I have been using the NaturalPoint Track IR5 Pro (http://www.naturalpoint.com/trackir/products/trackir5/) head tracker in my Condor flying for several years now (see my July 2012 Condor Corner article), and have been recommending it to my XC students as being far and away superior to the use of a ‘hat’ switch or mouse for Condor view control. Because it translates small physical head movements into much larger view movements, the TIR5 system is much more intuitive and immersive than any other view control setup, to the point where I quickly forget I’m not in a real glider cockpit, looking around naturally.

However, as I have recently discovered by working with several of my more ‘technically challenged’ students, the Track IR5 (TIR5) system can be a bit intimidating to get set up properly the first time. In particular, the response curve that translates physical head movements to virtual ones seems to be somewhat tricky to get right for each individual pilot; too sensitive and the pilot literally gets a ‘head-spinning’ feeling. Too coarse and the pilot loses sight of the PC screen when looking to the left or right. So, I thought I would share my experiences with TIR5 configuration in this article so that others can benefit.

**TIR5 System Components:**

The TIR5 system is composed of three distinct elements; a camera/LED emitter that sits on top of the PC monitor, an active headset-mounted IR LED or passive baseball cap-mounted IR reflector, and the software that converts head movement to Condor view movement commands. Figure 1 below shows the author with the headset-mounted active LED emitter, and the IR camera mounted on top of the PC monitor. Figure 2 shows the passive IR reflector setup on my pair-flying partner’s cool FBI cap.
Figure 1: The author wearing the 'TrackClip PRO' active IR LED emitter on the left side of the headset. Note the tracking camera on top of the PC monitor.
There are two significant steps involved in getting your TIRS system configured properly for Condor. The first step is to get the camera and the head-mounted unit (headset-mounted TrackClip PRO or ballcap-mounted passive reflectors) aligned properly so that the signal from the head unit is visible to the camera throughout the user’s physical head motion range. The second step is to configure the physical-to-virtual head movement transfer function.

**Step 1: Camera/Head Unit Alignment**

To align the camera and the head-mounted unit, select the ‘Camera/First Person’ view as shown below, and then adjust the camera’s physical position and pointing angle in small increments until the head unit signal (shown as three green blobs) is at the center of the alignment grid when you are looking at the center of the PC monitor. Figure 3 shows the signal from the TrackClip PRO, and Figure 4 shows the one from the passive IR reflector ballcap clip. Make sure you get this step right, as nothing will work correctly without it. If you don’t see all three green blobs, or you see any red dots/blobs, you need to get this fixed before moving to step 2.
Figure 3: Camera/Head Unit alignment - TrackClip PRO

Figure 4: Camera/Head Unit alignment - passive ballcap reflector
Step 2: Physical-to-Virtual Head Movement Response Configuration

The physical head movement to virtual head movement transfer curves configuration is done using the Track IR control panel, as shown below. Figure 5 shows the overall TIR5 control panel, with the significant sections highlighted.

Figure 5: Track IR5 Pro control panel

The ‘Response Profile Configuration Area’ is where the user configures the physical-to-virtual head movement transfer response, and this will be treated in detail shortly. The ‘Grid View’ shows how the virtual view will change as the user moves his/her head around. In Condor, it is important to be able to change the view at least plus/minus 90° horizontally so both wings are viewable (I have mine set so I can easily look plus/minus 120°), and plus 90/minus 45° vertically without losing sight of the actual PC monitor view. The ‘Hud’ area shows a virtual head as it would move in the game view, along with a mini-view of what the IR camera sees from the top of the PC monitor.
Figure 6 below shows a close-up of the response profile configuration area (cut into two pieces for more magnification), with significant items highlighted, as follows:

- **Motion Control section**, with ‘Speed’ and ‘Smoothness’ sliders. The ‘Speed’ slider controls how little or how much physical head movement is required to produce a certain virtual view change. I have mine set at ‘3.8’ to be very sensitive – very little head movement is required to achieve a full plus/minus 120° horizontal view change. John Mittel has his set much lower (around 2.0 I think), and others may prefer a ‘Speed’ setting even lower than that. Of course, if it is set too low, then the user won’t be able to see the PC screen, or will have to view the scene out of the corner of one eye for large view deflections. Too high, and it will be almost impossible to keep the view from shaking back and forth due to unconscious (and unwanted) head movements. The ‘Smoothness’ slider seems to control how often the virtual view is updated – a high ‘Smoothness’ setting may cause the virtual view to lag behind physical head movements, leading to overshoot and even nausea; too low, and the virtual view may jerk around a lot.
- **Profile Name**: A ‘profile’ is the saved collection of response settings, in XML format. There are several profiles supplied with the system, and these are a good place to start. However, I recommend the user create their own profile, or use one from another experienced Condor user (I will be happy to share mine with anyone who requests it). Profiles are stored in XML format in the `NaturalPoint\TrackIR5\Profiles` folder (C:\Program Files\NaturalPoint\TrackIR5\Profiles on Windows).
my XP PC). Any profile file placed in this folder will be available for selection the next time the TIR5 software is launched. To save a profile design, click on the floppy disk icon and provide an appropriate name.

- ‘Center’ Hotkey assignment: One of the things that was most frustrating to me when I first got started using TIR5 was that there was often a discrepancy between where I felt I was looking physically and where the Condor view was pointing, when I was trying to look straight ahead. I sometimes felt that I had to physically look slightly to one side or the other, or slightly above or below the PC monitor’s centerline in order to achieve a ‘straight ahead’ view in Condor, and it was driving me (more) nuts! Then I discovered that simply by activating TIR5’s ‘Center’ function, I could instantly remove any such discrepancies and re-synch my physical and virtual views.

  Now I use the ‘Center’ function all the time, even going so far as to use slightly different offsets in cruise and climb, to put the top of the glider’s glareshield further into or out of my view. So, knowing the ‘hotkey’ assignment for the ‘Center’ function is an absolute necessity. The hotkey assignment can be changed from the default F12 to anything (essential to avoid keys that are used in the simulator for something else) – I selected F10 as being easier to reach on my keyboard.

- ‘Motion Adjustment’ checkboxes: TIR5 can accommodate all 6 degrees of physical head movement freedom (pitch, roll, yaw, and translations in all three Cartesian axes). However, Condor only responds to pitch and yaw inputs. Therefore it is useful to disable the unused degrees of freedom in the control panel, so that the Grid (3D) View shows only what Condor is going to do, without being confused by the unused axes.

- Template Name: TIR5 displays the currently selected template as a light dotted line in the response curve display area, to be used as a guide when designing one’s own response curve. In this figure, the ‘Deadzone’ template is shown. This template has a flat spot right around $0^\circ$ true head position, so small left/right head movements are ignored. I personally like having a very responsive system, but John Mittell likes a small dead zone.

- Response Curve Display Area: The response curve for each axis (degree of freedom) can be viewed and adjusted individually, by selecting the axis in the ‘Axis’ window. In the figure, the ‘Yaw’ axis is selected. The green curve is the ‘response design’ curve with white ‘command dots’ (my term) arrayed symmetrically about the centerline. The command dots can be dragged up/down and left/right with the mouse to achieve the desired virtual view response curve, shown in yellow. If the ‘Mirror’ checkbox is checked (it is checked by default), then dragging a command dot on one side of the centerline will cause the corresponding dot on the other side to move symmetrically. The horizontal axis is ‘True Head Angle (deg)’, while the vertical axis is ‘Rotation Speed (deg/deg)’. So, in the curve shown, any true head rotation between $0^\circ$ and $15^\circ$ causes the Condor view to rotate at linearly changing speed from $0^\circ/\circ$ to $27^\circ/\circ$. So, by the time my physical head has rotated $7^\circ$, the Condor view has rotated well past $90^\circ$

When configuring the physical-to-virtual head movement response, I strongly suggest you start with the ‘default’ profile, and see how that works. Use the ‘3D View’ (grid display) to see exactly how far left/right/up/down you can ‘see’ in the simulator – if you can easily swing the grid view to plus/minus $90^\circ$ horizontally and vertically without losing sight of the PC screen, then you should be OK. If not, you
may have to increase the ‘speed’ slider to increase the rate at which the 3D view changes for a given
head movement. Remember to use the ‘Center’ hotkey liberally when doing these tests, as it isn’t
unusual for the crosshairs to be slightly off center when you think you are staring at the physical center
of the PC monitor. Rather than trying to move your head a fraction of a degree to center the crosshairs,
simply use the ‘Center’ key to tell TIR5 to move the crosshairs to the center of the grid.

Once you have a design you like, save it to disk with a name of you choosing by clicking on the floppy
disk icon and typing in the profile name. From then on, the last used profile will automatically be loaded
whenever you start TIR5. Of course, the proof of the pudding is how the system operates in Condor, but
if the 3D View is OK, then Condor will almost undoubtedly be OK too. Just remember that the TIR5
‘center’ hotkey is your friend ;-).

Tips and Tricks:

- If you wear progressive lens glasses, you might have problems. If you are like me, you get into
  the habit of moving your head up and down to bring whatever you are looking at into focus;
  however, when you do this with the TIR5 system, the view moves when you do this, so you
  never seem to get the right focus. I recommend you get a pair of single focal-length glasses for
  computer use.
- Use Condor in Windowed (or Windowed Emulation) mode so you can use ALT-TAB to switch
  back and forth between Condor and the TIR5 3D (Grid) View screen. This way you can tell what
  TIR5 is doing to produce the Condor view you want.
- The critical view angles are the ‘up and right, and ‘up and left’ view angles, because that is
  where other gliders and/or clouds are going to be seen. To check these particular views in TIR5:
  In Condor, look halfway between the nose and one wingtip, and then look straight up/down as
  high/low as you can. Then ALT-TAB back into TIR5 and check the pointing angles in the 3D (Grid)
  view for the virtual pointing angle – it should be about 45° either side, and roughly 80-90° up or
down.
- Physical head angles beyond plus/minus 10-15° are irrelevant, so the ‘command curve
  resolution can be increased within this range by moving all the command dots more to the
  center, as shown in John Mittell’s profile below.
Figure 7: John Mittel (BZ)'s Track IR5 profile