

Design of Experiments – TEMP Body Example

3.4.2.# Design of Experiments (Subpara to 3.4.2 Operational Evaluation Framework)

Design and Analysis of Experiments will be used to develop test plans for the developmental, integrated, and operational testing of system XYZ. The T&E WIPT will identify the following components of the experimental design: (1) goals, (2) metrics, (3) factors and levels that impact the outcome of the test, (4) a strategic method for varying those factors and levels across all tests, and (5) appropriate statistical power and confidence levels for important responses for which they make sense.

Note: Table 3.1, Top-Level Evaluation Framework Matrix, should capture the key test goals and metrics/measures that are discussed in the test design section of the TEMP.

The T&E WIPT will use a sequential approach in test planning, meaning that screening of factors will occur in DT and integrated test events, only factors that are deemed significant or of particular operational interest will be investigate in OT. The overarching test strategy outlined in this TEMP is adequate to support the OTA’s evaluation plan. Tables 3.X1 – 3.XX provide the overall DOE strategy for each test objective. The overarching test strategy may change after the initial test events are conducted to allow for increased information on the effect of the factors on the critical responses. See the DOE Appendix for supporting information on the statistical qualities of the experimental design (factor selection, process diagrams, exact designs, and power/confidence levels).

Table 3.X: Overview of DOE Strategy for Test Objective 1

		Test Phase			
		DT	MS	IT	IOT
Critical Responses (Only MOE’s, MOP’s, KPP’s, MOS’s that relate to the current test objective should be included)		Select MOE, MOP, MOS, KPP	Select MOE, MOP, MOS, KPP	Select MOE, MOP, MOS, KPP	Select MOE, MOP, MOS, KPP
Factors	Factor Levels				
Factor 1	Categorical 2 levels	SV*	SV	SV	Record*
Factor 2	Continuous	HC*	HC	SV	SV
Factor 3	Continuous	SV	SV	SV	SV

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Factor 4	Categorical 6 levels	SV	SV	SV	SV, Demo 2 levels
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*In Table 3.X there are three common factor management strategies used (1) systematically vary (SV) the factor by including the factor in the experimental design, (2) hold constant (HC) at a fixed level during testing to minimize its impact on the test outcome, (3) record the level of the factor. Additionally, there are two levels of the fourth factor that will only be demonstrated (demo) in operational testing because of the cost associated with testing those levels.

Best Practices for Table 3.X:

Note 3.X can be replicated as many times as needed to ensure that all major test objectives are captured. These tables should not be exhaustive; instead they should capture the major test objectives, the primary measures (or response variables), and the factors that will be considered in test planning.

Recordable factors across all test phases should only be included in the DOE strategy table if they are expected to have a large impact on the outcome of the test objective. Other recordable factors can be included in a footnote and documented in more detail in the test plan.

It is also possible to have a factor or levels of a factor that will be systematically varied during a test but not in a statistically defensible fashion. These conditions are sometimes necessary to demonstrate (demo) in tests for safety, cost, or simply the fact that they rarely occur in regular operation of the system