

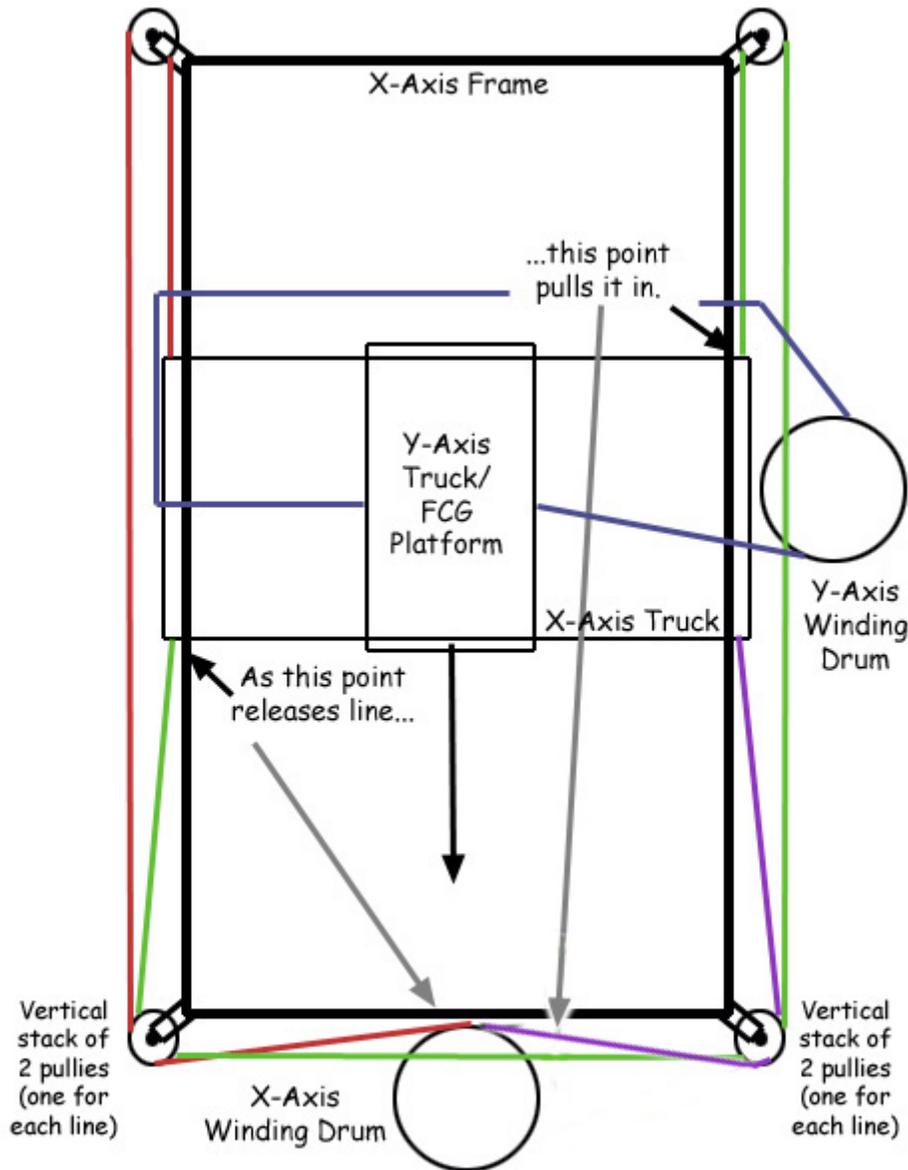


<http://www.phantasmechanics.com/CGS/index.html>

## The Coordinate Ghost System (CGS)

This project began as an attempt to answer a question posed in the Halloween-L mailing list in 1997: Would it be possible to build a device capable of flying a ghost anywhere in an outdoor scene? I remember that one requirement was that there be no visible crosspiece - something I decided was impossible - well, let's say *impractical*. I gave up on any sort of outdoor application, but I still wanted to make it work indoors - in my room at House of Shock, the Ballroom (also known as the Ghost Room) - and not be seen by patrons.

I drew a sketch similar to the first one below showing how the drive system would work, but the device wasn't completed until 2000. It took 3 months of daily work, and was built in three stages, in three different locations. As you can see, it's similar to a gantry crane in a factory; and this was my inspiration.



**Coordinate Ghost System (CGS)**  
**schematic diagram**  
 (not to scale)

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## POWER

The motive power comes from 2 **winding drums** which are similar to those used on high-speed elevators. In that application, a single length of cable runs from the top of the car up to a large drum, around which it is wrapped numerous times. The other end of the line drops from the drum down a wall of the shaft, and is attached to a counterweight approximately equal in weight to the car. The motor then only needs to

move passenger weight. The loops around the drum provide the enormous friction required to stop the cable from slipping.

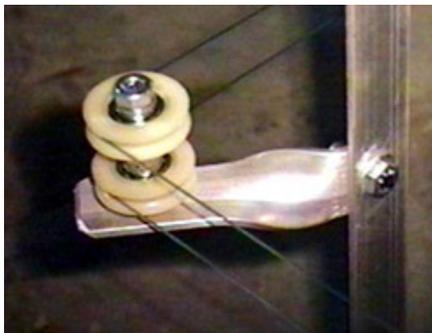
In the CGS, the winding drums work in two directions at once. The red and purple lines are both anchored to the X-Axis Drum in the center at points opposite one another. As one line unspools (50-lb. test monofilament), the other line reels in. As shown in the diagram, the X-Axis truck moves out and back, depending upon the direction of rotation of the drum. Enough line is stored on the drum to allow travel down the 17 feet of the X-Axis frame.

The Y-Axis truck, with its drum assembly attached to the X-Axis Truck, is carried along, trailing power and control wires dangling from shower curtain hooks on a PVC 'curtain rod.' The Y-Truck can move about 7 feet from side to side, and it also houses a full FCG mechanism, with a radically modified linefeed that lets the ghost "Do the FCG Dance" while also allowing it to drop quickly - for nearly 6 feet!

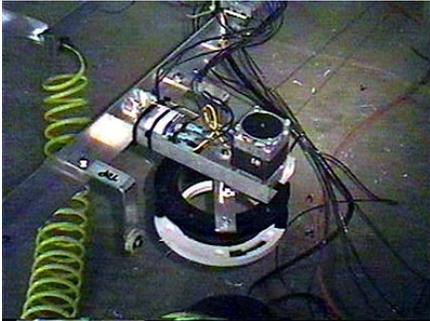
Both X- and Y- Axis rails have limit switches at the extremes of travel that force a power disconnect on the appropriate drum motor, to keep overly enthusiastic operators from wrecking the machine. Control is by a home-brew joystick which trips an array of micro switches to control power and reversal of the motors.

The gear motors are of the run-capacitor type, wired to be reversible. All you have to do is switch the capacitor connections with a DPDT relay. They are 60 RPM, if I remember correctly ;-). These are motors of relatively little torque, and they provide further insurance against self-destruction. For instance, the motor stalls before it breaks the line.

The drums themselves are made from 2 types of PVC/ABS toilet flange from (you guessed it) Home Depot. One is flat; the other has a 6" wide length of pipe protruding from it. I simply glued them into a spool configuration. For attachment to the gear motor, I used the good old u-bolt and aluminum flat bar system from the FCG, and it worked perfectly from the start. The flat bar is bracketed so that the bar can be bolted to the motor axle with the u-bolt. The U-bolt is thus oriented properly to connect with the shaft. The lines go through two small holes on opposite sides off the spool, and are tied in knots once inside the holes.



Here are some close-ups: Left, the double pulley assembly; Right, the Y-Axis winding drum assembly on the X-Axis Truck.



This is the X-Axis winding drum. Note the run-capacitor mounted behind the motor.

## THE SPACE

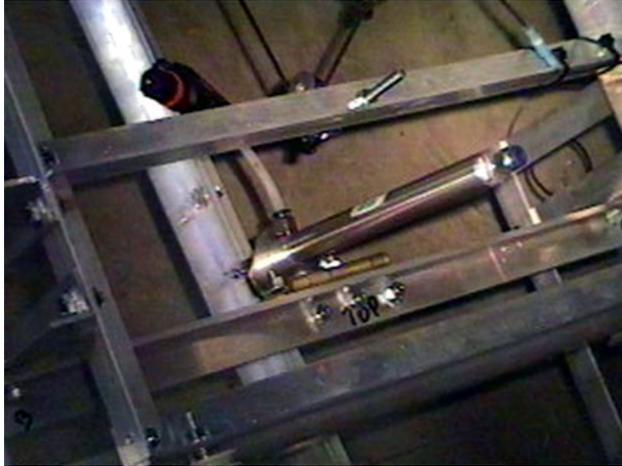
As mentioned above, the FCG can descend upon any patron standing in the room. We shortened the shroud to make the ghost about 4' tall, and were careful to make sure patrons couldn't grab it. (A good operator can prevent this by quickly raising the ghost, but we took no chances.)

The Ghost Room is over 15' tall, so we had plenty of space to hang the bulky - and modestly heavy - CGS mechanism. Nevertheless, I didn't construct the device in the room. The X-Y components began life in a garage, were disassembled, moved, and then re-assembled in the H.O.S. engineering facility. At this point the FCG mechanism and drop arm were added. In the video clip, you can see the weights on the T-bar which substitute for a marionette load, and also the dimensions of the rails.

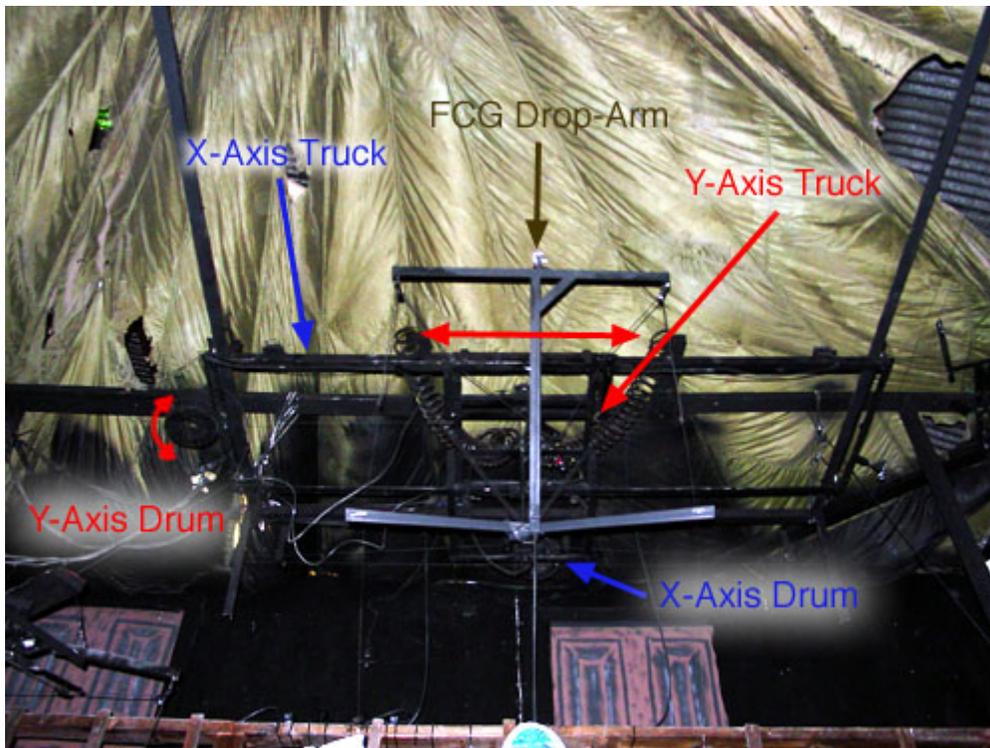
The unit is suspended from 6 sets of tackle - 3 supports on each side of the X-Axis. It took 7 people and a supervisor (myself) to level and secure the platform. I had any number of concerns about the device once it was installed, but as it turned out; all that was needed was a few minor adjustments and the addition of some nylon line guides.

The only real problem was the ghost drop - it needed more travel. To address this, we added a high T-bar, which can be seen in the next illustration, below. What the bar does is add line travel at the cost of mechanical disadvantage. When the bar drops, the ghost drops almost twice as far. I used a single pneumatic actuator to raise the bar. To drop it, the pressure is released through a flow restrictor valve, to keep the movement from being too violent.

That is the key to the success of this prop, which - I am proud to say - have not failed in 4 years of operation. Never is any movement too quick or extreme, and if you add the flexibility of the aluminum stock, plus the sway inherent in rope rigging, the excess kinetic energy is safely absorbed.



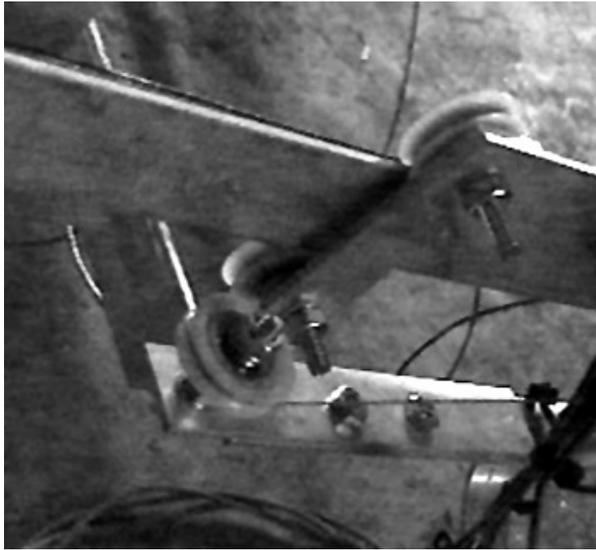
Here is an image of the pneumatic actuator on the FCG drop rig. The little black and red gadget is a flow restrictor to control movement speed.



Above, the room is 'roofed' with a parachute. When the lights are off, this disappears in the darkness, and the CGS is painted flat black. Magicians and theater crews refer to this as 'Black Art' and it dates back to the early days of the theatrics. The idea is that visible light in the foreground (here, floor level, since our 'stage' is the upper floor area) blinds the patron sufficiently to hamper night vision. Thus, the modus operandi is not seen. Yes, it does work here.

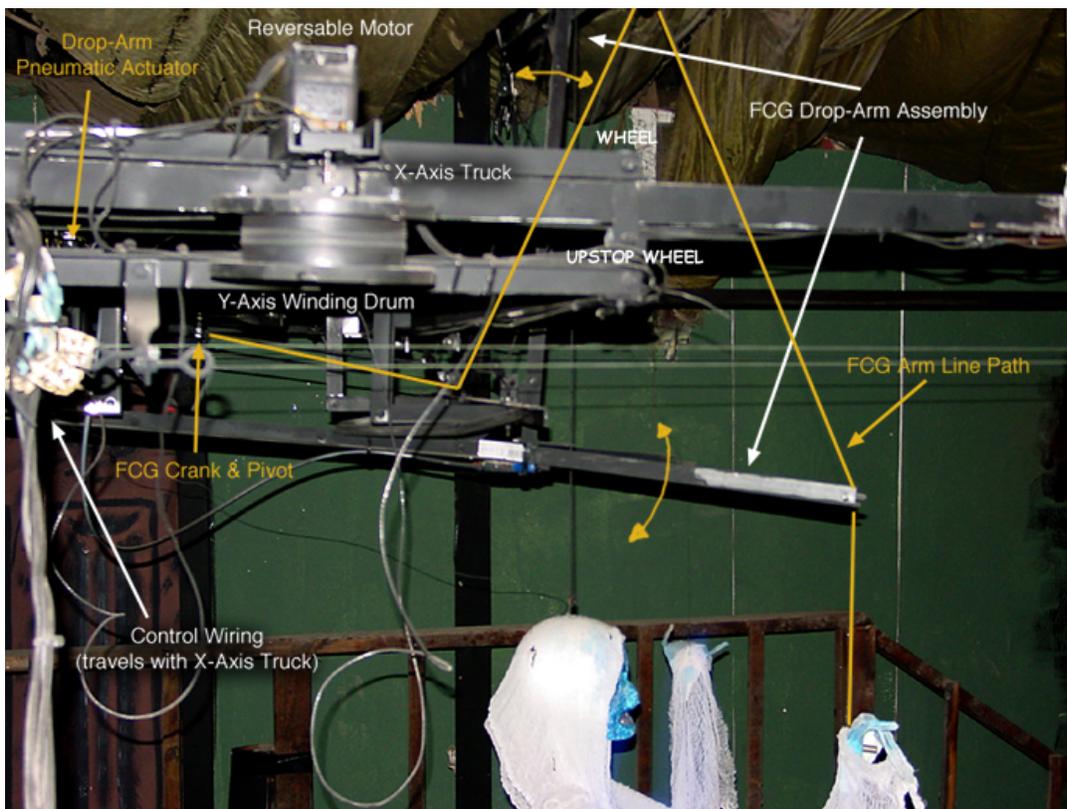
## DETAILS

The X- and Y-Axis trucks ride on little nylon wheels that are shaped like pulleys. These came from Home Depot's repair parts for sliding doors, and are the same as the cam follower used in the Cam Drive Floater we sell. Above the rails, the groove in the wheel rides on the edge of the rail.



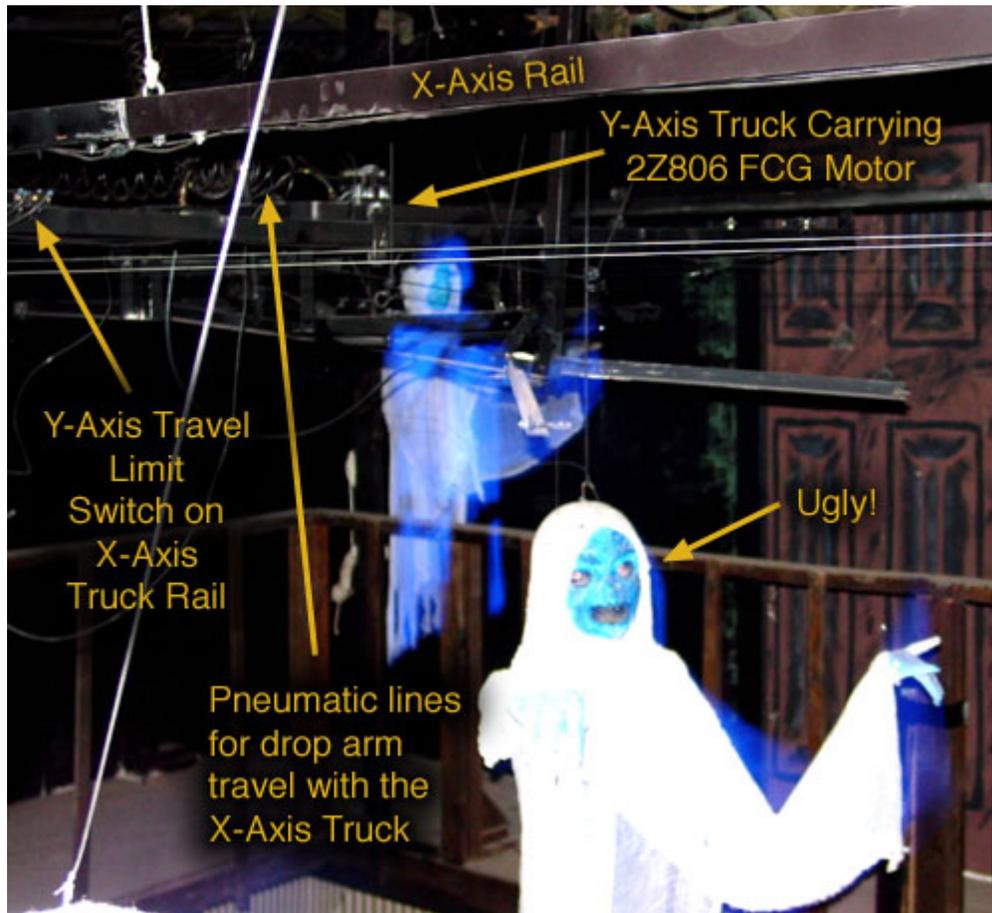
Here, the wheel functions like the up stop wheel on a roller coaster, preventing derailment; it rides flat against the bottom of the channel (see image below for clarification.)

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The above image also helps clarify how the FCG lines are fed, and how the drop arm moves. By the way, in case you're curious, there's a little pneumatic rig attached to the drop arm which I intended to use as an air jet, but you couldn't feel it on the floor. (An air cannon would have been way too heavy for the rig.) Thus, the X-Truck pulls two coiled air lines with it (the first one is the drop or Z-Axis actuator), and they tend to act like

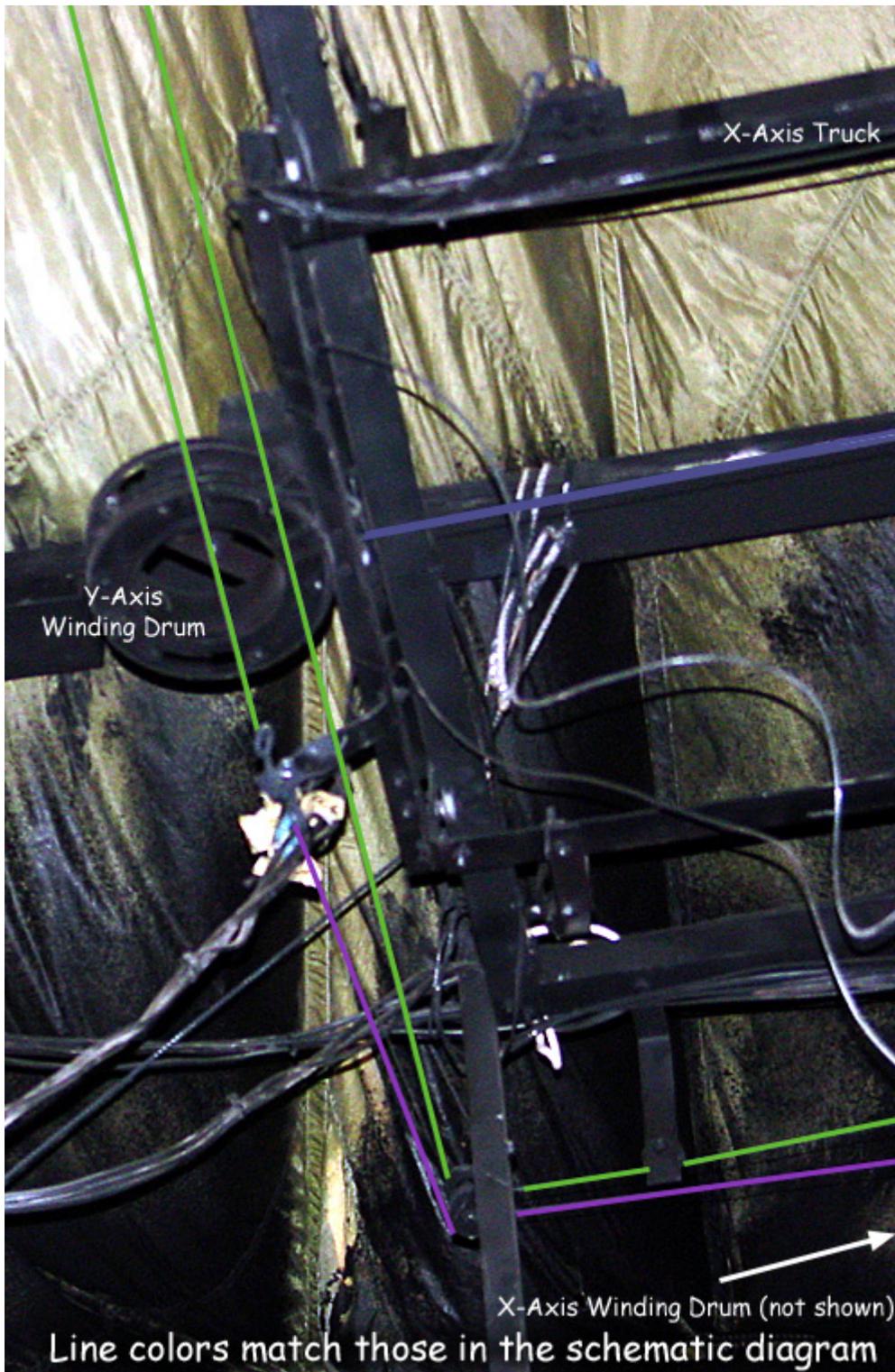
springs, pulling the truck back. This is not a problem, as it only becomes an issue at the farthest extreme of travel. It actually helps damp over travel, so I never have 'fixed' it. :-)



Here's a diagonal view from the balcony of the Ghost Room, just outside the operator's station. In the background is one of the 3 conventional FCG units in the room. The operator's station is a little cubicle surrounded by scrim cloth. You can see out, but no one can see in. It overlooks the room from directly over the door where patrons enter. Across the room from this corner cubicle is a working staircase with a Drop-FCG which the operator also controls. This is a mutant FCG rig, to be sure! (Details to come shortly.)

Above, note the center support line at the midpoint of the X-Axis rail. Also note the dual monofilament X-Axis drive lines, about a third of the way down the image, as well as a typical travel limit switch (there are four of them on the CGS.)

The image below shows more detail on the X-Axis Truck as seen from the floor. The monofilament line colors are keyed to the first diagram in the article, for clarity. The dangling umbilicus is the control-power wire set mentioned earlier.



The next image shows our Drop-FCG. The photo is fairly self-explanatory, save for the orientation of the FCG motor platform. If you're familiar with the T-shaped FCG motor platform, imagine it in the configuration of a Christian Cross (metaphor unintentional.) It is mounted in this way to the wall opposite the dropper, its lines feeding toward the

stairway, the motor to its back, against the wall below the operator's booth. You can see the 3 control lines from the motor platform in the upper right hand corner of the photo. (If you are still scratching your head over the FCG motor platform, hit your back button and go read about it!)



The final image shows what the guest sees, after encountering the spectre that dropped down the stairs. And hey - that ghost in the center - she just might *follow* you...

The Ghost Room - almost ready for business. The CGS (center) is hidden by the black art principle.



**"Would you be willing to build another of these things?"** - Yes, for \$15,000. It was real work, and was the single most complex thing I ever did, outside our dark ride.

**"Are you going to make the blueprints available?"** - No. Consider this a master's thesis in Halloween imagineering. If you finish it, I'll personally award you a diploma. After all, I didn't exactly starve you of information. :-)