

DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188

2. TITLE

VULNERABILITY ANALYSIS REPORT

1. IDENTIFICATION NUMBER

DI-MISC-80564

3. DESCRIPTION/PURPOSE

3.1 The Vulnerability Analysis Report presents the results of analyses performed to identify system (or subsystem/equipment) response to specified threat parameters and provides quantified measures of vulnerability (vulnerability indices).

3.2 Analysis results are used for: design analyses and trade studies to evaluate effectiveness of design changes or techniques to harden the system; one set of inputs for survivability analyses; and may be used as a basis for determining compliance with specification requirements.

3.3 The report may be used to assist in formulation of deployment and operational tactics, and support functions.

4. APPROVAL DATE
(YYMMDD)

880408

5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

F/AFSC-ASD

6a. DTIC REQUIRED

6b. GIDEP REQUIRED

7. APPLICATION/INTERRELATIONSHIP

7.1 This Data Item Description (DID) contains format and content preparation instructions for the data product generated by a specific and discrete task requirement in the contract.

7.2 This DID may be applied to any contract and any program phase to acquire a vulnerability analysis. Although acquired primarily during system/major equipment full scale development programs, this analysis report is also applicable to development efforts during conceptual and demonstration/validation phases.

7.3 This DID supersedes DI-R-30513.

8. APPROVAL LIMITATION

9a. APPLICABLE FORMS

9b. AMSC NUMBER

F4377

10. PREPARATION INSTRUCTIONS

10.1 *Content and format.* The Vulnerability Analysis Report shall include the data described below, as applicable to the threat types specified for analysis.

10.1.1 *Introductory information.* An overview of the analysis shall be provided including discussion of the intended usage of the results, such as for development of hardening criteria for a new design, quantifying vulnerabilities of a system design, determining the effectiveness of various vulnerability reduction (hardening) designs.

10.1.2 *Air vehicle design description.* Descriptions of all subsystems shall be provided covering their current design, function, redundancies, and hardening features. Design changes or hardening features proposed but not yet incorporated shall be described and identified as either being excluded from the analysis or included for comparative analysis purposes. The description shall be supported by scaled (no smaller than 1:20) three-view and inboard profile drawings accurately showing the location of flight and mission-critical elements and items providing significant masking or shielding. Nomenclature and coding used on the drawings shall be consistent with those used in applicable damage modes and effects analyses and computerized target descriptions.

10.1.3 *Analysis conditions.* Specific conditions used in the analysis shall be described, to include:

- a. A summary of pertinent threat characteristics (types, sizes, etc.) for each threat/threat effect analyzed. Source data for threat characteristics shall be referenced (document number, title, page number, as appropriate).
- b. A listing and definition of each kill level or damage category specified for the analysis. Any unique categories shall also be defined.
- c. A description of the air vehicle configuration(s), mission phases, and flight conditions applicable to the analysis.

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11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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Block 10, Preparation Instructions (continued)

10.1.4 *Analysis inputs and procedures.* All analysis inputs, procedures, and assumptions with justifications shall be described, to include:

a. A summary of the results of the Failure Modes and Effects Criticality Analysis (FMECA), if not included as an appendix to this report.

b. The Damage Modes and Effects Analysis (DMEA) data, included as an appendix to this report. DMEA data shall consist of a set of tables presented in matrix form which identifies each component and interrelates the threat level, component failure/damage mode(s), redundancy/back-up capability, kill category (attrition or mission abort), and component $P_{K/H}$ function. Supporting documentation included with the DMEA shall consist of (1) disablement diagrams (systematic portrayal of damage modes and resulting kill levels) and (2) fault trees structured to be compatible with the methods and computer models used to quantify vulnerabilities.

c. For nonnuclear analyses, a listing of the component probability of kill given hit ($P_{K/H}$) functions and a discussion of their source or development. If contractor developed, verification data for their derivation shall be provided.

d. For nuclear analyses, identification and discussion of component safety margins.

e. A discussion of the confidence in the DMEA, component $P_{K/H}$ functions, and component safety margins.

f. A detailed description of analysis techniques and computer models used.

10.1.5 *Analysis results.*10.1.5.1 *Nonnuclear analysis:*

a. For nonexplosive projectiles. Analysis results shall be provided in tabular summary form showing vulnerable area (A_v) of nonredundant (singly vulnerable) components for each combination of threat, kill category, attack aspect, and striking velocity (V_s). Each major redundant (multiply vulnerable) component will be shown separately. A total air vehicle vulnerable area tabular summary shall be provided for each attack aspect (6-view or 26-view) analyzed.

b. For explosive projectiles and contact-fuzed missiles. Analysis results shall be provided in summary form showing vulnerable area (A_v) of nonredundant (singly vulnerable) components for each combination of threat, kill category, and attack aspect. Results usually are not presented with respect to striking velocity (V_s). Each major redundant (multiply vulnerable) component will be shown separately. For HE (high explosive) projectiles, in addition to total aircraft A_v , the contribution by subsystem or aircraft region shall also be presented in the form of a sketch of the air vehicle identifying vulnerable regions of the aircraft plus a tabular summary of A_v for each region.

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Block 10, Preparation Instructions (continued)

c. For externally detonating projectiles and missiles. Analysis results shall be provided for component single fragment vulnerable areas (A_v) and external blast kill contours or volumes.

(1) Fragment A_v shall be provided for each combination of fragment size, kill category, attack aspect, and striking velocity (V_s). Since the results are usually inputs to missile terminal encounter simulations, results shall be provided for each component assessed and summed for the total air vehicle. Each vulnerable component location shall also be included.

(2) External blast vulnerability shall normally be provided in terms of equivalent bare charge weight of TNT or 50/50 pentolite vs distance from the air vehicle for selected target/warhead burst orientations and kill categories; or in terms of isokill contours for various charge weights and kill categories shown on three-view drawings.

d. For directed energy threats, the results of calculations for thermal and other damaging effects, the affects of material/coating properties and absorptivities, and vulnerable areas shall be provided.

10.1.5.2 Nuclear analysis:

a. Vulnerability envelopes and levels shall be provided for each burst orientation (top, side, rear, and front views or the number of orientations specified by the procuring activity), kill level (sure safe, mission abort, sure kill) and nuclear weapon effect.

b. For conceptual phase analysis, isotropic (invariant with respect to direction) hardnesses can be presented.

c. For analyses conducted during full scale development, anisotropic (differ with respect to direction) hardnesses shall be presented.

d. Analysis results shall include the actual and allowable loads for and response of each subsystem and element thereof for each weapon effect analyzed.

10.1.6 Summary and conclusions. An overall summary and conclusions shall be provided identifying: (1) areas of high uncertainty including any application of confidence level assessment methods; (2) limitations on use of the data; (3) recommendations for additional hardening or testing; and (4) other applicable comments.

10.1.7 Appendices. The following types of data, as applicable, should be included as appendices to the report:

- a. Flight and Mission Essential Functions Analysis
- b. Failure Modes and Effects Criticality Analysis (FMECA)
- c. Damage Modes and Effects Analysis (DMEA)
- d. Computerized Target Description
- e. Description of computer models used in the analysis.