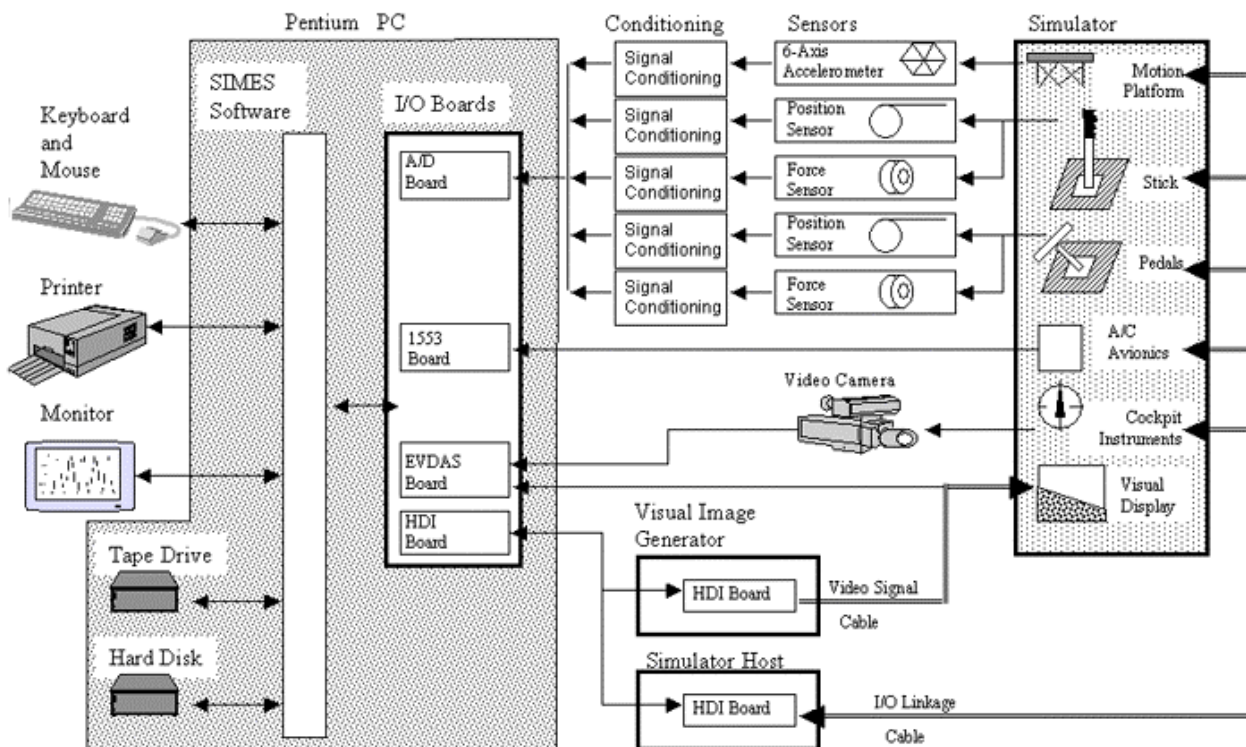


SIMES - Simulator Evaluation System

The Simulator Evaluation System (SIMES) is a portable, comprehensive instrumentation system designed specifically for a simulator and is intended to be used for three main purposes:

1. Acceptance testing of any simulation system including cueing systems
2. Fidelity testing, debugging, or subsystem testing of a simulator system
3. Simulator sickness studies

With ever-declining budgets and a simultaneous increase in system complexity, the importance of simulation in system development and training is constantly increasing. In an aircraft simulator, the pilot can perform many missions and flight training tasks that are very expensive or sometimes impractical to perform in flight. However, in recent years, the complexity and capability of simulation systems procured has, in many cases, exceeded the capability of the procuring agencies to test, validate, support or update the simulations. This is the motivation for SIMES.



General Architecture of the SIMES System

SIMES is designed to test statically and dynamically the primary cueing systems of a simulator; visual, motion, control loading, and flight instrumentation. SIMES also has the provisions for aural cueing, cockpit environment and biomedical system instrumentation. SIMES is low cost, easy to use, and designed to incorporate future expansion and upgrades. These include increased testing capabilities, such as for simulator sickness studies, as well as increased hardware capability. SIMES has an almost completely non-intrusive interface to the Host computer or computers with the capability to simultaneously interface to any I/O computers. This gives the test engineer access to all the sensors already incorporated in a simulator. Equally important, especially for acceptance testing, SIMES has its own sensors for instrumentation of the simulator cueing systems.

SIMES is designed to be portable, so it can be moved from site to site with the test team. It is designed to use off-the-shelf hardware and integrate multiple packages of off-the-shelf software into one cohesive system with a single user interface. Once installed, the system will enable the simulation engineer to probe the inner workings of a complex flight simulator system, allowing for better understanding of each subsystem and their inter-relations.

Static and Dynamic Testing of Simulator Cueing Systems

SIMES includes the instrumentation and computer controlled test procedures to test statically and dynamically the performance of visual systems, motion systems, control loading, and flight instrumentation. Time delay and frequency response tests can be performed on each subsystem independently or through end-to-end tests of the entire system. SIMES can also be used to test the math model of the vehicle by overriding input and state variables in the model. In addition to the SIMES preprogrammed tests, user defined test procedures can be incorporated into SIMES. SIMES test procedure programming is object- oriented, which makes it fast and easy to define test procedures in the lab or in the field and easily incorporate them into SIMES. SIMES preprogrammed tests include:

- Visual Tests - Time and Frequency Response, Throughput Delay, Update Rate
- Motion Tests - Time and Frequency Response, Vibration Power Spectrum, Accuracy, Smoothness, Crosscoupling
- Control Loader - Force vs. Displacement, Push/Pull and Release
- Flight Instruments - Time and Frequency Response

Non-Intrusive Interface with Host Computer

SIMES has an almost completely non-intrusive interface to the Host computer or computers through the Host Data Interface (HDI). The HDI can connect multiple host computers and microprocessors of dissimilar hardware configuration by the use of reflected (or multi-port) memory cards. The host computer will be instructed to set variables equal to a memory location on the reflected memory card and the reflected memory will repeat the write to the SIMES system. This places almost no burden on the host computer. SIMES can also provide inputs to the host computer through the use of the reflected memory.

Additional Features



- Graphical User Interface - The SIMES User Interface was designed to be intuitive and easy to use. It runs under the Microsoft Windows environment and takes advantage of the many Windows features and capabilities.
- Built-in Analysis Tools - Incorporated into the SIMES system are a wealth of mathematical functions to analyze the data once collected. Analysis is run automatically in the preprogrammed tests.
- Easy Import and Export of Data - Since the user interface is run under Windows, data can be easily exported out of SIMES or other data can be imported for comparison. SIMES can use advanced Windows features such as Dynamic Data Exchange (DDE) to pass the data to other Windows compatible programs.
- Automatic Logging of Data - The SIMES system will automatically log the data to disk that was collected during an acquisition.
- Automatic Generation of Test Reports - SIMES automatically generates test reports which record the system configuration during the test, information about the acquisition and results of the test. These reports include graphics as well as text.

Flexibility - Acceptance Testing - Avionics Testing

The value to the government and industry of such a system is that it cannot only be used to test a flight simulator to assure that what has been delivered meets the specification requirements but it can also be used to debug problems in the flight simulator, and to independently test specific subsystems as installed (for example, input tests to the visual system from the Host computer). Therefore, it is suitable for acceptance testing, fidelity enhancement, and simulation improvement studies. SIMES also includes a MIL-STD 1553 A/B bus interface to provide access to any aircraft avionics that are part of the simulator.

Portability

Finally, the system is designed to be portable, not only between simulators of similar configurations but between simulators of differing configurations. This enables consistent comparison between data collected from different simulators.

Basic System Configuration

SIMES Data Acquisition System

Visual System Test Instrumentation

Control Loading Test Instrumentation

Motion System Test Instrumentation

Flight Instrument Test Instrumentation

Host Data Interface

Optional Instrumentation:

- 1553 A/B Bus Interface
- G-Seat, G-Suit, Lap Belt Instrumentation
- Biomedical Instrumentation
- Aural Cueing and Cockpit Environment Instrumentation

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