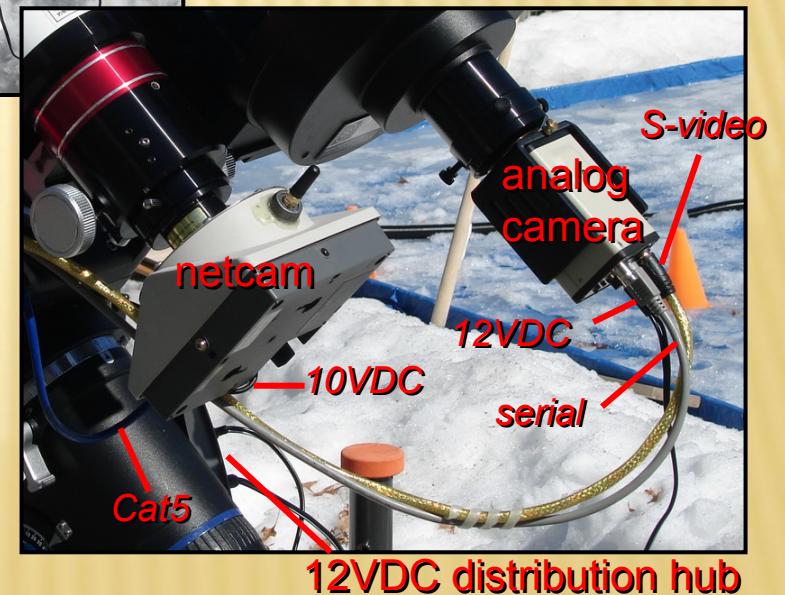- ► eg. commercial Cat6 cable insulation cracks below -20°C

DEMONSTRATION

route cables along
mount rotational axis
to minimize movement

laptop provides mount control &
camera display at scope that
you remotely login to from inside

mount

laptop

analog
monitor

mount
hand
control

Cat5

common 12VDC
supply

March 19th, 2011

S-video

analog
camera

netcam

12VDC

10VDC

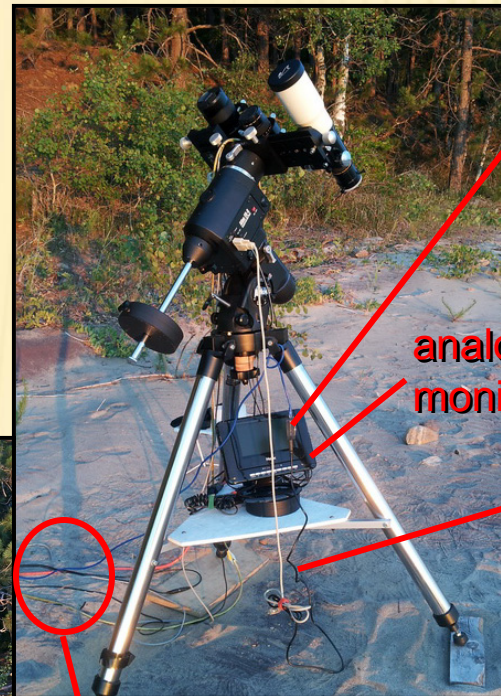serial

Cat5

12VDC distribution hub

DEMONSTRATION

wireless router

laptop

second monitor

mount control USB transmitted 50' using Cat5 baluns

analog monitor

serial-to-USB adapter cable

July 11th, 2012

cozy sleep cabin, safe from mosquitoes, skunks, & bears!

used wi-fi tablet to remote login to laptop and control mount from beach

110VAC
S-video
composite video
serial (camera)
Cat5 (mount USB balun)