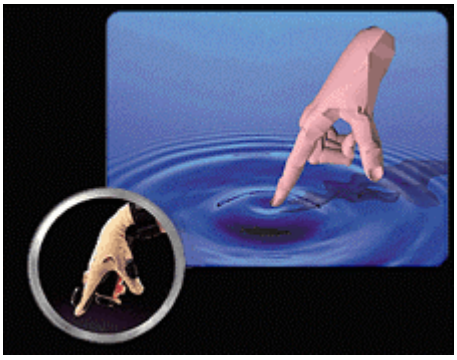
Haptic Virtual Simulator for the FCS Operator Station

Main Entry*:* ***hap·tic***
Pronunciation: ***'hap-tik***
Function: ***adjective***
1: ***relating to or based on the sense of touch***
Merriam-Webster's Dictionary OnLine
http://www.m-w.com



Project Overview

This project will assemble a basic haptic test bed (Phase 1 – one year) and explore the application of haptic technology in virtual prototyping and crew training for the Future Combat System (FCS) (Phase 2 – one year). Conducted by IST, this project represents STRICOM's initial exploration into haptic technology. Phase 1 is funded and work started early March '01. The second phase is expected in FY02.

Future Combat System

This program is a revolutionary US Army initiative to field an ensemble of manned and potentially unmanned combat systems. The systems are designed to ensure that the future Objective Force is strategically responsive and dominant at every point on the spectrum of operations from non-lethal to full-scale conflict. FCS will provide a rapidly deployable capability for mounted tactical operations by conducting direct combat, delivering both line-of-sight (LOS) and beyond-line-of-sight (BLOS) precision munitions, providing variable lethal effect (non-lethal to lethal), performing reconnaissance, and transporting troops.

FCS Operator Station Concept

A virtual model of a conceptual FCS operator station (figure 1) was built using commercial 3D editing software for use in the haptic project. This model is being used for testing purposes and for the proof of concept demonstration.

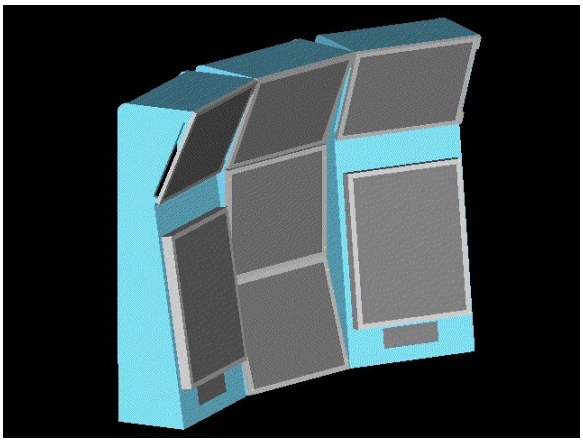


Fig 1. FCS operator station concept

Test Bed Configuration

Our proof-of-concept prototype is a fully immersive, virtual reality platform assembled, essentially, from two commercial components. The first is a regular head mounted display

(HMD). The second is an 18-sensor, instrumented glove that provides tactile feedback. The glove features small vibrato-tactile stimulators on each finger and the palm of the glove. Each stimulator can be individually programmed to vary the strength of touch sensation. The array of stimulators can generate simple sensations such as pulses or sustained vibration that can be used in combination to produce complex tactile feedback patterns.

The supporting software used in this project is the Virtual Environment Software Sandbox (VESS). VESS is a suite of libraries developed jointly by the Virtual Reality Applications Lab and Networked Virtual Environments Lab at IST.

Benefits

This test bed represents a valuable tool, not only to understand the technical and engineering challenges related to user-system interaction in the FCS, but also to better understand what and how the operator interacts with the crew station. The test bed may also have a prominent role in evaluating training concepts of future crewmembers of the FCS, and examining human factor issues, such as decision-making under high stress environments, situation awareness and performance under fatigue.

Since the model is virtual, the layout of displays and information can be changed reasonably quickly to determine the effect on information transfer. This type of analysis could provide feedback on crew station designs or suggest more effective layouts.

Future work

Our current plan for the second phase of this effort is to show the utility of the tool in evaluating training concepts. Since haptic technology is well suited for studying operator interface issues, an alternative under consideration would examine issues such as control station layout and data visualization dynamics. Potentially, this test bed could be linked with a more sophisticated HMD (developed at UCF's CREOL) that includes a laser-based eye-tracker. Adding this eye tracker would allow precise tracking of an operator's area of interest, permitting evaluation of the operator's interactions with multiple information displays. This would show the location of the operator's attention over time, patterns in viewing information and whether or not they are seeing critical information at the right time in a given scenario.

Future efforts will also consider upgrading the vibrato-tactile interface to a more sophisticated haptic interface (figure 2) that will provide full force feedback. This interface allows users to feel the resistance of objects as well as their weight.

Fig 2. State-of-the-art force feedback interface

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