Kline Technical Consulting LLC

Turbine Simulator with Extensive Graphical Emulator Trains Military Personnel for Successful Field Operations

Challenge: Creating a flexible, software-driven turbine simulator for an Army customer that could also function as a virtual trainer for military teams and be accessible from anywhere in the world. The system needed to emulate the exact actions and operations of the eight turbines and controllers so that military personnel could learn exactly how to interact with the turbines in the field.

Solution: Kline Technical Consulting (KTC) designed, developed, tested, and fielded a turbine simulation system and virtual trainer with a complete graphical user interface (GUI) for the U.S. Army Corps of Engineers, Middle East, Gulf Region Division (USACE/ME in GRD).

"The Kline team executed an extremely difficult task – to emulate eight different turbine-controller pairs in under three months and develop a system that trains military personnel to operate the turbines. They delivered on budget and two days early. Our company benefits every day from the lasting impact of a well-developed turbine emulator with a competent virtual trainer companion to educate our staff." -- ***Mr. Isaac Gibson, Chairman and CEO of Wintara***

Turbines and Controllers Accommodated:
- GE LM6000 Gas Turbine with GE MK VI Millennium Controllers;
- GE LM6000 Gas Turbine with Woodward MicroNet Controllers;
- GE LM6000 Gas Turbine with Woodward NetCon5000 Controllers;
- GE Frame 9E Gas Turbine with GE MK V Controllers (Windows and DOS);
- GE LM 2500 Gas Turbine with Woodward MicroNet and/or NetCon 5000 Controllers;
- Siemens V64.2 Gas Turbine with Siemens Teleperm Controller;
- Siemens V94.2/3Gas Turbine with Siemens Teleperm Controller

Background:
In August of 2006 the U.S. Army Corps of Engineers (USACE) in Iraq was revitalizing, repairing, updating, and linking electricity-generating turbines under the control of the Iraqi Ministry of Electricity. To ensure safe and effective operation of the turbines, USACE needed a team of IT specialists to develop a turbine simulation system and train military personnel to run a turbine control room.

Application:
KTC developed a simulation system for the USACE that included computer-driven turbine emulators, controller emulators, control room simulators, virtual training tools and the IT networking to connect these components of the solution.

The KTC team programmed a system to simulate any turbine and controller combination. The simulated turbine running in the background on the emulator has the exact same meters, digital and analog devices, timings, readouts, and sequencing as the actual system.

Then, the team created an emulation system with a graphical user interface (GUI) to train military personnel on how to operate the turbines.

Fueled by accurately simulated turbines and an extensive and comprehensive GUI, the virtual training system was designed to train military personnel for the exact turbines that are in the field. For example, if a student crashes the turbine, he has to restart the system and retry the process until he accurately operates the system. The system has drills – simulated tests – that give a trainee a sudden problem, like increased vibration on the main axis of the turbine controller. The trainee must immediately begin the correct set of steps and complete them within a specific timeframe; if not, the trainee is moved back in the program. Until the program is successfully completed, the trainee cannot move into the actual control room.

The virtual training system is controlled by an instructor or by a built-in self-training module, which allows a trainee to work through sections of the course or the entire course of study until he has passed all of the training modules.

Deliverables:
The complete solution included a textbook (Principles of Turbine Operation), computers and drives, and the complete underlying program with end-user license agreement. KTC also delivered curriculum, designed for a novice operator.

Results:
The USACE can now train military personnel on the turbines and controllers from anywhere in the world, at no additional cost, using standard PCs, with a full range of built-in tools. The system is available for daily training to equip the military personnel for success in the field.

Lead Project Manager: Dr. Robert Kline
Kline Technical Consulting's Dr. Robert Kline was the chief scientist on the DOD Tri-Service Artificial Intelligence program. His IT experience includes developing several virtual emulators, simulators, and trainers for fighter aircraft, gunnery, and flightline maintenance.

Dr. Kline worked with AT&T/Bell Labs, US DOE/Y-12 (Oak Ridge National Laboratories), US Navy, and the NSA on similar tools (the latter as a key member of the MCC AI Program), making him a prime candidate to lead the simulation system development for this Army project. Work on the simulation system involved people in three continents, all working seven-day weeks and 10+ hour days; at heaviest load there were 34 persons on task.

"We were of course pleased to receive the contract and to execute on time,. But even more, this application became the basis for a strong working relationship with one of the premier providers of energy and force protection vendors in the USA." –Dr. Robert Kline