



Motion Simulator

Shown below is a model of the Magic Motion Simulator™ 30 Series, a cabin flight simulator for science museums and recreational attractions produced by InterActive Simulation Inc. (ISI), Toronto, Ontario. ISI pioneered the use of flight simulators as theater attractions and is the world's leading supplier of simulator-based

attractions; the 30 Series machines are the first electric-powered simulators and the electric motion actuators they employ are products of space technology.

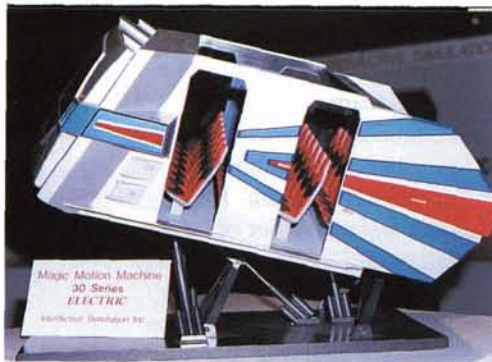
The full size simulator made its debut as a 30-seat theater at the U.S. Space and Rocket Center, Huntsville, Alabama, ISI's first customer for electric simulators. Opened to the

public on May 15, 1993, the Space and Rocket Center's unit takes passengers on a realistic flight to Jupiter.

The electric motion system, developed by MOOG, Inc.'s Motion Systems Division, East Aurora, New

York, generates a quiet, smooth, powerful range of computer-guided motions — including simulated free fall — to heighten the sense of moving through space. Motion is coordinated with visual effects provided by a MotionVision 70™ projection system; the system projects a 70 millimeter image onto a 15 by 7-foot curved screen that fills the viewers' peripheral vision. Realism is further heightened by a digital laser-based sound system with 11 speakers.

Below is a view from the interior of the cabin of the Space and Rocket Center's simulator; the image on the screen is a space view but it can be any kind of environment that can be filmed, for example, a trip to the ocean depths.



SPACE SHUTTLE
TECHNOLOGY IS
INCORPORATED IN A
NEW RECREATIONAL
ATTRACTION

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At right is a closeup view of the electric actuators that move and shake the cabin.

The development of the electric actuator represents an unusual case of space technology transfer wherein the product was commercialized before it was used for the intended space purpose. MOOG, which supplies the TVC (thrust vector control) hydraulic actuators for the Space Shuttle and brake actuators for the Shuttle Orbiter, initiated development of electric actuators for aerospace and industrial use in the early 1980s. By 1989, the company had successfully developed units with peak power ratings as high as 10 horsepower. At that time, MOOG learned that NASA was interested in electric actuators for a possible next generation Space Shuttle or for a new, advanced launch system being studied.

After discussions with Shuttle contractors and officials of Marshall Space Flight Center (MSFC), MOOG decided — in 1990 — to go ahead, under company funding, with design and demonstration of an electric replacement for the Shuttle main engine TVC actuator. This represented a significant development, because the TVC actuator would require a peak power of 40-plus horsepower and other technological advancements to compete with hydraulic actuator performance and durability.

MSFC cooperated in the development by providing MOOG design information relative to TVC operating data and system performance. MSFC also participated in a number of

technical interchange meetings with MOOG engineers to assess program status and to exchange information on design progress and test requirements. MOOG delivered a completed unit to MSFC for an evaluation, which is still in progress.

Having advanced the art of electromechanical motion control, MOOG decided to pursue the commercial potential by initiating development of an electrically actuated motion system capable of manipulating a load of 13,000 pounds in four degrees of freedom. That led to the partnership with ISI for production of cabin flight simulators.

The advantages of electric actuation — in comparison with the hydraulic actuators used in prior ISI simulators — include

easy installation and reduced environmental risk, along with lower operating costs, noise, heat, maintenance and staff requirements. In addition to the Space and Rocket Center's unit, ISI has delivered simulators for the Canadian Pavillion of the Taejon (Korea) Expo '93 and a museum at the City of Science and Technology, La Vilette Parc, Paris. •

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