⚠️	Critical point
😃	General principle
😎	Practical guideline

Comments & suggestions welcome

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		Before you get started it is always a good idea to check the weather and other conditions. In particular,	
		⚠️ make sure to be in lightning shutdown if there is a risk of lightning, and	
		⚠️ do not open the dome or run the fans when there is smoke and ash.	
		⚠️ **ALWAYS BE WITHIN EARSHOT OF A TWO-WAY RADIO TUNED TO THE MGIO REPEATER!** ⚠️	
		😃 This is not only for your benefit but also for the benefit of your colleagues in this remote location. You may be the closest to an injured person calling for help.	
		😎 In particular, if you are alone at the VATT, carry a LIVE unit with you at all times when taking the elevator, when in the dome, when you go for a walk outside, etc.	
		😎 If there is more than one person in the VATT building, one can be by the radio, and then the other does not have to be.	
		Dome floodlights	
		😃 The dome fluorescent lights are operated by an inconveniently placed switch. Avoid finding yourself walking in the dark. Use the dome floodlights operated from the control room. 😎 Prior to leaving the control room for the dome, turn on the dome floodlights (switch to the left of the door to the SW porch off the control room).	
		Cameras	
		😃 At all times, take advantage of the Hikvision and Axis cameras in order to monitor the status of the telescope. Dome, Security & Finderscope Cameras	
		Porch doors	
		😃 It is only too easy to lock oneself out when stepping onto the SW porch off the control room and the W landing off the dome. Do not panic if you do. Climb down the ladder and circle around to front door of the building.	
		VATTtel	
		😃 Once every few days it is prudent to reboot VATTtel. 😎 Reboot VATTtel daily.	
		Thermalizing M1 and its mirror cell	
		😃 When night and day temperatures inside the dome differ greatly (wintertime; greenhouse effect), it is advisable to take a couple of hours before opening to thermalize. The chief remedy is to open the dome slit because the outside air is significantly cooler than the air inside the dome. See Gradual Thermalization	
		😃 In summertime, nights are often warm on Mt Graham, with relatively small night/day temperature differences.	
		😃 The outside air temperatures are often too high in the afternoons, so that opening the dome is not very useful until dusk/sunset.	
		😃 Badly thermalized M1 is **not** a major contributor to dome seeing. The primary purpose of thermalizing M1 prior to opening is safety, i.e., avoiding thermal shock to M1.	
		😎 This document describes a streamlined process, to be used in the summertime.	
		An hour before sunset	

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Basement	Check dry air supply system dew point (typ. ~ -47°F; now tends to be 10°F warmer)		
Basement	Turn on building & pier fans		
Basement	Start the azimuth hydrostatic oil bearing		
Dome	Open dome register vents (there are four pairs of them)		
Dome	Remove Dome Short		
Dome	⚠ CAUTION ⚠ Never open the dome shutters unless you are sure it will be safe for you and the equipment. In particular, there may be snow on the dome shutters in winter.		
Dome	**Equinox**	**Solstice**	
Dome	Opening the dome slit is the most effective way of letting the hot air out of the dome. But, around the equinoxes, the setting sun will shine on the secondary barrel. This is to be avoided. ⚠ Keep the sun off the secondary barrel ⚠		
Dome/ Control room **later**	Open dome shutters (slit) about half way: at quad box on curved wall below the dome short installation position plug dome into the power socket (**note on safety: this ensures dome short is out: tether attached to cord**); operate the dome shutters by turning the control button on the electric box on the silo wall to the SE; stop the opening about half way by unplugging the power cord; this keeps the sun off the secondary barrel	Open dome shutters (slit) fully: at quad box on curved wall below the dome short installation position plug dome into the power socket (**note on safety: this ensures dome short is out: tether attached to cord**). No further action required in the dome: Shutters can be opened fully using TCSglue.	
Dome	Check dome home position (Homing the Dome) and if necessary, correct it by lifting the encoder wheel, spinning it about ½ - turn (usually clockwise as viewed from the top) and immediately setting the wheel back down, into contact with the abrasive surface. Watch dome position until it settles down (usually overshoots at least twice, at varying velocities).		
Dome	Check derotator position (home switch magnet is showing, near sensor, to its right); check cable wrap is not twisted		
Dome	Turn on power supply of the legacy finder telescope camera (on top of box on South side of East fork)		
Dome	Open legacy finder telescope objective cover		
Dome	Open the new finder telescope objective cover		
Dome	Andor Apogee guider camera power supply (a white inline electric switch mounted on the N side of the "guide box"): Turn power "ON"		
Dome	Disengage stow pins (~100 on LCD readout), note telescope is south heavy if mirror cover is closed (which it should be), and it is possible that it will have to be raised slightly in elevation towards zenith with hand pressure, until marks align. If misaligned, the stow pins may bind, resulting in failure of pins to fully release.		
Dome	Check azimuth axis "home". (The pointers, black arrows on white labels, are best visible from lower level by the entrance to dome.)		
Dome	Check AZ hard stop flippers are showing green sides north (manually flip if not; before you do, double check that the telescope is truly in its stow position)		
Dome	☺ West door (leading to ladder to the roof) is to remain closed (for efficient airflow over the telescope)		

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Dome	😎 Make sure West door (leading to ladder to the roof) is closed and locked for safety reasons (a person on the roof could get swept down by the rotating dome's shutters)		
Dome	Check all lights off (except for the floodlight operated from Control Room) and close door to elevator vestibule when leaving		
Silo 2nd lvl	🔧Fix Me! Start NESLAB See What's New at VATT		
TCS room	*If you intend to home the dome during this procedure,* toggle power switch "ON" on the DOME amplifier (fan will start, and amps will show on LCD readout)		
Control room	🔧Fix Me! ~~TCS glue - Mount Control tab: Turn on M1 cell fans.~~[1] See What's New at VATT		
	😃 After turning NESLAB on, the TCS takes several minutes to register the fact. The following 4 four steps fill this wait time.		
Control room	Turn on the intercom (pressing the buttons marked Dome West and Dome South, depending on which area you want to monitor more closely; for general use, Dome West is better)		
Control room	Turn on the main dome fan (green button on a strip to the right of the SW balcony door); adjust the speed to maximum by turning the knob on the top of the strip counter-clockwise to the limit (yes, 0 = the highest speed); listen to sound of proper operation over the intercom		
Control room	**@ VATTCONTROL (console) while logged in to vattcontrol as *vattobs*…**		
Control room	Start TCS_GLUE (double click desktop icon)		
Control room	🔧Fix Me! ~~MOUNT CONTROL tab: Wait for NESLAB is On to appear~~ See What's New at VATT		
Control room	🔧Fix Me! ~~THERMAL tab: note temperature differential (strut & mirror)~~ See What's New at VATT		
Control room	🔧Fix Me! ~~THERMAL tab: radio button "ON" (do not use setpoint; setpoint to be used EXCLUSIVELY to change mirror temperature fast in time-critical situations ⇒ CLOSE SUPERVISION REQUIRED)~~ See What's New at VATT		
Dome	**Equinox**	**Solstice**	
Control room	MOUNT CONTROL tab: Press "Open Slit" button (no action will ensue because the dome shutters are not powered yet but VATTtel will toggle into the state corresponding to your earlier manual action)	MOUNT CONTROL tab: Press "Open Slit" button. Use the intercom and/or cameras to monitor the action of the shutters.	
	15 minutes before sunset		
everywhere	Shutter all windows with blackout shades and curtains (with the exception of the window by the SW porch door in the control room; this can be useful to check the sky brightness visually, as the cameras are very sensitive and may create the false impression that the sky is brighter than it truly is)		
Control room	Turn big fan down to speed 8 (knob on top of strip to the right of SW balcony door), to make the dome comfortable for procedures to be carried out there, and later, when conducting startup procedures in the control room, to hear the sounds from the dome better over the intercom		
Control room	TCSglue main window: turn on dome tracking		
Dome	**VATT 4k CCD Imager only:** start filling science camera dewar with LN2; if using remotely controllable valve follow instructions in a separate document		
Dome	**VATT 4k CCD Imager only:** fill out LN2/camera log – listen for full dewar, cease flow when dewar is full		
Dome	Check dome shutters are plugged into the wall power socket (if the dome shutters were left half way open, they will finish opening fully)		

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Dome	**VATT 4k CCD Imager only:** disconnect LN2 filler hose from camera dewar, move storage dewar off of telescope platform and south, to dome silo wall)	
Dome	**VATT 4k CCD Imager only:** remove camera ground wire and clip it on silo, near storage dewar	
TCS room	M2 PI Controller: turn on; it takes a few minutes to boot (monitor status LEDs)	
TCS room	Check both toggle switches on clear panel under VATTtel keyboard are toggled down	
TCS room	Turn on VATTtel monitor and check for error messages	
TCS room	Toggle power switches "ON": AZ, EL & DEROTATOR amplifiers (should see some values on dome current (ampere) readout; the rest are dead) *DO NOT POWER UP COUNTERWEIGHTS AMPLIFIER*	
TCS room	😀 **PEPSI** Even though the derotator must remain inactive during PEPSI runs, the derotator amplifier must be powered up.	
TCS room	Turn off light	
2nd lvl lobby	Close doors to silo and to the instrument room (air flow management)	
Control room	TURN ON VIDEO MONITORS for the legacy Dome, FinderScope and Porch Sky camera feeds, as well as the dome floodlight (left of the SW balcony door)	
Control room	Enable `Live View` from the Hikvision dome, the Hikvision new FinderScope camera, and the Axis thermal IR P12 camera ([Dome, Security & Finderscope Cameras](#))	
Control room	**Mandatory for remote operation:** check that Skype is running on the Samsung Galaxy Tablet A using the Skype username and password listed on the intercom unit	
Control room	**PEPSI only:** , log in to *vattarchive* as *vattobs*	
Control room	**PEPSI only:** At the HP ThinPro xterm unit closest to the old printer, open a terminal and start the VNC viewer using this command: `vncviewer —via ajarvinen@ssh.lbto.org —shared —viewonly 192.168.164.19:1` (pressing the "Up" arrow at the command prompt should load this stored command). Enter password when prompted.	
Control room	**PEPSI only:** At the "principal" HP ThinPro xterm unit (at the angle of the table; this unit will run a `VATTcontrol` session), keep a browser window displaying http://10.0.2.11/local/viewer/axisvid.html.	
Control room	MOUNT CONTROL tab: Make sure dome shutters (slit) are open (visual inspection via Dome camera). If they are closed, press `Open Slit`, listening for sound of proper operation over the intercom and/or watching the dome cameras.	
Control room	MOUNT CONTROL tab: Open mirror cover, listening for sound of proper operation over the intercom	
Control room	MOUNT CONTROL tab: Enable drives (automatically releases brake: listen over intercom for a "clunk")	
Control room	TCSglue main window: **PEPSI only** Make absolutely certain that ⚠ Derotator tracking is disabled ⚠ : click on the derotator position field, opening a small dialog box, and toggle the tracking there, then close dialog box	
Control room	TCSglue main window: Enable Derotator tracking if disabled: click on the derotator position field, opening a small dialog box, and toggle the tracking there, then close dialog box	
Control room	⚠ **DO NOT "Calibrate"** ⚠	
Control room	TCSglue main window: Make sure dome tracking is enabled (left-clicking on the dome-position field toggles between tracking enabled/disabled)	

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Control room	Set a dome tracking offset *if applicable:* Right mouse click on the dome-position field opens offset input dialog box. Enter inputs and watch dome movement (floodlight on). Kill dialog box.	
Control room	Start INDI server (double click desktop icon): a terminal appears; you may minimize it	
Control room	Start "Secondary and Guidebox" GUI using the desktop launcher. This will open a Firefox browser window should Firefox not be running yet. If Firefox is already running, an error message will appear. Simply open a Firefox tab manually and go to `localhost:4002/guidebox_4k.html`. Select VATTSpec or VATT4k (default for all other instruments). The top controls the M2 PI hexapod and the bottom controls various motors in and on the Guide box. The diagram and the text output box scale with CTRL+/- (or CTRL and mouse scroll wheel). Other elements scale when the window is resized.	
Control room	Start autocollimation (more detailed instructions are in a separate document): Press `Connect` button; field surrounding button should turn green; press `Reference` button; field surrounding it turns yellow(ish); wait for it to turn green; press `Auto Collimate` button; M2 will move to previous night's final positions	
Control room	Connect the Guidebox part of the GUI to the hardware by pressing the `Connect` button. After any loss of power to the Guidebox you must click `Reference` (the procedure takes several minutes). Use the `Initialize` button if one of the axes becomes unresponsive (e.g., stuck in a limit). In more extreme cases, e.g., coming out of lightning shutdown, the guide box is likely to run into communication problems. The remedy is to run the `INDImon` script (its launcher on VATTcontrol's desktop is labeled `Restart indidriver`), selecting option (3) `Filter/Guidebox driver`.	
Control room	Start PHD2 (double click desktop icon): your main reference should be a separate dedicated document; instructions that follow here are simplified	
Control room	PHD2: Main tool bar, click icon that looks like a USB male connector: `connect equipment` window appears	
Control room	PHD2: `connect equipment`, in the camera row, click on the icon that looks like a screwdriver and wrench in an "X": `INDI Configuration` window should appear	
Control room	PHD2: `INDI Configuration` window: click the INDI button near the bottom of the window: `INDI options` window appear	
Control room	PHD2: `INDI Options` window: select `Apogee CCD` tab, check network settings, and click the `connect` button in the `Connection` field: after a few seconds, a bunch of new fields and tabs appears. (The message "[ERROR] Model is not supported by the INDI Apogee driver" may mean that the camera is not powered up.) Set binning to 8×8 and check that the cooling system is on.	
Control room	PHD2: Close the two INDI-related windows. Back in the `Connect Equipment` window click the `Connect` buttons for `Camera` and `Mount`. Ignore error message, "Bad-pixel map does not match camera…" If the Mount does not connect the first time (there may be an error message), try clicking the "Connect" again.	
Control room	Start XEPHEM (double click desktop icon)	
Control room	XEPHEM: main window: click "Now" on top right and "Update" in bottom bar, then toggle the small "RT" button to the right of `Looping` [2]; check that the bottom bar says `Stop`	
Control room	XEPHEM: *If applicable,* "Data" menu: Load/delete local files	
Control room	XEPHEM: *If applicable,* dialog box/"filter" field: ENTER PATH TO USER FILES	

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Control room	XEPHEM: A new version made this unnecessary: ~~Make sure that XEPHEM communicates with the telescope: In the "Telescope" pull-down menu, select "INDI Panel", which opens, and then toggle "Connect" at the panel's bottom. Check that there is a graphical representation of the telescope's position (bull's eye) in the SKY VIEW chart.~~	
Control room	XEPHEM: SKY VIEW window: We used to click grid control (under Images menu) twice, turning RA–DEC grid off and then Alt–Az grid on. This does not seem to work anymore. In the "Control" pull-down menu select "Options", which opens a new window, and toggle "Alt-Az" at the top left of the window.	
Control room	😎 First initialization of coordinates can be performed shortly after sunset, using a very bright star (<2mag).	
Control room	XEPHEM: SKY VIEW window: Find a bright star near the meridian, at Elevation 30°-60°; based on RA and DEC, picture 1st move in ALT–AZ telescope will make; after selecting star in Sky View window, hit "Telescope GoTo"; WATCH telescope to see whether it is moving as envisaged. BE READY with software stop (hover mouse over "STOP" button); Watch for target star on the finder telescope monitor.[3]	
Control room	Watch 🥴 the telescope behavior immediately after commanding the motion, to make sure the motion seems to be appropriate and that the telescope is not accelerating to slew-speed, non-commanded co-ordinates (i.e., "running away").	
Control room	If the telescope runs away during a slew (an exceedingly rare phenomenon), immediately click the red Stop button at the top of the TCS Information Window. If the telescope still continues to accelerate, hit the red Emergency Stop button on the console, to your right, above the phone. (See Recovering from a Stall.)	
Control room	Paddle: push telescope until object is in grease pencil cross-hairs circle	
Control room	TCSglue main window: Left-click the `Init. coords.` button. 🙂 This can be done at any point, and more than once.	
Control room	Turn up the main dome fan to speed 6 (strip to the right of the SW balcony door)	
Control room	Turn intercom down	
Control room	Start Trouble Report (TRVATT): In menu bar at top of *vattcontrol* desktop, start Firefox; Trouble Report page will open (https://cbtest.as.arizona.edu/mtnops-trouble-report/). Use the VATT Weather Dashboard (wfrog, the `3 Hours` tab). Fill in pertinent fields along top (Observer(s), Instrument, Operator(s), etc.).	
	TELESCOPE "Go Live" SEQUENCE COMPLETE	
Control room	It is highly advisable to collimate the telescope using a star in the vicinity of your science target field.	
Control room	When slewing, WATCH 🥴 the telescope to see whether it is moving as envisaged. BE READY with software stop (hover mouse over "STOP" button).	
Control room	XEPHEM SKY VIEW WINDOW: Identify a collimation object (magnitude < 7). Use XEPHEM **GoTo** function.	
Control room	Paddle: Jog selected object into finder telescope monitor cross hairs	
Control room	TCSglue main window: Init co-ords (do this again because it will improve localized pointing: collimation object is in the vicinity of the science target)	
Control room	*Check/optimize telescope focus with science instrument prior to collimation*	
Control room	*"Autocollimation" must be running throughout the collimation & focusing procedure!*	

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Control room	Adjust focus with Secondary GUI, taking an exposure with the science camera, and **when using the 4k CCD Imager**, evaluate the distribution curve fit in IRAF xgterm	
Control room	Guidebox GUI: insert Center field pickoff mirror	
Control room	Use PHD2 to observe the object. If the image is noisy, you may need to check whether PHD2 is correctly processing the image. Open the `Darks` pull-down menu and select `Use dark library`. A tick-mark appears to the left. Refer to PHD2's help files.	
Control room	Paddle: push collimation object to center of guider monitor @ rate of 5 sec/sec. DO NOT USE GUIDER STAGES TO CENTER OBJECT.	
Control room	Guidebox GUI: defocus to obtain "donut" (offset -30)	
Control room	Secondary GUI: adjust TipX, TipY to even out light distribution in "donut", re-centering object with paddle	
Control room	Guidebox GUI: refocus (eliminate/adjust offset; it will be a value close to 0)	
Control room	Guidebox GUI: select U-mirror	
Control room	Check/optimize telescope focus with science instrument (after collimation)	
	Collimation & focusing completed	
Control room	Select target and use XEPHEM **GoTo** function. Monitor 🥴 the telescope motion during slewing.	
Control room	Use Paddle to center target in the Finder	
Control room	**VATT 4k CCD Imager only:** Take image with main science camera to check the field; use paddle to adjust; re-initialize coordinates as required	
	Target acquired	
Control room	Instructions for guiding are provided in a separate document. Briefly, once you have a guide star, click on it. A yellowish frame appears. Open the `Tools` pull-down menu, select `Modify calibration > Clear calibration data`, answer in the affirmative when asked whether you know what you are doing, and click on the green `Guide` icon in the main tool bar. PHD2 will perform a calibration of the corrective motions and start guiding.	
Control room	*IRAF* In order to work with multi-extension fits files in IRAF, load mscred in IRAF (typing `mscred`), and use `mscexam` command to interact with ds9 (rather than imexam).	

[1)]
When in doubt, send co-observer to listen in the Dome to make sure that the cell fans will be turned on correctly because the only confirmation available will be their sound. Listening at the East fork is best.

[2)]
These steps were unnecessary at one stage of software development.

[3)]
FIRST POINTING: The star will be in the new Finder Scope's field. Place the target to the right of the tiny orange arrow using the MOUNT CONTROL tab: Open paddle, select 100 arcsec/sec rate, and push telescope (usually NORTH) until object is near the mark on the monitor. Pick a slow speed (1"/sec or 5"/sec) and then use paddle to center it, first by the mark in the Finder Scope and then also on the Offset Guider Andor Apogee camera monitored via PHD2.

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