

ROOT CAUSE PROBLEM SOLVING METHODS

OVERVIEW

- TACOM-ARDEC STRENGTH AREA
- IMPORTANT FUNCTION TO DEVELOP
- HIGH VALUE TO GOVERNMENT AND INDUSTRY
- SIGNIFICANT PAY OFF HISTORICALLY

PURPOSE

- INDEPENDENT ASSESSMENTS
- RED TEAM/BLUE TEAM
- FAILURE ANALYSIS
- CORRECTIVE ACTION

SYNERGISM

- APPLICABLE TO MANY FUNCTIONAL AREAS
- TRAINING INCREASES PROBLEM SOLVING EFFECTIVENESS
- ANALYSIS TOOLS/TECHNIQUES

FAULT TREE ANALYSIS (FTA)

FTA is a systematic, deductive design evaluation technique that defines a single specific undesirable event and determines all possible reasons (failures) that could cause that event to occur.

The undesired event constitutes the top event in a fault tree diagram and generally represents a complete or catastrophic failure of the system or product under analysis.

FAULT TREE ANALYSIS (FTA)

- PERFORMED ON ALL ITEMS AS PART OF DEVELOPMENT/DESIGN EFFORT
- UTILIZED US ARMY FUZE SAFETY BOARD EVALUATION/CERTIFICATION
- ALSO UTILIZED DURING ROOT CAUSE/PROBLEM SOLVING INVESTIGATIONS

F M E C A

FAILURE MODES AND EFFECTS CRITICALITY ANALYSIS

FMECA is a design evaluation technique that examines the potential failure modes within a system in order to determine the effects of failures on equipment or system performance.

This approach begins at the lowest level of the system hierarchy and traces up through the system hierarchy to determine the end effect on system performance.

F M E C A

FAILURE MODES AND EFFECTS CRITICALITY ANALYSIS

- ROUTINELY USED IN ALL DESIGN EVALUATION EFFORTS
- GREATLY AIDED PENETRATION AUGMENTED MUNITION (PAM) GET-WELL PROGRAM



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DESIGN OF EXPERIMENTS (DOE)

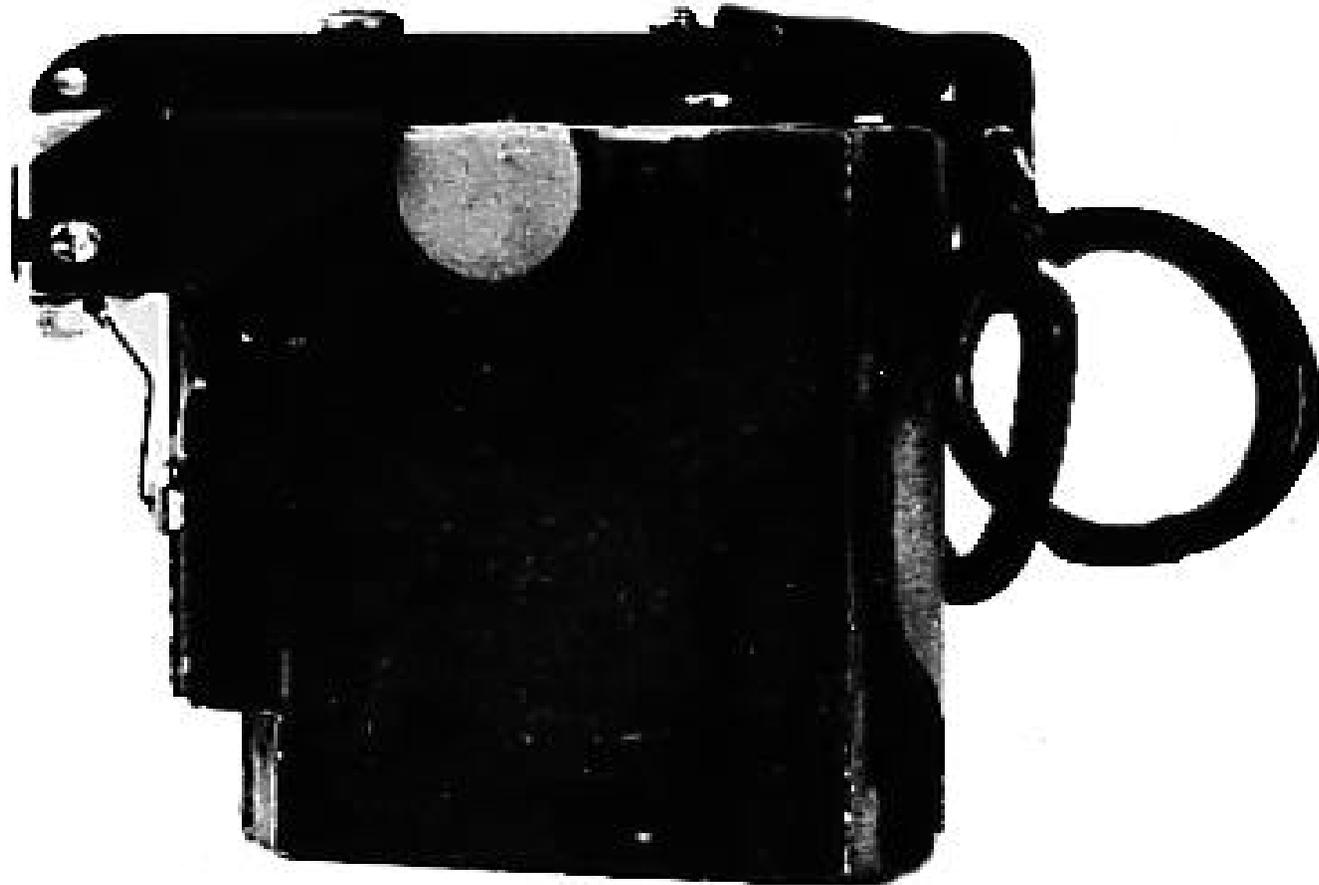
Design of Experiments is an efficient, statistical methodology for studying the effects of experimental factors on response variables of interest.

By applying DOE, the individual effects of a complex system of multiple experimental factors can be studied simultaneously, thereby avoiding the very inefficient “change-one-factor-at-a-time” testing approach.

DESIGN OF EXPERIMENTS (DOE)

- SIGNIFICANT AIDE TO TEST EFFORTS
- USED EXTENSIVELY IN BATTERY RE-DESIGN FOR PURSUIT DETERRENT MUNITION (PDM) PROGRAM WHICH INCORPORATED A RE-ENGINEERED AREA DENIAL ARTILLERY MUNITION (ADAM) BATTERY DUE TO SIGNIFICANTLY DIFFERENT MISSION ENVIRONMENTS

PDM



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PARETO ANALYSIS

Pareto Analysis is a TQM evaluation technique that sorts data, traditionally using a histogram technique, to help separate the few critical factors from the many trivial factors.

PARETO ANALYSIS

- UTILIZED RECENTLY IN WIDE AREA MUNITION (WAM) BATTERY DESIGN CHANGE VERIFICATION
- DOE USED FOR SENSITIVITY TESTING OF CHANGES



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ROOT CAUSE ANALYSIS RELIABILITY PHYSICS

Reliability Physics identifies the fundamental failure mechanisms of failed parts and materials through physical, chemical and/or electrical failure analysis techniques.

Root Cause Analysis seeks to go beyond the symptomatic defect, and when successful, identifies and corrects the basic underlying part or process problem.

ROOT CAUSE ANALYSIS (RCA)

- RECENTLY UTILIZED FOR OBJECTIVE INDIVIDUAL COMBAT WEAPON (OICW) FAILURE INVESTIGATION
- RCA, FTA, DOE TOOL USED



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QUALITY & RELIABILITY ENGINEERING TOOLS

Requirements Analysis

Program Plan

Design Reviews

FRACAS

Root Cause Analysis

R&M Modeling

R&M Allocation

R&M Prediction

Finite Element Analysis FEA

Fuze Board Reviews

Simulation

Thermal Analysis

FMECA

Fault Tree Analysis FTA

Parts Program

R&M Critical Parts

Parts Control

Derating

Tolerance Analysis

ESS

Sneak Circuit Analysis

Testing

Reliability Growth

Variability Analysis

Design of Experiments

Accelerated Life/Reliability Demo

QUALITY & RELIABILITY ENGINEERING TOOLS

Maintainability Demo
Life Extension/Predictive
Obsolescence
Surveillance
Durability
Software Reliability
Reliability Physics
Physics of Failure
TQM
Flow Charts
Ishikawa Diagrams
Pareto Analysis

Histograms
Checklists
Control Charts
Scatter Diagrams
Benchmarking
ISO 9000-2000
Quality Function
Deployment
Logic Diagrams
House of Quality
Opportunity Grids
Brainstorming