

AD-A188 739

TRAINER FLIGHT SIMULATOR(U) ARMY TEST AND EVALUATION
COMMAND ABERDEEN PROVING GROUND MD 29 AUG 87
TOP-7-3-118

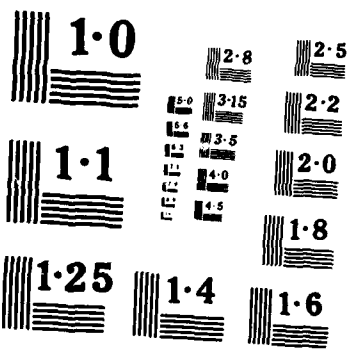
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<p>This document identifies existing test methods and techniques necessary to determine the degree to which a flight simulator trainer and associated equipment meet the mission requirements stated in the Training Device Requirement (TDR) or other governing documents and whether or not these items are suitable for Army use.</p>			
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U.S. ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

AMSTE-RP-702-106

*Test Operations Procedure (TOP) 7-3-110

29 August 1987

AD NO.

TRAINER, FLIGHT SIMULATOR

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1. SCOPE. This document identifies existing test methods and techniques necessary to determine the degree to which a flight simulator trainer and associated equipment meet the mission requirements stated in the Training Device Requirement (TDR) or other governing documents and whether or not these items are suitable for Army use.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

<u>ITEM</u>	<u>REQUIREMENTS</u>
Equipment shelter	Large enough to house the simulator and all supporting equipment
	Lighting
	AC power of the correct voltage and phase for the simulator system
Tempest	As required.

*This TOP supersedes MTP 7-3-110, 4 March 1971.

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Footnote numbers match reference numbers in Appendix B.

Safety, Placards, Hazards, etc.

Heating and air conditioning to maintain the recommended environment for the system

Photographic laboratory and equipment

Still photograph processing

Video laboratory

Editing and reviewing video recordings

Maintenance facility

Appropriate to trainer maintenance concept

2.2 Instrumentation.

DEVICES FOR MEASURING

PERMISSIBLE ERROR OF MEASUREMENT*

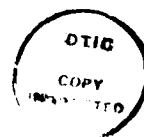
Length, width, thickness (e.g. hand tools such as calipers, rulers, etc. See TOP 7-3-500¹).

As stated in TOP 7-3-500

3. REQUIRED TEST CONDITIONS.

- a. Consult USATECOM Regulation 70-24² to formulate the test plan.
- b. Review the test directive documents to determine the test objectives.
- c. Develop checklist/data sheets from the technical manuals of the aircraft and trainers to address functional characteristics and instructor/operator controls.
- d. Obtain and become familiar with the System Specification, Test and Evaluation Master Plan (TEMP), Required Operational Capability (ROC) and other related documents.
- e. Become familiar with test plans from previous tests of related systems, if they exist.
- f. Incorporate the proper safety precautions into all test procedures. See TOP 7-3-506³ for guidance.

* The permissible error of measurement for instrumentation is the two-sigma value for normal distribution; thus, the stated errors should not be exceeded in more than one measurement of 20.



By _____	
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A-1	

g. Incorporate the following security precautions into all test procedures if required:

- (1) Classification of test data.
- (2) Signal security.
- (3) ADP approved to process classified/sensitive information.
- (4) Personnel security clearances.
- (5) Security training for test force and support personnel.
- (6) Operations Security.

h. Ensure that personnel of the correct MOS are trained to operate and maintain the system.

i. Ensure availability of maintenance support facilities, special test equipment, repair parts, and personnel.

j. Ensure that arrangements for supporting and participating agencies, activities, and facilities have been made.

k. Ensure that complete documentation on the aircraft system that the trainer simulates is available. The documentation should emphasize crew station characteristics, flight characteristics, and operational procedures.

l. Ensure availability of key flight crew participants who are qualified and experienced in the aircraft system.

3.1 Facilities.

3.1.1 Equipment shelter. Ensure that the equipment shelter meets the minimum requirements described in paragraph 2.1.

3.1.2 Photo/video laboratories. Investigate the laboratories capabilities and compare them to the requirements established for the test.

3.2 Instrumentation.

a. Ensure the equipment needed for photography, video and audio recording and processing is available and in working order.

b. Obtain enough film and video/audio tapes to last the duration of the test.

c. Ensure all measuring equipment is available and calibrated if required.

3.3 Test controls.

3.3.1 Data management. Prepare a data management plan that ensures all test data are properly collected, labeled, and stored during the test.

3.3.2 Test item performance test. Using the manufacturer's technical manuals, develop a test item performance checklist. Use the checklist before and after each test mission to verify proper performance of the test item.

3.3.3 Quality control. Check the results of each test to ensure no critical data points were missed and to annotate known erroneous data.

3.3.4 Instrumentation. Develop an instrumentation checklist to verify instrumentation systems are in operational order. Complete the checklist before and after each test.

3.3.5 Cost tracking. Keep track of test funds expended and remaining for the test program. Expenses should be reviewed on a weekly basis.

3.3.6 Configuration management. Establish procedures for documenting and tracking hardware/software configuration. The procedures should include policies for permitting configuration change during the test and for documenting how the changes affect the trainer system.

4. TEST PROCEDURES.

4.1 Cockpit Simulator Physical Characteristics (in addition to TOP 7-3-500).

a. Method.

(1) Verify that the cockpit simulator console, instrument panel, controls, and displays are of the same size, shape, and physical layout as the aircraft being simulated.

(a) Compare the technical drawings of the aircraft being simulated with the technical drawings of the cockpit simulator section of the simulator.

(b) Compare the physical layout of the cockpit simulator section of the simulator with the aircraft and simulator drawings.

(c) Photograph the cockpit simulator section console, instrument panel, controls, and displays.

(d) Document any differences between the aircraft and the simulator.

(2) Test the adequacy of simulated controls and displays versus flight hardware.

(a) Verify that the substitution of nonfunctional or non-representative controls/displays does not impact accomplishment of the training mission (i.e., the physical feel and motion of a control or response of a display is not critical in performing a specific training task).

(b) Document the differences between the aircraft and simulator.

(3) Test the range of motion characteristics of the primary and secondary flight controls.

(a) Exercise the flight controls to the limits of their motion.

(b) Compare the simulator range of motion characteristics with the equivalent aircraft characteristics.

(c) Assess the impact of nonrepresentative flight control range of motion characteristics on the training mission.

(d) Document the deficiencies.

(4) Test the adequacy of simulated flight control characteristics versus flight hardware.

(a) Test the force characteristics of the simulator flight controls.

(b) Compare the simulator control force characteristics with the equivalent aircraft characteristics.

(c) Assess the impact of nonrepresentative simulator control force characteristics on the training mission.

(d) Document the deficiencies.

(5) Verify the adequacy of crew station seating and associated equipment.

(a) Compare the crew station seating and associated equipment with the equivalent aircraft equipment.

(b) Assess the impact of nonrepresentative equipment to accomplish the training mission.

(c) Document the deficiencies.

(6) Test the quality, adequacy, and field of view of external visual displays.

(a) Include simulated daytime and nighttime conditions if appropriate.

(b) Document any deficiencies noted.

(7) Evaluate the quality and adequacy of internal and external voice, audio alerts, and other audio signals. Document any deficiencies noted.

b. Data required.

(a) Engineering notes.

(b) Audio tapes of simulator and aircraft.

(c) Annotated photographs.

(d) Aircrew qualitative assessment.

(e) Document any deficiencies. Verify that the functional characteristics of the simulator are representative of the functional characteristics of the aircraft being simulated and that they fully support the accomplishment of the intended training mission.

4.2 Functional Characteristics.

a. Method.

(1) Setup and operate the simulator through various mission-oriented flight profiles.

(2) Evaluate the quality and adequacy of the following items and characteristics in a simulated flight environment:

Switchology and symbology.

Flight control feel characteristics and simulator response to inputs.

Cockpit simulator motion cues, if appropriate.

External visual displays in representing dynamic flight conditions.

(3) Compare the simulator dynamic functional characteristics with the equivalent aircraft characteristics using simulated flight profiles.

(4) Verify that the simulator dynamic functional characteristics are adequate to support the training mission.

(5) Document the differences.

b. Data required.

(a) Voice and video recorded data.

(b) Aircrew written qualitative assessment.

4.3 Instructor/Operator Console.

a. Method.

(1) Evaluate the capability to pre-program training mission scenarios appropriate to the training requirements and specifications.

(a) Using navigational charts, simulated navigation aides, simulated visual displays and other available navigation data, pre-program the simulator to support an appropriate mission-oriented flight profile.

(b) Pre-program malfunctions, failures, emergency conditions, and audiovisual alerts consistent with the mission-oriented simulated flight profile.

(c) Evaluate the procedural requirements and console interaction during the mission pre-programming.

(d) Assess the instructor/operator skill level and workload requirements for pre-programming the mission.

(e) Document the deficiencies, if any.

(2) Evaluate the adequacy of instructor/operator console switchology and symbology to initiate, monitor, and control training missions.

(a) Run the pre-programmed mission scenario.

(b) Assess the capability to monitor the mission profile with the instructor/operator console data.

(c) Compare the cockpit simulator navigation data with the instructor/operator data to ensure consistency.

(d) Evaluate the timing and console-presented data for monitoring the pre-programmed malfunctions, failures, and emergency conditions.

(e) Assess the quality and adequacy of the cockpit simulator cues in representing the simulated malfunctions, failures, and emergency conditions to include audio, visual, and motion cues as appropriate.

(f) Evaluate the capability to suspend, freeze, reset, and resume the mission scenario at any point.

(g) Evaluate the capability to reset the pre-programmed malfunctions, failures, or emergency conditions to any point.

(h) Assess the instructor/operator skill level and workload requirements for initiating, monitoring, and controlling the training mission.

(i) Document the deficiencies, if any.

(3) Evaluate the quality and adequacy of recorded audio, video or printed data used to conduct the mission debriefing.

(a) Assess the mission debriefing data, to include annotated navigation charts, printed data, and audio and video recorded data as appropriate.

(b) Assess the ability to conduct a mission debrief (instructor/operator and aircrew) using the available post mission data.

(c) Assess the adequacy of the post mission data in reconstructing the mission to highlight mission-profile navigation errors and improper responses to malfunctions, failures, and emergency conditions.

(d) Document the deficiencies.

b. Data required.

(a) Mission debrief data.

(b) Engineering notes.

(c) Still photographs, audio and video tapes.

(d) Instructor/operator qualitative assessment.

(e) Aircrew qualitative assessment.

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4.4 Maintenance.

a. Method. Use TOP 7-3-507⁴ to develop test procedures to evaluate the maintenance characteristics of the system.

b. Data required. As required by TOP 7-3-507.

4.5 Reliability/Availability/Maintainability (RAM).

a. Method. Use TOP 7-3-507 and TOP 7-3-508⁵ to develop test procedures to evaluate RAM.

b. Data required. As required by TOP 7-3-507 and TOP 7-3-508.

4.6 Draft technical manuals.

a. Method. Use TOP 1-2-609⁶ to determine the adequacy of draft technical manuals.

b. Data required. As required by TOP 1-2-609

4.7 Safety evaluation.

a. Method. Determine the test item safety hazards resulting from transport, operations, and maintenance in accordance with the criteria of TOP 7-3-506.

b. Data required. Record data in accordance with TOP 7-3-506.

4.8 Human factors.

a. Method. Perform a human factors evaluation of the test item using the criteria of TOP 1-2-610⁷.

b. Data required. As required by TOP 1-2-610.

4.9 Training requirements.

a. Method. Perform a training assessment in accordance with TOP 7-3-501⁸.

b. Data required. As required by TOP 7-3-501.

4.10 Physical characteristics.

a. Method. Perform a physical characteristics evaluation using the criteria of TOP 7-3-500.

b. Data required. As required by TOP 7-3-500.

5. PRESENTATION OF DATA.

a. Processing of raw data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to subtest title.

b. Test criteria or specifications shall be noted on the test data presentation to facilitate analysis and comparison.

c. Test data measurement units shall be compatible with units given by test criteria or specifications.

d. Prepare a composite documentation of the reduced and correlated data arranged by test phases in the general form of narrative description. The narrative description shall be supported by diagrams, annotated still photographs, graphs and tabular data wherever possible.

e. The data presentation should support conclusions and recommendations in the following areas:

(1) Enhancing features.

(2) Requirements and specification compliance/noncompliance.

(3) The fidelity of the cockpit physical and functional characteristics in supporting the mission flight profiles.

(4) Adequacy of the external visual, aural and motion cues in representing the mission profile environment.

(5) Use of the instructor/operator console in programming, initiating, monitoring, and controlling mission flight profiles, to include malfunctions, failures, and emergency conditions.

f. Include supplements or annexes to the basic document, delineating the common service test factors which are of sufficient scope, importance and/or complexity to warrant separate treatment. Each supplement shall include the applicable supporting data.

g. Present recommendations as to the suitability of the flight simulator and its maintenance test package for use by the Army.

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Recommended changes to this publication should be forwarded to: Commander, U.S. Army Test and Evaluation Command, ATTN: AMSTE-TC-M Aberdeen Proving Ground MD 21005-5055. Technical information may be obtained from the preparing activity: Commander, U.S. Army Aviation Development Test Activity, Fort Rucker, ATTN: STEBG-MP-P, AL 36362-5276. Additional copies are available from the Defense Technical Information Center, Cameron Station, Alexandria, VA 22314-6145. This document is identified by the accession number (AD No.) printed on the first page.

APPENDIX A

TEST OPERATIONS CHECKLIST

Date-Initials

- 1. Project notebook initiated. _____
- 2. Test parameters established. _____
- 3. Test facility and support instrumentation scheduled for test duration. _____
- 4. Test item checked for handling and shipping damage. _____
- 5. Test item and instrumentation installed. _____
- 6. Instrumentation checked for proper functioning and appropriate calibration. _____
- 7. Locks, interlocks and warning devices of test facility checked for proper operation. _____
- 8. Safety requirements accomplished and SOP posted at test facility. _____
- 9. Test personnel briefed on test requirements, special procedures and hazards. _____

APPENDIX B

REFERENCES

1. TOP 7-3-500, Physical Characteristics (Aviation Material), 29 November, 1977.
2. USATECOM Regulation 70-24, Research and Development: Documenting Test Plans and Reports, 22 June 1981
3. TOP 7-3-506, Safety (Aviation Material), 18 January 1982.
4. TOP 7-3-507, Integrated Logistic Supportability (Aviation Material), 1 September 1983.
5. TOP 7-3-508, Reliability (Aviation Material), 28 July 1977.
6. TOP 1-2-609, Instructional Material Adequacy Guide and Evaluation Standard, January, 1981
7. TOP 1-2-610, Human Factors Engineering, Part I, Test Procedures, Part II, HEDGE, 30 November 1983.
8. TOP 7-3-501, Personnel Training/Training Evaluation, 8 July 1983.

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