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20. ABSTRACT (Continue on reverse side if necessary and identify by block number):

This document presents information and procedures for testing aircraft flight and systems performance instruments in the functional environment of the designated aircraft.

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US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

DRSTE-RP-702-105
Test Operations Procedure 6-3-013 11 February 1981
AD No

TESTING AIRCRAFT INSTRUMENTS

1. SCOPE. This TOP establishes procedures and provides guidance for the functional testing of aircraft instruments and for the testing of the logistics support system required to return aircraft instruments to proper functioning condition after failure. Aircraft instruments include basic flight and aircraft systems performance/health indicators. Functional testing implies the test item is properly installed in the appropriate aircraft and evaluated throughout the operational range of the aircraft mission scenario. The primary objectives of this TOP are: (a) To determine if the designated aircraft instrument performs its intended function in accordance with the requirements presented in the applicable approved documents; Letter Requirement (LR), Letter of Agreement (LOA), Required Operational Characteristics (ROC), Materiel Needs (MN), etc., as reflected through the TECOM Test Directive; (b) To evaluate the human factors engineering (HFE) functional characteristics; and (c) To evaluate the installation and operational compatibility of the designated aircraft instrument with the aircraft interface, other instruments, and aircraft systems.

2. FACILITIES, EQUIPMENT, INSTRUMENTATION, AND SUPPORT REQUIREMENTS.

Functional developmental testing of aircraft instruments will be accomplished within the aircraft environment of the designated aircraft and in accordance with standard Army operational and maintenance procedures established for the type of instrument under test. Facilities, equipment, instrumentation, and support requirements to support the developmental test should be defined in the TECOM Test Directive or the Maintenance Support Plan (MSP); however, if these data are not available, the following should be addressed as a minimum to support the test.

2.1 Facility.

CHARACTERISTICS	MINIMUM REQUIREMENTS
Operational airfield	As required to support designated aircraft.
Instrumentation shop	As required to support test.
Maintenance	As required to support aircraft and test item.
Airspace	As appropriate to conduct materiel test.
Data reduction facility	As required to support data reduction.

2.2. Equipment.

Maintenance support	Standard Army tool set.
Photographic	Color camera (motion, still), as required.
Appropriate aircraft and aircraft support equipment.	As required.
Calibration equipment	As required.

2.3 Instrumentation.

Photometer	5^{-5} to 10^{7} ft-lamberts $\pm$ 4%R (3.0×10^{-4} to 3.0×10^{7} cd/m^2 $\pm$ 4%R) (x100 attenuator to 30,000 ft lambert $\pm$ 5%R)

CHARACTERISTICS	MINIMUM REQUIREMENTS
Spot brightness meter	$1x10^8$ ft-lamberts $\pm$ 5%R (0.3 to $3.43x10^8$ cd/m^2 $\pm$ 5%R)
Spectro-Radiometer	Chromaticity requirements (350-700 manometers wave length range).
Noise Level Recorder	As required.
Transducers	As required.

2.4 Support Requirement.

2.4.1 Personnel.

Photographic	As required.
Instrumentation	As required.
Data reduction	As required.
Maintenance	As required.
Pilots	As required.
Human Factors Engineer	As required.

2.4.2 References.

a. Army Regulation 385-16, System Safety.

b. AMC Regulation 700-38, w/TECOM Supplement 1 and USAAVNDTA Supplement 1, Test and Evaluation -- Incidents Disclosed During Materiel Testing.

c. DARCOM Regulation 70-8, w/TECOM Supplement 1, DARCOM Value Engineering Program.

d. DARCOM Regulation 700-15, w/TECOM Supplement 1, Preservation - Packaging, Packing and Marking of Items of Supply.

e. AMC Regulation 385-12, w/TECOM Supplement 1, Life Cycle Verification of Materiel Safety.

f. TECOM Regulation 108-2, Audio Visual Services; Administrative and Technical Procedures, as implemented by USAAVNDTA Memo 108-1.

g. MIL-C-55163, Calibration of Test and Measuring Equipment.

h. MIL-H-46855, Human Engineering Requirements for Military Systems, Equipment, and Facilities.

i. MIL-S-1472, Human Engineering Design Criteria for Military Systems, Equipment, and Facilities.

j. TM 55-411, Maintenance Quality Control and Technical Inspection Guide for Army Aircraft.

k. TOP 7-3-058, Built-In Test Equipment.

l. TOP 7-3-059, Diagnostic and Inspection Equipment (Aviation).

m. TOP 7-3-519, Photographic Coverage.

n. TOP 7-3-530, Vulnerability and Security (Aviation Materiel).

o. Requirements documents (LR, LOA, ROC, MN, etc.).

3. PREPARATION FOR TEST. This section provides guidance for planning a functional developmental test of aircraft instruments. Consummate the planning phase with a detailed test plan. The test plan will establish the test methodology and provide the procedures for gathering and reducing data to accommodate each developmental test objective. The test plan will also identify all facility, instrumentation equipment, and support requirements including any specialized training requirements. Follow the appropriate test planning steps as outlined below to insure a complete, thorough, and cost-effective test.

3.1 Review. Review all pertinent data related to the materiel development test.

a. Requirements documents (LR, LOA, ROC, MN, ETC.).

b. TECOM combined plan (IEP/TDP).

c. Applicable material available from the procuring agency or developer/contractor.

d. Pertinent reports on previous tests of like equipment.

e. Any other applicable source of information (AR's, TOP's, TM, etc.).

3.2 Test Objective. Establish the test objectives. The test objectives should be available in the TECOM Test Directive; however, if this data is not available, review the requirements documents for developmental criteria and establish appropriate subtest objectives such as:

a. Initial Inspection. Determine the condition and completeness of the test item in accordance with TOP 7-3-503.[1*] Perform the following as a minimum.

(1) An inventory check against the Basic Issue Item List (BIL). Submit an equipment performance report (EPR) for any discrepancies in accordance with reference 2.4.2.e.

(2) Remove all protective coverings and preservatives, and inspect for defects.

(3) Check for completeness of assembly.

(4) Examine the system support package for completeness, discrepancies, or defects.

b. Physical Characteristics. Determine the physical characteristics of the test item in accordance with TOP 7-3-500.[2] Perform the following as a minimum.

(1) Photograph as appropriate and note the legibility and effectiveness of the test item's legends, markings, etc.

(2) Determine the physical dimensions, weight, and volume of all subsystem components.

(3) Determine the weight volume of the total system.

c. Installation Characteristics. Determine the installation/removal characteristics of the test item in accordance with TOP 7-3-502.[3] Perform the following as a minimum.

(1) Evaluate the installation instructions for accuracy and completeness.

(2) Evaluate the installation technique and mounting provisions to protect the test item against shock and vibrations, as applicable.

(3) Evaluate all subsystem, system, or equipment interfaces (plugs, cables, connectors, etc.) for positive response and secure locking.

(4) Evaluate the system/component installation characteristics for ease and quickness. Assess the following:

(a) Accessibility.

(b) Mounting flexibility.

(c) Quick disconnect design.

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* Footnote numbers match reference numbers in Appendix C.

d. Compatibility. Determine if the aircraft instrument is compatible with each aircraft for which it was designed, compatible with the mission objective of the designated aircraft, and compatible with all other instruments and equipment on the designated aircraft. Do this in accordance with the compatibility TOP 7-3-509.[4]

e. Performance Test. Determine the adequacy and suitability of the aircraft instrument to perform its intended function in all applicable operational environments and flight modes in which the designated aircraft is expected to perform. Follow the testing procedures as presented in paragraph 5, Performance Test, this TOP. Pay particular attention to the lighting and HFE considerations. If instrumentation of the aircraft is required to verify the performance sensitivity of the test instrument, see TOP 6-3-526.[5]

f. Reliability, Availability, and Maintainability (RAM). Evaluate the RAM characteristics of the aircraft instrument in accordance with TOP 7-3-507[6] and TOP 7-3-508.[7]

g. Technical Manuals. Determine the adequacy of the technical manuals in accordance with TOP 1-2-609.[8]

h. Personnel Training. Assess the scope of training required to efficiently operate and use the instrument under all aircraft flight environments in the designated aircraft mission scenario. Assess any maintenance training required to maintain the instrument. (See TOP 7-3-501)[9]

i. Human Factors and Lighting Characteristics. Assess the aircraft instrument for readibility characteristics, and for a positive response reaction to the data displayed. See TOP 1-2-610[10] and TOP 7-3-527.[11]

j. Safety. Identify and evaluate any characteristic of the aircraft test instrument which could lead to a flight safety consideration. Such a condition could result from insufficient or extraneous information as well as critical information grouping/layout or display technique. Insure that all failure modes are fail-safe. (See TOP 7-3-506)[12]

3.3 Schedule. Prepare a detailed test time line depicting each test associated event which must occur to accomplish the test objectives and to insure facilities, logistics, personnel, and support equipment are available in a time frame conducive to accomplishing a comprehensive and cost-effective test. The time line should show sufficient time periods allotted to accomplish each test objective, insuring that adequate amounts of test data are taken to project required statistical confidences to the test results. The following schedule items should be addressed as a minimum.

a. Facility. Schedule the applicable facility requirements presented in section 2.1. Facility requirements associated with adverse flight conditions due to meteorological environmental considerations should not be overlooked. Flights at night and, in particular, under Instrument Meteorological Conditions (IMC), place the greatest demand on aircraft instruments.

b. Instrumentation Equipment and Support. Schedule, as applicable, instrumentation support test equipment and support requirements as presented in sections 2.2, 2.3, and 2.4.

c. Logistics. As appropriate, schedule logistics requirements including ground handling equipment, administrative transportation of both personnel and equipment, aircraft fueling, and other servicing accommodations.

3.4 Plan of Test. Develop a detailed test plan in accordance with TECOM Regulation 70-24.[13] This plan will provide the test data requirements and the data collection procedures to satisfy each test objective.

3.5 Test Safety. Assess any potential safety consideration for test personnel and equipment. Take appropriate steps (training, safety checklist, posters, etc.) to insure that the safety measures are observed throughout the test. Comply with AR 70-10, paragraph 2-21.[14] Acquire any test safety releases, as required.

3.6 Environmental Impact. Determine if there are any environmental considerations. If environmental considerations exist, develop procedures or outline precautions to be observed to protect the environment.

3.7 Security. Security safeguards for the United States Government and for the security of the proprietary rights of the test materiel developer/civilian contractor must be considered early in the test planning stage. The following steps must be taken:

a. Consult the security classification guide for the project, as appropriate.

b. Consult the primary test agency security representative for security guidance. Coordinate with security personnel of other test support agencies and industry, as appropriate.

c. Take appropriate security measures throughout the test to safeguard intra-industry proprietary rights and to safeguard the security of government property.

4. TEST CONTROLS. The aircraft instrument test will be conducted and test data will be recorded in strict compliance with the TECOM test directive. If specific directions are not available, the following guidelines will prevail:

a. Reduce measurements to universal metric and English units.

b. Round out numerical observations to the nearest tenth.

c. Report time to the nearest hundredth of an hour.

d. Accomplish and record physical characteristics in compliance with TOP 7-3-500.[15]

e. Instrumentation and test equipment must be properly calibrated and have a current calibration certificate.

f. Conduct all tests and collect data in compliance with prescribed and/or standard procedures and when deviations are required, justification will be documented. Deviations must be coordinated with TECOM Headquarters, particularly deviations to an approved test plan.

g. Record and process all data in a timely fashion.

h. Assign only properly trained and qualified personnel to participate in the conduct of the test. In particular, pilot qualifications/capability must reflect the expertise necessary to fly the test flight profiles with precision and safety.

i. Using the operational mode summary/mission profile for the particular item being tested (Ref. AR-702-3),[16] conduct the aircraft instrument test.

j. Conduct each test run under documented conditions, such that the test results could be duplicated or compared.

k. Follow the detailed test plan; document any deviations from same. Deviations from an approved test plan must be coordinated with TECOM Headquarters.

l. Avoid nonessential test delays due to aircraft scheduled maintenance. This can be accomplished through coordination and planning. Conduct the test in accordance with the operational mode summary/mission profile, as defined in AR 702-3.[17]

5. <u>FUNCTIONAL PERFORMANCE TESTS.</u> The objective of this subtest is to outline a series of engineering test procedures which can be used to determine the operational range and accuracy of specific aircraft instruments in the aircraft flight environment. The conduct of this subtest will be performed in compliance with the TECOM test directive. However, if specific guidance is not available, the following general guidance and specific test methodology will be used to evaluate the functional performance of specified aircraft instruments.

5.1 <u>General Guidance.</u> General guidance establishes certain test procedures common to the functional performance testing of each aircraft instrument within the scope of this TOP.

a. Determine specific functional characteristics from the test criteria that the test item (developmental aircraft instrument) must demonstrate in the operational environment.

b. Prepare an aircraft flight profile reflecting specific flight modes and characteristics which will exercise each functional characteristic of the developmental instrument.

c. Install, check out, and calibrate the developmental aircraft instrument in accordance with the installation instructions. Insure input signals are within specified limits and that no operational hazards exist.

d. Install, check out, and calibrate test instrumentation as required to record test flight data. Photographs, motion picture, and/or video tape recordings are conventional methods of collecting performance data for comparing a certified standard instrument, of known accuracy, and the developmental aircraft instrument.

e. Test equipment and instrumentation shall have the accuracy and readout capability of at least five times greater than the aircraft instrument under test.

f. Calibrate all test equipment and instrumentation in accordance with TECOM Supplement 1 to AR 750-25.[18]

g. Provide local meteorological support as required during all flight test phases.

h. Insure adequate data are recorded during each flight mode to provide statistical confidences as to the accuracy or discrepancy of the test instrument when compared to the certified standard instrument of known accuracy. (See TOP 3-1-002) [19]

i. Perform an instrumentation functional test and calibration check prior to each test flight and record the following information:

(1) Test run and sequence number description.

(2) Test item nomenclature and serial number.

(3) Accuracy tolerance for particular functional characteristic of the test instrument to be evaluated during a particular test run.

(4) Correlate test run and sequence number to the data recorded.

(5) Results of instrumentation functional test and calibration check.

j. Fly the predetermined flight profile using the test instrument if applicable as the primary flight instrument. Record pertinent flight, meteorological, and instrument performance data as required.

5.2 Aircraft Airspeed System. Chapter 12, AMC Pamphlet 706-204, Engineering Design Handbook (Helicopter Performance Testing),[20] presents four standard methods (pacer vehicle, trailing bomb, tower flyby, ground speed course) to flight calibrate an aircraft airspeed system. The purpose of flight calibration is to determine the magnitude of system error introduced by the aerodynamic force and temperature variations caused by an aircraft flight through an air mass. These are the same reasons for the functional performance subtest of a developmental airspeed system. Therefore, the test methods and rationale, as to the advantages and disadvantages of each test method, presented in the referenced document are applicable in satisfying the objectives of this subtest. One additional and preferred set of equipment (nose data head mounted on aircraft data boom) and methodology not presented in the above referenced pamphlet will be addressed. A typical nose data head (Figure 1) provides static and total pressure, angle of attack, and angle of side slip information. The forward vane mounted horizontally on the left side is normally used for angle of attack measurements, and the aft vane mounted vertically and below the boom measures angle of side slip. The pitot-static sensor, should be gimbal mounted to permit universal movement of the pitot-static sensor, allowing it to weather vane into the true airstream of the aircraft. The data head mounted on the aircraft via the data boom should be designed such that pressure measurement errors (angle of attack, side slip angle, and velocities) are essentially zero throughout the range of the test criteria. The boom mounted data head methodology is preferred for the following reasons:

a. Velocity errors not exceeding 0.5 percent are reasonable within its operational range.

b. Airspeed versus angle of attack and side slip angle are required for a complete and comprehensive evaluation of the performance characteristics of an airspeed system. These measurements can be taken simultaneously allowing direct correlation of indicated and calibrated airspeeds versus aircraft flight mode characteristics.

c. Post-installation calibration and checkout of the system can be flown independent of test ground support personnel. Normal flight profiles can be flown and the developmental system can be evaluated under actual mission conditions.

5.2.1 Test Method. Perform the steps outlined in paragraphs 5.1 a - j.

5.2.2 Data Required. Record and time correlate the following:

a. Flight profile information to include test run sequence number and profile description.

b. Meteorological conditions during each test run; i.e., temperature, relative humidity, atmospheric pressure, wind speed and direction, and other weather characteristics observed during testing.

c. Test engineering data:

(1) Developmental airspeed instrument responses.

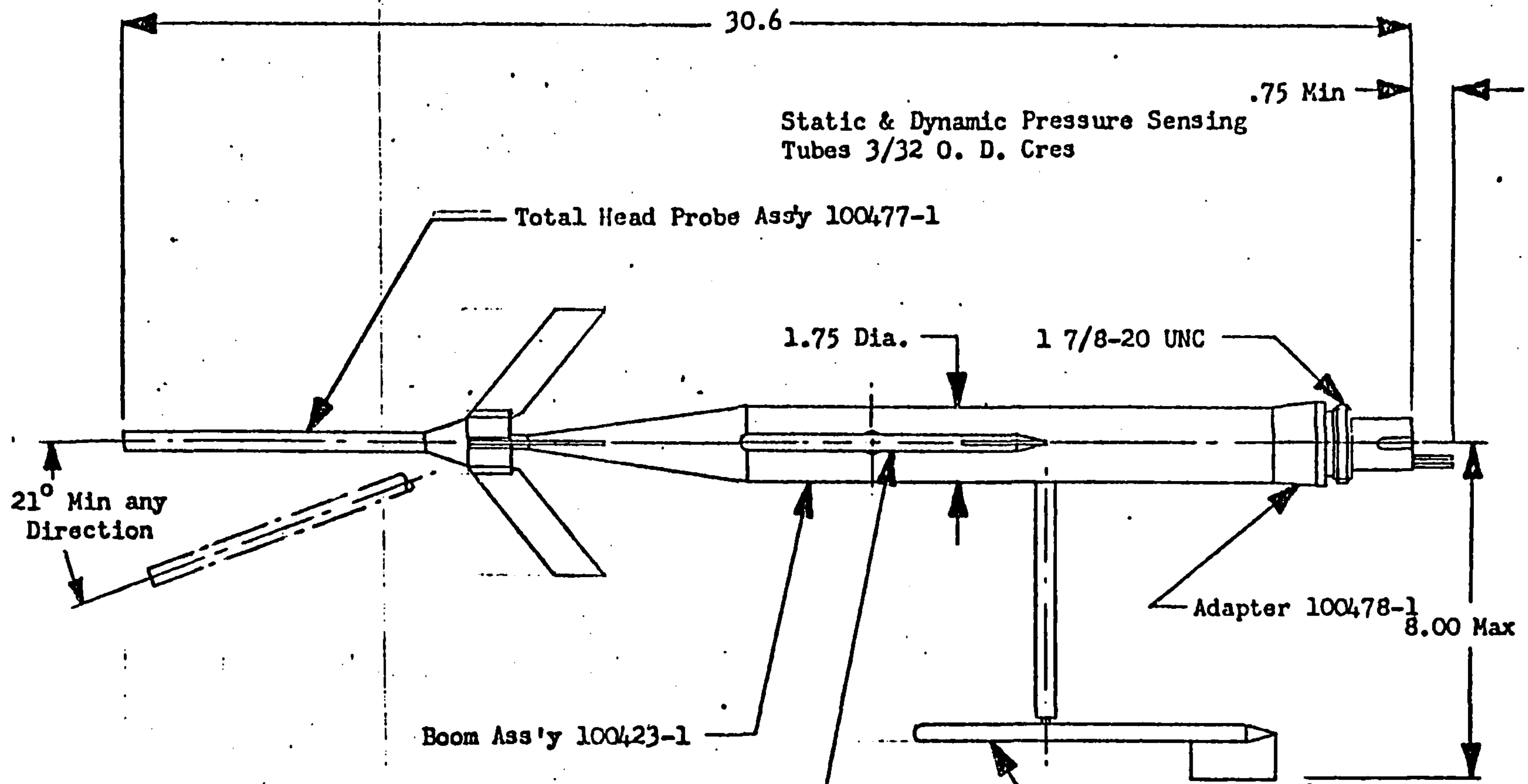
(2) Calibrated airspeed from boom mounted data head.

(3) Angle of attack, side slip angle, and altitude from boom mounted data head.

(4) Rate of climb or descent and bank angle from aircraft instruments.

(5) Time marked to a known reference.

5.3 Aircraft Altimeter. Functional performance test methodology will be addressed for the barometric and absolute/radar altimeters, respectively.



Weight 2.7 lb. approx. less electrical components
Electrical leads extend 12" min beyond aft end or
as specified by customer
Finish: Bare aluminum polished
Pitch and yaw vane potentiometers as specified by customer

Figure 1

5.3.1 Functional Performance Barometric Altimeter. The barometric altimeter senses atmospheric pressure differentials which are calibrated to aircraft altitude above mean sea level. Functional performance implies the instrument will be tested installed in the aircraft under dynamic flight conditions.

5.3.1.1 Test Method. Install the test barometric altimeter into the designated aircraft static pressure system parallel to a calibrated barometric altimeter of known operational characteristics and accuracy. Accomplish installation checkout and calibration in accordance with the procedures outlined in the system support package. Insure operational biases between the calibrated and test instrument are minimized due to identical installation. Install a video camera to record, with minimum parallax, the calibrated and test altimeters simultaneously, as well as airspeed, rate of climb/descent, G-rate, and a time elapse display to correlate each test event.

a. Functional Static Test. Perform a calibration check, using a portable pitot-static test set, of the calibrated and test altimeters installed in the designated aircraft. Simulate a series of altitude changes to evaluate the accuracy and hysteresis effect of the test altimeter as compared to the calibrated altimeter, and to establish static data points to compare with inflight data points. This procedure will demonstrate the flight dynamics effect on the test altimeter.

(1) Set the local barometric pressures into the calibrated and test altimeters. Check the altitude indicator of the test and calibrate altimeter with respect to the known field elevation. Record any discrepancies.

(2) Set the local referenced pressure into the altimeters. Use the pitot-static test set to simulate altitudes in 100 foot increments throughout the altitude range of the test altimeter. Smaller 10 foot increments should be simulated in the proximity of critical flight altitudes.

(3) Record the calibrated altimeter reading at each test point up and down the altitude scale.

(4) Record the test altimeter altitude indication corresponding to each test point of the calibrated altimeter in paragraph (3) above.

(5) Record the barometric pressure indication at each test point in paragraphs (3) and (4) above.

(6) Observe and time, if practical, any response (lead or lag) time of the test altimeter versus the calibrated altimeter.

b. Functional Flight Test. Fly the aircraft using the test altimeter as the basic flight altitude instrument. Record the following parameters, altitude, airspeed, rate of climb/descent, and time:

(1) Execute a rapid and continuous ascent to the aircraft airworthiness limitations. Record the flight parameters, reaction of both altimeters, and times; observe any lead or lag in altitudes of the test altimeter versus the calibrated altimeter.

(2) Execute a rapid and continuous descent from the maximum altitude, recording and observing the reaction of both altimeters.

(3) If any appreciable differences in the altimeter reactions exist during maneuvers (1) and (2), execute a stair step maneuver, maintaining rate of climb or descent to predetermined altitudes to determine if both altimeters stabilize at the same altitude indication. This maneuver should determine if a lead or lag is a result of hysteresis or barometric pressure altitude error.

(4) Execute a buildup series of high G maneuvers to include the following:

(a) Ascending and descending left and right turns, maintaining maximum bank angle and airspeed. Develop max-G rates up to the aircraft airworthiness limitations.

(b) Porpoising maneuver, developing maximum ascent and descent velocities alternately between altitude differences of 500 feet MSL. Develop max - G levels up to the aircraft airworthiness limitations. Record the altitude, airspeed, rate of climb/descent, aircraft G's, and time during each maneuver.

5.3.1.2 Data Required.

a. Functional Static Test.

(1) Photograph of test setup.

(2) Tabulated data called out in the Test Method section, paragraph 5.3.1.1a, Functional Static Test, procedures (1) through (6).

b. Functional Flight Test.

(1) Photograph of test setup.

(2) Video recording of the parameters presented in the Test Method section, paragraph 5.3.1.1b, Functional Flight Test, flight maneuvers (1) through (4) (a) and (b).

(3) Pertinent meteorological data and pilot/observer comments.

5.3.2 Functional Performance Radar Altimeter. The radar altimeter is referred to as an absolute altimeter as it determines the absolute vertical separation between the aircraft and the surface of the earth. Many factors affect the functional performance of the radar/absolute altimeter. Among these are meteorological conditions, aircraft attitude, and terrain (water, rock, snow, ice, etc.) reflection characteristics. TOP 6-1-013[21] is devoted to the testing of absolute altimeters. In particular, the Dynamic Test section, paragraph 6.2.6.2, satisfies the objective for this TOP with regard to the radar altimeter. Therefore, the developmental testing of radar altimeters should be accomplished in compliance with TOP 6-1-013.[22]

5.4 Rate of Climb Indicator. TOP 6-2-235[23] is devoted entirely to testing the rate of climb indicators. The Flight Test section, paragraph 6.2.7, satisfies the objective for this TOP with regard to the functional performance test of the rate of climb indicator. Therefore, the developmental testing of a rate of climb indicator should be accomplished in compliance with TOP 6-2-235.[24]

5.5 Attitude Indicator. Attitude indicators utilize gimbal mounted gyros to sense angular displacement in attitude (roll, pitch) from a referenced platform. The attitude angular displacements are projected to the pilot indicator through mechanical linkages in some self-contained units or through electrical signal takeoffs from each axis of the referenced platform to drive a remote pilot indicator. The functional test procedures for either unit are presented below:

5.5.1 Method. This section supplements and provides specific details to the general test guidance presented in sections 5 and 5.1.

a. Install the test attitude indicator and a calibrated attitude indicator of known accuracy and operational characteristics into the designated aircraft. Accomplish installation and checkout procedures in compliance with the guidance presented in the preliminary draft technical manual (PDTM).

b. Fly a buildup series of test profiles which will stress the operational capability of the attitude indicator up to the G limits of the designated aircraft. Include the following maneuver types in the flight test profile depending upon aircraft mission requirements and airworthiness limitations.

(1) Roll maneuver up to the airworthiness limitation of the designated aircraft.

(2) Ascending and descending left and right turns maintaining maximum bank angle and airspeed. Develop maximum G rates up to the aircraft airworthiness limitations.

(3) Porpoising maneuver, developing maximum ascent and descent velocities alternately between altitude differences of 500 feet MSL. Develop maximum ±G levels up to the aircraft airworthiness limitations.

5.5.1.2 Data Required.

a. Photograph via video camera the performance of the calibrated and test attitude indicator throughout the test flight maneuvers.

b. Record of the following parameters time synchronized to the video photographs:

(1) Altitude.

(2) Airspeed.

(3) Rate of climb/descent.

(4) Aircraft G level of instrument panel.

(5) Pitch, yaw, roll rates of the aircraft.

(6) Time.

c. Pertinent meteorological data.

d. Pilot/observer comments.

e. Flight profile data.

5.6 Aircraft Health Instruments. Aircraft health instruments predominantly use transducers to transform pressures, temperatures, or angular momentum into electrical signals. Small motor-like devices known as servos utilize these electrical signals to drive a pointer around a fixed face pilot indicator calibrated to the parameter under consideration. Under normal circumstances the accuracy of such instruments does not exceed one percent of the parameter range being measured. Greater accuracy is not normally required to alert the pilot to developing or impending problems. A functional performance test of an aircraft health instrument must accomplish two objectives: (1) Establish the accuracy of the instrument in the flight environment, and (2) Establish that the pilot display readout sensitivity meets the specified accuracy requirements in the flight environment.

5.6.1 Method. Accomplish the applicable procedures presented in the General Guidance section, paragraph 5.1. Develop your flight profile to stress the particular aircraft system/subsystem for which the developmental test health indicator instrument is intended to monitor.

a. To establish the accuracy and sensitivity of the developmental health indicator, the designated aircraft system/subsystem must be instrumented such that the same parameters being monitored by the health indicator system can be independently recorded and time synchronized to the flight profile.

b. Record via video camera the operational performance of the test health indicator and corresponding standard indicator if applicable. Also record a flight time elapse display synchronized to the flight profile in addition to essential flight parameters (airspeed, rate of climb/descent, N1, torque, etc.) such that repeatability is enhanced in the event of an operatioanl phenomenon with the developmental test item.

5.6.2 Data Required.

a. Video record of the performance characteristics of the test and standard health indicators.

b. Video record of essential flight parameters:

(1) Altitude.

(2) Airspeed.

(3) Rate of climb/descent.

(4) Attitude.

(5) N1.

(6) N2.

(7) Flight time.

c. Pertinent meteorological data.

d. Pilot/observer comments.

e. Flight profile data.

6. DATA REDUCTION AND PRESENTATION.

6.1 Data Reduction. Identify, organize, and correlate raw test data as to time, parameter grouping, and test run. As required, convert raw test measurements to engineering units. Analyze the performance data for the aircraft instrument to satisfy the test objectives and determine compliance or noncompliance with the test instrument developmental criterion or specifications. Institute a "quick-look data" system where practical. Quick-look data will provide for initial and periodic checks to see if the data is reasonable. Further, system malfunctions can be detected and, in some instances, corrected early.

6.2 Data Presentation.

a. Prepare a narrative document of the test results to include diagram, graphs, photographic, tabular, and other reduced data, as required, to support the test conclusions and recommendations. The degree to which the test item satisfies the test criteria or specifications in the operational environment should be clearly evident.

b. In the instance of a total or partial failure of the test item to perform its intended function, reference the failure definition/scoring criteria developed for the test in compliance with AR 702-3.[25] Assess the implications of the failure and present recommendations as applicable.

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

APPENDIX A-1

PRETEST CHECKLIST

TESTING AIRCRAFT INSTRUMENTS

1. Have facilities, test equipment, instrumentation, and support requirements been scheduled or secured? See paragraphs 2 through 2.4.2, this TOP.

Yes______ No______.

2. Has appropriate test planning been accomplished in accordance with paragraphs 3.1 through 3.7, this TOP? Yes______ No______.

3. Have test control measures been implemented such that test results could be duplicated or compared? See paragraphs 4a through 4k, this TOP.

Yes______ No______.

APPENDIX A-2

POST-TEST CHECKLIST

TESTING AIRCRAFT INSTRUMENTS

1. Have test data been collected, recorded, and presented in accordance with this TOP? Yes______ No______ Comment:____

2. Were the facilities, test equipment, instrumentation, and support accommodations adequate to accomplish the test objectives? Yes______ No______ Comment:__________
____

3. Have all data collected been reviewed for correctness and completeness?
Yes______ No______ Comment:____
____

4. Were the test results compromised in any way due to insufficient test planning?
Yes______ No______ Comment:____
____

5. Were the test results compromised in any way due to test performance procedures?
Yes______ No______ Comment:____
____

6. Were the test results compromised in any way due to test control procedures?
Yes______ No______ Comment:____
____

7. Were the test results compromised in any way due to data collection, reduction, or presentation technique? Yes______ No______ Comment:__________________________
____

APPENDIX B

DATA COLLECTION FORM

TESTING AIRCRAFT INSTRUMENTS

SAMPLE

1. Date ________________________ Aircraft Tail No ________________________

II. Test Run Identification ____________________ Profile No. ____________

III. Test Item Identification.

Nomenclature	Model No	Serial No
________________________	____________	____________

IV. Data Collection Technique. ____

____

____

____

V. Data Parameters Being Recorded.

1.

2.

3.

4.

..

..

VI. Data Collection Rate/Frequency.

____

____

____

VII. Time Mark to Correlate Data.

VIII. Test Data. (Sample)

Time	DATA							
	Calibrated Instrument Parameter				Test Instrument Parameter			
	Airspeed K	Torque %	N1 RPM	Temp C	Airspeed K	Torque %	N1 RPM	Temp C
xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx

IX. Test Run Atmospheric Conditions.

1. Ambient Temperature ______________________.

2. Relative Humidity ________________________.
3. Atmospheric Pressure _____________________.

4. Precipitation ____________________________.

X. Observer/Operator Comments Including:

1. Commenter identification ____.

Test responsibility ____.

2. Instrument utility.

3. Advantages/disadvantages.

4. Operational complexity.

____

____

____

____

____

____

____

XI. Test Incident Narrative Description Including:

1. Observer/narrator identification ______________________________.

2. Test event time line surrounding incident.

3. Pertinent circumstances surrounding incident.

4. Pertinent environmental, flight, or test parameter changes surrounding the incident.

____

____

____

XII. Test Personnel.			
Name	Title	Test Function	Comments Experience
1.			
2.			
3.			
4.			

APPENDIX C

FOOTNOTE REFERENCES

TESTING AIRCRAFT INSTRUMENTS

1. TOP 7-3-503, Arrival Inspection Pre-Operational Inspection (Aviation Materiel).

2. TOP 7-3 -500, Physical Characteristics (Aviation Materiel).

3. TOP 7-3-502, Installation Characteristics.

4. TOP 7-3-509, Compatibility/Related Equipment (Aviation Materiel).

5. TOP 6-3-526, Functional Requirements/Aircraft Test Instrumentation.

6. TOP 7-3-507, Maintenance (Maintainability, Availability).

7. TOP 7-3-508, Reliability (Aviation Materiel).

8. TOP 1-2-609, Instructional Material Adequacy Guide and Evaluation Standard (IMAGES).

9. TOP 7-3-501, Personnel Training.

10. TOP 1-2-610, Human Factors Engineering.

11. TOP 7-3-527, Internal/External Lighting (Aviation Materiel).

12. TOP 7-3-506, Safety.

13. TECOM Regulation 70-24, Research and Development: Documenting Test Plans and Reports, w/changes 1 and 2.

14. AR 70-10, Test and Evaluation During Development and Acquisition of Materiel.

15. TOP 7-3-500, Physical Characteristics (Aviation Materiel).

16. AR 702-3, Army Materiel Reliability, Availability and Maintainability (RAM)

17. Ibid.

18. AR 750-25, w/TECOM Supplement 1, Army Metrology and Calibration System.

19. TOP 3-1-002, Confidence Intervals and Sample Size.

20. AMC Pamphlet 706-204, Engineering Design Handbook (Helicopter Performance Testing).

21. TOP 6-1-013, Absolute Altimeters.

22. Ibid.

23. TOP 6-2-235, Rate of Climb Indicators.

24. Ibid.

25. AR 702-3, Army Materiel Reliability, Availability and Maintainability (RAM).

DATE

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