

Sarnicola Simulation Systems, Inc.

Sarnicola Uses Galil for Aircraft Training and Thrill Ride Simulators

Galil provides precise X, Y, Z, Yaw, Pitch and Roll control of motion simulator platforms.

While motion simulators are used to train professionals such as jet pilots, truck drivers and high-rise construction crane operators, they can thrill families who ride the *Star Tours* and *Mission Space* attractions at Disney World and *SHREK 4D* at Universal Studios.

At the heart of each of these simulators is a motion platform. John Sarnicola, President of Sarnicola Simulation Systems, Inc. (SSSI), designs his patented Triad and Hexad series of motion platforms for handling virtually any mode of motion. Applications range from training and entertainment to trade shows, military, testing, research and education.

Essentially, an SSSI system includes the motion platform, controller and software. Placed on top of the platform is the customer's compartment simulating the cab or cockpit for the pilot or passenger. Handling the precise motion for the Triad is a DMC-4030 3-axis Ethernet motion controller from Galil Motion Control. Their DMC-4060 6-axis Ethernet controller is used with the Hexad series.

Suitable for vehicle driver, machine operator training, and other similar applications, the Triad series handles 1,200–4,500 lb. payloads and moves in three degrees of freedom using three independent axes of motion: Roll (X), Pitch (Y), and Heave (Z). The Hexad platform handles 2,000–30,000 lb. payloads and can move in six degrees of freedom including three rotations and three linear movements, making it ideal for duplicating an aircraft in flight. The three rotations are 1) Pitch for nose up and down, 2) Roll for rotating in either wing direction, and 3) Yaw for turning left and right. The three linear movements are 1) Heave for up and down, 2) Sway for left and right sideways motion, and 3) Surge for longitudinal acceleration and deceleration.

To accomplish this, Sarnicola collaborates with Mark Barry, President of InMotion Simulation, to download the X, Y, Z, Yaw, Pitch and Roll motion parameters from the host computer into the DMC-4060, which computes the “leg” extensions from the equations of motion transformations. Using the Position Tracking Mode of the controller, new positions are sent to each “leg” on the fly and at a rate of 50Hz or better. The controller then executes an on-board program which computes inverse kinematics equations—



which are calculations that translate the X, Y, Z, Yaw, Pitch and Roll data into target positions—for each individual axis.

This capability led Sarnicola to build three systems for a Mine Shaft ride located in Russia. The ride places 8 to 10 people inside a simulated mining wagon situated on top of a hydraulic motion platform. Synchronized to the movie, the simulator sends riders on a furious ride through tunnels with hair-raising drops and turns.

“Of course, everyone actually moves just a few feet in each direction,” said Sarnicola.

Prior to using Galil's controller, Sarnicola built his own 12-bit controller, but it did not provide the resolution needed for larger simulators. Galil's controller provides 16-bit resolution, which helps provide a far smoother and precise simulation. “I investigated several other controllers and Galil provided the performance and features I needed and at a lower cost. It also has simple commands so programming was easy and straightforward. Bottom line, the Galil controller increased the performance of my motion platform for the Mine Shaft ride by 50%,” Sarnicola said.

“What is important in simulators is the ‘feel’ that relates to the acceleration. For example, roller coasters have a bumpy feel, jet fighter simulators have an intense feel, and vehicle transport simulators are more sluggish feeling. The ‘feel’ must be translated into the proper set of equations and Sarnicola develops programs for each specific application. The role of the Galil controller is critical to enact these motions,” Sarnicola added. ■

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