

# REPORT DOCUMENTATION PAGE

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<b>14. ABSTRACT</b> This document defines procedures that can be followed to help maximize the usefulness of data collected during testing where the purpose is to assess the reliability, availability, maintainability, durability (RAM-D) and/or Integrated Product Support (IPS) of a system(s) or equipment. This document will help to clarify scoring conventions to be used for scoring incidents.						
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U.S. ARMY TEST AND EVALUATION COMMAND  
TEST OPERATIONS PROCEDURE

\*Test Operations Procedure 02-2-001  
DTIC AD No.

1 June 2022

MAINTENANCE BASED SEGMENTED RELIABILITY, AVAILABILITY,  
MAINTAINABILITY (RAM)

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1. SCOPE.

a. This Test Operations Procedure (TOP) defines procedures that can be followed to help maximize the usefulness of data collected during testing where the purpose is to assess the reliability, availability, maintainability, durability (RAM-D) and/or Integrated Product Support (IPS) of a system(s) or equipment. A primary focus of these procedures is ensuring the proper information is gathered to help determine the severity of an incident and the impact on test item function(s). While TOP 02-2-506A<sup>1\*\*</sup> details procedures for structuring an endurance test of wheeled or tracked vehicles, it does not require testing to be broken down into individual segments nor, by extension, does it provide instructions on how to handle incidents that occur during those segments. When an incident does occur during a segment, sometimes a decision is made to perform corrective maintenance immediately instead of considering whether the test item could have continued test operations. Taking such an approach often leads to questions later about how much additional operation the test item could have completed. Having information to answer those questions is especially important for tests where incidents are classified by failure severity. This document will help clarify what to do in this type of situation. Ensuring a consistent test approach adds confidence when comparing RAM-D and/or IPS results between different test centers, test phases, or between similar commodities.

b. A segment in the context of this TOP refers to either a distance, a time, or a task interval. Once started, a segment should continue until an incident occurs that is severe enough to stop the current operation. Any incidents that occurred during and were deferred until the end of a segment must be evaluated again at the end of the segment to determine whether the test item can start a new segment without performing corrective maintenance. The information obtained while evaluating each incident must be recorded so it can be used to help determine the severity of the incident and the impact on test item function(s).

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

The facilities required will be specified in applicable Standard Operating Procedures (SOPs), TOPs, the test directive, and/or detailed test plan.

2.2 Instrumentation.

The instrumentation required to monitor test item activity and record the required test data will be specified in applicable SOPs, TOPs, the test directive and/or detailed test plan.

\*\* Superscript numbers correspond to Appendix B, Reference.

### 3. REQUIRED TEST CONDITIONS.

For general guidance on structuring an endurance test of wheeled or tracked vehicles, refer to TOP 02-2-506A. This TOP should be used as a compliment to TOP 02-2-506A to provide additional data on the impact of incidents in order to more accurately score them as they occur.

### 4. TEST PROCEDURES.

Additional test procedures and policies dividing the total endurance test mileage or mileage cycles into smaller segments should be established, specified in the test directive or detailed test plan, and communicated to all test personnel involved with documenting and reviewing test data.

#### 4.1 Establish Segments.

One of the key benefits of Maintenance Based Segmented RAM (MBSR) is inserting additional operational realism into developmental testing by dividing the endurance subtest total mileage or mileage cycles into smaller segments. The methodology used to divide the total mileage or mileage cycles into segments is dependent on the scope of the test. The length of each segment should be agreed upon by key test program personnel.

Step 1: Determine if a segment length has already been established during previous testing of the same or similar platform.

Step 2: Discuss if the previously established segment length is applicable to the current platform and scope of test. If it is agreed to use the established segment length, proceed to Step 4.

Step 3: If a segment length has not already been established or the established length is not applicable to the current test, discuss with key test personnel (e.g., RAM/Endurance Integrated Product Team (IPT)) to determine an appropriate segment length. Factors to consider when determining segment length could include information from the operational mode summary/mission profile (OMS/MP), concept of operations (CONOPS), fuel range data, and/or fielded system data, if available.

Step 4: Publish the agreed upon segment length in the applicable test documents and communicate plan of action to all test personnel.

#### 4.2 Learn Applicable Failure Definitions.

All mileage accumulated from the initiation of RAM or Endurance testing to the initiation of a RAM or Endurance Final Inspection is to be counted toward the total required mileage. All incidents will be scored in accordance with the Failure Definition and Scoring Criteria (FDSC) regardless of situational factors. The test center Test Officer should become familiar with the FDSC applicable to the test in preparation for accurately classifying test incidents that may occur. The FDSC should be used as a general guideline for determining the incident's severity

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and impact on the test item function(s). This is important because the FDSC classification helps determine when corrective maintenance should be applied in response to an incident. If an official FDSC is not provided, an agreed upon scoring methodology should be established prior to the start of testing. An example of FDSC classifications and corresponding corrective maintenance schedule are provided in Table 1 to illustrate the kind of guidance this information can provide.

TABLE 1. CORRECTIVE MAINTENANCE APPLICATION SCHEDULE  
BASED ON FDSC CLASSIFICATIONS  
(EXAMPLE ONLY)

FDSC CLASSIFICATIONS	CORRECTIVE MAINTENANCE APPLICATION
Rapidly Recoverable Event (RRE)	Corrected by crew level personnel within time limits during the segment using onboard equipment/publications.
Non-Essential Function Failure (NEFF)	Corrective maintenance delayed until scheduled maintenance.
Essential Function Failure (EFF)	Corrective maintenance applied prior to next segment initiation.
System Abort (SA)	Corrective maintenance applied prior to segment completion.

#### 4.3 Determine Appropriate Incident Response.

a. When an incident occurs, response should be based on the impact of the incident to the test item. The test center Test Officer should assess the test item degradation towards completing a segment. If it is determined the test item cannot continue the segment or perform its mission essential functions at minimum standards, appropriate corrective maintenance should be performed immediately. If it is determined the test item can continue to perform its mission essential functions, an attempt should be made to complete the segment without performing corrective maintenance while continuously monitoring the incident. At this point, the test center Test Officer should consider a preliminary score for the incident in accordance with the procedures in Section 4.2. If needed to support the preliminary score decision, additional testing should be conducted. In addition, significant environmental and safety hazards and their associated mitigations, if necessary, should be considered when determining how to score the incident and when to perform corrective maintenance. Maintenance time associated with applying mitigating strategies for environmental and safety hazards is not chargeable.

b. After completion of the segment, the incident should be repaired unless determined the repair could be deferred until the next scheduled service or later. Deferred incidents should be monitored throughout testing. Changes in severity may necessitate re-evaluation and/or a scoring change. Continue until completion of the associated segment as defined by applied score or until corrective maintenance is required.

## 5. DATA REQUIRED.

a. Procedures should be established to ensure segment data are documented in test incident reports (TIRs) and, if desired, in any test operations tracking forms being used. Establish a way of documenting the segment number when the incident occurred within the TIR narrative and/or a data field in the Special Requirements section of a TIR.

b. The first sentence of the TIR narrative should document the current segment number if applicable, or the next segment number if performing a before preventive maintenance checks and services (PMCS), or the prior segment number if performing an after PMCS. If an incident occurs before a test item has started the next segment, the TIR narrative should indicate the activity or procedure being performed.

c. If corrective maintenance is being deferred until the end of the segment or later, any data relevant to the characteristics of the incident over time as testing is continued should be documented within the TIR narrative. Some examples include:

- (1) Additional mileage completed with an active leak.
- (2) Leak classification and progression.
- (3) Crack measurements to monitor crack propagation.
- (4) Details from data bus or instrumentation data.
- (5) Recorded sensor or gauge readings, e.g., temperature or pressure readings.
- (6) Software codes and frequency/change in frequency of code appearance as mission is continued.
- (7) Component cycles or weapon round counts.

## 6. PRESENTATION OF DATA.

For the presentation of data collected during testing, refer to TOP 02-2-506A.

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APPENDIX A. ABBREVIATIONS.

CONOPS	Concept of Operations
EFF	Essential Function Failure
FDSC	Failure Definition and Scoring Criteria
IPS	Integrated Product Support
IPT	Integrated Product Team
MBSR	Maintenance Based Segmented RAM
NEFF	Non-Essential Function Failure
OMS/MP	Operational Mode Summary/Mission Profile
PMCS	Preventive Maintenance Checks and Services
RAM-D	Reliability, Availability, Maintainability, Durability
RRE	Rapidly Recoverable Event
SA	System Abort
SOP	Standard Operating Procedure
TIR	Test Incident Report
TOP	Test Operations Procedure

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APPENDIX B. REFERENCE.

1. TOP 02-2-506A, Wheeled and Tracked Vehicle Endurance Testing, 2 October 2014.

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APPENDIX C. APPROVAL AUTHORITY.

CSTE-CI

1 June 2022

MEMORANDUM FOR

Commander, U.S. Army Operational Test Command  
Director, U.S. Army Evaluation Center  
Commanders, ATEC Test Centers  
Technical Directors, ATEC Test Centers

SUBJECT: Test Operations Procedure 02-2-001 Maintenance Based Segmented Reliability, Availability, Maintainability (RAM)

1. Test Operations Procedure (TOP) 02-2-001 Maintenance Based Segmented Reliability, Availability, Maintainability (RAM), has been reviewed by the U.S. Army Test and Evaluation Command (ATEC) Test Centers, the U.S. Army Operational Test Command, and the U.S. Army Evaluation Center. All comments received during the formal coordination period have been adjudicated by the preparing agency.
2. Scope of the document. This TOP defines procedures that can be followed to help maximize the usefulness of data collected during testing where the purpose is to assess the reliability, availability, maintainability, durability, and/or Integrated Product Support of a system or equipment. This document will help to clarify scoring conventions to be used for scoring incidents.
3. This document is approved for publication and has been posted to the Reference Library of the ATEC Vision Digital Library System (VDLS). The VDLS website can be accessed at <https://vlds.atc.army.mil/>.
4. Comments, suggestions, or questions on this document should be addressed to U.S. Army Test and Evaluation Command (CSTE-CI), 6617 Aberdeen Boulevard-Third Floor, Aberdeen Proving Ground, MD 21005-5001; or e-mailed to [usarmy.apg.atec.mbx.atec-standards@mail.mil](mailto:usarmy.apg.atec.mbx.atec-standards@mail.mil).

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Forward comments, recommended changes, or any pertinent data which may be of use in improving this publication to the following address: Policy and Standardization Division (CSTE-CI-P), U.S. Army Test and Evaluation Command, 6617 Aberdeen Boulevard, Aberdeen Proving Ground, Maryland 21005-5001. Technical information may be obtained from the preparing activity: RAM/ILS Engineering & Analysis Division (TEAT-ADR), U.S. Army Aberdeen Test Center, 6943 Collieran Road, Aberdeen Proving Ground, MD 21005-5059. Additional copies can be requested through the following website: <https://www.atec.army.mil/publications/documents.html>, or through the Defense Technical Information Center, 8725 John J. Kingman Rd., STE 0944, Fort Belvoir, VA 22060-6218. This document is identified by the accession number (AD No.) printed on the first page.