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Original title on 712 A/B: Performance Operational Risk Assessment Tool (SPORAT)

Revised title:

Presented in (input and Bold one): (WG 27, CG__, Special Session ___, Poster, Demo, or Tutorial):

This presentation is believed to be:
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Unclassified
**System Performance Operational Risk Assessment Tool (SPORAT)**

**US Army Aviation and Missile Command Bldg 5308 Room 8440 Redstone, Al 35898**

System Performance Operational Risk Assessment Tool
SPORAT

73rd MORSS
21-23 June 2005

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Purpose

- Performance as a variable in decision risk assessment
- Define the relationship of system availability from acquisition development to battlefield consequences.
- Define the cost risk methodology
System Performance Operational Risk Assessment Tool (SPORAT) Concept

**Inputs**

- **Elements**
  - Contractor/Gov data-bases
    - Cost
    - Schedule
    - Performance
  - Cost, Schedule performance analysis

- **Products**
  - Cost, schedule performance baselines
  - Tracking system
  - Risk forecasts
  - Impacts of changes
  - What if’s

**Tools**

- **SPORAT simulation**
  - Element-level simulation
  - Cost
  - Schedule
  - Performance

**User groups**

- Program analyst
- Risk analysts
- Integrated product team
- Managers/decision makers

**SPORAT capabilities**

- **Cost** can be modeled using a wide range of data, BCE, PMA, CPR, etc.
- **Schedule** can be modeled using Artemis, Openplan, MACPROJECT PRO, and many others.
- **Performance** is derived from TPMs, TRDs, element simulations (EADSIM, TACSIM, RADCAM, etc.), actual test data, expected test data, or theoretical analysis.
- The problem can be modeled at any level from component to system or a combination of various levels.
- **Cost, schedule and performance** can be represented as mathematical formulas or probability distributions or a combination of both.
- The network logic is flexible enough to model complex interrelationships such as test failures, redesign and retest of components or systems, thus, providing the probable time, cost and system performance associated with such a failure.
Network Development

- Logic network of project
- Initial development by benchmark
- Decomposition of benchmark activities
- Assignment of activity durations
- IPT quality review
- Input logic activities into SPORAT
- IPT final verification and validation
## Overall TPP Matrix

<table>
<thead>
<tr>
<th>TECHNICAL PERFORMANCE PARAMETER</th>
<th>APPLIED</th>
<th>CONDITIONS FOR DRAW</th>
<th>CONSEQUENCES IF A FAILURE OCCURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK FILE OBJECTS (NUMBER)</td>
<td>BM 0.5  N311-N370</td>
<td>NORMAL DISTRIBUTION</td>
<td>REWORK TIME &amp; COST</td>
</tr>
<tr>
<td></td>
<td>BM 1.0  N591-N600</td>
<td>MAX 200, MIN 1</td>
<td>5%-10% DIST.</td>
</tr>
<tr>
<td></td>
<td>BM 2.0  N730-N731</td>
<td>BM 0.5 - MEAN 100,</td>
<td>REWORK TIME &amp; COST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 SEC STD 10</td>
<td>35%-50%</td>
</tr>
<tr>
<td>TRACK UPDATE LATENCY (SECONDS)</td>
<td>BM 0.5  N465-N490</td>
<td>BM 1.0 - MEAN 100,</td>
<td>REWORK TIME &amp; COST</td>
</tr>
<tr>
<td></td>
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<td>3 SEC STD 10</td>
<td>10%-20% DIST.</td>
</tr>
<tr>
<td></td>
<td>BM 2.0  N740-N741</td>
<td>BM 2.0 - MEAN 100,</td>
<td>15% HW COST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 SEC STD 5</td>
<td>HDWE INSTL TIME</td>
</tr>
<tr>
<td>TRACK PURGE (SECONDS)</td>
<td>BM 1.0  N604-N605</td>
<td>BM 1.0 - MEAN 100,</td>
<td>REWORK TIME &amp; COST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 SEC STD 10</td>
<td>35%-50%</td>
</tr>
<tr>
<td>MESSAGE HANDLING RATE (MSGS PER SEC)</td>
<td>BM 1.0    N652-N660</td>
<td>GAMMA DIST. R=2</td>
<td>REWORK 15% HW COST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAX 50, MIN 5, 1 SEC</td>
<td>TIME &amp; COST 5%-10% DIST.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MEAN 17, STD 12</td>
<td></td>
</tr>
<tr>
<td>MESSAGE HANDLING LATENCY (SECONDS)</td>
<td>BM 1.0    N654-N655</td>
<td>BM 1.0 - MEAN 100,</td>
<td>REWORK TIME &amp; COST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 SEC STD 30</td>
<td>10%-20% DIST.</td>
</tr>
<tr>
<td>C(^2) PROCESSING</td>
<td>BM 0.5  N311-N370</td>
<td>NORMAL DISTRIBUTION</td>
<td>REWORK TIME &amp; COST</td>
</tr>
<tr>
<td></td>
<td>BM 1.0  N591-N600</td>
<td>MAX 200, MIN 100</td>
<td>5%-10% DIST.</td>
</tr>
<tr>
<td></td>
<td>BM 2.0  N730-N731</td>
<td>MEAN 100, STD 30</td>
<td></td>
</tr>
</tbody>
</table>

- SOFTWARE REWORK NOT LESS THAN ONE DAY
- HARDWARE UPGRADE INCLUDES COST PLUS ONE WEEK DELIVERY DELAY
How TPP’s are Applied

- Tracked Objects Database
- Incoming Sensor Data Sets
- Designation of Objects to be Updated

UPDATE
OBJECT ASSIGNMENTS

- New Object-Data Association

- Accuracy of Correlations
- Number of Hits Needed for Correlation
- Correlation Cycle Timeline
- False Correlations
- Correctness of Correlation Thresholds
- Robustness in Utilization of Inaccurate or Incomplete Sensor Data
- Erroneous Object Updates
- Are Correlation Thresholds Being Met?
- Task Processing Timelines

Technical Performance Parameter

| • Accuracy of Object Correlations |
| • Number of Hits Needed for Correlation |
| • Correlation Cycle Timeline |

Metric

| • Percent of Correct Correlations |
| • Average Counts of Hits (#) |
| • Average Time |
Application of TPPs

TRACK FILE OBJECTS (BM 0.5/1.0/2.0)

Normal Distribution

Mean = 100
SD = (30 / 10 / 5)

SDM Coding

Pass
GE 100 Objects

Fail
LT 100 Objects

Escape

Results

Logarithmic Function

TRACK LATENCY (BM 0.5 / 1.0 / 2.0)

Internal/Integrated Testing

Pass
GE 3 Sec Update

Fail
LT 3 Sec Update

Escape

Fix: Uniform Distribution

Cost Time
0.5 5-10% 5-10%
1.0 35-50% 35-50%
2.0

Fix: Uniform Distribution

Cost Time
0.5 5-10% 5-10%
1.0 H/W 7 Days
2.0

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Software Integration Phase 5

**Cost**

**Schedule**

**Performance**

- Performance Distribution
- Filter Logic w/Consequences
- 1000 Iterations

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**Software Integration Phase 5**

Planning  Coding  Testing

CI-1  CI-2

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U.S. Army Aviation and Missile Command G3
Tracked Objects Technical Performance

**Analysis Steps**

- Developed Baseline Network
- Strategically Placed Technical Performance Distributions at Appropriate Benchmark Activities
- Developed and Analyzed Pass/Fail Performance Criteria
- Accumulated Progressive Technical Performance With Narrowed Distributions
- Assessed Cost/Schedule/Technical Performance
- Produced Graphical Results for Cumulative Risk Functions

![Graphical Results for Cumulative Risk Functions](image)
3D Dynamics of Cost, Schedule & Performance Risk
Approach to Software Development Program

For Each Increment Build:

**Req Def.**

Gov works w/ Cont to:
- Define Inc Objectives
- Trace to TPM’s/ SE Req
- Define Pre-demo Chk List
- Verify Executability
  - Understand:
    - Objectives
    - Tasks
    - Resources Req’d
- Assess Cont Plan “Can it work ?”

**Design & Code**

Gov:
- Understands tech details
- Guide issue resolution
- Doc decisions
- Track issue resolution

**Int & Test**

Gov:
- McCabe Tool (or equiv)
- Witness key testing

**Pre-Demo**

Pre-demo Test:
- Informal
- Verity Chk List
- Eng Lvl

**Demo**

Demo:
- Cont & Gov share in tech briefing
- Show traceability: TPMs/ SE Req to Chk List, Demo
- “Score Card”
- Development Performance:
  - S/W Metrics
  - Defects Removed
  - S/W Rel, Maint.
  - Issue Resolution

Key to Success ... realistic ... actuals ... DTC focus !!

Start S/W Metrics Foundation . . .

. . . Cont to grow S/W Metrics Data Base

... Goal: Calibrate our IPT to support Inc Build Executability Verification

Wkly Status  Wkly Status  Wkly Status  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  ■  Wkly Status
TPP/TPM Integrated Assessment Capabilities

- Technical Design Minimums
  - Design goal achieved
  - What resources
  - Probability of goal
  - Cost impact

- Track Purge Applied
  - Resources need
  - Could the goal have been met
  - Better probability of success

- Deobligation of Funds
  - Least affected
  - Completion Affected
  - Achievement of next event

  ✔ Windfall Funds
    - Acceleration of tasks
    - New technical goals

  ✔ New Requirement
    - Evaluate costs
    - Impact on original schedule

  ✔ Network Path Analysis
    - Time slices
    - Probability of success

  ✔ Technical Goal Not Achievable
    - What resources needed
    - What-ifs
System Operational Availability
Technical Risk & Logistics Analysis

• Performance Risk Identification /Mitigation
• System Maintenance Concept
• Weapon System Concept Trades
• Sensor vs. Interceptor Trades
• Supportability Design Criteria
• Cost

Unclassified
Radar Cost/Schedule/Performance

Contract Cost

Contractor Schedule

Component Failure Rates

- Failure Distribution
- Filter Logic w/Consequences
- 1000 Iterations

Unclassified
Radar Operational Availability Battlefield Environment

37% decrease in total LRU failure rate
9% decrease in Sustainment Cost
12% decrease in Leakers

**Component Failure Rate**

**Component Cost**

**Sustainment Simulation**

**LOGAM**

**Battlefield Simulation**

**TACSIM**

**System Operational Availability**

**System Sustainment Cost**

**LEAKERS**