

ServoCAT Version 7.0.A

- Requirements, Corrections, Exceptions lists
- New Features
- Some suggestions on using the new system (ServoCAT 7 mated with Argo Navis verion 3.0.x)
- BEEP TONES
- So how do I use it?!

Requirements:

- Generation 2 or 3 *ServoCAT*

[Regarding Generation 1 ServoCATs (off-white box): This version last shipped in early 2005. Due to hardware changes upgrades are no longer available. We do offer a 'plug-n-play' upgrade to Gen3, contact StellarCAT at techsupport@servocat.com for details.]

- EasyTrack - no other equipment necessary for tracking alone.

- Full GOTO: Argo Navis DTC using version 3.0.x firmware or later.

-Standard requirements (the usual - like a telescope with the motors installed!)

- *Note: the last and final release for use with the Sky Commander is version 6.0E. This document only refers to use with the Argo Navis using version 3.0.x*

Corrections:

Bug Fixes (from version 6.0E released March 2010):

- *Occasional errant track rate jump.*
This occurred rarely but it did occur occasionally. This has been eliminated.
- *Connection fall back to 'Sky Comm' mode if the **ServoCAT** power is cycled.*
If a connection with the Argo Navis using 'servocat' protocol was made and later the *ServoCAT* power were cycled (say to download new parameter values) the new connection would not be in 'servocat' mode rather it would be in 'skycomm' mode. In which case all the extra '*ServoCAT/Argo Navis*' features would be lost until a complete new connection were made (i.e. the Argo also power cycled and a new alignment is done). This has been corrected - now a power cycle in the *ServoCAT* will 'see' that the Argo has already been aligned and is already in 'servocat' mode.
- *On rare occasions the GOTO button press was not seen* - Fixed
- *EasyTrack would not allow all 4 possible motor directions* - Fixed
- SPM light (yellow light) now (properly) functions when going into SPM mode (AutoCAL), previously it was the red AUX light that came on.

Exception introduced:

When used with a Gen2 ServoCAT (no built in USB PC port) the ServoCAT dat file parameter list values for "encoder" for both axes needs to be changed from 2000 to 1000. See the section on 'updating' in the Main Manual. This is due to a hardware difference between Gen2 and Gen3.

- **New Features**

(components: *ServoCAT* refers to the *ServoCAT* or *ServoCAT/Argo Navis* referred to as '*System*');

- *ServoCAT: Power up indicator ServoCAT version:* On power up there will be a pattern of lights. The light sequence will be used moving forward as a 'version' indicator.
Version 7.0 indicator is: AUX followed by SLEW/SYNC alternating flash.
- *ServoCAT: Power up indicator of connection to the Argo Navis (indicating proper version):* three beeps on first connection to the AN - helps to ensure the "connect before the alignment is finished" process.
- *ServoCAT:* If reconnecting (cycling power to the *ServoCAT* with a still on and aligned Argo) the user will hear dual beeps with alternating SLEW and SYNC lights on the *ServoCAT*. The system will initialize in the proper 'servocat' mode.
- *System: ALT sensitive AZ GUIDE and Spiral Search rates defined by the ALT angle.*
The AZ GUIDE rate will increase as one increases in ALT angle. Also the Spiral Search patterns will reflect a faster AZ rate as the ALT angle is increased thus making the pattern more of a true spiral as you approach the zenith.
- *System: Last move for a GOTO is in the Sidereal direction. All lash will thus be taken up.*
When doing a GOTO and *not in AutoLOCK* mode the last move of the GOTO will be in the same direction as the normal sidereal track direction for that position in the sky. This is best used on high performance mounts with very low backlash. On more standard mounts it is still best for the user to optimize the Backlash Compensation (built in software feature - been there since day one) in order to make best use of this feature as well as best use of the hand controller.
- *System: ALT Tracking automatically turns off when an object hits the programmed Horizon Limit*
Note: Date/Time/Location in Argo Navis have to be properly programmed! There's a distinct downbeat 'bee-boooop' when this happens letting the user know it's no longer tracking in Altitude.
- *System: AutoLOCK.*
One can now lock onto a point in space. This feature provides ease of centering and re-locking on an object. It will track on 0.0, 0.0 until turned off or the object goes below the Argo Navis programmed HORIZON LIMIT (SETUP GUIDE). If **AutoLOCK** is enabled and a GOTO is initiated, whether through selecting an object in the Argo Navis or through a planetarium software connection it will go back to **AutoLOCK** after finishing the GOTO.

- **System:** *Local Sync Automatic reset of offset when in **AutoLOCK** (GOTO > 9° radius).*
If **AutoLOCK** is enabled and a GOTO is initiated, whether through selecting an object in the Argo Navis or through a planetarium connection it will go back to **AutoLOCK** after finishing the GOTO. If the GOTO move was less than 9 degrees from the point where the GOTO was initiated any user applied offset to compensate for alignment errors (i.e. pointing issues corrected for by the use of "Local Sync") will apply to the new object. If however the move is more than ~ 9° in radius the offset will automatically be set to 0 in both axes. A single tone quick 'beep' will sound indicating that LOCAL SYNC offset has been reset to 0 since one left the 'local area' where it was initially defined.
- **System:** *When **AutoLOCK** on Satellites the **GUIDE** motion buttons are track rate sensitive.*
Used when tracking and **AutoLOCK**ed to a Satellite.
- **System:** *When **AutoLOCK** on a Satellite there are audible indicators of limit status.*
The Argo will indicate with a beep tone if the object crosses below the programmed local horizon limit (down-beat tones) and if rising above the limit (current 'end of GOTO' up-beat tone). See CAVEAT in 'use' section below.
- **ServoCAT:** *Download of ServoCAT stored user parameters.* Through the use of a PC based command the internal user parameters can be uploaded to the PC. See Pete Eschmans "SCU" below.

Hardware Features:

- **System:** *No DSC encoders needed, motor encoder (60,000 counts) fed to Argo Navis via serial.*
The Argo does not have to have external encoders connected OR if they are not working properly (the encoders, their mounting, or their cable) this can be used to continue to fully use the system. This provides an effective 60,000 count encoder resolution to the Argo Navis. NOTE: In this mode the motors have to be left in line (cannot be disengaged) at all times including during the alignment process. Any backlash will decrease the accuracy of the pointing of the system.
- **ServoCAT:** *Support for 2.5X higher resolution on the motor encoder (applies to Gen3 only)*
This will provide very tight regulation of the track speed - it is designed for those doing imaging and video work and is *absolutely not necessary* for visual work. It is factory installed. It can be retrofitted but would require the **ServoCAT** and motors come back for the modification. Further note: testing has shown that the **ServoCAT** tracks EXTREMELY smoothly with peak changes in position that are less than 0.1 arcsecs. This higher res feature will decrease that further. *In essentially all cases the mount will be the limiting factor and not the smoothness of the tracking!*
- **ServoCAT:** *Hardware "PARK" capability.*
A 'button' can be (obtained and) wired in using the AUX jack in the back of the **ServoCAT** to allow one to 'PARK' a **ServoCAT** at its power up position. For observatory based scopes. See also ASCOM for the ability to do this from a PC program using ASCOM, no extra hardware required.

ASCOM FEATURES (provided by Peter Eschman):

These require the latest ASCOM driver and planetarium program that support the use of these features.

- *System: ASCOM HIGH RESOLUTION* readout of current position - increases accuracy of positioning from 54 arcseconds to 0.54 in AZ and 3.6 to 0.36 in ALT.
- *System: ASCOM HIGH RESOLUTION GOTO* - increases GOTO resolution from 54 arcseconds to 0.54 in AZ and 3.6 to 0.36 in ALT.
- *ServoCAT: ASCOM PARK* - when selected does a GOTO back to the power up position of the scope
- *ServoCAT: ASCOM TRACK OFF/ON* - toggle function turns tracking for both axes off and on.
- *ServoCAT: ASCOM VERSION REPORT* - reports the current *ServoCAT* version
- *ServoCAT: ASCOM MOVE* - allows a 'handpad' to be used to move around the sky from the PC program
- At this time, the current release version of the ASCOM *ServoCAT* driver is v5.2.0, available here: <http://www.unm.edu/~eschman/>

[NOTE: ASCOM is not required to use the *ServoCAT*/Argo Navis system. This is only for those that *do* use it.]

- In order to take full advantage of recent changes to *ServoCAT* and ArgoNavis firmware, you should use ASCOM *ServoCAT* driver v5.2.0. Refer to the following both for details on how each of these features work as well as how to get and install the driver. <http://www.unm.edu/~eschman/>

Please report any ASCOM *ServoCAT* driver problems to Peter Eschman, eschman@unm.edu

- NOTE: Gen2/3 hardware will work fine with the above. To obtain *some* of these ASCOM features on a Gen1 there is a *non-released* version of firmware: 6.1B. It is believed to work fine with the above. It is available on request from StellarCAT. Note Gen1 *ServoCAT*'s (off white box), introduced in early 2002, are no longer supported. Final note: this version of the *ServoCAT* ASCOM driver is both compatible with and suggested to be used by older versions of the *ServoCAT* firmware.

New *ServoCAT* Utility - "SCU" provided by Peter Eschman :

SCU Features :

- *Check version of *ServoCAT* code*
- *Check 'status' of *ServoCAT* including: Track, HC motion use, Park, Alignment (Argo Navis)*
- *Control Tracking & PARK: tracking ON/OFF (for both axes); execute PARK/unPARK command.*
- *Download the internal parameter set from the *ServoCAT* to the user. Provides this data set in either a *ServoCAT*-Sky utility compatible file or a 'view' text file.*
- *This utility and these functions are designed to work with version 61B or later.*
- *This utility is used standalone and is independent of ASCOM.*
- *refer to this link for more details and the program itself: <http://www.unm.edu/~eschman/>*

////////////////////////////////////\////////////////////////////////////

TRACKING CAVEAT FOR ALL OBJECTS:

For all objects: When the system has followed an object to where that object goes below the user set HORIZON LIMIT the system will stop tracking in Altitude. The Azimuth axis on the other hand will continue to track at the currently selected objects rate. So if left unattended it will continue to move in AZ as long as the Argo Navis is set to that object.






For sidereal objects this isn't necessarily an issue – except to realize that the AZ will continue, albeit at a very slow rate (~ 24 hours to do one rotation).

CAUTION TRACKING CAVEAT FOR SATELLITES:

For satellites, asteroids, and comets – especially for non-geosynchronous satellites the track rate might be substantial and it might be in the opposite direction (than sidereal). If a satellite circles the earth in say 2 hours then it will do a 360 degree rotation in AZ in that time frame! To **'stop'** this (higher track rate for a satellite) change the CATALOG object type in the Argo Navis away from SATELLITES.

Suggestions on how to use the new features...

INDICATOR LIGHTS on the *ServoCAT* FRONT PANEL:

-  SLEW ON SOLID : As has been the SLEW light is on during normal operation. It can be thought of as a "permissive" indicator indicating that 'all systems are go'.
-  SLEW BLINKING: The GOTO function on the hand controller (referred to from here on as the "HC") has been disabled. To DISABLE or RE-ENABLE the GOTO function:
 - Gen2 with older 6 button handpad: Push and hold the **GOTO** and the **FUNCT** buttons for one second. Repeat to re-enable the GOTO.
 - Gen3 (or Gen2 using the 'next-gen' wired hand controller): push the **GOTO** button on the wired HC (and the earlier versions of the 'next-gen' wireless) for more than about 3/4 seconds. Repeat to re-enable. On the latest version of the WL the time is 2 seconds or more to disable/re-enable.
-  SYNC: The SYNC is the LOCAL SYNC light. If AUX is off (down) then **AutoLOCK** is disabled. Local Sync (LS) provides a means to increase the accuracy of the pointing of the system by remembering the offset from where the scope is currently to where the Argo Navis thinks the scope should be for the currently displayed object. If AUX is UP then pressing the SYNC button will enable both Local Sync and **AutoLOCK**. See the Main Manual for an overall description on how best to use Local Sync - and know that it is a powerful feature and SHOULD be used!
-  AUX: If the AUX switch is UP **AutoLOCK** is enabled when the object type is not a satellite. When the object is a satellite AUX UP will automatically turn on **AutoLOCK**. The AUX light indicates when **AutoLOCK** is ON. To turn **AutoLOCK** on for non-satellite objects: AUX up (enables) and push the HC **SYNC** button to turn it on.
-  SPm: Used as an indicator during SuperProgram Mode. See the Main Manual for details of SuperProgram.

On Power up.... This version shows the following light sequence on power up:

Version 7.0 indicator is: AUX followed by SLEW/SYNC alternating flash.

If the system hasn't already been used (an alignment done) then both units need to start from a power off condition. It doesn't matter which is turned on first as long as both get turned on (and the beep happens) before the alignment is done. The Argo Navis will beep three times when it connects to the ServoCAT (it takes about 8-10 seconds from the last unit being powered up). Again this is during the first alignment process. **Its best to learn to listen for this beep.**

If you don't do it already learn to take advantage of using the ServoCAT HC (hand controller) **GOTO** button during the alignment. It takes the place of and will be seen as the equivalent of the Argo Navis ENTER button when doing the 2 star alignments. This can ensure that the 'enter' is hit when you are looking in the eyepiece at the star and you KNOW it is centered! Thus possibly/probably increasing the alignment accuracy.

Last Move is Sidereal (referred to as LMIS)

ALL systems - all amateur and even most professional systems - will have some amount of backlash. Even high end and custom designed systems (think: expensive) have some small amount of lash. When not in **AutoLOCK** the system will remove the backlash allowing tracking to start immediately with no delays. *For this feature to work one has to have taken the time to ensure the programmed Backlash Compensation value, shown in the "ServoCAT-Sky" dat template, has been properly set on their scope.* There is a document on the ServoCAT CD entitled "Backlash Optimization" that can and should be followed instructing one on how to do this.

Note backlash will have two negative effects: 1) it causes a momentary loss of tracking if the last move were in the opposite direction of tracking where the lash has to be removed from the system before tracking resumes and 2) it is seen, while looking in to an eyepiece, as a delay when doing a **GUIDE** and reversing directions using the hand controller. Backlash compensation, a feature that has been in the ServoCAT since day one (2002), is there to reduce these effects by automatically compensating for the lash. However one has to take the time to program it to best suit their needs.

Another way to eliminate backlash, on GOTO's, is to always ensure that the last move to the end point (the object or point in space if from a planetarium program) is in the sidereal direction and is at least equal to the amount of lash in the system thus removing all lash from the system. This is what LMIS does. **Last Move is Sidereal is automatic when not in AutoLOCK.** Since **AutoLOCK** will resolve backlash as well LMIS is not used when in **AutoLOCK**. If one does a **GOTO** to an object and the **AutoLOCK** is currently off the GOTO will resolve directions at the end of the move. This will slightly increase the time at the end of a GOTO as it does this. When the Argo Navis beeps - it's done. The GUIDE values should read less than one encoder count (typically 0.04 degrees). Tracking should start immediately from that point. If not - if it is larger than this then you've not properly set the internal ServoCAT motor backlash compensation value.

AutoLOCK

AutoLOCK allows one to 'lock' on to a point in space and track that point with zero long term error limited mostly by the DSC encoders resolution. It will do this even with ratios that are not precisely set. (Note however it is not a substitute for properly programming the system!)

In order to use **AutoLOCK** on a non-satellite object the AUX switch has to be UP. When used for a non-satellite object this 'enables' the function - it doesn't in itself turn it on. One of two ways **to turn AutoLOCK OFF if it is on is to flip the AUX switch down**. The red AUX light will go out (as will the Local Sync light).

The most common way to use the system with **AutoLOCK** will be to, as usual, find your object in the Argo Navis CATALOG. Once entered hit GOTO. Since **AutoLOCK** is off at this time (it hasn't been turned on yet) the scope will automatically resolve any backlash by doing a LMIS (see description above). Tracking will start immediately.

To turn AutoLOCK ON push the SYNC Local Sync button. The Local Sync light on both the front of the *ServoCAT* and on the HC (on Gen3 units) will come on indicating Local Sync is on and the AUX red light will also come on indicating it's in **AutoLOCK**. The system will 'hold' to this point all night long. If the object is not in the eyepiece field (a pointing issue most commonly *not* related to the *ServoCAT*) you can use the HC **GUIDE** buttons as usual to find the object and center it. When using **GUIDE** to move around the field the yellow Local Sync and the red **AutoLOCK** lights will temporarily turn off. Approximately one second from the last **GUIDE** button push the 2 indicator lights will come back on. At this instant in time the current offset values as shown on the Argo are "remembered" as the new reference offset. The tracking and lock will be relative to this new point. The object displayed on the Argo Navis when a GOTO was initiated is called the 'reference object'. The offset distance is the distance from where the scope is currently to the calculated position of the reference object. Note both **AutoLOCK** and Local Sync are on at this time. Refer to the main manual on best uses of Local Sync - a powerful tool that can be used to compensate for pointing issues (mount error being the predominant one) and provide higher precision pointing in a local area. Note further when doing a GOTO from one object to another with **AutoLOCK** on the lash is not compensated for automatically. It is instead compensated for by **AutoLOCK**. This might take a minute to resolve itself (depending on the overall level of lash in your telescope) but note it *will* get to the point where it was set! Have just a little patience.

To **get back to the original position of the object** as calculated by the Argo Navis simply **turn the Local Sync function off** (push **SYNC**). This will turn **AutoLOCK** and Local Sync off. Then hit **GOTO**. The GOTO will finish with a LMIS sequence with zero offset from where the Argo Navis calculates it to be. Turn Local Sync (and **AutoLOCK**) back on as desired. Re-center as needed.

If AutoLOCK and Local Sync are already on and a new GOTO is initiated they will remain on and the new object on the Argo Navis display becomes the reference object. The current offset will then apply to this new object. Be aware: Local Sync is a LOCAL function! Due to field rotation (as well as mount errors) it will only be accurate in a relatively small field of 5 - 10 degrees radius. When doing a GOTO that is larger than 9° radius from the current point the Local Sync offset value will automatically be reset to 0. Further note that if one moved in small increments - **GOTO** hoping from object to object less than the 9° radius the offset will NOT be shut off! So it is possible (although highly unlikely) to move great distances across the sky and still have a(n incorrect) Local Sync OFFSET value! **AutoLOCK AND Local Sync can be turned off simply by turning off the Local Sync (push the SYNC button, the LS light will go off as will the AutoLOCK light).**

Due to their faster (to much faster) track rates **AutoLOCK** is automatically on when the object is a satellite AND the AUX switch is UP AND it is within the LOCK range. This LOCK radius is ± 5 degrees (in each axis) from the calculated position of the satellite. While in this range the track rates will be those for the satellite and the "AUX" light will be on indicating it is in **AutoLOCK**. When in this zone the **GUIDE** speeds will be proportional to the satellites track rate in order to best find the object. If you leave this area the AUX light will go off indicating you've 'left' the zone, lock is off and tracking is back to sidereal. A double 'beep' will sound when exceeding the defined lock radius allowing you to know it's out of range - hit the **GOTO!** to bring it back within the lock range.

NOTE: If AutoLOCK is ON and either the SLEW or the JOG speed on the HC are used the system will force AutoLOCK OFF. It is assumed by hitting either of these one is moving to another part of the sky and any offsets currently in place will not be of use.

Since **AutoLOCK** is a tracking function it is assumed that if the user moves using **SLEW** or **JOG** (a much greater distance in a short period of time) that **AutoLOCK** is no longer needed. Thus **AutoLOCK** is turned off if either **SLEWing or JOGging**. Note its not the act of hitting the SLEW or the JOG speed button but rather doing this AND then doing an actual move using one of the yellow motion buttons. If one hits the SLEW or the JOG and realizes they don't want to do this and lose LOCK - and haven't hit any of the yellow motion buttons, just change the speed by hitting one of the **GUIDE** buttons.

Note **Spiral Search is not enabled when in AutoLOCK**. To use Spiral Search to find an object turn off Local Sync (and thus **AutoLOCK**) - do the Spiral Search - then re-enable **AutoLOCK/Local Sync** by turning Local Sync back on.

The effects of scope mechanics and using a closed loop controller...

A caution when using **AutoLOCK**. The bane of any control system is going to be the amount and types of forces that are needed to be overcome to produce motion. The amount can be an issue say in the AZ axis where forces in excess of 10, 15, even 25 pounds are required to start to move a scope (applied at the outside edge radius of the rocker with the full weight of the scope involved - equivalent to trying to manually move a scope at the zenith) ... if this is excessive (and these numbers ARE - but are not uncommon!) it can result in slippage which is a serious concern, one that can damage the ground board. If built properly and installed properly this should never happen! The other concern is the types of force. The 'break-away' force just mentioned, that required to get the scope to START to move is what is called STATIC friction... the force required to keep it moving once it is moving is the dynamic friction. Ideally these values are the same - in reality they will not be. When there is a large difference you get the classically referred to 'stiction' issue where the scope won't move (trying to manually center an object while looking in the eyepiece for example) ... won't move, won't move finally it jumps too much and you overshoot the object and have to repeat the process going the other direction. A frustration as many will attest! In addition to wanting these to be as close to the same as is practical the force amount itself is important in this regard.

The result of too much stiction when using the **ServoCAT** is no different than when doing it manually... the **ServoCAT** motor is turning extremely smoothly and continuously... but the static friction means the scope isn't responding to this motion.... it holds... it holds... it holds and then it jumps... and repeats.

In the current release version of the **ServoCAT** (6.0E or before) what this will mean is, if you don't have the exact ratio programmed (which is common) the tracking will not be exactly right. The result of which with higher power you see more 'drift' in the field. If there is a good deal of static friction you will see a jerking motion when at higher power. But it will eventually (falsely due to the ratios) track out of the view.

With **AutoLOCK**, which is fully closed loop control, the **ServoCAT**, along with the Argo Navis, is constantly trying to correct for any position error. So what is seen here IF this mechanical stictional force is high, is that it will still jerk - but it will bring it back to the same point! So IF you have this excessive stiction you will see this jerking more simply because it is in the field all the time versus drifting out of the field (and/or requiring more frequent hand controller corrections). So please don't think of this as "its not tracking right"... it IS - but due to mechanical issues beyond the ability of the system to control (like trying to push a wet noodle) it will act as such. If you want to learn how best to correct for these mechanical issues contact us - tell us which axis is doing it and we'll go from there. Note further that this jumping will be evident more, at higher powers, when trying to GUIDE at a slow speed!

Also note that **AutoLOCK** will lock on to a point in space with a long term error of zero! Its not claimed to lock on to an object (unless it's a perfect equatorial mount)! The reason for this is simple: because of mount error and field rotation an object will move relative to the field! So if you did a GOTO to an object and had to move from the 0.0, 0.0 point to find it you've now defined a radius from the defined location of the object. This radius arm will rotate around a point. So an object might be at one location as seen in the eyepiece when in the east and opposite it when in the west. So **AutoLOCK** WILL lock - but the object will, over much longer time frames, need to be corrected for due to offsets caused by mount errors and field rotation.

Argo Navis/ServoCAT 'Beep' tones

UP BEAT : "beeboop beeboop beeboop " : First time power up (alignment not finished yet) sequence indicating the ServoCAT and the Argo Navis seeing each other and have entered the 'servocat' mode.

UP BEAT : "beeboop beeboop" : Heard if the ServoCAT is power cycled (it is shut off and turned back on again - say to download parameters to it or to change out a main battery). This happens if it sees an Argo that is already on and that has already been aligned while in the 'servocat' model.

UP BEAT : "beeboop beeboop" : Heard during the alignment process if the *ServoCAT* HC GOTO button is pushed as the equivalent of an Argo Navis ENTER function.

UP BEAT : "beeboop" : GOTO: Signals the completion of a GOTO move.

DOWN BEAT : "beeboooooooooop beeboooooooooop beeboooooooooop " : GOTO: If an object is selected in the Argo Navis (MODE CATALOG, IDENTIFY, TOUR), one that is below the programmed local horizon limit horizon (Argo Navis: SETUP GOTO | HORIZON LIMIT) and a GOTO is attempted this down beep sound will be heard and the GOTO will not be allowed. Note if you determine by looking the situation over that you could actually go to this particular object (JUST below the limit programming for example) you can of course use the GUIDE numbers on the Argo Navis display and the SLEW/JOG/GUIDE buttons to bring the scope to a 0,0 display value.

DOWN BEAT : "beeboooooooooop" : **NEW** TRACKING BELOW HORIZON LIMIT: **When tracking an object that goes below the programmed local horizon (Argo Navis: SETUP GOTO | HORIZON LIMIT) the ALT tracking will be turned off.** Also a down-beat 'beep' will sound indicating this fact. The AZ will continue to track at the proper rate where the scope is pointed at that time. If viewing of an object below this limit line is desired you can a) set the HORIZON LIMIT lower to allow this whether temporarily or as a new limit or b) if it is an object to the south, or north, where the need to go down further is mostly used (if in the east you simply wait for it to rise), the ALT changes very little (zero as it crosses the meridian) and tracking, or the loss of tracking, in ALT is not of much consequence.

TRACKING CAVEAT FOR ALL OBJECTS:

For all objects: When the system has followed an object to where that object goes below the user set HORIZON LIMIT the system will stop tracking in Altitude. The Azimuth axis on the other hand will continue to track at the currently selected objects rate. So if left unattended it will continue to move in AZ as long as the Argo Navis is set to that object.

For sidereal objects this isn't necessarily an issue – except to realize that the AZ will continue, albeit at a very slow rate (~ 24 hours to do one rotation).

CAUTION TRACKING CAVEAT FOR SATELLITES:

For satellites, asteroids, and comets – especially for non-geosynchronous satellites the track rate might be substantial and it might be in the opposite direction (than sidereal). If a satellite circles the earth in say 2 hours then it will do a 360 degree rotation in AZ in that time frame! To **'stop'** this (higher track rate for a satellite) change the CATALOG object type in the Argo Navis away from SATELLITES.

QUICK BEEP : "beep beep" : **NEW** SATELLITE moving outside the "LOCK RANGE" (defined as a radius of 5° around the calculated position of the satellite). Track rate reverts back to sidereal. To get the satellite back in the lock range use the SLEW and motion buttons or the GOTO. Note the center of this lock range changes if the user uses GUIDE to move around the field to find the object.

QUICK BEEP : "beep" : **NEW** LOCAL SYNC offset reset. If in **AutoLOCK**, on a non-satellite object, and doing a GOTO that is more than 9° from the current spot (vector) the LOCAL SYNC offset will be set to 0. **AutoLOCK** is not canceled - just the offset is reset to zero. A single 'beep' is heard indicating this action.

SO HOW DO I USE IT?!

Simple....

- 1) Turn both units on. LISTEN for the 3 beeps from the Argo indicating they 'see' each other (the red DSC light on the front of the ServoCAT is now flashing)
- 2) Do the alignment. Remember to use the HC GOTO button as the equivalent of the ENTER button when entering each of the two alignment stars (while SEEING that they are at that very moment - centered). This WILL improve your alignment accuracy.
- 3) If you've not engaged both axes already do so.
- 4) Flip the AUX switch UP.
- 5) Find the object you want to go to in the Argo MODE : CATALOG or IDENTIFY or TOUR - hit ENTER on the Argo Navis.
- 6) Do a GOTO. Wait for the beep to indicate it has finished the GOTO.
- 7) Turn on Local Sync/ AutoLOCK by pushing the SYNC button (FUNCT + CCW on Gen2). The red AUX light as well as the SYNC light will come on indicating both modes are on and it is LOCKED!
- 8) Move around to center the object as needed using the GUIDE buttons.
- 9) Enjoy!

END OF DOCUMENT