



Western Services Corporation

Scenario Based Testing, the First Decade

What SBT is Not!



- A Panacea
- As Rigorous as flight simulator testing
- Does not force Scenario Validation prior to use in operator training
- Analysis is not accomplished by Instructors
- “Simulator Testing”, only an element of the Section 4 mandated simulator testing
- Training
- Malfunction testing

What SBT is:



- **Concept:** Test the Simulator as it will be used
 - Software developed under a structured methodology
 - Top down design, bottom up testing
 - Draw on industry systematics from IEEE Standards
 - Take advantage of simulator scenario guides and scenario validation process
 - Test integrated operation

- **4.4.3.2 Simulator Scenario-Based Testing.** Scenarios developed for the simulator, including the appropriate instructor interfaces and cueing, shall be tested before use for operator training or examination. The simulator shall be capable of being used to satisfy predetermined learning or examination objectives without exceptions, significant performance discrepancies, or deviation from the approved scenario sequence. A record of the conduct of these tests, typically in the form of a completed scenario or lesson plan checklist, and the evaluation of the test results, shall be maintained.

ANSI/ANS-3.5 1998

Appendix A



- **A4. Simulator Test Documentation.** The documentation of simulator performance criteria and simulator testing should include the following basic information:
 - (1) The initial condition;
 - (2) The perturbations made to induce the transient, such as malfunctions, remote functions, or operator actions;
 - (3) The responses of pertinent simulator parameters;
 - (4) An evaluation and validation of test results; and
 - (5) The update of related documentation.

NRC Presentation at SCS 2004



- Test the simulator, not the student
- Must be done before training scenarios administered to students
- Assumption upon which SBT allowed (assumes proper initial testing)
- Must support training
- Must have performance criteria
- Must document performance criteria are met
- Use reference plant data if available (see definition of performance testing)
- Periodicity (if nothing has changed, not necessary to repeat)
- NRC checks (through events, inspections, etc.)

4.4.3.2 Simulator Scenario-Based Testing.

The intent of scenario-based testing is to ensure the simulator is capable of producing the expected reference unit response to satisfy predetermined learning or examination objectives by utilizing the existing training and examination scenario validation process to ensure the following:

1. The scenario meets the predetermined learning or examination objectives and includes the appropriate instructor interfaces, operator actions, and operator cues; and
2. The simulator is capable of producing the expected reference unit response without significant performance discrepancies, or deviation from an approved scenario sequence.

Draft ANS-3.5 200x



Test data shall be acquired during scenario validation for subsequent evaluation of malfunctions, local operator actions, and other features exercised by the scenario. Evaluation of the test data shall consider:

1. The simulator allows the use of applicable reference unit procedures;
2. Any observable change in simulated parameters corresponds in direction to the change expected from actual or best estimate response of the reference unit to the malfunction;
3. The simulator shall not fail to cause an alarm or automatic action if the reference unit would have caused an alarm or automatic action under identical circumstances; and
4. The simulator shall not cause an alarm or automatic action if the reference unit would not cause an alarm or automatic action under identical circumstances.

Draft ANS-3.5 200x



Results of this evaluation shall be documented and include:

1. The initial conditions, description of the scenario, and perturbations used to induce the transient;
2. Positive demonstration or, alternatively, an assertion that the learning or examination objectives were met;
3. Listing of key parameters checked and assertion that there were no unexpected changes;
4. Listing of key alarms and automatic actions occurring and assertion that they would be expected for the scenario; and
5. Assertion that no unexpected alarms and automatic actions occurred.

NRC/NEI-LOTF Meeting

12 July 2005



AI #7: Industry SBT Approach (cont.)

The group agreed that the industry will always do validation, since it is a function of sound training principles. Therefore, the group will propose to the NRC the means to accomplish SBT (and thus meet the first three bullets above) are as follows:

Bound the number of SBTs:

- Only examination scenarios utilized for requal annual operating exams and initial license exams will be utilized as SBTs.
- Examination scenarios would not undergo SBT each time they are used; SBT would be conducted again only if the scenario has been significantly modified or simulator modeling has been significantly modified since the last time SBT was conducted.

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Bound the extent of testing and documentation in SBT:

Utilize paragraph 4.1.4 of the 1998 standard to evaluate the causes and effects directly related to scenario malfunctions used in SBTs as follows:

- To meet (1) of 4.1.4, validate that the simulator scenario utilizes plant procedures without deviation or exception.
- To meet (2) of 4.1.4, perform an evaluation of parameter trends relevant to the use of the malfunction in the scenario (Malfunction Cause & Effect document or similar).
- To meet (3) of 4.1.4, perform an evaluation of annunciator response and automatic actions relevant to the malfunction (Malfunction Cause & Effect document or similar).
- To meet (4) of 4.1.4, assert that no unexpected alarms or automatic actions occurred relevant to the malfunction.

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Document SBT IAW Appendix A, paragraph A.4 of the 1998 standard as follows:

- To meet A.4 (1) and (2), reference the simulator scenario and revision utilized.
- To meet A.4 (3), attach simulator parameters and trend plots used for the evaluation of SBT.
- To meet A.4 (4) and (5), list or reference the malfunction cause and effects used for evaluation and validation of malfunction response. List any simulator discrepancies identified as a result of SBT evaluation.

The Testing “Box”

