PER-005 System Personnel Training
Reference Document

Reference #1: Determining Task Performance Requirements

The purpose of this reference is to provide guidance in writing a performance standard that describes the desired outcome of a task. A standard for acceptable performance should be in either measurable or observable terms.

Clear standards of performance are necessary for an individual to know when he or she has completed the task and to ensure agreement between employees and their supervisors on the objective of a task. Performance standards answer the following questions:

How timely must the task be performed?

Or

How accurately must the task be performed?

Or

With what quality must it be performed?

Or

What response from the customer must be accomplished?

When a performance standard is quantifiable, successful performance is more easily demonstrated. For example, in the following task statement, the criteria for successful performance is to return system loading to within normal operating limits, which is a number that can be easily verified.

> Given a System Operating Limit violation on the transmission system, implement the correct procedure for the circumstances to mitigate loading to within normal operating limits.

Even when the outcome of a task cannot be measured as a number, it may still be observable. The next example contains performance criteria that is qualitative in nature, that is, it can be verified as either correct or not, but does not involve a numerical result.

> Given a tag submitted for scheduling, ensure that all transmission rights are assigned to the tag per the company Tariff and in compliance with NERC and NAESB standards.

Reference #2: Systematic Approach to Training References:

The following list of hyperlinks identifies references for the NERC Standard PER-005 to assist with the application of a systematic approach to training:

(1) DOE-HDBK-1078-94, A Systematic Approach to Training
http://www.hss.energy.gov/NuclearSafety/techstds/standard/hdbk1078/hdbk1078.pdf

(2) DOE-HDBK-1074-95, January 1995, Alternative Systematic Approaches to Training, U.S. Department of Energy, Washington, D.C. 20585 FSC 6910
http://www.hss.energy.gov/NuclearSafety/techstds/standard/hdbk1074/hdb1074.html

(3) ADDIE — 1975, Florida State University
http://www.nwlink.com/~donclark/history_isd/addie.html

(4) DOE Standard — Table-Top Needs Analysis
DOE-HDBK-1103-96
http://hss.energy.gov/NuclearSafety/techstds/standard/hdbk1103/hdbk1103.pdf

Reference #3: Normal and Emergency Operations Topics

These topics are identified as meeting the topic criteria for normal and emergency operations training per Requirement 1 and Requirement 3 of this standard.

A. Recognition and Response to System Emergencies

1. Emergency drills and responses
2. Communication tools, protocols, coordination
3. Operating from backup control centers
4. System operations during unstudied situations
5. System Protection
6. Geomagnetic disturbances weather impacts on system operations
7. System Monitoring – voltage, equipment loading
8. Real-time contingency analysis
9. Offline system analysis tools
10. Monitoring backup plans
11. Sabotage, physical, and cyber threats and responses

B. Operating Policies and Standards Related to Emergency Operations

1. NERC standards that identify emergency operations practices (e.g. EOP Standards)
2. Regional reliability operating policies
3. Sub-regional policies and procedures
4. ISO/RTO policies and procedures

C. Power System Restoration Philosophy and Practices

1. Black start
2. Interconnection of islands – building islands
3. Load shedding – automatic (under-frequency and under-voltage) and manual
4. Load restoration philosophies

D. Interconnected Power System Operations

1. Operations coordination
2. Special protections systems
3. Special operating guides
4. Voltage and reactive control, including responding to eminent voltage collapse
5. Understanding the concepts of Interconnection Reliability Operating Limits versus System Operating Limits
6. DC tie operations and procedures during system emergencies
7. Thermal and dynamic limits
8. Unscheduled flow mitigation − congestion management
9. Local and regional line loading procedures
10. Radial load and generation operations and procedures
11. Tie line operations
12. E-tagging and Interchange Scheduling
13. Generating unit operating characteristics and limits, especially regarding reactive capabilities and the relationship between real and reactive output

E. Technologies and Tools

1. Forecasting tools
2. Power system study tools
3. Interchange Distribution Calculator (IDC)

F. Market Operations as They Relate to Emergency Operations

1. Market rules
2. Locational Marginal Pricing (LMP)
3. Transmission rights
4. OASIS
5. Tariffs
6. Fuel management
7. Real-time, hour-ahead and day-ahead tools

Definitions of Simulation and Simulators

Georgia Institute of Technology
Modeling & Simulation for Systems Engineering
http://www.pe.gatech.edu/conted/servlet/edu.gatech.conted.course.ViewCourseDetails?COURSE_ID=840

Simulation is the process of designing a model of a system and conducting experiments to understand the behavior of the system and/or evaluate various strategies for the operation of the system. The modeling & simulation life cycle refers to steps that take place during the course of a simulation study, which include problem formulation, conceptual model development, and output data analysis. Explore modeling & simulation, by using the M&S life cycle as an outline for exploring systems engineering concepts.

University of Central Florida – Institute for Simulation & Training
http://www.ist.ucf.edu/overview.htm

Just what is "simulation" anyway (or, Simulation 101)?
And what about "modeling"? (see below)
But what does IST do with simulations? (answer)

In its broadest sense, simulation is imitation. We've used it for thousands of years to train, explain and entertain. Thanks to the computer age, we're really getting good at using simulation for all three.

Simulations (and models, too) are abstractions of reality. Often they deliberately emphasize one part of reality at the expense of other parts. Sometimes this is necessary due to computer power limitations. Sometimes it's done to focus your attention on an important aspect of the simulation. Whereas models are mathematical, logical, or some other structured representation of reality, simulations are the specific application of models to arrive at some outcome (more about models, below).

Three types of simulations
Simulations generally come in three styles: live, virtual and constructive. A simulation also may be a combination of two or more styles.

Live simulations typically involve humans and/or equipment and activity in a setting where they would operate for real. Think *war games* with soldiers out in the field or manning command posts. Time is continuous, as in the real world. Another example of live simulation is testing a car battery using an electrical tester.

Virtual simulations typically involve humans and/or equipment in a computer-controlled setting. Time is in discrete steps, allowing users to concentrate on the important stuff, so to speak. A flight simulator falls into this category.

Constructive simulations typically do not involve humans or equipment as participants. Rather than by time, they are driven more by the proper sequencing of events. The anticipated path of a hurricane might be "constructed" through application of temperatures, pressures, wind currents and other weather factors.

A simulator is a device that may use any combination of sound, sight, motion and smell to make you feel that you are experiencing an actual situation. Some video games are good examples of low-end simulators. For example, you have probably seen or played race car arcade games.

The booths containing these games have a steering wheel, stick shift, gas and brake pedals and a display monitor. You use these devices to "drive" your "race car" along the track and through changing scenery displayed on the monitor. As you drive, you hear the engine rumble, the brakes squeal and the metal crunch if you crash. Some booths use movement to create sensations of acceleration, deceleration and turning. The sights, sounds and feel of the game booth combine to create, or simulate, the experience of driving a car in a race.

Most people first think of "flight simulators" or "driving simulators" when they hear the term "simulation." But simulation is much more.

Because they can recreate experiences, simulations hold great potential for training people for almost any situation. Education researchers have, in fact, determined that people, especially adults, learn better by experience than through reading or lectures. Simulated experiences can be just as valuable a training tool as the real thing.

Simulations are complex, computer-driven *re*-creations of the real thing. When used for training, they must recreate "reality" accurately, otherwise you may not learn the right way to do a task.

For example, if you try to practice how to fly in a flight simulator game that does not accurately *model* (see definition, below) the flight characteristics of an airplane, you will not learn how a real aircraft responds to your control.

Building simulator games is not easy, but creating simulations that *accurately* answer such questions as *"If I do this, what happens then?"* is even more demanding.

Over the years, government and industry, working independently with new technologies and hardware, developed a wide range of products and related applications to improve simulation science. This independence, however, often led to sporadic or redundant research efforts.

To benefit from each other's latest advances, researchers from across the country needed better communication and, ideally, a common source of supporting academic studies. The State of Florida recognized these needs and in 1982 established the Institute for Simulation and Training at the University of Central Florida.

What we do at IST

IST's mission is to advance the state of the art and science of modeling and simulation by

- performing basic and applied simulation research
- supporting education in modeling and simulation and related fields
- serving public and private simulation communities

We don't produce simulator hardware. That's a job for industry. But we've successfully developed working prototype hardware that provides new uses for simulations. We'll also help develop new applications for existing hardware, and scientifically test the results using human factors and other criteria for effective human-machine interface and learning. Too often overlooked, human factors testing is crucial to ultimate simulation effectiveness. We're fortunate to be closely connected, through joint faculty appointments and working relationships, with one of the top, if not the leading human factors department in the nation—right here at UCF.

We also explore the frontiers of simulation science, expanding our knowledge of ways to stimulate the human senses with advanced optical, audio and haptic technologies.

Still obfuscated? Go here...

Modeling: a model definition

A computer model, as used in modeling and simulation science, is a mathematical representation of something—a person, a building, a vehicle, a tree—any object. A model also can be a representation of a process—a weather pattern, traffic flow, air flowing over a wing.

Models are created from a mass of data, equations and computations that mimic the actions of things represented. Models usually include a graphical display that translates all this number crunching into an animation that you can see on a computer screen or by means of some other visual device.

Models can be simple images of things—the outer shell, so to speak—or they can be complex, carrying all the characteristics of the object or process they represent. A complex model will simulate the actions and reactions of the real thing. To make these models behave the way they would in real life, accurate, real-time simulations require fast computers with lots of number crunching power.